City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting

Aubrey City Hall
107 S Main St
Aubrey, TX 76227
August 22, 2024
6:00 PM

**(Notice of Potential Quorum for Planning & Zoning Commission, Board of Adjustment, Library Board, Municipal Development District, and Parks and Recreation Board - even though a quorum of the members of these boards may or may not be present, no official action will be taken by their members.)*

Notice Regarding Remote Participation of Council Members

Pursuant to Section 551.127, Texas Government Code, one or more Council Members may attend this meeting remotely using videoconferencing technology. A quorum of the board will be physically present at the location provided above. The video and audio feed of the videoconferencing equipment can be viewed and heard by the public by accessing Zoom utilizing the Public Participation link identified below.

Notice Regarding Public Participation

Individuals may attend the meeting in person at the above address, or access the meeting via videoconference, or telephone conference call.

Join the Zoom Meeting by clicking on the following link:
https://us06web.zoom.us/j/84174692322?pwd=6KYvTlaFhiv1e0CpLC5adrkePOml7E.1

Meeting ID:841 7469 2322 Password: 419105

To join the meeting by phone, dial 1 (346) 248-7799 and use the Meeting ID and password above.

Call to Order - Determine if a Quorum is Present:

Invocation & Pledge of Allegiance: Pledge of Allegiance to the Texas Flag - "Honor the Texas flag; I pledge allegiance to thee, Texas, one state, under God, one, and indivisible."

Community Announcements: Items of community interest may include recognizing Citizens and Staff for outstanding contributions to the community, a reminder about an upcoming event that is organized or sponsored by the governing body, and announcements of an imminent threat to public safety that has arisen after the posting of this agenda.

Announcements:

- Annual Peanut Festival, October 5th beginning at 9:00 a.m.
- National Night Out will be October 1st.
- Trunk or Treat and Movie in the Park, October 26th at the library at 5:30 p.m.
- Business Resource Fair, August 28th at the Aubrey Area Library Community Center from 4:30 to 6:30 p.m.

Presentations:

- Live United Proclamation
- Constitution Week Proclamation
- Development Services New Hire
- Police Department Promotion

Citizen Input: Any person may address the City Council. If your comments are concerning an agenda item, you may wait until the discussion on that item if you prefer. Once recognized by the Mayor, please step forward to the speaker's podium, state your name and address and speak directly into the microphone so that people in the room and those attending remotely can hear comments and see presentations. To request to speak via videoconference, click on "Participants" at the bottom of the screen, and click "Raise Hand." The Mayor will acknowledge your request and allow you to speak. Citizen comments are limited to three (3) minutes per individual unless additional time is otherwise required by law. No discussion or action may be taken at this meeting on any item not listed on the agenda, other than to make statements of factual information or recite existing policy in response to a citizen's inquiry.

Consent Items: Items placed on the Consent Agenda are considered routine in nature and non-controversial. The Consent Agenda can be acted upon in one motion. Items may be removed from the Consent Agenda by the request of Council, board members or staff. Consideration and action on the following:

1. Approve minutes of the July 25, 2024 Regular Meeting and July 31, 2024 Special Meeting and Workshop.

2. Approve Monthly Staff Reports

3. Approve Monthly Financial Report.

4. Approve the transfer of ownership of a 2017 Ford Explorer and a 2019 Chevrolet Tahoe from the City of Aubrey to the Town of Providence Village due to established vehicle replacement criteria and authorize the Police Department to execute title transfer documents on behalf of the City of Aubrey.

5. Authorize 2017 Ford Explorer and 2014 Chevrolet Tahoe to be disposed of by public auction and authorize the Police Department to execute necessary documents on behalf of the City of Aubrey.

6. Resolution 977-24 accepting a dedication of approximately 0.47 acre tract of real property situated in the F. Trevino Survey, abstract No 1243, City of Aubrey, Denton County, Texas for Municipal use, and authorizes the Mayor to execute necessary documents.

7. Approve a Professional Engineering Services Agreement with Birkhoff, Hendricks and Carter for a Stormwater Master Plan and Stormwater Utility District Rate Study, in the amount not to exceed $110,000, and authorize the City Manager to execute the agreement.

8. Approve a Professional Engineering Services Agreement with Birkhoff, Hendricks and Carter for the Dane Street Roadway Improvements and City Hall Parking Lot, in the amount not to exceed $129,800, and authorize the City Manager to execute the agreement.

9. Approval of Ordinance 864-24 amending Chapter 9, “Personnel”, Article 9.01 of the Code of Ordinances regarding the City’s participation in Texas Municipal Retirement Benefits by authorizing annually accruing Updated Service Credits and annually accruing cost of living adjustment; and providing an effective date.

10. Approve a Permanent Sanitary Sewer Easement Acquisition for the Aubrey Blackjack Sewer Improvement Project.

11. Approve a Permanent Sanitary Sewer Easement Acquisition for the KLLB AIV Sewer Improvement Project.

12. Approve a Permanent Sanitary Sewer Easement Acquisition for the Highpointe Corner Sewer Improvement Project.

13. Approving the City Manager to enter into a professional services agreement with Westwood Consulting for a Downtown Farmers Market concept plan in the amount of $24,500.

14. Approve a Professional Engineering Services Agreement Amendment with Mead & Hunt for the design of the Wastewater Treatment Plant Expansion in the amount of $64,027, and authorize the City Manager to execute necessary documents.

15. An Ordinance approving a settlement between the Atmos Cities Steering Committee (“ACSC”) and Atmos Energy Corp., Mid-Tex Division, regarding the company’s 2024 rate review mechanism filings, and adopting tariffs that reflect the rate adjustments.

16. Approve disposal of computers replaced during the capital replacement program.

17. Approve a Professional Engineering Services Agreement with Westwood Professional Services, Inc. for Trivedi Park, Phase I, in the amount not to exceed $99,900, and authorize the City Manager to execute the agreement.

18. Acceptance of the understanding of continuing services for City Auditor and authorizing the Mayor to execute said contract on behalf of the City.

Recess into Tax Increment Reinvestment Zone No. 1, City of Aubrey, Texas Board Meeting

Call to Order

1. Consider and make a recommendation to City Council regarding an Ordinance approving the proposed amendment to the approved Amended Project Plan and Financing Plan for Tax Increment Reinvestment Zone Number One, City of Aubrey, Texas (the “zone”) resulting in the decrease of the participation rate pursuant to Chapter 311, Texas Tax Code.

Reconvene into Regular Session

New Business: New items requested for consideration.

1. Hold a Public Hearing, Consider and take appropriate action regarding an Ordinance of the City Council of Aubrey, Texas, approving the proposed amendment to the approved Amended Project Plan and Financing Plan for Tax Increment Reinvestment Zone No. 1, City of Aubrey, Texas (the “zone”) resulting in the decrease of the participation rate pursuant to Chapter 311, Texas Tax Code.

2. Presentation from Rodney Dryden, from Hub International, regarding the city's health insurance plans, and consideration and action for making plan changes.

3. Hold a Public Hearing, Consider and take appropriate action regarding an Ordinance of the City Council of Aubrey, Texas, making appropriations for the support of the City, appropriating money to a sinking fund to pay interest and principal of the City's indebtedness; approving and adopting the annual Budget of the City of Aubrey, Texas for the 2024-2025 Fiscal Year; providing for the filing of the budget in the Office of the City Secretary; and providing an effective date.

4. Hold a Public Hearing, Consider and take appropriate action regarding an Ordinance of the City Council of the City of Aubrey, levying taxes and fixing and adopting the tax rate on all taxable property for the year 2024 at the rate of $0.464000 per one hundred dollars ($100.00) assessed value on all taxable property within the corporate limits of the City of Aubrey, Texas; the said tax rate having a maintenance and operations component and a debt service component; providing when taxes shall become due and when same shall become delinquent if not paid together with penalties and interest thereon; and providing an effective date.

5. Consideration and action on a Resolution ratifying the property tax revenue increase reflected in the Budget for Fiscal Year 2024-2025.

6. Conduct a Public Hearing regarding a request from Republic Services of Lewisville for a CPI rate increase for Residential Solid Waste and Recycling Collection Services and Containers and for Commercial Solid Waste Collection Services and Containers; discussion of same.
   -Presentation of rate increase request from Republic Service
   -Public Comment
   -Discussion by Council

7. Consider and take appropriate action regarding Ordnance No. 869-24 amending Ordinance No. 781-24 approving an Exclusive Agreement for Solid Waste and Recycling Services between the City and Republic Services of Lewisville (the "Franchise Agreement") to increase various Residential solid waste collection and recycling rates, including rates for containers, to increase various Commercial solid waste collection rates, including rates for containers; providing for a change in bulk waste pickup frequency; approving the amendment of the Franchise Agreement; providing an effective date of October 1, 2024 for the implementation of amendments; and authorizing the Mayor to execute necessary documents.

8. Consider and take appropriate action regarding Ordinance No. 870-24 amending Chapter 13, "Utilities", Article 13. 02, "Solid Waste and Recycling", Section 13.02.005, "Monthly Rates" of the Aubrey Code of Ordinances to amend various rates for solid waste and recycling collection services provided to residential and commercial customers; and providing an effective date of October 1, 2024.

9. Consideration and action on a Site Plan application for proposed Lot 1, Block A, Aubrey High School Addition, being approximately 63.613 acres out of the Francisco Trevino Survey, Abstract 1243 generally located south of FM 428 (Spring Hill Road) and east of U.S. Highway 377, City of Aubrey, Denton County, Texas. *(AISD)*

10. Consideration and action on a Final Plat application for Lot 1, Block A, Aubrey High School Addition, being approximately 63.613 acres out of the Francisco Trevino Survey, Abstract 1243 generally located south of FM 428 (Spring Hill Road) and east of U.S. Highway 377, City of Aubrey, Denton County, Texas. *(AISD)*

11. Consideration and action on a Preliminary Plat application for Lots 1-13, Block A, Highpointe Commercial, being approximately 27.243 acres out of the Francisco Trevino Survey, Abstract 1243 generally located north of FM 428 (Spring Hill Road) and east of U.S. Highway 377, City of Aubrey, Denton County, Texas. *(Highpointe Commercial, LLC)*

12. Conduct the first public hearing in accordance with Texas Local Government Code Section 43.063(a) and other applicable law, to consider testimony and provide members of the public an opportunity to be heard on the proposed annexation of a portion of FM 2931, beginning at the intersection of FM 2931 and Frontier Parkway,

continuing north to the intersection of FM 2931 and Spring Hill Road, and any additional adjacent right-of-way, Denton County, Texas.

13. Update and discussion on the Final Plan of Finance to fund project cost of FY 2024-2025 Utility Capital Improvement Projects.

14. Receive a report, hold a discussion, and take action on awarding a bid to Gracon Construction, Inc. for a 2.25 MGD Wastewater Treatment Plant Expansion in the amount not to exceed $39,957,140 and authorize the City Manager to execute necessary documents.

15. Receive a report, hold a discussion, and take action on a Professional Services Agreement with Plummer Associates for Construction Management and Resident Project Representative Services for the construction of the wastewater treatment plant, in the amount not to exceed $1,997,504 and authorize the City Manager to execute necessary documents.

16. Consideration and action on removing and/or appointing member(s) to the Aubrey Area Library Advisory Board.

17. Consideration and action on appointing member(s) to the Aubrey Parks and Recreation Board.

Department Updates and Discussion:

1. Library:
   - Program Update

2. Fire Department:
   - Station Update
   - New Medic

3. Police Department:
   - Council Chamber/Community Center Update
   - Assistant Chief Johnson

4. Public Works:
   - Rock Hill Well Update

5. Human Resources: None

6. Municipal Development:
   - Mural Update

Future Agenda Requests: Council or Board Members, City Staff, and Citizens may request items to be included on future agendas. Discussion is limited to what the request is for, and if and when the item can be put on a future agenda.

*****EXECUTIVE SESSION***** In accordance with Texas Government Code, Section 551.001, et seq., the City Council will recess into Executive Session (closed meeting) to discuss the following:

1. **Section 551.071(1) and (2) Consultation with Attorney.** For Council to seek the advice of its attorney about pending or contemplated litigation or a settlement offer and to consult with the City Attorney on a matter in which the duty of the attorney to the governmental body under the Texas Disciplinary Rules of Professional Conduct of the State Bar of Texas clearly conflicts with the Texas Open Meetings Act:
   - Municipal Development District Annual Budget
   - High Pointe Ranch Development
   - Blackjack Development Agreement
   - High Country Casitas Development
   - Knuckles Road Development
   - Highmeadow Development
   - Springhill Development
   - West Sherman Development
   - Project 38 / South Magnolia and Blackjack Road property acquisition
   - *City of Aubrey, Texas and Town of Providence Village, Texas v. Denton County Fresh Water Supply District 8-A, et al*, Cause No. 24-1985-431, Denton County, Texas

2. **Section 551.072 Real Property.** Deliberate the purchase, exchange, lease, or value of real property if deliberation in an open meeting would have a detrimental effect on the position of the governmental body in negotiations with a third person.
   - Property acquisition for municipal purposes

3. **Section 551.087 Economic Development Negotiations.** To discuss or deliberate regarding commercial or financial information that the City has received from a business prospect that the City seeks to have locate, stay, or expand in or near the territory of the City and with which the City is conducting economic development negotiations; and/or to deliberate the offer of a financial or other incentive to the business prospect:
   - High Country Casitas Development
   - Knuckles Road Development

4. **Section 551.071 (2) and 551.074 Personnel Matters.** Consultation with the City Attorney on a matter in which the duty of the attorney to the governmental body under the Texas Disciplinary Rules of Professional Conduct of the State Bar of Texas clearly conflicts with the Texas Open Meetings Act and Deliberation regarding the appointment, employment, evaluation, reassignment, duties, discipline or dismissal of public officer or employee or to hear a complaint or charge against an officer or employee:
   - City Manager

Motion to Recess into Executive Session.

Reconvene into Open Session: In accordance with Texas Government Code, Chapter 551, the City Council will reconvene into Regular Session to consider and take appropriate action, if any, regarding any items discussed in Executive Session.

1. Consider and take appropriate action regarding a Development Agreement between the City and Pretium Capital for the property generally located at 1382 E. Blackjack Road, within the City's ETJ; and authorizing the City Manager to execute necessary documents.

2. Consideration and action on a Resolution granting a petition requesting annexation into the extraterritorial jurisdiction and corporate limits of the City of Aubrey by Pretium Capital LLC, owner of approximately 20 acres of land, located at 1382 E Blackjack Road out of the Francisco Trevino Survey, Abstract No 1243, Denton County, Texas, setting a Public Hearing for the annexation; authorizing and directing the city secretary to have notices of such public hearing be provided as prescribed by law.

3. Consideration and action on the fiscal year 2024-2025 Aubrey Municipal Development District Budget.

-ADJOURN-

I, Jenny Hicks, City Secretary, certify that this Notice of Meeting was posted, per the Open Meetings Act, on the official bulletin board at the City Hall of the City of Aubrey, Texas and on the City's website at www.aubreytx.gov in accordance with Chapter 551, Texas Government Code, and shall remain posted until the meeting is adjourned.

I certify that the attached notice and agenda of items to be considered by the City Council of the City of Aubrey, Texas was removed by me from the official bulletin board of the City of Aubrey, Texas, 107 South Main St, Aubrey, Texas on the _____day of _____, 2024.

(The City Council reserves the right to adjourn into closed session at any time during the course of this meeting to consult with its attorney regarding any of the matters listed on this document, as authorized by Texas Government Code Section 551.071 Consultation with Attorney.)

This facility is wheelchair accessible and accessible parking spaces are available. Requests for accommodation or interpretive services must be made 48 hours prior to this meeting. Please contact the City Secretary's office at (940) 440-9343 for further information.

City Council Meeting Minutes

Aubrey City Hall
107 S. Main St
Aubrey, TX 76227
July 25, 2024
6:00 PM

The meeting was called to order at 06:00 p.m.

Present: Jeff Perry, Chuck Fikes, Randy Jones, Chris Rich, Erin Allen

Absent: Matt Jones

Staff Present: City Attorney Patricia Adams, City Manager Charles Kreidler, City Secretary Jenny Hicks, Finance Director Mike English, Fire Chief Eric Schlotter, Police Chief Richard Brooks, Director of Development Services and Public Works Leanne Wilson, Library Manager Brittany McLain, HR Director Shaena Williams, CIP & Permits Manager Shanda Guffee, Municipal Development Director Christine Gossett, Planner Helen-Eve Beadle (via videoconference)

Council Member Jeff Perry offered the Invocation and led the Pledge of Allegiance.

Community Announcements:

1. Mayor Rich announced the Annual Peanut Festival will be October 5th beginning at 9:00 a.m. at Veterans Memorial Park; National Night Out will be October 1st; Trunk or Treat and Movie in the Park will be October 26th at the library at 5:30 p.m.
2. Chief Schlotter announced the promotion of Chase McClurg and Rob Capule to Engineers and new firefighters Collin Cook, Sean O'Neil, Clayton Cooper and Cody Perkins were sworn in.
3. Christine Gossett announced the Business Resource Fair on August 28th in the Community Center.

Citizen Input: None

Consent Items:

1. Approve the Minutes of the June 27, 2024 and June 29, 2024 meetings.
2. Approve Monthly Staff Reports
3. Approve Monthly Financial Report.

4. Approve Quarterly Investment Report
5. Approve Electronics Decommission of Library Equipment
6. Approve a request for a twelve-month extension to the September 22, 2024, expiration date for the Preliminary Plat for the Saratoga Development.
7. Accept the resignation of Billy Trujillo from the Board of Adjustment.
8. Approve Ordinance #855-24 amending Chapter 12 "Traffic and Vehicles", Division 2 Golf Carts, Article 12.07.032 Equipment and License Plate.

   Approve an Interlocal Agreement between Denton County and the City of Aubrey Fire and Police Departments for the use of the Denton County Radio Communications System, authorizing the City Manager, Fire Chief and Chief of Police to execute the same on behalf of the City of Aubrey.
9. Awarding bid #2024-05 for a towing service provider to All American Towing and authorizing the City Manager to enter into a contract with All American Towing for towing services.
10. Consideration and Approval of the Authorized Personnel List
11. Resolution 970-24 accepting a donation of approximately 21.794 acre tract of real property situated in the Francisco Trevino Survey, abstract No 1243, City of Aubrey, Denton County, Texas for Municipal use.
12. Resolution 971-24 accepting a donation of approximately 1.334 acre tract of real property situated in the Frederick Pollard Survey, abstract No 995, City of Aubrey, Denton County, Texas for Municipal Right-of-Way use.
13. Acceptance of the 2023 CIP Project S1 - Pecan Creek Sewer Lift Station and authorize final payment to Acadia in the amount of $118,734.93; and authorize the City Manager to execute necessary documents.
14. Approve a professional services agreement with Raftelis Financial Consultants, Inc. for a Water and Wastewater Cost-of-Service Study for an amount not to exceed $37,540 and authorize the City Manager to execute necessary documents.
15. Approve a consulting agreement between the City of Aubrey and HUB International.
16. Consider and take action on approving a purchase in the amount of $127,703.74 from THI Water Well for emergency repairs to the Rockhill Water Well.

    Council Member Jeff Perry made a motion to approve the consent agenda items not including item number 8. Council Member Chuck Fikes seconded. Motion carried unanimously.

    Council Member Jeff Perry made a motion to approve item number 8 with the amendment to the Article number being 12.07.005. Council Member Randy Jones seconded. Motion carried unanimously.

New Business: New items requested for consideration.

1. Presentation, hold discussion and provide direction regarding future consideration of a Cost of Living Adjustment (COLA) and updated service credit to the City TMRS plan.

   Anthony Mills with TMRS presented information.

2. Consideration and action on an Ordinance regarding the 2024-2025 annual service plan update to the Service and Assessment Plan for the Winn Ridge South Public

Improvement District and providing an effective date.

Abdi Yassin, with Municap, provided information.

Council Member Erin Allen made a motion to approve the Ordinance regarding the 2024-2025 annual service plan update to the Service and Assessment Plan for the Winn Ridge South Public Improvement District. Council Member Chuck Fikes seconded. Motion Passed (4:0). None opposed. (Ordinance 856-24)

3. Consideration and action on an Ordinance regarding the 2024-2025 annual service plan update to the Service and Assessment Plan for the Jackson Ridge Public Improvement District and providing an effective date.

Abdi Yassin, with Municap, provided information.

Council Member Randy Jones made a motion to approve the Ordinance regarding the 2024-2025 annual service plan update to the Service and Assessment Plan for the Jackson Ridge Public Improvement District . Council Member Chuck Fikes seconded. Motion Passed (3:1). Council Member Erin Allen opposed. (Ordinance 857-24)

4. Consideration and action on an Ordinance regarding the 2024-2025 annual service plan update to the Service and Assessment Plan for the Aubrey Public Improvement District No 1 (Keeneland) and providing an effective date.

Abdi Yassin, with Municap, provided information.

Council Member Erin Allen made a motion to approve an Ordinance regarding the 2024-2025 annual service plan update to the Service and Assessment Plan for the Aubrey Public Improvement District No 1 (Keeneland). Council Member Jeff Perry seconded. Motion Passed (4:0). None opposed. (Ordinance 858-24)

5. Receive a presentation, consider and act on an Initial Plan of Finance to fund projected cost of FY 2024-2025 Utility Capital Improvement Projects and direct staff to finalize cost and timing after August 1, 2024 bid opening.

Jim Sabonis, with Hilltop Securities, provided information.

No action taken.

6. Consideration and action on a Resolution authorizing the publication of Notice of Intent to issue Certificates of Obligation, Series 2024 for purchase and installation of water and sewer system upgrades and construction of a wastewater treatment plant.

Council Member Erin Allen made a motion to approve a Resolution authorizing the publication of Notice of Intent to issue Certificates of Obligation, Series 2024 for purchase and installation of water and sewer system upgrades and construction of a wastewater treatment plant. Council Member Chuck Fikes seconded. Motion Passed (4:0). None opposed. (Resolution 975-24)

7. Consideration and action on a Final Plat for Aubrey Heights containing 142 residential lots and seven (7) open space lots in 39.51 acres of land out of the J. Fisher Survey, Abstract No. 432, City of Aubrey, Denton County, Texas (*Roger & Lisa Prier)*

City Planner Helen-Eve Beadle provided information.

Council Member Erin Allen made a motion to Approve with the 9 conditions listed and authorizing the City Manager to execute the Rough Proportionality Agreement. Council Member Randy Jones seconded. Motion Passed (3:1). Council Member Jeff Perry opposed.

Conditions:

1. **The Final Plat shall be revised per the City Engineer and City Planner reviews;**
2. **Final Plat approval for the development is subject to the Rough Proportionality share of offsite water and sewer improvements to fund upgrades to the systems. An executed Development Agreement for payment of the Development Fees shall be required as a condition of Final Plat approval. The DA shall be executed prior to the Final Plat being filed;**
3. **Provide visibility easements (25'X25') at all ROW intersections;**
4. **HOA documents shall be approved by the City Attorney and filed in conjunction with the Final Plat. HOA Documents have been submitted and in review;**
5. **Civil plans shall include current Standard Details for City of Aubrey;**
6. **All engineering plans shall be revised per the City Engineer's review and approval. Subsequent resubmission may generate new comments and the plans are subject to additional review comments;**
7. **No lot-to-lot drainage is permitted and civil engineering plans shall be revised to meet the Subdivision Ordinance;**
8. **The landscape and screening plans shall be revised per the City Planner's review to illustrate ROW labels and lot/HOA lot identification for lots adjacent to Blackjack Road and FM 423/Sherman Drive on the Landscape Plans. Verify plans match civil plans and Final Plat;**
9. **Bar scale and text call out scale on Landscape Plans appear to be incorrect. Revise accordingly.**

8. Consider and act on an Ordinance annexing the hereinafter described territory known as the portion of FM 1385, beginning at the city limits just south of the intersection of FM 1385 and Winn Ridge Blvd, continuing north to the intersection of FM 1385 and FM 428, and to include any additional adjacent right-of-way, Denton County, Texas; extending the boundary limits of the City so as to include the described property.

City Planner Helen-Eve Beadle provided information.

Council Member Randy Jones made a motion to approve an Ordinance annexing the hereinafter described territory known as the portion of FM 1385, beginning at the city limits just south of the intersection of FM 1385 and Winn Ridge Blvd, continuing north to the intersection of FM 1385 and FM 428, and to

include any additional adjacent right-of-way, Denton County, Texas; extending the boundary limits of the City so as to include the described property. Council Member Jeff Perry seconded. Motion Passed (4:0). None opposed. (Ordinance 859-24)

9. Consider and act on an Ordinance annexing the hereinafter described territory known as the portion of FM 428, beginning at the intersection of FM 1385 and FM 428, continuing west to the intersection of FM 428 and FM 2931, and to include any additional adjacent right-of-way, Denton County, Texas; extending the boundary limits of the City so as to include the described property

   City Planner Helen-Eve Beadle provided information.

   Council Member Randy Jones made a motion to approve an Ordinance annexing the hereinafter described territory known as the portion of FM 428, beginning at the intersection of FM 1385 and FM 428, continuing west to the intersection of FM 428 and FM 2931, and to include any additional adjacent right-of-way, Denton County, Texas; extending the boundary limits of the City so as to include the described property. Council Member Jeff Perry seconded. Motion Passed (4:0). None opposed. (Ordinance 860-24)

10. Conduct a public hearing in accordance with Texas Local Government Code Section 43.063(a) and other applicable law, to consider testimony and provide members of the public an opportunity to be heard on the proposed annexation of Denton CAD ID 52165, being approximately 159.941 acres of land, generally located south of FM 428, west of FM 1385 and east of Coffey Road out of the F.H. Pollard Survey, Abstract No. 995, Tract 34, Denton County, Texas.(Duck Point)

    The Public Hearing opened at 7:36 p.m. and closed at 7:37 p.m.

    City Planner Helen-Eve Beadle provided information.

11. Consideration and action on an Ordinance annexing of Denton CAD ID 52165, being approximately 159.941 acres of land, generally located south of FM 428, west of FM 1385 and east of Coffey Road out of the F.H. Pollard Survey, Abstract No. 995, Tract 34, Denton County, Texas, and any associated right-of-way; adopting a municipal services agreement; and providing an effective date. (Duck Point)

    Council Member Randy Jones made a motion to approve an Ordinance annexing Denton CAD ID 52165, being approximately 159.941 acres of land, generally located south of FM 428, west of FM 1385 and east of Coffey Road out of the F.H. Pollard Survey, Abstract No. 995, Tract 34, Denton County, Texas, and any associated right-of-way; adopting a municipal services agreement; and providing an effective date. Council Member Jeff Perry seconded. Motion Passed (4:0). None opposed. (Ordinance 861-24)

12. Conduct a public hearing, consider and act on an Ordinance changing the zoning from unzoned land previously located in the City of Aubrey Extraterritorial Jurisdiction to Planned Development District (PD) with a base zoning district of SF75 – Single Family Residential 7,500 Square Feet on approximately 159.941 acres of land located in the Frederick H. Pollard Survey, Abstract No. 995, Denton County, Texas.

The property is generally located west of FM 1385 and south of FM 428. DCAD Parcel ID 52165 (MM AUBREY 160 LLC, Duck Point)

The Public Hearing opened at 7:38 p.m. and closed at 7:41 p.m.

City Planner Helen-Eve Beadle provided information.

Council Member Erin Allen made a motion to approve an Ordinance changing the zoning from unzoned land previously located in the City of Aubrey Extraterritorial Jurisdiction to Planned Development District (PD) with a base zoning district of SF75 – Single Family Residential 7,500 Square Feet on approximately 159.941 acres of land located in the Frederick H. Pollard Survey, Abstract No. 995, Denton County, Texas. The property is generally located west of FM 1385 and south of FM 428. DCAD Parcel ID 52165. Council Member Jeff Perry seconded. Motion Passed (4:0). None opposed. (Ordinance 862-24)

13. Conduct a public hearing in accordance with Texas Local Government Code Section 43.063(a) and other applicable law, to consider testimony and provide members of the public an opportunity to be heard on the proposed annexation of a portion of Denton CAD ID 986865, being an approximate 1.33 acre tract of land situated in the F.H. Pollard Survey, Abstract No. 995, generally located west of FM 1385, south of FM 428, and east of Coffey Road. (Pickens ROW)

    The Public Hearing opened at 7:42 p.m. and closed at 7:42 p.m.

    City Planner Helen-Eve Beadle provided information.

14. Consideration and action on an Ordinance annexing a portion of Denton CAD ID 986865, being an approximate 1.33 acre tract of land situated in the F.H. Pollard Survey, Abstract No. 995, generally located west of FM 1385, south of FM 428, and east of Coffey Road, and any associated right-of-way; adopting a municipal services agreement; and providing an effective date. (Pickens ROW)

    City Planner Helen-Eve Beadle provided information.

    Council Member Erin Allen made a motion to approve an Ordinance annexing a portion of Denton CAD ID986865, being an approximate 1.33 acre tract of land situated in the F.H. Pollard Survey, Abstract No. 995, generally located west of FM 1385, south of FM 428, and east of Coffey Road, and any associated right-of-way; adopting a municipal services agreement; and providing an effective date. Council Member Randy Jones seconded. Motion Passed (4:0). None opposed. (Ordinance 863-24)

15. Consideration and action on a Resolution granting a petition requesting annexation into the extraterritorial jurisdiction and corporate limits of the City of Aubrey by Jen Holdco 24 LLC, owners of approximately 47.3 acres of land, located at 4721 and 4799 FM 2931 out of the J. Bridges Survey, Abstract No 36, Denton County, Texas, setting a Public Hearing for the annexation; authorizing staff to negotiate and enter into a written services agreement with Owner. (Palomino Development)

    City Planner Helen-Eve Beadle provided information.

Council Member Jeff Perry made a motion to approve a Resolution granting a petition requesting annexation into the extraterritorial jurisdiction and corporate limits of the City of Aubrey by Jen Holdco 24 LLC, owners of approximately 47.3 acres of land, located at 4721 and 4799 FM 2931 out of the J. Bridges Survey, Abstract No 36, Denton County, Texas, setting a Public Hearing on August 22, 2024 at 6:00 p.m. at City Hall for the annexation; authorizing staff to negotiate and enter into a written services agreement with Owner. Council Member Randy Jones seconded. Motion Passed (4:0). None opposed. (Resolution 972-24)

16. Consideration and action on a Resolution setting dates, time, and place for public hearings on the proposed annexation of property identified as being the portion of FM 2931, beginning at the intersection of FM 2931 and Frontier Parkway, continuing north to the intersection of FM 2931 and Spring Hill Road, and any additional adjacent right-of-way, Denton County, Texas, by the City of Aubrey, Texas; authorizing and directing the City Secretary to publish and mail such public hearings; and authorizing and directing city staff to prepare a service plan for said property.

    City Planner Helen-Eve Beadle provided information.

    Council Member Erin Allen made a motion to approve a Resolution setting public hearings for August 22, 2024 and August 28, 2024 at 6:00 p.m. at City Hall on the proposed annexation of property identified as being the portion of FM 2931, beginning at the intersection of FM 2931 and Frontier Parkway, continuing north to the intersection of FM 2931 and Spring Hill Road, and any additional adjacent right-of-way, Denton County, Texas, by the City of Aubrey, Texas; authorizing and directing the City Secretary to publish and mail such public hearings; and authorizing and directing city staff to prepare a service plan for said property. Council Member Jeff Perry seconded. Motion Passed (4:0). None opposed. (Resolution 973-24)

17. Consideration and action on an Ordinance amending the Fiscal Year 2024 Budget.

    Finance Director Mike English presented information.

    Council Member Jeff Perry made a motion to approve Ordinance amending the Fiscal Year 2024 Budget. Council Member Randy Jones seconded. Motion Passed (4:0). None opposed. (Ordinance 863-24)

18. Discussion regarding the draft Fiscal Year 2024-2025 budget.

    Finance Director Mike English presented information.

19. Consideration and action on future meeting dates.

    City Manager Charles Kreidler held discussion and received direction to hold meetings on the following dates: July 31 (Special Meeting), August 22 (Regular Meeting), August 28 (Special Meeting), September 26 (Regular Meeting), October 23 (Regular Meeting), November 20 (Regular Meeting), December 18 (Regular Meeting)

20. Receive a report, and take action on awarding a bid to Pace Construction, LLC for Main Street Beautification Project F2024(957), Phase I, in an amount not to exceed $573,000, and authorizing the City Manager to execute the necessary contract documents.

    Director of Public Works and Development Services Leanne Wilson provided information.

    Council Member Erin Allen made a motion to award a bid to Pace Construction, LLC for Main Street Beautification Project F2024(957), Phase I, in an amount not to exceed $573,000, and authorizing the City Manager to execute the necessary contract documents. Council Member Jeff Perry seconded. Motion Passed (4:0). None opposed.

Department Updates and Discussion:

1. Administration & Finance: Community Center/Council Chamber update, Board Portal Information

2. Library: None

3. Fire Department: Station Update; Notification will be made to residents 0n Aslyn Circle regarding early morning work

4. Police Department: None

5. Public Works: Rock Hill well is not in operation; Faulkner well is in operation; Notification will be made to residents near Leslie Park regarding early morning work

6. Human Resources: None

7. Municipal Development: Mural Update; Business Resource Fair; Farmers Market

Future Agenda Requests: Council Member Perry requested information on Farmers Market

*****EXECUTIVE SESSION***** In accordance with Texas Government Code, Section 551.001, et seq., the City Council will recess into Executive Session (closed meeting) to discuss the following:

1. **Section 551.071(1) and (2) Consultation with Attorney.** For Council to seek the advice of its attorney about pending or contemplated litigation or a settlement offer and to consult with the City Attorney on a matter in which the duty of the attorney to the governmental body under the Texas Disciplinary Rules of Professional Conduct of the State Bar of Texas clearly conflicts with the Texas Open Meetings Act:
   - High Pointe Ranch Development
   - Project 38 / South Magnolia and Blackjack Road property acquisition
   - *City of Aubrey, Texas and Town of Providence Village, Texas v. Denton County Fresh Water Supply District 8-A, et al*, Cause No. 24-1985-431, Denton County, Texas

- Highmeadow Development

2. **Section 551.072 Real Property.** Deliberate the purchase, exchange, lease, or value of real property if deliberation in an open meeting would have a detrimental effect on the position of the governmental body in negotiations with a third person.
   - Project 38 / South Magnolia and Blackjack Road property acquisition

3. **Section 551.071 (2) and 551.074 Personnel Matters.** Consultation with the City Attorney on a matter in which the duty of the attorney to the governmental body under the Texas Disciplinary Rules of Professional Conduct of the State Bar of Texas clearly conflicts with the Texas Open Meetings Act and Deliberation regarding the appointment, employment, evaluation, reassignment, duties, discipline or dismissal of public officer or employee or to hear a complaint or charge against an officer or employee:
   - City Manager (Organizational Structure)

Council Member Jeff Perry made a motion to recess into Executive Session at 8:12 p.m. Council Member Randy Jones seconded. Motion Passed (4:0). None opposed.

Reconvene into Open Session at 10:39 p.m.: In accordance with Texas Government Code, Chapter 551, the City Council will reconvene into Regular Session to consider and take appropriate action, if any, regarding any items discussed in Executive Session.

1. Consider and Act on a Resolution of the City Council of the City of Aubrey, Texas finding that a public necessity exists and authorizing condemnation to acquire a 29.688 acre fee simple tract and a 0.265 acre water utility easement for public purposes for a public project, including but not limited to, municipal athletic fields, a waterline pump station, water and wastewater transmission lines, public roadways, drainage, such appurtenant facilities as may be necessary, and other public uses, on real property generally described as being located at 418 South Magnolia Street, Aubrey, Denton County, Texas, in the Francisco Trevino Survey, Abstract No. 1243, Property ID #51948, such property is generally located on the southwest corner of US 377 and Blackjack Road, and being more particularly described herein; providing notice of an official determination to acquire real property for a fee simple and a water utility easement, such appurtenant facilities as may be necessary, and other public uses; authorizing the City Manager or designee to obtain the necessary appraisal reports and make bona fide offers of just compensation for the fee simple and easement; ratifying prior documents made for acquisition of the fee simple and easement; authorizing legal counsel to institute eminent domain proceedings on behalf of the City for the acquisition of the fee simple and easement on said tract if negotiations are unsuccessful; appropriating funds from a lawful source; providing a cumulative repealer clause; providing a severability clause and providing for an effective date.

   Council Member Jeff Perry made a motion that the City Council of the City of Aubrey adopt Resolution 974-24 and authorize the use of the power of eminent domain to acquire a 29.688 acre fee simple tract and a 0.265 acre water utility easement on real property generally described as being located at 418 South Magnolia Street, Aubrey, Denton County, Texas, in the Francisco Trevino Survey, Abstract No. 1243, Property ID #51948, such property generally located

on the southwest corner of US 377 and Blackjack Road (as more fully described and depicted in Exhibits "A" and "B" of the proposed resolution for this item) for public purposes for a public project, including but not limited to municipal athletic fields, a waterline pump station, water and wastewater transmission lines, public roadways, drainage, such appurtenant facilities as may be necessary, and other public uses, with this first record vote applying to all units of property to be condemned. Council Member Chuck Fikes seconded.

The results of the Roll Call Vote on Resolution No. 974-24 were:
Mayor Pro Tem Jeff Perry - For
Deputy Mayor Pro Tem Chuck Fikes - For
Council Member Erin Allen - For
Council Member Matt Jones - Absent
Council Member Randy Jones - For
Motion to approve Resolution No. 974-24 passed 4 to 0.

2. Consider and take appropriate action regarding an Assignment Acknowledgment Agreement for the High Pointe Ranch development.

   Council Member Erin Allen made a motion to approve an Assignment Acknowledgment Agreement for the High Pointe Ranch development. Council Member Chuck Fikes seconded. Motion Passed (4:0). None opposed.

3. Consider and take appropriate action regarding a Cost Participation Letter Agreement between the City, Lennar Homes of Texas Land and Construction, Ltd., and Aubrey Blackjack Partners, LLC related to the High Pointe development agreement to allocate costs for infrastructure improvements; and authorizing the Mayor or designee to execute necessary documents.

   Council Member Erin Allen made a motion to approve a Cost Participation Letter Agreement between the City, Lennar Homes of Texas Land and Construction, Ltd., and Aubrey Blackjack Partners, LLC related to the High Pointe development agreement to allocate costs for infrastructure improvements; and authorizing the Mayor or designee to execute necessary documents. Council Member Jeff Perry seconded. Motion Passed (4:0). None opposed.

The meeting was adjourned at 10:45 p.m.

PASSED and APPROVED by the City Council of the City of Aubrey, Texas this 22nd day of August, 2024.

Chris Rich, Mayor

ATTEST:

Jenny Hicks, City Secretary

City Council Meeting Minutes

Aubrey City Hall
107 S. Main St
Aubrey, TX
76227
July 31, 2024
6:00 PM

The meeting was called to order at 06:00 PM.

Present: Jeff Perry, Matt Jones, Erin Allen, Chris Rich, Randy Jones, Chuck Fikes

Staff Present: City Manager Charles Kreidler, City Secretary Jenny Hicks, Finance Director Mike English, Fire Chief Eric Schlotter, Assistant Police Chief Jeremy Johnson, HR Director Shaena Williams, Municipal Development Director Christine Gossett

Council Member Jeff Perry offered the Invocation and led the Pledge of Allegiance.

Community Announcements: None

Citizen Input: None

New Business: New items requested for consideration.

1. Discussion regarding the Fiscal Year 2024-2025 Proposed Budget and action to set a public hearing date and vote on the proposed budget. **The final budget will be approved after the public hearing on August 22, 2024.**

   Council Member Erin Allen made a motion to set a public hearing date and vote on the proposed Fiscal Year 2024-2025 Budget for August 22, 2024 at 6:00 p.m. at City Hall. Council Member Jeff Perry seconded. Motion Passed (5:0). None opposed.

2. Discussion regarding the proposed 2024 Tax Rate and action on a Resolution to set a public hearing date for August 22, 2024 and scheduling a vote on the tax rate for August 22, 2024. **An action taken on this item at this meeting will not adopt a tax rate.**

   Council Member Jeff Perry made a motion to propose the 2024 Tax Rate as $0.464 and set a public hearing date and vote on the proposed tax rate for August 22, 2024 at 6:00 p.m. at City Hall. Council Member Chuck Fikes

seconded. Motion Passed (5:0). None opposed.

3. Consideration and action directing the City Manager to make adjustments to the Fiscal Year 2025 budget for salary and position changes as proposed.

   Council Member Randy Jones made a motion to direct the City Manager to incorporate the organizational changes along with the associated costs into the Fiscal Year 2025 budget. Council Member Jeff Perry seconded. Motion Passed (4:1). Council Member Erin Allen opposed.

Workshop Items:

1. Discuss City finances, tax rate, budget, initiatives, operations, projects, and strategic plans not limited to, but including:

   a. Direction regarding tax rate
   b. Employee compensation and benefits
   c. FY 24-25 projects
   d. City departments and services - revenues and expenditures
   e. Water and Wastewater rates
   f. Capital Improvement Plan

- **Fire Chief Eric Schlotter spoke regarding budget savings and advised using $30,000 of the $90,000 saved for renovations to the north side of Fire Station No. 1.**
- **Finance Director Mike English provided information regarding a few changes to the original proposed budget, provided information on the tax rate calculations**
- **Human Resources Director Shaena Williams provided information on TMRS Updated Service Credit and Cost of Living Adjustments options.**

The meeting was adjourned at 7:40 p.m.

PASSED and APPROVED by the City Council of the City of Aubrey, Texas this 22nd day of August, 2024.

_____

Chris Rich, Mayor

ATTEST:

_____

Jenny Hicks, City Secretary

City of Aubrey
Departmental Report
Library

To: City Council Members

From: Brittany McLain, Library Manager

RE: Departmental Report - July 2024

Monthly Report	July 2024		Fiscal Year to date
People & Activity	New Cards Issued	137	1067
	Number of Patrons	3939	23836
	Patrons per Hour (Average)	23	18
	Volunteer Hours / Persons	87/15	441/15
	Number of Days Open	21	201
	Number of Hours Open	171	1650
Material Usage	Total Items checked out	12796	95564
	Items per Hour (Average)	75	578
	Adult Material Checked Out	1569	11730
	Juvenile Material Checked Out	9602	68791
	Self-Checkout Use	0	979
	Digital Materials Checked Out	1625	15043
	Interlibrary shipped	196	1824
	Interlibrary received	208	1850
	Reference	454	3169
	Computer Sessions	206	1752
	Computer Usage (hours)	145	1427
Programs	Community Center Event Hrs	0	51
	Total Number of Programs	41	347
	Total Program Attendance	1185	6941

*Total Programs include Summer Reading, Regular Programming, and Passive Programs/Take & Makes.

Total Summer Reading: 715 July Passive Programs: 344

City of Aubrey - Police Department

July 2024 Statistical Report

Calls for Police Service		% + / -
July 2024	807	11%
July 2023	725	
YTD - 2024	4,901	-5%
YTD - 2023	5,158	

Calls for Service - Dispatched		% + / -
July 2024	622	16%
July 2023	538	
YTD - 2024	3,767	3%
YTD - 2023	3,652	

Calls for Service - Officer Initiated		% + / -
July 2024	185	-1%
July 2023	187	
YTD - 2024	1,134	-25%
YTD - 2023	1,506	

Calls for Service By Area

Aubrey		% + / -
July 2024	216	-13%
July 2023	249	
YTD - 2024	1,279	-30%
YTD - 2023	1,834	

Providence Village		% + / -
July 2024	320	24%
July 2023	259	
YTD - 2024	1,813	-2%
YTD - 2023	1,848	

Sandbrock		% + / -
July 2024	55	77%
July 2023	31	
YTD - 2024	349	38%
YTD - 2023	253	

Silverado		% + / -
July 2024	110	-7%
July 2023	118	
YTD - 2024	677	-4%
YTD - 2023	702	

Winn Ridge		% + / -
July 2024	76	31%
July 2023	58	
YTD - 2024	554	16%
YTD - 2023	476	

Outside ETJ		% + / -
July 2024	13	30%
July 2023	10	
YTD - 2024	144	220%
YTD - 2023	45	

Criminal Offenses/Arrests

Criminal Offenses		% + / -
July 2024	72	36%
July 2023	53	
YTD - 2024	426	-4%
YTD - 2023	446	

Arrests		% + / -
July 2024	38	73%
July 2023	22	
YTD - 2024	307	48%
YTD - 2023	207	

Motor Vehicle Crashes - Aubrey

Non-Injury Crashes		% + / -
July 2024	5	25%
July 2023	4	
YTD - 2024	41	41%
YTD - 2023	29	

Injury Crashes		% + / -
July 2024	1	-67%
July 2023	3	
YTD - 2024	13	-38%
YTD - 2023	21	

Motor Vehicle Crashes - Providence Village

Non-Injury Crashes		% + / -
July 2024	2	100%
July 2023	1	
YTD - 2024	31	29%
YTD - 2023	24	

Injury Crashes		% + / -
July 2024	0	100%
July 2023	3	
YTD - 2024	11	10%
YTD - 2023	10	

Traffic Stops and Citations

Traffic Stops		% + / -
July 2024	1,232	81%
July 2023	679	
YTD - 2024	7,311	63%
YTD - 2023	4,484	

Warnings		% + / -
July 2024	1096	89%
July 2023	579	
YTD - 2024	6,780	92%
YTD - 2023	3,533	

Total Citations		% + / -
July 2024	566	60%
July 2023	354	
YTD - 2024	3,397	51%
YTD - 2023	2,244	

Citations - Aubrey		% + / -
July 2024	366	147%
July 2023	148	
YTD - 2024	1,714	83%
YTD - 2023	937	

Citations - Providence Village		% + / -
July 2024	131	-24%
July 2023	172	
YTD - 2024	1,010	6%
YTD - 2023	952	

Citations - JP 5		% + / -
July 2024	69	103%
July 2023	34	
YTD - 2024	673	91%
YTD - 2023	352	

Top 10 Calls			
Type of Call	Providence Village	Aubrey	Total
Suspicious Activity	48	52	100
Alarm	12	59	71
Fireworks Complaint	16	38	54
Disturbance	18	25	43
Welfare Concern	11	31	42
Traffic Crash	11	19	30
Animal Complaint	10	16	26
Noise Complaint	5	19	24
Open Door	9	10	19
Motorist Assist	3	15	18

427

Neighborhood Safety Initiative		% + / -
July 2024	9,167	46%
July 2023	6,281	
YTD - 2024	55,578	59%
YTD - 2023	35,016	

Providence Village Data

Close Patrols - Providence Village		%+/-
July 2024	3,016	32%
July 2023	2,291	
YTD - 2024	19,418	43%
YTD - 2023	13,537	

Walk Through - Providence Village		%+/-
July 2024	94	-36%
July 2023	147	
YTD - 2024	655	-12%
YTD - 2023	744	

Total - Providence Village		%+/-
July 2024	3,110	28%
July 2023	2,438	
YTD - 2024	20,073	41%
YTD - 2023	14,281	

Department Data

Percentage - Crime/Order Maintenance/Service Calls		
Top 10 Calls Total		427
Crime	22	5%
Service Calls	384	90%
Order Maintenance	21	5%
Reported Crime	72	9%

Authorized Strength		%+/-
Sworn - Authorized	32	91%
Sworn - Current	29	
Civilian Authorized	2	100%
Civilian - Current	2	

Criminal Investigations Statistical Data

CID Case Assignment		%+/-
July 2024	72	112%
July 2023	34	
YTD - 2024	426	55%
YTD - 2023	275	

Patrol Case Assignment		%+/-
July 2024	36	-22%
July 2023	46	
YTD - 2024	254	14%
YTD - 2023	223	

CID Arrests		%+/-
July 2024	2	100%
July 2023	1	
YTD - 2024	52	189%
YTD - 2023	18	

Case Status - Cleared by Arrest		%+/-
July 2024	38	-17%
July 2023	46	
YTD - 2024	306	31%
YTD - 2023	234	

Case Status - Suspended		%+/-
July 2024	23	53%
July 2023	15	
YTD - 2024	165	85%
YTD - 2023	89	

Case Status - Cleared by Exception		%+/-
July 2024	2	50%
July 2023	0	
YTD - 2024	18	157%
YTD - 2023	7	

Case Status - Unfounded		%+/-
July 2024	5	0%
July 2023	5	
YTD - 2024	33	136%
YTD - 2023	14	

Cases - Open		%+/-
Yearly Total	292	

City of Aubrey - Development Services

July 2024 Activity Report

No. Permits Issued

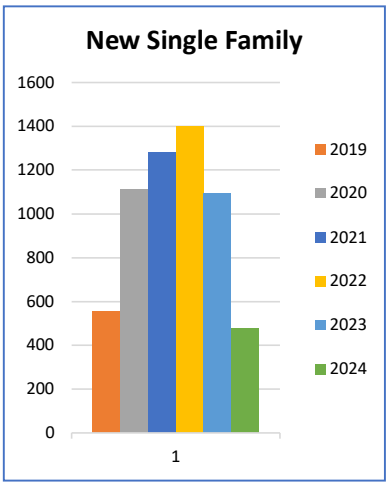
New Single Family	222
Residential Misc	46
Commercial	13
Variance or Zoning Change	3
Total	**284**

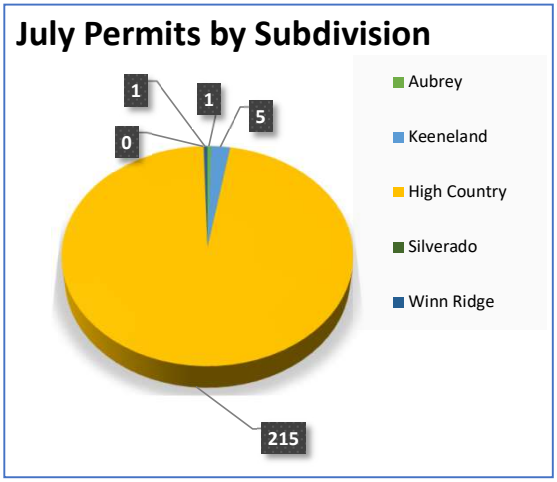
Fees Collected

New Single Family	$ 748,192.95
Residential Misc	$ 8,311.62
Commercial	$ 155,120.22
Variance or Zoning	$ 4,071.41
Total	**$ 915,696.20**

Annual New Single Family

2019	556
2020	1,113
2021	1,279
2022	1,400
2023	1,095
2024 YTD	477
2019 - 2024 Total:	**5,920**





Total House Count

8019

Location	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24
Winn Ridge	**1563**	**1602**	**1632**	**1651**	**1667**	**1688**
Silverado	**2684**	**2746**	**2870**	**2935**	**2997**	**3080**
Aspen Meadows	**302**	**306**	**308**	**309**	**307**	**311**
Sandbrock	**1354**	**1376**	**1415**	**1435**	**1470**	**1493**

Project Status

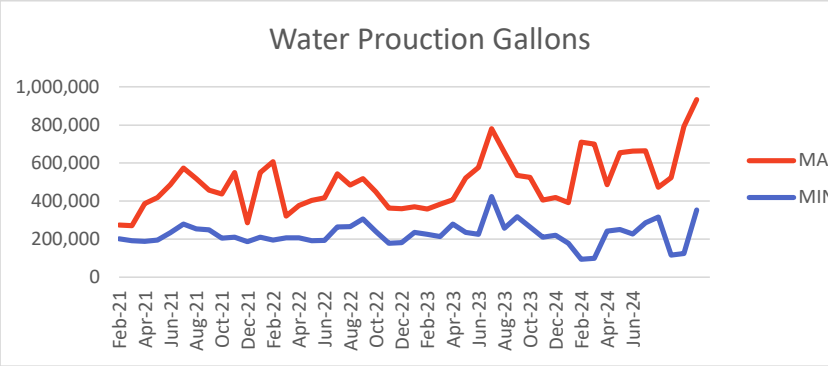
Saratoga Preliminary Plat	Motion to approve a 12 month extension for the Saratoga Preliminary Plat, new expiration 09-22-2025.
Aubrey Heights Final Plat	Motion to approve the Final Plat for Aubrey Heights with conditions.
Pickens ROW Annexation	Motion to approve ORD-863-24 annexing a portion of parcel 986865.
Palomino	Motion to approve resoltion grating a petition requesting annexation into the ETJ and corporate limits.
FM 1385 Annexation	Motion to approve ORD-859-24 annexing a portion of FM 1385; beginning at the city limits just south of the intersection of FM 1385 and Winn Ridge Blvd, continuing north to the intersection of FM 1385 and FM 428.
FM 428 Annexation	Motion to approve ORD-860-24 annexing a portion of FM 428; beginning at the intersection of FM 1385 and FM 428, continuing west to the intersection of FM 428 and FM 2931.
Duck Point Annexation & Zoning	Motion to approve ORD-861-24 annexing parcel 52165 and ORD 862-24 changing the zoning from unzoned to a PD with a base zoning of SF75.

City of Aubrey - Public Works

July 2024 Activity Report

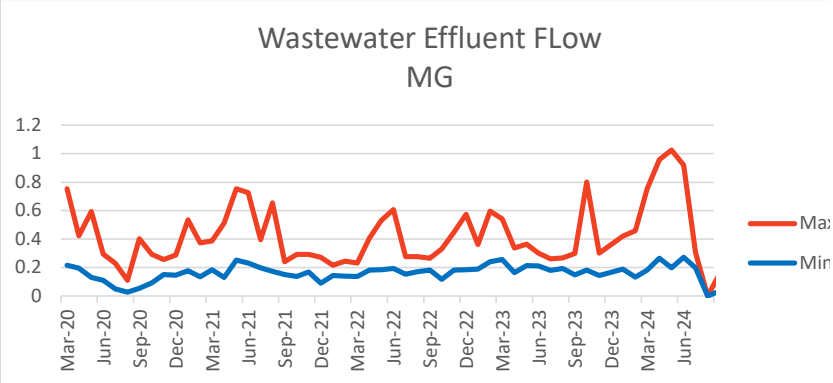
Water Production MG

Jul-24	18,548,800
Jun-24	12,330,700
May-24	11,561,800
Daily Average Gal	471,570



Wastewater Treatment MG

Jul-24	7,301,000
Jun-24	12,805,000
May-24	13,813,000
Daily Average Gal	376,878



Work Orders

Water & Sewer Maintenance	68
Cut-offs Non Payment	15
Street Repairs & Signs	22
Line Locates	66
Billing and Meters	119
Total	222

Fees Collected

	July
Water Impact	$29,100.00
Sewer Impact	$21,172.00
Roadway Impact	$121,208.00
Parks Fee	$27,000.00
Total	$198,480.00

Projects

Public Works Building	Working on landscape and sign
Rockhill Well	Working on production issue
High Pointe Phase 1A	Started paving process
High Pointe Phase 1B	Utilites being installed

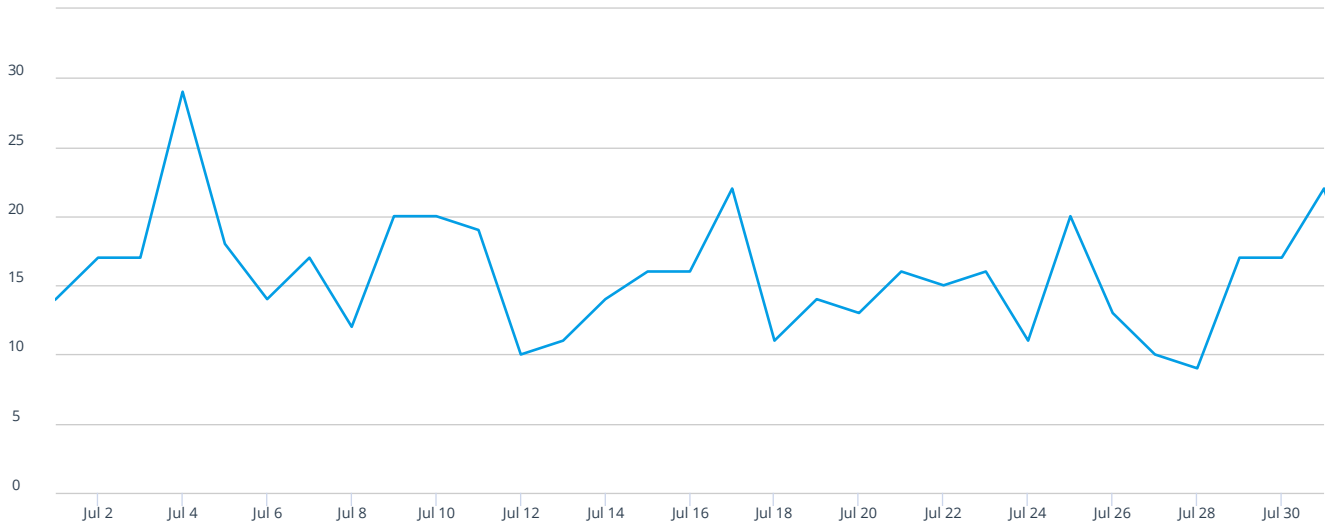
Previous Month Jul 1, 2024 - Jul 31, 2024

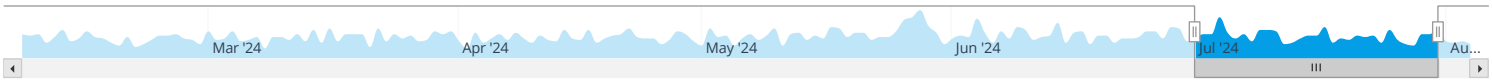
35%
FIRE
Percentage of Total Incidents

65%
EMS
Percentage of Total Incidents

490
INCIDENTS
In Selected Time Slice

31
DAYS
In Selected Time Slice





Counts | % Rows | % Columns | % All

Week Ending	7/7/24	7/14/24	7/21/24	7/28/24	8/4/24	8/11/24	8/18/24	8/25/24	9/1/24	9/8/24	9/15/24	9/22/24	9/29/24	Total
Aubrey Fire Station 1	59	40	37	39	20									195
Aubrey Fire Station 2	67	66	71	55	36									295
Total	126	106	108	94	56									490

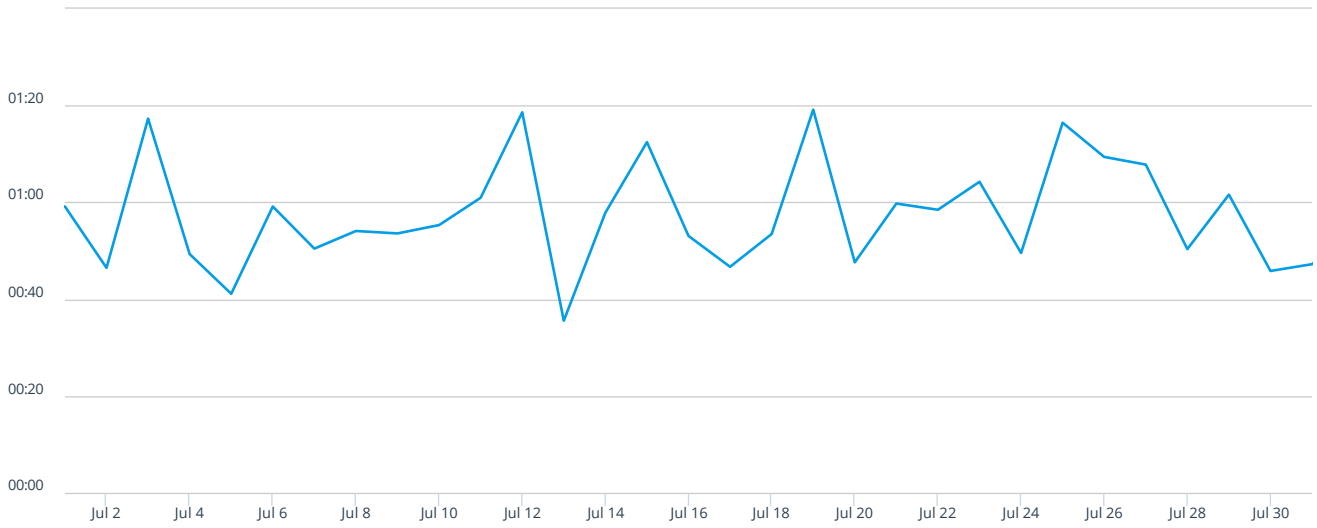
Previous Month ∨ Jul 1, 2024 - Jul 31, 2024 ∨

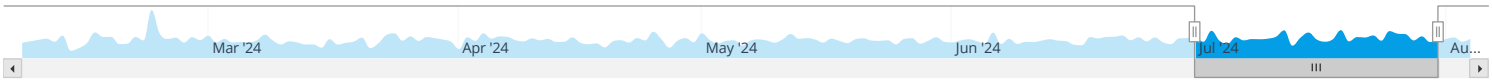
00:57
MM:SS
Average First Apparatus Turnout Time

01:46
MM:SS
90th Percentile First Apparatus Turnout Time

31
DAYS
In Selected Time Slice

488
INCIDENTS
In Selected Time Slice





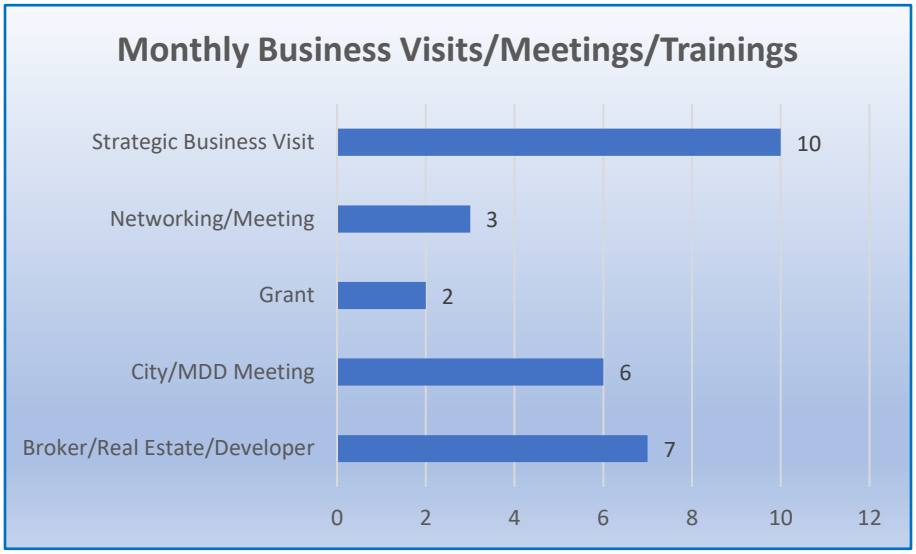
Counts | % Rows | % Columns | % All

Week Ending	7/7/24	7/14/24	7/21/24	7/28/24	8/4/24	8/11/24	8/18/24	8/25/24	9/1/24	9/8/24	9/15/24	9/22/24	9/29/24	Total
00:00 - 00:29	43	26	25	14	18									126
00:30 - 00:59	35	30	32	33	17									147
01:00 - 01:29	28	35	31	24	13									131
01:30 - 01:59	14	10	14	21	5									64
02:00 - 02:59	2	4	5	1	3									15
03:00 - 04:59	2		1	1										4
05:00 - 09:59	1													1
Total	125	105	108	94	56									488
Exceptions														2

JULY 2024 – STAFF REPORT
Aubrey Municipal Development District

Christine Gossett – Executive Director

Business Activity and Updates



Commercial Property for Sale/Lease/Build-to-Suit:

Available: *Aubrey Creek Retail – 1001 US-377: retail space (+/- 2000 SF), 2 pad sites available (+/- 9,000 SF)*

Available for sale or lease: *Former restaurant - 204-208 Main St: 5,130 total SF (2,088 & 2,610 each)*

Available/Coming Soon: *Pine Ridge Pavilion North - 501 Pine Ridge Ln: 2 spaces: 1 retail; 1 restaurant.*

Available/Coming Soon: *Pine Ridge Pavilion South - 500 Pine Ridge Ln: 2 spaces: 1 retail; 1 restaurant.*

Available/Coming Soon: *216 S. Main Street: +/- 1,323 SF (2 space for retail, salon, office, other*

Coming Soon: *Commercial pad sites Springhill and US-377.*

Business Activity and Updates

New Business Openings:

- N/A

Business Closings:

- The Wet Hen Salon

Marketing and New Projects

New:

- Filmed footage for Economic Development video on July 19th.
- Met with 2 businesses regarding TIP Grant application.
- Continued planning and promotion for the Aubrey Business Resource Fair to be held on August 28th.
- Selected artist for Aubrey MDD/Chamber building mural; met on site with artist to discuss final execution of mural painting that will start Oct. 5, 2024.
- Presented Aubrey updates and growth information to 2 commercial development firms.

On-Going/Marketing:

- Maps and Website: Updates to MDD website Business Resource page.
- Social media/Facebook: Manage regular posts on activities, area business and local posts. July's highest performing post was downtown building renovation with1,086 Reach & 1,260 Engagement.
- Website Traffic/July: 433 Views & 248 Visitors
- Data and Analytics: Reports for Placer AI, ZacTax, social media and website stats.

Sales & UseTax Allocation:

- Payment Received in July: $90,213.58

City of Aubrey - Municipal Court Report

July 2024 Report

New Cases Filed	
July -Traffic	248
July - Non Traffic	19

Total Fines Collected	
July - State	$14,329.00
July - City	$19,446.00

Final Disposition	
July - Traffic	117
July - Non Traffic	9

Fiscal YTD Collected	
YTD - State	$ 92,153.00
YTD - City	$137,906.00

Warrants	
Issued	20
Cleared	18
Pending	1323

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Approve Monthly Financial Report.

Staff Contact
Mike English, Finance Director
menglish@aubreytx.gov
940-440-9343

Summary
The monthly financial report for the month and year to date July 31, 2024, includes the following financial reports: Revenue and Expense Summary, Balance Sheet and Cash Analysis Report.

Financial Summary
Through the fiscal year to date ending July 31, 2024, both revenue and expense outperformed budget for both General Fund and Enterprise Fund. Cash balances remain strong. Tables below summarize financial performance through fiscal year to date ended July 31, 2024 for Cash, Revenue and Expense.

Cash Balance and Interest Earned July 2024

	Balance	July Interest	YTD Interest
General Fund	$ 6,255,003	$ 28,978	$ 225,570
Enterprise Fund	2,593,387	11,884	83,482
Debt Service	509,875	2,270	23,183
Grant Fund	1,084,252	4,916	36,069
TIF	279,780	2,248	16,726
Special Revenue	46,090	206	1,402
CIP	26,143,471	76,219	531,054
MDD	2,415,780	11,664	86,310
Public Safety Fund	4,398,357	19,492	131,717
Park Fees	2,254,439	10,167	64,269
Streets Fund	3,093,138	14,322	98,021
Development Fund	432,889	1,977	13,521
Operating	2,698,337	9,751	54,572
Total	**$ 52,204,798**	**$ 194,093**	**$ 1,365,897**

GENERAL FUND	Annual Budget	Year to Date Actual	Remaining Budget
Revenue			
Fines and Fees	$ 82,000	$ 133,328	$ (51,328)
Taxes	5,988,000	5,877,977	110,023
Grants	131,686	65,843	65,843
Donations	256,357	279,858	(23,501)
Charges for Services	8,804,329	7,751,339	1,052,990
Permits	2,648,680	2,023,536	625,144
Interest Income	400,000	370,469	29,531
Other	447,102	263,268	183,834
Total	**$ 18,758,154**	**$ 16,765,618**	**$ 1,992,536**

Expense			
Administration	$ 1,565,363	$ 1,173,368	$ 391,995
Police Department	4,120,917	3,262,253	858,664
Fire Department	6,687,424	5,290,214	1,397,210
Streets Department	508,682	407,725	100,957
Development Services	2,383,344	1,776,865	606,479
Municipal Court	110,513	86,941	23,572
Parks & Recreation	426,236	284,283	141,953
Aubrey Area Library	468,314	399,243	69,071
Total	**$ 16,270,793**	**$ 12,680,892**	**$ 3,589,901**

ENTERPRISE FUND	Annual Budget	Year to Date Actual	Remaining Budget
Revenue			
Fines and Fees	$ 646,000	$ 660,138	$ (14,138)
Charges for Services	5,417,654	4,426,032	991,622
Interest Income	105,000	81,786	23,214
Other	2,000	7,048	(5,048)
Total	**$ 6,170,654**	**$ 5,175,004**	**$ 995,650**

Expense			
Water Department	$ 2,568,129	$ 1,512,754	$ 1,055,375
Sewer Department	905,099	865,919	39,180
Garbage Department	2,263,208	1,772,914	490,294
Total	**$ 5,736,436**	**$ 4,151,587**	**$ 1,584,849**

Staff Recommended Motion
Approve

Conditions
N/A

Monthly Cash Activity

(Unaudited)

July 2024

FUND: ALL DATES: 7/01/2024- 7/31/2024

ACCT: ALL

TYPE: ALL CASH

ACCOUNT NO#	CHECKS	DEPOSITS	SVC CHARGE	INTEREST	MISC.	NET CHANGE	BALANCE
101-11-000-00	0.00	630,120.04	0.00	1,239.30	517,210.68CR	114,148.66	345,311.97
101-11-000-10	0.00	0.00	0.00	0.00	0.00	0.00	200.00
101-11-000-20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
101-11-000-58	0.00	0.00	0.00	0.00	0.00	0.00	0.00
101-11-000-84	0.00	2,008,041.59	0.00	9,835.38	1,140,837.50CR	877,039.47	5,046,924.09
101-11-000-90	0.00	137,803.91CR	0.00	25,502.91	0.00	112,301.00CR	5,456,180.42
101-11-027-87	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200-11-000-84	0.00	0.00	0.00	0.00	0.00	0.00	0.00
201-11-000-00	0.00	90,408.66	0.00	519.80	41,329.34CR	49,599.12	115,041.86
201-11-000-10	0.00	0.00	0.00	0.00	0.00	0.00	200.00
201-11-000-84	0.00	133,620.86	2,185.61CR	0.00	31,281.82	162,717.07	1,456,213.41
201-11-000-85	0.00	0.00	0.00	0.00	0.00	0.00	0.00
201-11-000-90	0.00	0.00	0.00	345.90	0.00	345.90	75,721.25
201-11-000-91	0.00	0.00	0.00	2,867.47	0.00	2,867.47	627,736.04
201-11-000-95	0.00	0.00	0.00	0.00	0.00	0.00	0.00
201-11-012-73	0.00	0.00	0.00	5.55	0.00	5.55	1,238.36
201-11-032-89	0.00	0.00	0.00	0.00	0.00	0.00	0.00
202-11-000-84	0.00	135,894.10	0.00	0.00	79,399.82CR	56,494.28	7,857,104.36CR
202-11-000-85	0.00	0.00	0.00	0.00	0.00	0.00	0.00
202-11-000-91	0.00	0.00	0.00	3,734.27	0.00	3,734.27	817,494.57
202-11-036-37	0.00	0.00	0.00	0.00	0.00	0.00	0.00
205-11-000-84	0.00	310,750.78	0.00	0.00	172,790.96CR	137,959.82	239,249.43CR
205-11-000-85	0.00	0.00	0.00	0.00	0.00	0.00	0.00
301-11-000-00	0.00	11,279.22	0.00	1,943.32	0.00	13,222.54	379,254.07
301-11-000-84	0.00	0.00	0.00	0.00	0.00	0.00	26,872.51CR
301-11-000-90	0.00	0.00	0.00	327.10	0.00	327.10	71,611.19
401-11-000-00	0.00	0.00	0.00	206.44	0.00	206.44	46,090.05
401-11-000-70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
401-11-000-84	0.00	2,186.78	0.00	0.00	2,379.56CR	192.78CR	22,332.58
401-11-058-24	0.00	0.00	0.00	0.00	0.00	0.00	0.00
402-11-000-00	0.00	0.00	0.00	2,248.00	625,943.55CR	623,695.55CR	279,780.00
403-11-000-00	0.00	0.00	0.00	1,846.22	0.00	1,846.22	412,187.72
404-11-000-00	0.00	0.00	0.00	1.16	0.00	1.16	259.02
404-11-000-50	0.00	67,850.00	0.00	10,166.76	0.00	78,016.76	2,254,439.17
404-11-000-60	0.00	136,234.00	0.00	19,491.97	0.00	155,725.97	4,398,356.54
404-11-000-70	0.00	2,637.00	0.00	14,321.92	62,500.00CR	45,541.08CR	3,093,138.10
404-11-000-90	0.00	0.00	0.00	1,977.40	0.00	1,977.40	432,889.49
405-11-000-00	0.00	0.00	0.00	4,915.57	22,731.75CR	17,816.18CR	1,084,251.59
405-11-000-84	0.00	0.00	0.00	0.00	3,567.60CR	3,567.60CR	416,703.06CR
406-11-000-00	0.00	0.00	0.00	6.85	0.00	6.85	1,529.03
406-11-000-41	0.00	0.00	0.00	0.00	0.00	0.00	0.00
406-11-000-42	0.00	0.00	0.00	0.00	0.00	0.00	0.00
406-11-000-43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
406-11-000-84	0.00	5,000.00	0.00	0.00	24,819.35CR	19,819.35CR	489,141.48
407-11-000-84	0.00	0.00	0.00	0.00	0.00	0.00	0.00
501-11-000-00	0.00	1,713.20CR	0.00	5.25	0.00	1,707.95CR	1,172.20
501-11-000-55	0.00	0.00	0.00	364.02	0.00	364.02	79,692.88
501-11-000-56	0.00	0.00	0.00	0.00	0.00	0.00	0.00
501-11-000-58	0.00	1,713.20	0.00	1,705.24	11,257.55CR	7,839.11CR	374,175.26

FUND: ALL DATES: 7/01/2024- 7/31/2024

ACCT: ALL

TYPE: ALL CASH

ACCOUNT NO#	CHECKS	DEPOSITS	SVC CHARGE	INTEREST	MISC.	NET CHANGE	BALANCE
501-11-000-59	0.00	353,035.67CR	0.00	27,000.51	0.00	326,035.16CR	5,831,117.59
501-11-000-60	0.00	0.00	0.00	22,891.50	179,733.75CR	156,842.25CR	4,889,584.83
501-11-000-61	0.00	112,779.25CR	0.00	24,482.14	0.00	88,297.11CR	5,334,075.66
501-11-000-62	0.00	10,000,000.00	0.00	0.00	0.00	10,000,000.00	10,000,000.00
501-11-000-63	0.00	0.00	0.00	0.00	0.00	0.00	0.00
501-11-000-84	0.00	479,802.51	0.00	0.00	701,852.80CR	222,050.29CR	1,929,474.50
501-11-000-90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
501-11-008-38	0.00	0.00	0.00	2,564.34	25,687.48CR	23,123.14CR	543,967.12
501-11-026-00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
601-11-000-00	0.00	0.00	0.00	84.45	0.00	84.45	18,854.17
601-11-000-84	0.00	0.00	0.00	84.45CR	0.00	84.45CR	703,914.12
701-11-000-00	0.00	97,152.01CR	0.00	4,300.29	0.00	92,851.72CR	811,209.97
701-11-000-84	0.00	188,865.59	0.00	0.00	16,632.74CR	172,232.85	0.00
701-11-000-90	0.00	0.00	0.00	7,363.25	0.00	7,363.25	1,611,933.70
701-11-088-41	0.00	0.00	0.00	0.00	0.00	0.00	0.00
801-11-000-00	0.00	113,856.64	0.00	432.97	105,272.68CR	9,016.93	57,521.36
801-11-000-84	0.00	113,856.64CR	0.00	0.00	113,896.64	40.00	62,190.41CR
802-11-000-00	0.00	0.00	0.00	0.00	0.00	0.00	203,803.26
802-11-000-01	0.00	0.00	0.00	0.00	0.00	0.00	1,457,348.31
802-11-000-02	0.00	0.00	0.00	0.00	0.00	0.00	1,104,449.62
802-11-000-05	0.00	0.00	0.00	0.00	0.00	0.00	1,176,506.46
802-11-000-06	0.00	0.00	0.00	0.00	0.00	0.00	282,321.25
802-11-000-07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
803-11-000-01	0.00	0.00	0.00	0.00	0.00	0.00	904,058.10
901-11-000-00	1,037,640.63CR	3,125,857.57	2,185.61CR	9,750.93	969,898.22CR	1,125,884.04	2,647,777.07
** TOTALS **	1,037,640.63CR	16,627,777.86	4,371.22CR	202,363.73	4,558,666.87CR	11,229,462.87	58,268,359.66

----- AVERAGE DAILY BALANCES -----

ACCOUNT	AVERAGE BALANCE
101 11-000-00	289,749.12
101 11-000-10	200.00
101 11-000-20	0.00
101 11-000-58	0.00
101 11-000-84	4,493,851.75
101 11-000-90	5,558,324.75
101 11-027-87	0.00
200 11-000-84	0.00
201 11-000-00	117,501.37
201 11-000-10	200.00
201 11-000-84	1,331,046.15
201 11-000-85	0.00
201 11-000-90	75,386.51
201 11-000-91	624,961.07
201 11-000-95	0.00
201 11-012-73	1,232.99
201 11-032-89	0.00
202 11-000-84	7,860,258.45CR
202 11-000-85	0.00
202 11-000-91	813,880.76
202 11-036-37	0.00

FUND: ALL DATES: 7/01/2024- 7/31/2024

ACCT: ALL

TYPE: ALL CASH

----- AVERAGE DAILY BALANCES -----

ACCOUNT	AVERAGE BALANCE
205 11-000-84	306,987.38CR
205 11-000-85	0.00
301 11-000-00	366,458.06
301 11-000-84	26,872.51CR
301 11-000-90	71,294.64
401 11-000-00	45,890.27
401 11-000-70	0.00
401 11-000-84	20,568.73
401 11-058-24	0.00
402 11-000-00	499,713.52
403 11-000-00	410,401.06
404 11-000-00	257.90
404 11-000-50	2,215,835.85
404 11-000-60	4,248,256.44
404 11-000-70	3,113,382.24
404 11-000-90	430,975.88
405 11-000-00	1,091,960.39
405 11-000-84	415,595.00CR
406 11-000-00	1,522.40
406 11-000-41	0.00
406 11-000-42	0.00
406 11-000-43	0.00
406 11-000-84	499,048.24
407 11-000-84	0.00
501 11-000-00	2,825.05
501 11-000-55	79,340.60
501 11-000-56	0.00
501 11-000-58	377,040.59
501 11-000-59	5,884,705.80
501 11-000-60	4,965,995.43
501 11-000-61	5,335,849.55
501 11-000-62	322,580.65
501 11-000-63	0.00
501 11-000-84	2,089,279.30
501 11-000-90	0.00
501 11-008-38	555,572.18
501 11-026-00	0.00
601 11-000-00	18,772.44
601 11-000-84	703,995.85
701 11-000-00	955,922.22
701 11-000-84	170,723.99CR
701 11-000-90	1,604,807.97
701 11-088-41	0.00
801 11-000-00	84,434.27
801 11-000-84	75,187.45CR
802 11-000-00	203,803.26
802 11-000-01	1,457,348.31
802 11-000-02	1,104,449.62
802 11-000-05	1,176,506.46

FUND: ALL DATES: 7/01/2024- 7/31/2024

ACCT: ALL

TYPE: ALL CASH

----- AVERAGE DAILY BALANCES -----

ACCOUNT	AVERAGE BALANCE
802 11-000-06	282,321.25
802 11-000-07	0.00
803 11-000-01	904,058.10
901 11-000-00	1,911,647.00

		BEGINNING BALANCE	TOTAL DEBITS	TOTAL CREDITS	ENDING BALANCE	AVERAGE DAILY BALANCE
General Fund						
101-11-000-00	General Fund Cas	231,163.31	713,595.42	599,446.76CR	345,311.97	289,749.12
101-11-000-10	Cash on hand - C	200.00	0.00	0.00	200.00	200.00
101-11-000-20	EMS Federal Govt	0.00	0.00	0.00	0.00	0.00
101-11-000-58	Cash in bank - T	0.00	0.00	0.00	0.00	0.00
101-11-000-84	Claim on Cash Ge	4,169,884.62	2,472,916.35	1,595,876.88CR	5,046,924.09	4,493,851.75
101-11-000-90	Investment Accou	5,568,481.42	94,420.00	206,721.00CR	5,456,180.42	5,558,324.75
101-11-027-87	Municipal Saving	0.00	0.00	0.00	0.00	0.00
	FUND 101 TOTAL	9,969,729.35	3,280,931.77	2,402,044.64CR	10,848,616.48	10,342,125.62
Utility Fund Pooled						
200-11-000-84	Water/Sewer/Tras	0.00	0.00	0.00	0.00	0.00
	FUND 200 TOTAL	0.00	0.00	0.00	0.00	0.00
Water Fund						
201-11-000-00	Water Fund Cash	65,442.74	100,519.80	50,920.68CR	115,041.86	117,501.37
201-11-000-10	Cash Drawer	200.00	0.00	0.00	200.00	200.00
201-11-000-84	Claim on Cash Wa	1,293,496.34	351,657.26	188,940.19CR	1,456,213.41	1,331,046.15
201-11-000-85	Water Claim on O	0.00	0.00	0.00	0.00	0.00
201-11-000-90	Investment Accou	75,375.35	345.90	0.00	75,721.25	75,386.51
201-11-000-91	Water Impact Fee	624,868.57	2,867.47	0.00	627,736.04	624,961.07
201-11-000-95	Cash - CO Keenel	0.00	0.00	0.00	0.00	0.00
201-11-012-73	Cash in bank - W	1,232.81	25,693.03	25,687.48CR	1,238.36	1,232.99
201-11-032-89	Cash in bank - T	0.00	0.00	0.00	0.00	0.00
	FUND 201 TOTAL	2,060,615.81	481,083.46	265,548.35CR	2,276,150.92	2,150,328.09
Sewer Fund						
202-11-000-84	Claim on Cash Se	7,913,598.64CR	137,385.48	80,891.20CR	7,857,104.36CR	7,860,258.45CR
202-11-000-85	Sewer Claim on O	0.00	0.00	0.00	0.00	0.00
202-11-000-91	Sewer Impact Fee	813,760.30	3,734.27	0.00	817,494.57	813,880.76
202-11-036-37	Sewer Reserve ca	0.00	0.00	0.00	0.00	0.00
	FUND 202 TOTAL	7,099,838.34CR	141,119.75	80,891.20CR	7,039,609.79CR	7,046,377.69CR
Solid Waste Fund						
205-11-000-84	Claim on Cash Ga	377,209.25CR	311,610.42	173,650.60CR	239,249.43CR	306,987.38CR
205-11-000-85	Trash Claim on O	0.00	0.00	0.00	0.00	0.00
	FUND 205 TOTAL	377,209.25CR	311,610.42	173,650.60CR	239,249.43CR	306,987.38CR

		BEGINNING BALANCE	TOTAL DEBITS	TOTAL CREDITS	ENDING BALANCE	AVERAGE DAILY BALANCE
Debt Service Fund						
301-11-000-00	Debt Service Cas	366,031.53	13,222.54	0.00	379,254.07	366,458.06
301-11-000-84	Claim on Cash De	26,872.51CR	0.00	0.00	26,872.51CR	26,872.51CR
301-11-000-90	Investment Accou	71,284.09	327.10	0.00	71,611.19	71,294.64
	FUND 301 TOTAL	410,443.11	13,549.64	0.00	423,992.75	410,880.19
Special Revenue Fund						
401-11-000-00	Special Revenue	45,883.61	206.44	0.00	46,090.05	45,890.27
401-11-000-70	Cash in bnk - Ho	0.00	0.00	0.00	0.00	0.00
401-11-000-84	Claim on Cash Sp	22,525.36	3,507.22	3,700.00CR	22,332.58	20,568.73
401-11-058-24	Seizure Fund Cas	0.00	0.00	0.00	0.00	0.00
	FUND 401 TOTAL	68,408.97	3,713.66	3,700.00CR	68,422.63	66,459.00
TIRZ Jackson Ridge						
402-11-000-00	TIRZ Cash	903,475.55	2,248.00	625,943.55CR	279,780.00	499,713.52
	FUND 402 TOTAL	903,475.55	2,248.00	625,943.55CR	279,780.00	499,713.52
Impact Fees						
403-11-000-00	Impact Fees Cash	410,341.50	1,846.22	0.00	412,187.72	410,401.06
	FUND 403 TOTAL	410,341.50	1,846.22	0.00	412,187.72	410,401.06
Development Fees						
404-11-000-00	Development Fees	257.86	62,501.16	62,500.00CR	259.02	257.90
404-11-000-50	Investment Acct-	2,176,422.41	78,016.76	0.00	2,254,439.17	2,215,835.85
404-11-000-60	Investment acct-	4,242,630.57	155,725.97	0.00	4,398,356.54	4,248,256.44
404-11-000-70	Investment Acct-	3,138,679.18	16,958.92	62,500.00CR	3,093,138.10	3,113,382.24
404-11-000-90	Investment Accou	430,912.09	208,698.40	206,721.00CR	432,889.49	430,975.88
	FUND 404 TOTAL	9,988,902.11	521,901.21	331,721.00CR	10,179,082.32	10,008,708.31
Grant Fund						
405-11-000-00	Grant Fund Cash	1,102,067.77	4,915.57	22,731.75CR	1,084,251.59	1,091,960.39
405-11-000-84	Claim on Cash Gr	413,135.46CR	22,731.75	26,299.35CR	416,703.06CR	415,595.00CR
	FUND 405 TOTAL	688,932.31	27,647.32	49,031.10CR	667,548.53	676,365.39

		BEGINNING BALANCE	TOTAL DEBITS	TOTAL CREDITS	ENDING BALANCE	AVERAGE DAILY BALANCE
Holding Acct Dev Agreemts						
406-11-000-00	Developer Cash H	1,522.18	6.85	0.00	1,529.03	1,522.40
406-11-000-41	Cash - Union Mai	0.00	0.00	0.00	0.00	0.00
406-11-000-42	Cash - Union Lif	0.00	0.00	0.00	0.00	0.00
406-11-000-43	Cash - Union ETJ	0.00	0.00	0.00	0.00	0.00
406-11-000-84	Claim on Cash Ho	508,960.83	5,000.00	24,819.35CR	489,141.48	499,048.24
	FUND 406 TOTAL	510,483.01	5,006.85	24,819.35CR	490,670.51	500,570.64
Fire Dept SAFR						
407-11-000-84	Claim on Cash SA	0.00	0.00	0.00	0.00	0.00
	FUND 407 TOTAL	0.00	0.00	0.00	0.00	0.00
Capital Projects Fund						
501-11-000-00	Capital Projects	2,880.15	5.25	1,713.20CR	1,172.20	2,825.05
501-11-000-55	Vehicle Replacem	79,328.86	12,618.42	12,254.40CR	79,692.88	79,340.60
501-11-000-56	Project 38 Fund	0.00	0.00	0.00	0.00	0.00
501-11-000-58	Cash - Tax Notes	382,014.37	3,418.44	11,257.55CR	374,175.26	377,040.59
501-11-000-59	Cash - CO 2022 P	6,157,152.75	27,000.51	353,035.67CR	5,831,117.59	5,884,705.80
501-11-000-60	Cash - CO 2023 K	5,046,427.08	22,891.50	179,733.75CR	4,889,584.83	4,965,995.43
501-11-000-61	Cash - CO 2024 S	5,422,372.77	24,482.14	112,779.25CR	5,334,075.66	5,335,849.55
501-11-000-62	ABP LLC Cash Esc	0.00	10,000,000.00	0.00	10,000,000.00	322,580.65
501-11-000-63	HPR Lennar Escro	0.00	0.00	0.00	0.00	0.00
501-11-000-84	Claim on Cash Ca	2,151,524.79	696,481.29	918,531.58CR	1,929,474.50	2,089,279.30
501-11-000-90	Investment Accou	0.00	0.00	0.00	0.00	0.00
501-11-008-38	Cash - Water Bon	567,090.26	2,564.34	25,687.48CR	543,967.12	555,572.18
501-11-026-00	Cash in LOGIC -	0.00	0.00	0.00	0.00	0.00
	FUND 501 TOTAL	19,808,791.03	10,789,461.89	1,614,992.88CR	28,983,260.04	19,613,189.15
NAVO FWSD Fund						
601-11-000-00	FWSD Cash	18,769.72	84.45	0.00	18,854.17	18,772.44
601-11-000-84	Claim on Cash NA	703,998.57	0.00	84.45CR	703,914.12	703,995.85
	FUND 601 TOTAL	722,768.29	84.45	84.45CR	722,768.29	722,768.29
MDD						
701-11-000-00	MDD Cash	904,061.69	94,513.87	187,365.59CR	811,209.97	955,922.22
701-11-000-84	Claim on Cash MD	172,232.85CR	188,865.59	16,632.74CR	0.00	170,723.99CR
701-11-000-90	Investment Accou	1,604,570.45	7,363.25	0.00	1,611,933.70	1,604,807.97
701-11-088-41	EDC cash	0.00	0.00	0.00	0.00	0.00
	FUND 701 TOTAL	2,336,399.29	290,742.71	203,998.33CR	2,423,143.67	2,390,006.20

		BEGINNING BALANCE	TOTAL DEBITS	TOTAL CREDITS	ENDING BALANCE	AVERAGE DAILY BALANCE
Employee Benefit Trust						
801-11-000-00	Employee Benefit	48,504.43	114,289.61	105,272.68CR	57,521.36	84,434.27
801-11-000-84	Claim on Cash EB	62,230.41CR	114,026.64	113,986.64CR	62,190.41CR	75,187.45CR
	FUND 801 TOTAL	13,725.98CR	228,316.25	219,259.32CR	4,669.05CR	9,246.82
Jackson Ridge PID						
802-11-000-00	Cash Collection	203,803.26	0.00	0.00	203,803.26	203,803.26
802-11-000-01	Cash in Wilmingt	1,457,348.31	0.00	0.00	1,457,348.31	1,457,348.31
802-11-000-02	Cash in Wilmingt	1,104,449.62	0.00	0.00	1,104,449.62	1,104,449.62
802-11-000-05	Cash in Wilmingt	1,176,506.46	0.00	0.00	1,176,506.46	1,176,506.46
802-11-000-06	Cash in Wilmingt	282,321.25	0.00	0.00	282,321.25	282,321.25
802-11-000-07	Cash in Wilmingt	0.00	0.00	0.00	0.00	0.00
	FUND 802 TOTAL	4,224,428.90	0.00	0.00	4,224,428.90	4,224,428.90
Winn Ridge South PID						
803-11-000-01	Cash in Wilmingt	904,058.10	0.00	0.00	904,058.10	904,058.10
	FUND 803 TOTAL	904,058.10	0.00	0.00	904,058.10	904,058.10
Pooled Cash Fund						
901-11-000-00	Pooled Cash	1,521,893.03	4,208,712.58	3,082,828.54CR	2,647,777.07	1,911,647.00
	FUND 901 TOTAL	1,521,893.03	4,208,712.58	3,082,828.54CR	2,647,777.07	1,911,647.00
	REPORT TOTALS	47,038,896.79	20,307,976.18	9,078,513.31CR	58,268,359.66	47,487,531.21

SELECTION CRITERIA

PRINT CURRENT

FUND: All

ACCOUNT TYPE: ALL CASH

TRANSACTION DATES: 7/01/2024 THRU 7/31/2024

PERIOD 13: EXCLUDE

PRINT OPTIONS

REPORT TYPE: SUMMARY

RECAP ONLY: NO

DESCRIPTIONS: NO

*** END OF REPORT ***

Revenue/Expense by Fund

(Unaudited)

July 2024

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

FINANCIAL SUMMARY % OF YEAR COMPLETED: 83.33

	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
REVENUE SUMMARY						
GENERAL REVENUE						
Fines and Fees	82,000	3,100.01	133,328.06	0.00	(51,328.06)	162.60
Taxes	5,988,000	471,007.93	5,877,976.63	0.00	110,023.37	98.16
Grants	131,686	0.00	65,842.88	0.00	65,843.12	50.00
Donations	256,357	283.97	279,857.99	0.00	(23,500.99)	109.17
Charges for Services	8,804,329	1,010,751.60	7,751,338.98	0.00	1,052,990.02	88.04
Permits	2,648,680	501,025.93	2,023,535.82	0.00	625,144.18	76.40
Miscellaneous	847,102	52,457.59	633,737.58	0.00	213,364.42	74.81
TOTAL GENERAL REVENUE	18,758,154	2,038,627.03	16,765,617.94	0.00	1,992,536.06	89.38
TOTAL REVENUE	18,758,154	2,038,627.03	16,765,617.94	0.00	1,992,536.06	89.38
EXPENSE SUMMARY						
Administration						
Personnel	813,050	74,413.58	681,619.85	0.00	131,430.15	83.83
Materials & Supplies	14,000	1,429.83	12,326.18	0.00	1,673.82	88.04
Repairs & Maintenance	45,044	2,667.45	19,040.25	4,140.98	21,862.77	51.46
Utilities	23,000	1,385.28	19,109.70	0.00	3,890.30	83.09
Contract Services	428,632	24,358.46	206,043.42	0.00	222,588.58	48.07
Fees & Other Services	196,637	13,466.96	213,145.75	51,960.00	(68,468.75)	134.82
Miscellaneous	45,000	1,433.99	22,083.15	94,015.44	(71,098.59)	258.00
TOTAL Administration	1,565,363	119,155.55	1,173,368.30	150,116.42	241,878.28	84.55
Police Department						
Personnel	2,298,471	204,211.33	1,778,428.30	0.00	520,042.70	77.37
Materials & Supplies	181,140	17,029.91	131,358.26	0.00	49,781.74	72.52
Repairs & Maintenance	65,186	6,130.63	53,716.30	0.00	11,469.70	82.40
Utilities	24,583	1,976.96	22,060.34	0.00	2,522.66	89.74
Contract Services	59,121	4,955.00	39,611.70	0.00	19,509.30	67.00
Fees & Other Services	97,347	16,068.94	74,027.96	0.00	23,319.04	76.05
Public Safety	205,199	(100.00)	120,964.37	15,709.92	68,524.71	66.61
Miscellaneous	65,843	0.00	65,846.88	0.00	(3.88)	100.01
TOTAL Police Department	2,996,890	250,272.77	2,286,014.11	15,709.92	695,165.97	76.80
Fire Department						
Personnel	5,318,181	401,539.02	4,054,146.51	0.00	1,264,034.49	76.23
Materials & Supplies	398,891	82,822.20	367,316.78	23,251.16	8,323.06	97.91
Repairs & Maintenance	507,592	26,745.80	525,770.34	15,096.03	(33,274.37)	106.56
Utilities	58,580	3,700.36	43,481.54	0.00	15,098.46	74.23
Contract Services	55,700	1,367.38	22,862.16	0.00	32,837.84	41.05
Fees & Other Services	162,151	23,750.33	121,306.66	0.00	40,844.34	74.81
Public Safety	90,893	14,202.54	75,799.96	0.00	15,093.04	83.39
Debt Service	95,436	7,952.98	79,529.80	0.00	15,906.20	83.33
TOTAL Fire Department	6,687,424	562,080.61	5,290,213.75	38,347.19	1,358,863.06	79.68

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

FINANCIAL SUMMARY % OF YEAR COMPLETED: 83.33

	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
AAA						
Streets Department						
Personnel	311,960	21,476.86	225,791.55	0.00	86,168.45	72.38
Materials & Supplies	29,051	2,768.64	31,432.50	0.00	(2,381.50)	108.20
Repairs & Maintenance	63,000	4,915.23	68,843.55	7,979.27	(13,822.82)	121.94
Utilities	38,270	1,080.08	41,476.22	0.00	(3,206.22)	108.38
Contract Services	20,350	0.00	9,900.49	0.00	10,449.51	48.65
Fees & Other Services	4,463	1,954.77	3,693.12	0.00	769.88	82.75
Miscellaneous	41,588	0.00	26,587.76	8,418.00	6,582.24	84.17
TOTAL Streets Department	508,682	32,195.58	407,725.19	16,397.27	84,559.54	83.38
Development Services						
Personnel	598,254	38,423.92	356,692.80	0.00	241,561.20	59.62
Materials & Supplies	13,600	95.54	8,210.27	0.00	5,389.73	60.37
Repairs & Maintenance	1,000	0.00	460.27	0.00	539.73	46.03
Contract Services	1,676,530	222,214.24	1,349,915.74	0.00	326,614.26	80.52
Fees & Other Services	43,960	886.55	34,046.37	0.00	9,913.63	77.45
Miscellaneous	50,000	0.00	27,539.40	0.00	22,460.60	55.08
TOTAL Development Services	2,383,344	261,620.25	1,776,864.85	0.00	606,479.15	74.55
Court						
Personnel	76,128	5,974.45	61,995.77	0.00	14,132.23	81.44
Materials & Supplies	800	83.70	957.05	0.00	(157.05)	119.63
Contract Services	27,900	1,400.00	21,156.50	0.00	6,743.50	75.83
Fees & Other Services	5,685	321.45	2,831.73	0.00	2,853.27	49.81
TOTAL Court	110,513	7,779.60	86,941.05	0.00	23,571.95	78.67
Parks & Recreation						
Personnel	213,066	15,982.04	153,421.19	0.00	59,644.81	72.01
Materials & Supplies	11,300	105.18	4,690.95	0.00	6,609.05	41.51
Repairs & Maintenance	30,000	8,328.89	26,685.87	0.00	3,314.13	88.95
Utilities	3,500	390.91	5,578.38	0.00	(2,078.38)	159.38
Fees & Other Services	8,370	370.90	3,294.99	0.00	5,075.01	39.37
Miscellaneous	160,000	1,260.92	90,611.51	0.00	69,388.49	56.63
TOTAL Parks & Recreation	426,236	26,438.84	284,282.89	0.00	141,953.11	66.70
Library						
Personnel	263,466	23,171.84	219,088.46	0.00	44,377.54	83.16
Materials & Supplies	55,060	5,712.39	43,670.89	413.65	10,975.46	80.07
Repairs & Maintenance	68,000	315.00	67,522.96	0.00	477.04	99.30
Utilities	20,974	445.36	14,024.74	0.00	6,949.26	66.87
Contract Services	1,800	2,950.00	3,400.00	0.00	(1,600.00)	188.89
Fees & Other Services	33,352	3,952.92	28,805.77	0.00	4,546.23	86.37
Miscellaneous	25,662	5,726.90	22,730.24	0.00	2,931.76	88.58
TOTAL Library	468,314	42,274.41	399,243.06	413.65	68,657.29	85.34

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

FINANCIAL SUMMARY % OF YEAR COMPLETED: 83.33

	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Providence Village PD						
Personnel	896,282	82,482.12	803,252.23	0.00	93,029.77	89.62
Materials & Supplies	85,040	1,627.10	35,422.87	0.00	49,617.13	41.65
Repairs & Maintenance	20,773	507.53	22,084.65	0.00	(1,311.65)	106.31
Utilities	5,655	992.61	8,730.58	0.00	(3,075.58)	154.39
Contract Services	3,300	0.00	2,130.00	0.00	1,170.00	64.55
Fees & Other Services	59,411	8,063.54	46,773.06	0.00	12,637.94	78.73
Public Safety	53,566	0.00	37,047.30	5,236.64	11,282.06	78.94
Miscellaneous	0	0.00	20,798.22	0.00	(20,798.22)	0.00
TOTAL Providence Village PD	1,124,027	93,672.90	976,238.91	5,236.64	142,551.45	87.32
Fleet						
HR						
TOTAL EXPENSES	16,270,793	1,395,490.51	12,680,892.11	226,221.09	3,363,679.80	79.33
REVENUE OVER/(UNDER) EXPENSES	2,487,361	643,136.52	4,084,725.83	(226,221.09)	(1,371,143.74)	155.12

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

% OF YEAR COMPLETED: 83.33

REVENUES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Fines and Fees						
101-4000-01-4400 Fines and fees	80,000	2,455.16	129,410.85	0.00	(49,410.85)	161.76
101-4000-01-4410 Warrant Income	2,000	644.85	3,917.21	0.00	(1,917.21)	195.86
TOTAL Fines and Fees	82,000	3,100.01	133,328.06	0.00	(51,328.06)	162.60
Taxes						
101-4000-02-4100 Property Taxes	2,380,000	10,560.29	2,494,662.12	0.00	(114,662.12)	104.82
101-4000-02-4130 Sales Taxes	2,300,000	177,923.13	2,007,274.59	0.00	292,725.41	87.27
101-4000-02-4140 Franchise Tax-Electric	300,000	74,088.91	310,740.76	0.00	(10,740.76)	103.58
101-4000-02-4141 Franchise Tax-Gas	12,000	3,587.75	18,183.24	0.00	(6,183.24)	151.53
101-4000-02-4142 Franchise Tax-Telephone	4,000	1,884.86	4,382.94	0.00	(382.94)	109.57
101-4000-02-4143 Franchise Tax-Cable TV	12,000	2,147.13	10,538.94	0.00	1,461.06	87.82
101-4000-02-4144 Franchise Tax-Water	700,000	200,815.86	815,695.01	0.00	(115,695.01)	116.53
101-4000-02-4146 Franchise Tax-Garbage	280,000	0.00	216,499.03	0.00	63,500.97	77.32
TOTAL Taxes	5,988,000	471,007.93	5,877,976.63	0.00	110,023.37	98.16
Grants						
101-4000-03-4391 Grants - Police	131,686	0.00	65,842.88	0.00	65,843.12	50.00
TOTAL Grants	131,686	0.00	65,842.88	0.00	65,843.12	50.00
Donations						
101-4000-04-4390 Donations-Police	0	0.00	1,261.00	0.00	(1,261.00)	0.00
101-4000-04-4392 Donations-Fire	250,357	0.00	252,306.71	0.00	(1,949.71)	100.78
101-4000-04-4393 Donations-Library	6,000	283.97	26,290.28	0.00	(20,290.28)	438.17
TOTAL Donations	256,357	283.97	279,857.99	0.00	(23,500.99)	109.17
Charges for Services						
101-4000-06-4104 Aspen Meadow Police	97,000	11,958.95	80,889.35	0.00	16,110.65	83.39
101-4000-06-4312 DC FWSD # 8A	0	27,094.62	138,213.75	0.00	(138,213.75)	0.00
101-4000-06-4314 DC FWSD # 8B	0	0.00	99,373.37	0.00	(99,373.37)	0.00
101-4000-06-4316 Providence Village WCID	0	46,912.30	458,075.90	0.00	(458,075.90)	0.00
101-4000-06-4318 DC FWSD # 10 Elm Ridge	0	51,736.19	424,406.04	0.00	(424,406.04)	0.00
101-4000-06-4319 Arrow Brook	0	0.00	141,727.39	0.00	(141,727.39)	0.00
101-4000-06-4320 DC FWSD # 11A	0	24,449.08	222,610.63	0.00	(222,610.63)	0.00
101-4000-06-4321 DC FWSD # 11B	0	18,740.93	206,440.41	0.00	(206,440.41)	0.00
101-4000-06-4323 DC FWSD #11C	0	16,710.32	89,520.46	0.00	(89,520.46)	0.00
101-4000-06-4370 DC FWSD Total Revenue	2,180,000	0.00	0.00	0.00	2,180,000.00	0.00
101-4000-06-4401 Providence Village Poli	1,274,388	104,465.81	1,053,756.81	0.00	220,631.19	82.69
101-4000-06-4402 Silverado Police	825,000	115,197.26	707,058.55	0.00	117,941.45	85.70
101-4000-06-4403 Sandbrock Police	350,000	72,556.15	354,603.56	0.00	(4,603.56)	101.32
101-4000-06-4404 DISD SRO	108,000	54,396.25	108,792.51	0.00	(792.51)	100.73
101-4000-06-4420 Accident Reports	500	60.00	510.00	0.00	(10.00)	102.00
101-4000-06-4480 Library fines & fees	500	0.00	373.00	0.00	127.00	74.60
101-4000-06-4481 Public Services - copie	1,500	0.00	1,461.61	0.00	38.39	97.44
101-4000-06-4482 Denton Co Library Pledg	22,500	0.00	2,500.00	0.00	20,000.00	11.11
101-4000-06-4483 Krugerville Library ILA	5,000	0.00	5,000.00	0.00	0.00	100.00
101-4000-06-4484 Cross Roads Library ILA	5,000	0.00	0.00	0.00	5,000.00	0.00
101-4000-06-4485 Providence Village Libr	32,500	0.00	32,543.00	0.00	(43.00)	100.13

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

% OF YEAR COMPLETED: 83.33

REVENUES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
101-4000-06-4486 Silverado Library Fee	11,240	0.00	11,240.00	0.00	0.00	100.00
101-4000-06-4501 Community Building rent	2,000	0.00	1,790.00	0.00	210.00	89.50
101-4000-06-4730 Denton County Pledge Fi	10,000	0.00	10,000.00	0.00	0.00	100.00
101-4000-06-4732 Denton Co Medic	385,882	0.00	385,882.00	0.00	0.00	100.00
101-4000-06-4735 Denton Co Fire Runs	800,000	108,500.00	854,900.00	0.00	(54,900.00)	106.86
101-4000-06-4741 Krugerville ILA Fire	165,000	41,908.75	125,726.25	0.00	39,273.75	76.20
101-4000-06-4742 Silverado Fire	900,000	133,115.30	771,403.25	0.00	128,596.75	85.71
101-4000-06-4744 Sandbrock Fire	250,000	48,433.91	240,589.66	0.00	9,410.34	96.24
101-4000-06-4745 Aspen Meadow Fire	110,000	13,827.44	87,946.11	0.00	22,053.89	79.95
101-4000-06-4746 Oak Point ILA EMS	50,469	0.00	50,469.00	0.00	0.00	100.00
101-4000-06-4748 Krugerville ILA EMS	17,850	0.00	0.00	0.00	17,850.00	0.00
101-4000-06-4749 Insurance Billing EMS	1,200,000	69,427.86	1,032,275.89	0.00	167,724.11	86.02
101-4000-06-4770 EMS Cost Reimbursement	0	51,260.48	51,260.48	0.00	(51,260.48)	0.00
TOTAL Charges for Services	8,804,329	1,010,751.60	7,751,338.98	0.00	1,052,990.02	88.04
Permits						
101-4000-07-4200 Building Permits	1,100,000	223,395.49	752,746.79	0.00	347,253.21	68.43
101-4000-07-4210 Plan Review fees	1,300,000	272,730.44	1,117,737.96	0.00	182,262.04	85.98
101-4000-07-4220 Inspection fees	225,000	3,905.00	127,224.00	0.00	97,776.00	56.54
101-4000-07-4250 Contractor registration	4,000	495.00	5,005.00	0.00	(1,005.00)	125.13
101-4000-07-4260 Other Permit fee	3,000	10.00	3,810.00	0.00	(810.00)	127.00
101-4000-07-4290 Health Permits	15,000	250.00	12,200.00	0.00	2,800.00	81.33
101-4000-07-4310 Demolition Permits	0	0.00	1,050.00	0.00	(1,050.00)	0.00
101-4000-07-4320 Sign Permit	1,200	100.00	2,642.07	0.00	(1,442.07)	220.17
101-4000-07-4330 Solicitation permit	360	140.00	500.00	0.00	(140.00)	138.89
101-4000-07-4350 Alcohol Permit	120	0.00	620.00	0.00	(500.00)	516.67
TOTAL Permits	2,648,680	501,025.93	2,023,535.82	0.00	625,144.18	76.40
Miscellaneous						
101-4000-09-4430 All Admin Fees	185,000	11,970.00	135,715.00	0.00	49,285.00	73.36
101-4000-09-4435 City Event Fees	80,000	3,890.00	39,620.00	0.00	40,380.00	49.53
101-4000-09-4500 Interest Income	400,000	36,577.59	370,469.07	0.00	29,530.93	92.62
101-4000-09-4540 Other Income	426	20.00	805.50	0.00	(379.50)	189.08
101-4000-09-4550 Gain on sale of assets	18,605	0.00	18,604.62	0.00	0.38	100.00
101-4000-09-4800 Insurance Proceeds	63,071	0.00	68,523.39	0.00	(5,452.39)	108.64
101-4000-09-5630 DC SRO Reimbursement	100,000	0.00	0.00	0.00	100,000.00	0.00
TOTAL Miscellaneous	847,102	52,457.59	633,737.58	0.00	213,364.42	74.81
Contingency/FB						
TOTAL REVENUE	18,758,154	2,038,627.03	16,765,617.94	0.00	1,992,536.06	89.38

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

DEPARTMENT - Administration % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
101-5101-01-5101 Salaries	675,000	58,713.99	560,132.56	0.00	114,867.44	82.98
101-5101-01-5105 Overtime	2,500	0.00	2,094.27	0.00	405.73	83.77
101-5101-01-5106 Longevity	1,950	0.00	1,950.00	0.00	0.00	100.00
101-5101-01-5107 Retirement - TMRS	42,500	3,816.41	35,972.11	0.00	6,527.89	84.64
101-5101-01-5108 Payroll Tax Expense (me	9,600	817.08	8,227.68	0.00	1,372.32	85.71
101-5101-01-5109 Group Health Insurance	65,000	9,552.92	63,044.41	0.00	1,955.59	96.99
101-5101-01-5110 Workers Comp TML	1,500	324.41	1,297.64	0.00	202.36	86.51
101-5101-01-5621 Travel & Training	15,000	1,188.77	8,901.18	0.00	6,098.82	59.34
TOTAL Personnel	813,050	74,413.58	681,619.85	0.00	131,430.15	83.83
Materials & Supplies						
101-5101-03-5050 Office Supplies	12,000	1,195.28	10,428.68	0.00	1,571.32	86.91
101-5101-03-5090 Postage	2,000	234.55	1,897.50	0.00	102.50	94.88
TOTAL Materials & Supplies	14,000	1,429.83	12,326.18	0.00	1,673.82	88.04
Repairs & Maintenance						
101-5101-04-5120 Building Maintenance	41,544	2,433.36	18,009.73	4,140.98	19,393.29	53.32
101-5101-04-5121 Equipment Maintenance	1,500	0.00	567.21	0.00	932.79	37.81
101-5101-04-5122 Vehicle Maintenance	2,000	234.09	463.31	0.00	1,536.69	23.17
TOTAL Repairs & Maintenance	45,044	2,667.45	19,040.25	4,140.98	21,862.77	51.46
Utilities						
101-5101-05-5616 Utilities -Electricity	8,000	327.60	7,118.63	0.00	881.37	88.98
101-5101-05-5617 Utilities -Gas	2,500	78.39	1,461.84	0.00	1,038.16	58.47
101-5101-05-5618 Utilities -Telephone	8,500	689.37	7,142.09	0.00	1,357.91	84.02
101-5101-05-5619 Utilities -Water/Sewer	4,000	289.92	3,387.14	0.00	612.86	84.68
TOTAL Utilities	23,000	1,385.28	19,109.70	0.00	3,890.30	83.09
Contract Services						
101-5101-06-5060 Election Services	132	0.00	132.00	0.00	0.00	100.00
101-5101-06-5230 Contract Labor	3,000	55.00	701.80	0.00	2,298.20	23.39
101-5101-06-5240 Drug testing/background	1,500	152.50	1,435.80	0.00	64.20	95.72
101-5101-06-5300 Benefits Administration	20,000	3,170.00	18,712.54	0.00	1,287.46	93.56
101-5101-06-5620 Legal & Professional	400,000	20,808.96	182,299.28	0.00	217,700.72	45.57
101-5101-06-5685 Storage Building	4,000	172.00	2,762.00	0.00	1,238.00	69.05
TOTAL Contract Services	428,632	24,358.46	206,043.42	0.00	222,588.58	48.07
Fees & Other Services						
101-5101-07-5150 Printing	12,200	0.00	20,633.63	0.00	(8,433.63)	169.13
101-5101-07-5190 Insurance - TML	6,000	1,483.61	5,806.15	0.00	193.85	96.77
101-5101-07-5220 Advertising & Notices	5,300	1,017.08	4,882.20	0.00	417.80	92.12
101-5101-07-5260 Dues and Membership	8,000	0.00	9,017.38	0.00	(1,017.38)	112.72
101-5101-07-5280 Copier Maintenance cont	9,000	738.40	6,529.95	0.00	2,470.05	72.56
101-5101-07-5310 Tax Assessor/Collector	3,000	0.00	10.25	0.00	2,989.75	0.34
101-5101-07-5320 Appraisal District Fees	31,165	0.00	23,373.60	0.00	7,791.40	75.00
101-5101-07-5540 Bond Insurance	1,407	0.00	1,407.00	0.00	0.00	100.00
101-5101-07-5665 Technology	115,000	10,227.87	133,143.49	51,960.00	(70,103.49)	160.96

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

DEPARTMENT - Administration % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
101-5101-07-5666 Bank Fees	5,565	0.00	8,342.10	0.00	(2,777.10)	149.90
TOTAL Fees & Other Services	196,637	13,466.96	213,145.75	51,960.00	(68,468.75)	134.82
Miscellaneous						
101-5101-09-5130 Community Development	25,000	987.27	7,992.38	0.00	17,007.62	31.97
101-5101-09-5131 Meetings	5,000	446.72	1,058.58	0.00	3,941.42	21.17
101-5101-09-5132 Employee Appreciation	15,000	0.00	13,032.19	1,600.00	367.81	97.55
101-5101-09-5685 Capital Expenditures	0	0.00	0.00	92,415.44	(92,415.44)	0.00
TOTAL Miscellaneous	45,000	1,433.99	22,083.15	94,015.44	(71,098.59)	258.00
Debt Service						
TOTAL Administration	1,565,363	119,155.55	1,173,368.30	150,116.42	241,878.28	84.55

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

DEPARTMENT - Police Department % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
101-5102-01-5101 Salaries	1,792,391	142,652.22	1,350,209.04	0.00	442,181.96	75.33
101-5102-01-5105 Overtime	50,127	7,793.59	41,802.80	0.00	8,324.20	83.39
101-5102-01-5106 Longevity	1,375	0.00	1,375.00	0.00	0.00	100.00
101-5102-01-5107 Retirement - TMRS	119,839	9,778.99	90,456.59	0.00	29,382.41	75.48
101-5102-01-5108 Payroll Tax Expense (me	28,597	2,104.89	20,234.91	0.00	8,362.09	70.76
101-5102-01-5109 Group Health Insurance	219,492	28,067.20	180,701.37	0.00	38,790.63	82.33
101-5102-01-5110 Workers Comp TML	60,045	12,165.43	72,209.37	0.00	(12,164.37)	120.26
101-5102-01-5621 Travel & Training	26,605	1,649.01	21,439.22	0.00	5,165.78	80.58
TOTAL Personnel	2,298,471	204,211.33	1,778,428.30	0.00	520,042.70	77.37
Materials & Supplies						
101-5102-03-5050 Office Supplies	9,212	1,457.56	9,558.04	0.00	(346.04)	103.76
101-5102-03-5051 Printing	2,500	0.00	0.00	0.00	2,500.00	0.00
101-5102-03-5080 Gas & Oil	129,000	11,652.94	89,070.55	0.00	39,929.45	69.05
101-5102-03-5081 Uniforms	25,804	544.52	22,401.65	0.00	3,402.35	86.81
101-5102-03-5082 Ballistic Vests	14,124	3,249.13	9,793.99	0.00	4,330.01	69.34
101-5102-03-5090 Postage	500	125.76	534.03	0.00	(34.03)	106.81
TOTAL Materials & Supplies	181,140	17,029.91	131,358.26	0.00	49,781.74	72.52
Repairs & Maintenance						
101-5102-04-5120 Building Maintenance	8,000	446.13	3,516.13	0.00	4,483.87	43.95
101-5102-04-5121 Equipment Maintenance	2,000	0.00	454.50	0.00	1,545.50	22.73
101-5102-04-5122 Vehicle Maintenance	55,186	5,684.50	49,745.67	0.00	5,440.33	90.14
TOTAL Repairs & Maintenance	65,186	6,130.63	53,716.30	0.00	11,469.70	82.40
Utilities						
101-5102-05-5616 Utilities -Electricity	3,500	0.00	2,946.88	0.00	553.12	84.20
101-5102-05-5618 Utilities -Telephone	18,883	1,877.02	18,115.68	0.00	767.32	95.94
101-5102-05-5619 Utilities -Water/Sewer	2,200	99.94	997.78	0.00	1,202.22	45.35
TOTAL Utilities	24,583	1,976.96	22,060.34	0.00	2,522.66	89.74
Contract Services						
101-5102-06-5240 Drug testing/background	2,700	0.00	5,840.50	0.00	(3,140.50)	216.31
101-5102-06-5610 Power DMS	25,371	0.00	25,371.20	0.00	(0.20)	100.00
101-5102-06-5620 Legal and Professional	3,000	0.00	2,500.00	0.00	500.00	83.33
101-5102-06-5621 Childerns' Advocacy Cen	3,500	3,500.00	3,500.00	0.00	0.00	100.00
101-5102-06-5685 Storage Building - Wils	540	0.00	480.00	0.00	60.00	88.89
101-5102-06-5690 Forensic Testing	24,010	1,455.00	1,920.00	0.00	22,090.00	8.00
TOTAL Contract Services	59,121	4,955.00	39,611.70	0.00	19,509.30	67.00
Fees & Other Services						
101-5102-07-5190 Insurance - TML	28,500	7,047.16	27,579.23	0.00	920.77	96.77
101-5102-07-5220 Advertising & Notices	300	0.00	265.00	0.00	35.00	88.33
101-5102-07-5260 Dues and Memberships	2,000	0.00	1,233.80	0.00	766.20	61.69
101-5102-07-5280 Maintenance contracts	50,000	6,394.86	7,948.21	0.00	42,051.79	15.90
101-5102-07-5665 Technology	16,547	2,626.92	37,001.72	0.00	(20,454.72)	223.62
TOTAL Fees & Other Services	97,347	16,068.94	74,027.96	0.00	23,319.04	76.05

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

DEPARTMENT - Police Department % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Public Safety						
101-5102-08-5070 Police Supplies	13,810	0.00	5,751.41	0.00	8,058.59	41.65
101-5102-08-5071 Communications Supplies	24,683	0.00	8,330.00	15,709.92	643.08	97.39
101-5102-08-5072 Promotional Supplies	5,840	0.00	4,280.18	0.00	1,559.82	73.29
101-5102-08-5625 Ammo/Firearms/Safety Eq	62,149	(100.00)	18,046.38	0.00	44,102.62	29.04
101-5102-08-5626 Taser 7 Lease	5,731	0.00	3,890.40	0.00	1,840.60	67.88
101-5102-08-5686 Flock Cameras	43,700	0.00	43,700.00	0.00	0.00	100.00
101-5102-08-5687 Denton Cty Communicatio	49,286	0.00	36,966.00	0.00	12,320.00	75.00
TOTAL Public Safety	205,199	(100.00)	120,964.37	15,709.92	68,524.71	66.61
Miscellaneous						
101-5102-09-5633 Capital - vehicles	0	0.00	(1.00)	0.00	1.00	0.00
101-5102-09-5685 Capital - equipment	65,843	0.00	65,847.88	0.00	(4.88)	100.01
TOTAL Miscellaneous	65,843	0.00	65,846.88	0.00	(3.88)	100.01
Debt Service						
TOTAL Police Department	2,996,890	250,272.77	2,286,014.11	15,709.92	695,165.97	76.80

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

DEPARTMENT - Fire Department % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
101-5103-01-5101 Salaries	3,831,375	268,671.07	2,926,348.19	0.00	905,026.81	76.38
101-5103-01-5105 Overtime	490,375	29,485.99	310,767.53	0.00	179,607.47	63.37
101-5103-01-5106 Longevity	7,850	0.00	7,850.00	0.00	0.00	100.00
101-5103-01-5107 Retirement - TMRS	282,724	19,337.34	209,937.00	0.00	72,787.00	74.26
101-5103-01-5108 Payroll Tax Expense (me	63,069	4,173.68	47,450.53	0.00	15,618.47	75.24
101-5103-01-5109 Group Health Insurance	459,888	49,230.08	360,666.95	0.00	99,221.05	78.42
101-5103-01-5110 Workers Comp TML	118,800	27,528.63	145,772.39	0.00	(26,972.39)	122.70
101-5103-01-5621 Travel/Training	64,100	3,112.23	45,353.92	0.00	18,746.08	70.75
TOTAL Personnel	5,318,181	401,539.02	4,054,146.51	0.00	1,264,034.49	76.23
Materials & Supplies						
101-5103-03-5080 Gas & Oil	109,800	7,023.48	75,530.04	0.00	34,269.96	68.79
101-5103-03-5081 Uniforms	114,091	49,658.29	148,263.19	5,017.94	(39,190.13)	134.35
101-5103-03-5090 Postage	300	0.00	218.95	0.00	81.05	72.98
101-5103-03-5150 Office Supplies	14,700	54.26	13,797.23	0.00	902.77	93.86
101-5103-03-5155 Supplies - Medic	160,000	26,086.17	129,507.37	18,233.22	12,259.41	92.34
TOTAL Materials & Supplies	398,891	82,822.20	367,316.78	23,251.16	8,323.06	97.91
Repairs & Maintenance						
101-5103-04-5120 Building Maintenance	71,000	5,633.92	98,030.92	14,850.03	(41,880.95)	158.99
101-5103-04-5121 Equipment Maintenace	302,592	5,091.20	278,059.80	0.00	24,532.20	91.89
101-5103-04-5122 Vehicle Maintenance	134,000	16,020.68	149,679.62	246.00	(15,925.62)	111.88
TOTAL Repairs & Maintenance	507,592	26,745.80	525,770.34	15,096.03	(33,274.37)	106.56
Utilities						
101-5103-05-5616 Utilities -Electricity	16,000	1,595.49	19,065.28	0.00	(3,065.28)	119.16
101-5103-05-5617 Utilities -Gas	6,900	63.62	3,843.84	0.00	3,056.16	55.71
101-5103-05-5618 Utilities -Telephone	25,980	1,212.59	13,321.70	0.00	12,658.30	51.28
101-5103-05-5619 Utilities -Water/Sewer	7,600	667.67	5,764.70	0.00	1,835.30	75.85
101-5103-05-5620 Direct TV Navo	2,100	160.99	1,486.02	0.00	613.98	70.76
TOTAL Utilities	58,580	3,700.36	43,481.54	0.00	15,098.46	74.23
Contract Services						
101-5103-06-5240 Drug testing/background	2,100	645.50	2,664.50	0.00	(564.50)	126.88
101-5103-06-5620 Legal and Professional	53,000	330.00	19,243.28	0.00	33,756.72	36.31
101-5103-06-5658 Fire Extinguishers	600	391.88	954.38	0.00	(354.38)	159.06
TOTAL Contract Services	55,700	1,367.38	22,862.16	0.00	32,837.84	41.05
Fees & Other Services						
101-5103-07-5190 Insurance - TML	77,751	19,225.38	75,239.00	0.00	2,512.00	96.77
101-5103-07-5260 Dues and Memberships	12,400	0.00	8,796.32	0.00	3,603.68	70.94
101-5103-07-5280 Copier Maintenance Cont	2,000	140.00	2,152.41	0.00	(152.41)	107.62
101-5103-07-5660 Admin Fee Navo	30,000	0.00	2,465.00	0.00	27,535.00	8.22
101-5103-07-5665 Technology	40,000	4,384.95	32,653.93	0.00	7,346.07	81.63
TOTAL Fees & Other Services	162,151	23,750.33	121,306.66	0.00	40,844.34	74.81

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

DEPARTMENT - Fire Department % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Public Safety						
101-5103-08-5070 Firefighting Supplies	35,000	14,202.54	33,877.96	0.00	1,122.04	96.79
101-5103-08-5687 Denton Cty Communicatio	55,893	0.00	41,922.00	0.00	13,971.00	75.00
TOTAL Public Safety	90,893	14,202.54	75,799.96	0.00	15,093.04	83.39
Miscellaneous						
Debt Service						
101-5103-98-5693 Capital Lease - '18 Pir	95,436	7,952.98	79,529.80	0.00	15,906.20	83.33
TOTAL Debt Service	95,436	7,952.98	79,529.80	0.00	15,906.20	83.33
TOTAL Fire Department	6,687,424	562,080.61	5,290,213.75	38,347.19	1,358,863.06	79.68

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

DEPARTMENT - AAA % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
Materials & Supplies						
Repairs & Maintenance						
Contract Services						
Fees & Other Services						
Public Safety						
Miscellaneous						

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

DEPARTMENT - Streets Department % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
101-5105-01-5101 Salaries	235,796	13,746.60	165,970.29	0.00	69,825.71	70.39
101-5105-01-5105 Overtime	6,000	881.40	7,151.78	0.00	(1,151.78)	119.20
101-5105-01-5106 Longevity	1,050	0.00	1,050.00	0.00	0.00	100.00
101-5105-01-5107 Retirement - TMRS	15,785	950.81	11,215.26	0.00	4,569.74	71.05
101-5105-01-5108 Payroll Tax Expense (me	3,521	210.35	2,815.24	0.00	705.76	79.96
101-5105-01-5109 Group Health Insurance	41,808	3,743.70	29,961.97	0.00	11,846.03	71.67
101-5105-01-5110 Workers Comp TML	3,000	695.17	2,780.68	0.00	219.32	92.69
101-5105-01-5121 Travel & Training	5,000	1,248.83	4,846.33	0.00	153.67	96.93
TOTAL Personnel	311,960	21,476.86	225,791.55	0.00	86,168.45	72.38
Materials & Supplies						
101-5105-03-5050 Office Supplies	2,000	365.00	1,741.71	0.00	258.29	87.09
101-5105-03-5080 Gas & Oil	8,251	644.89	7,716.62	0.00	534.38	93.52
101-5105-03-5081 Uniforms	2,000	103.60	1,974.17	0.00	25.83	98.71
101-5105-03-5607 Rock, Sand and Gravel	8,800	761.40	12,888.51	0.00	(4,088.51)	146.46
101-5105-03-5608 Chemicals Purchased	4,000	0.00	1,311.84	0.00	2,688.16	32.80
101-5105-03-5630 Tools	4,000	893.75	5,799.65	0.00	(1,799.65)	144.99
TOTAL Materials & Supplies	29,051	2,768.64	31,432.50	0.00	(2,381.50)	108.20
Repairs & Maintenance						
101-5105-04-5121 Equipment Maintenance	10,000	1,560.52	15,744.75	0.00	(5,744.75)	157.45
101-5105-04-5122 Vehicle Maintenance	0	0.00	1,692.33	0.00	(1,692.33)	0.00
101-5105-04-5609 Street Signs	45,000	3,028.00	45,223.38	7,979.27	(8,202.65)	118.23
101-5105-04-5629 Street maintenance	8,000	326.71	6,183.09	0.00	1,816.91	77.29
TOTAL Repairs & Maintenance	63,000	4,915.23	68,843.55	7,979.27	(13,822.82)	121.94
Utilities						
101-5105-05-5616 Utilities - Electricity	38,270	1,080.08	41,476.22	0.00	(3,206.22)	108.38
TOTAL Utilities	38,270	1,080.08	41,476.22	0.00	(3,206.22)	108.38
Contract Services						
101-5105-06-5240 Drug testing/background	350	0.00	177.50	0.00	172.50	50.71
101-5105-06-5620 Legal and Professional	20,000	0.00	9,722.99	0.00	10,277.01	48.61
TOTAL Contract Services	20,350	0.00	9,900.49	0.00	10,449.51	48.65
Fees & Other Services						
101-5105-07-5190 Insurance - TML	1,563	386.48	1,512.50	0.00	50.50	96.77
101-5105-07-5220 Advertising & Public No	250	0.00	0.00	0.00	250.00	0.00
101-5105-07-5260 Dues and Memberships	650	0.00	0.00	0.00	650.00	0.00
101-5105-07-5665 Technology	2,000	1,568.29	2,180.62	0.00	(180.62)	109.03
TOTAL Fees & Other Services	4,463	1,954.77	3,693.12	0.00	769.88	82.75
Miscellaneous						
101-5105-09-5685 Capital - equipment	26,588	0.00	26,587.76	0.00	0.24	100.00
101-5105-09-5689 Capital - streets	15,000	0.00	0.00	8,418.00	6,582.00	56.12
TOTAL Miscellaneous	41,588	0.00	26,587.76	8,418.00	6,582.24	84.17
TOTAL Streets Department	508,682	32,195.58	407,725.19	16,397.27	84,559.54	83.38

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

DEPARTMENT - Development Services % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
101-5107-01-5101 Salaries	481,829	26,784.93	268,495.20	0.00	213,333.80	55.72
101-5107-01-5105 Overtime	4,000	789.29	6,952.65	0.00	(2,952.65)	173.82
101-5107-01-5106 Longevity	250	0.00	250.00	0.00	0.00	100.00
101-5107-01-5107 Retirement - TMRS	25,000	1,792.33	18,027.61	0.00	6,972.39	72.11
101-5107-01-5108 Payroll Tax Expense (me	6,000	388.67	3,822.33	0.00	2,177.67	63.71
101-5107-01-5109 Group Health Insurance	60,000	6,239.50	42,260.28	0.00	17,739.72	70.43
101-5107-01-5110 Workers Comp TML	16,000	1,832.92	15,405.16	0.00	594.84	96.28
101-5107-01-5621 Travel/Training	5,175	596.28	1,479.57	0.00	3,695.43	28.59
TOTAL Personnel	598,254	38,423.92	356,692.80	0.00	241,561.20	59.62
Materials & Supplies						
101-5107-03-5050 Office Supplies	7,000	0.00	6,461.44	0.00	538.56	92.31
101-5107-03-5080 Gas & Oil	3,000	86.85	458.34	0.00	2,541.66	15.28
101-5107-03-5081 Uniforms	600	0.00	428.54	0.00	171.46	71.42
101-5107-03-5090 Postage	1,500	8.69	391.95	0.00	1,108.05	26.13
101-5107-03-5150 Printing	1,500	0.00	470.00	0.00	1,030.00	31.33
TOTAL Materials & Supplies	13,600	95.54	8,210.27	0.00	5,389.73	60.37
Repairs & Maintenance						
101-5107-04-5122 Vehicle Maintenance	1,000	0.00	460.27	0.00	539.73	46.03
TOTAL Repairs & Maintenance	1,000	0.00	460.27	0.00	539.73	46.03
Contract Services						
101-5107-06-5240 Drug testing/background	400	0.00	400.50	0.00	(0.50)	100.13
101-5107-06-5620 Legal and Professional	75,000	15,261.31	104,569.50	0.00	(29,569.50)	139.43
101-5107-06-5723 Animal Control	56,130	0.00	35,935.50	0.00	20,194.50	64.02
101-5107-06-5724 Code Enforcement	0	0.00	4,186.20	0.00	(4,186.20)	0.00
101-5107-06-5725 Mowing and clean-up	35,000	8,326.76	51,624.54	0.00	(16,624.54)	147.50
101-5107-06-5763 Inspectors - Bureau Ver	1,450,000	198,558.10	1,073,043.22	0.00	376,956.78	74.00
101-5107-06-5764 Planners	60,000	68.07	80,156.28	0.00	(20,156.28)	133.59
TOTAL Contract Services	1,676,530	222,214.24	1,349,915.74	0.00	326,614.26	80.52
Fees & Other Services						
101-5107-07-5190 Insurance - TML	1,300	321.45	1,258.00	0.00	42.00	96.77
101-5107-07-5220 Advertising & Notices	2,000	0.00	964.35	0.00	1,035.65	48.22
101-5107-07-5260 Dues and Memberships	2,160	23.85	888.17	0.00	1,271.83	41.12
101-5107-07-5665 Technology	35,000	0.00	27,196.35	0.00	7,803.65	77.70
101-5107-07-5762 Filing Fees	3,000	541.25	3,739.50	0.00	(739.50)	124.65
101-5107-07-5765 Property Liens	500	0.00	0.00	0.00	500.00	0.00
TOTAL Fees & Other Services	43,960	886.55	34,046.37	0.00	9,913.63	77.45
Miscellaneous						
101-5107-09-5685 Capital Equipment	50,000	0.00	27,539.40	0.00	22,460.60	55.08
TOTAL Miscellaneous	50,000	0.00	27,539.40	0.00	22,460.60	55.08

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

DEPARTMENT - Development Services % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Debt Service						
TOTAL Development Services	2,383,344	261,620.25	1,776,864.85	0.00	606,479.15	74.55

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

DEPARTMENT - Court % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
101-5108-01-5101 Salaries	59,100	4,702.34	48,884.59	0.00	10,215.41	82.72
101-5108-01-5105 Overtime	1,000	0.00	640.17	0.00	359.83	64.02
101-5108-01-5106 Longevity	350	0.00	350.00	0.00	0.00	100.00
101-5108-01-5107 Retirement - TMRS	3,929	305.66	3,241.90	0.00	687.10	82.51
101-5108-01-5108 Payroll Tax Expense (me	877	65.74	727.42	0.00	149.58	82.94
101-5108-01-5109 Group Health Insurance	10,452	872.90	7,540.45	0.00	2,911.55	72.14
101-5108-01-5110 Workers Comp TML	120	27.81	111.24	0.00	8.76	92.70
101-5108-01-5621 Travel/Training	300	0.00	500.00	0.00	(200.00)	166.67
TOTAL Personnel	76,128	5,974.45	61,995.77	0.00	14,132.23	81.44
Materials & Supplies						
101-5108-03-5050 Office Supplies	200	0.00	500.69	0.00	(300.69)	250.35
101-5108-03-5090 Postage	500	83.70	456.36	0.00	43.64	91.27
101-5108-03-5150 Printing	100	0.00	0.00	0.00	100.00	0.00
TOTAL Materials & Supplies	800	83.70	957.05	0.00	(157.05)	119.63
Repairs & Maintenance						
Contract Services						
101-5108-06-5235 Contract Jail Services	2,900	0.00	0.00	0.00	2,900.00	0.00
101-5108-06-5620 Legal & Professional	10,000	0.00	7,156.50	0.00	2,843.50	71.57
101-5108-06-5765 Contract Svcs - Judge	15,000	1,400.00	14,000.00	0.00	1,000.00	93.33
TOTAL Contract Services	27,900	1,400.00	21,156.50	0.00	6,743.50	75.83
Fees & Other Services						
101-5108-07-5190 Insurance - TML	1,300	321.45	1,258.00	0.00	42.00	96.77
101-5108-07-5260 Dues and Memberships	150	0.00	302.90	0.00	(152.90)	201.93
101-5108-07-5540 Bond Insurance	235	0.00	0.00	0.00	235.00	0.00
101-5108-07-5665 Technology	4,000	0.00	1,270.83	0.00	2,729.17	31.77
TOTAL Fees & Other Services	5,685	321.45	2,831.73	0.00	2,853.27	49.81
Debt Service						
TOTAL Court	110,513	7,779.60	86,941.05	0.00	23,571.95	78.67

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

DEPARTMENT - Parks & Recreation % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
101-5110-01-5101 Salaries	160,000	10,606.22	106,404.14	0.00	53,595.86	66.50
101-5110-01-5105 Overtime	6,000	507.48	7,611.54	0.00	(1,611.54)	126.86
101-5110-01-5106 Longevity	50	0.00	0.00	0.00	50.00	0.00
101-5110-01-5107 Retirement - TMRS	8,968	722.39	7,410.99	0.00	1,557.01	82.64
101-5110-01-5108 Payroll Tax Expense (me	2,000	160.94	1,701.91	0.00	298.09	85.10
101-5110-01-5109 Group Health Insurance	30,000	3,363.42	24,518.01	0.00	5,481.99	81.73
101-5110-01-5110 Workers Comp TML	2,048	512.11	2,048.44	0.00	(0.44)	100.02
101-5110-01-5121 Travel & Training	4,000	109.48	3,726.16	0.00	273.84	93.15
TOTAL Personnel	213,066	15,982.04	153,421.19	0.00	59,644.81	72.01
Materials & Supplies						
101-5110-03-5050 Office Supplies	6,000	0.00	968.38	0.00	5,031.62	16.14
101-5110-03-5080 Gas & Oil	1,200	105.18	674.00	0.00	526.00	56.17
101-5110-03-5081 Uniforms	600	0.00	479.88	0.00	120.12	79.98
101-5110-03-5150 Printing	400	0.00	0.00	0.00	400.00	0.00
101-5110-03-5608 Chemicals	600	0.00	950.00	0.00	(350.00)	158.33
101-5110-03-5630 Small Tools	2,000	0.00	1,618.69	0.00	381.31	80.93
101-5110-03-5903 Parts and Fittings	500	0.00	0.00	0.00	500.00	0.00
TOTAL Materials & Supplies	11,300	105.18	4,690.95	0.00	6,609.05	41.51
Repairs & Maintenance						
101-5110-04-5121 Equipment Maintenance	6,000	559.90	6,263.33	0.00	(263.33)	104.39
101-5110-04-5122 Vehicle Maintenance	4,000	0.00	3,869.62	0.00	130.38	96.74
101-5110-04-5630 Park Maintenance	20,000	7,768.99	16,552.92	0.00	3,447.08	82.76
TOTAL Repairs & Maintenance	30,000	8,328.89	26,685.87	0.00	3,314.13	88.95
Utilities						
101-5110-05-5616 Utilities - Electricity	2,500	0.00	3,685.94	0.00	(1,185.94)	147.44
101-5110-05-5619 Utilities - Water/Sewer	1,000	390.91	1,892.44	0.00	(892.44)	189.24
TOTAL Utilities	3,500	390.91	5,578.38	0.00	(2,078.38)	159.38
Contract Services						
Fees & Other Services						
101-5110-07-5190 Insurance - TML	1,600	370.90	1,451.54	0.00	148.46	90.72
101-5110-07-5260 Memberships and Dues	770	0.00	550.00	0.00	220.00	71.43
101-5110-07-5280 Maintenance Contract	0	0.00	293.45	0.00	(293.45)	0.00
101-5110-07-5624 Equipment Rental	2,000	0.00	0.00	0.00	2,000.00	0.00
101-5110-07-5665 Technology	4,000	0.00	1,000.00	0.00	3,000.00	25.00
TOTAL Fees & Other Services	8,370	370.90	3,294.99	0.00	5,075.01	39.37
Miscellaneous						
101-5110-09-5131 City Events	160,000	1,260.92	90,611.51	0.00	69,388.49	56.63
TOTAL Miscellaneous	160,000	1,260.92	90,611.51	0.00	69,388.49	56.63
TOTAL Parks & Recreation	426,236	26,438.84	284,282.89	0.00	141,953.11	66.70

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

DEPARTMENT - Library % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
101-5111-01-5101 Salaries	201,890	16,567.39	164,964.03	0.00	36,925.97	81.71
101-5111-01-5105 Overtime	3,000	649.45	4,110.02	0.00	(1,110.02)	137.00
101-5111-01-5106 Longevity	150	0.00	150.00	0.00	0.00	100.00
101-5111-01-5107 Retirement - TMRS	9,545	963.95	9,785.83	0.00	(240.83)	102.52
101-5111-01-5108 Payroll Tax Expense (me	2,973	240.70	2,457.44	0.00	515.56	82.66
101-5111-01-5109 Group Health Insurance	41,808	4,611.32	34,606.36	0.00	7,201.64	82.77
101-5111-01-5110 Workers Comp TML	600	139.03	556.12	0.00	43.88	92.69
101-5111-01-5621 Travel/Training	3,500	0.00	2,458.66	0.00	1,041.34	70.25
TOTAL Personnel	263,466	23,171.84	219,088.46	0.00	44,377.54	83.16
Materials & Supplies						
101-5111-03-5050 Office Supplies	5,460	0.00	5,363.71	0.00	96.29	98.24
101-5111-03-5052 Library Supplies	4,000	578.07	2,959.78	0.00	1,040.22	73.99
101-5111-03-5090 Postage	1,600	0.00	1,016.72	0.00	583.28	63.55
101-5111-03-5661 Collection Development	44,000	5,134.32	34,330.68	413.65	9,255.67	78.96
TOTAL Materials & Supplies	55,060	5,712.39	43,670.89	413.65	10,975.46	80.07
Repairs & Maintenance						
101-5111-04-5120 Building Maintenance	68,000	315.00	67,522.96	0.00	477.04	99.30
TOTAL Repairs & Maintenance	68,000	315.00	67,522.96	0.00	477.04	99.30
Utilities						
101-5111-05-5616 Utilities - Electricity	13,000	0.00	8,536.54	0.00	4,463.46	65.67
101-5111-05-5618 Utilities - Telephone	4,248	323.05	3,230.40	0.00	1,017.60	76.05
101-5111-05-5619 Utilities - Water/Sewer	3,726	122.31	2,257.80	0.00	1,468.20	60.60
TOTAL Utilities	20,974	445.36	14,024.74	0.00	6,949.26	66.87
Contract Services						
101-5111-06-5620 Legal & Professional	300	0.00	0.00	0.00	300.00	0.00
101-5111-06-5658 Fire Extinguishers	1,500	2,950.00	3,400.00	0.00	(1,900.00)	226.67
TOTAL Contract Services	1,800	2,950.00	3,400.00	0.00	(1,600.00)	188.89
Fees & Other Services						
101-5111-07-5150 Printing	500	0.00	419.65	0.00	80.35	83.93
101-5111-07-5190 Insurance - TML	11,000	2,719.96	10,644.63	0.00	355.37	96.77
101-5111-07-5260 Dues and Memberships	4,352	0.00	3,537.00	0.00	815.00	81.27
101-5111-07-5280 Copier Maintenance Cont	500	0.00	849.39	0.00	(349.39)	169.88
101-5111-07-5665 Technology	17,000	1,232.96	13,355.10	0.00	3,644.90	78.56
TOTAL Fees & Other Services	33,352	3,952.92	28,805.77	0.00	4,546.23	86.37
Miscellaneous						
101-5111-09-5130 Community Development	13,400	5,575.40	12,321.73	0.00	1,078.27	91.95
101-5111-09-5667 Senior Programs	3,000	151.50	1,146.40	0.00	1,853.60	38.21
101-5111-09-5685 Capital Equipment	9,262	0.00	9,262.11	0.00	(0.11)	100.00
TOTAL Miscellaneous	25,662	5,726.90	22,730.24	0.00	2,931.76	88.58
TOTAL Library	468,314	42,274.41	399,243.06	413.65	68,657.29	85.34

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

DEPARTMENT - Providence Village PD % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
101-5114-01-5101 Salaries	693,243	58,447.01	624,633.21	0.00	68,609.79	90.10
101-5114-01-5105 Overtime	20,007	3,325.01	31,167.36	0.00	(11,160.36)	155.78
101-5114-01-5106 Longevity	1,200	0.00	975.00	0.00	225.00	81.25
101-5114-01-5107 Retirement - TMRS	46,138	4,015.14	42,690.27	0.00	3,447.73	92.53
101-5114-01-5108 Payroll Tax Expense (me	16,761	857.50	9,522.46	0.00	7,238.54	56.81
101-5114-01-5109 Group Health Insurance	94,068	9,930.04	71,447.81	0.00	22,620.19	75.95
101-5114-01-5110 Workers Comp TML	9,106	2,452.78	9,811.12	0.00	(705.12)	107.74
101-5114-01-5621 Travel & Training	15,759	3,454.64	13,005.00	0.00	2,754.00	82.52
TOTAL Personnel	896,282	82,482.12	803,252.23	0.00	93,029.77	89.62
Materials & Supplies						
101-5114-03-5050 Office Supplies	4,428	899.15	6,336.99	0.00	(1,908.99)	143.11
101-5114-03-5051 Printing	2,500	0.00	0.00	0.00	2,500.00	0.00
101-5114-03-5080 Gas & Oil	63,328	677.97	14,902.80	0.00	48,425.20	23.53
101-5114-03-5081 Uniforms	12,045	49.98	8,015.82	0.00	4,029.18	66.55
101-5114-03-5082 Ballistic Vests	2,739	0.00	6,167.26	0.00	(3,428.26)	225.16
TOTAL Materials & Supplies	85,040	1,627.10	35,422.87	0.00	49,617.13	41.65
Repairs & Maintenance						
101-5114-04-5121 Equipment Maintenance	3,000	209.40	2,094.00	0.00	906.00	69.80
101-5114-04-5122 Vehicle Maintenance	17,773	298.13	19,990.65	0.00	(2,217.65)	112.48
TOTAL Repairs & Maintenance	20,773	507.53	22,084.65	0.00	(1,311.65)	106.31
Utilities						
101-5114-05-5618 Utilities - Telephone	5,655	992.61	8,730.58	0.00	(3,075.58)	154.39
TOTAL Utilities	5,655	992.61	8,730.58	0.00	(3,075.58)	154.39
Contract Services						
101-5114-06-5240 Drug testing/background	800	0.00	1,380.00	0.00	(580.00)	172.50
101-5114-06-5690 Forensic Testing	2,500	0.00	750.00	0.00	1,750.00	30.00
TOTAL Contract Services	3,300	0.00	2,130.00	0.00	1,170.00	64.55
Fees & Other Services						
101-5114-07-5190 Insurance - TML	21,374	5,563.54	21,773.06	0.00	(399.06)	101.87
101-5114-07-5660 Administrative Fee	30,000	2,500.00	25,000.00	0.00	5,000.00	83.33
101-5114-07-5665 Technology	8,037	0.00	0.00	0.00	8,037.00	0.00
TOTAL Fees & Other Services	59,411	8,063.54	46,773.06	0.00	12,637.94	78.73
Public Safety						
101-5114-08-5070 Police Supplies	6,702	0.00	2,498.93	0.00	4,203.07	37.29
101-5114-08-5071 Communications Supplies	6,171	0.00	2,218.10	5,236.64	(1,283.74)	120.80
101-5114-08-5072 Promotional Supplies	1,600	0.00	1,356.27	0.00	243.73	84.77
101-5114-08-5625 Ammo/Firearms/Safety Eq	12,767	0.00	12,767.00	0.00	0.00	100.00
101-5114-08-5626 Taser 7 Lease	2,050	0.00	0.00	0.00	2,050.00	0.00
101-5114-08-5687 Denton Co Communication	24,276	0.00	18,207.00	0.00	6,069.00	75.00
TOTAL Public Safety	53,566	0.00	37,047.30	5,236.64	11,282.06	78.94

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

DEPARTMENT - Providence Village PD % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Miscellaneous						
101-5114-09-5633 Capital - Vehicles	0	0.00	20,798.22	0.00	(20,798.22)	0.00
TOTAL Miscellaneous	0	0.00	20,798.22	0.00	(20,798.22)	0.00
Debt Service						
TOTAL Providence Village PD	1,124,027	93,672.90	976,238.91	5,236.64	142,551.45	87.32

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

101-General Fund

DEPARTMENT - HR % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
Materials & Supplies						
Repairs & Maintenance						
Utilities						
Contract Services						
Fees & Other Services						
Miscellaneous						
Contingency/FB						
TOTAL EXPENSES	16,270,793	1,395,490.51	12,680,892.11	226,221.09	3,363,679.80	79.33
REVENUE OVER/(UNDER) EXPENSES	2,487,361	643,136.52	4,084,725.83	(226,221.09)	(1,371,143.74)	155.12

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

201-Water Fund

FINANCIAL SUMMARY % OF YEAR COMPLETED: 83.33

	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
REVENUE SUMMARY						
GENERAL REVENUE						
Fines and Fees	338,000	24,696.20	324,829.31	0.00	13,170.69	96.10
Charges for Services	2,065,886	275,484.30	1,841,811.05	0.00	224,074.95	89.15
Miscellaneous	67,000	6,860.81	52,328.44	0.00	14,671.56	78.10
TOTAL GENERAL REVENUE	2,470,886	307,041.31	2,218,968.80	0.00	251,917.20	89.80
TOTAL REVENUE	2,470,886	307,041.31	2,218,968.80	0.00	251,917.20	89.80
EXPENSE SUMMARY						
Water						
Personnel	429,180	38,158.35	315,588.29	0.00	113,591.71	73.53
Materials & Supplies	234,000	14,216.02	262,582.00	8,175.00	(36,757.00)	115.71
Repairs & Maintenance	354,500	35,051.51	168,781.35	0.00	185,718.65	47.61
Utilities	102,200	771.35	104,247.65	0.00	(2,047.65)	102.00
Contract Services	98,850	6,702.93	21,819.09	0.00	77,030.91	22.07
Fees & Other Services	75,753	7,533.10	61,007.64	0.00	14,745.36	80.53
Debt Service	715,006	0.00	496,528.13	0.00	218,477.87	69.44
Contingency/FB	558,640	8,220.00	82,200.00	13,200.00	463,240.00	17.08
TOTAL Water	2,568,129	110,653.26	1,512,754.15	21,375.00	1,033,999.85	59.74
TOTAL EXPENSES	2,568,129	110,653.26	1,512,754.15	21,375.00	1,033,999.85	59.74
REVENUE OVER/(UNDER) EXPENSES	(97,243)	196,388.05	706,214.65	(21,375.00)	(782,082.65)	704.26-

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

201-Water Fund

% OF YEAR COMPLETED: 83.33

REVENUES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Fines and Fees						
201-4000-01-4012 Late Penalties-Water	26,000	2,384.20	26,210.31	0.00	(210.31)	100.81
201-4000-01-4013 Application fee	5,000	860.00	6,340.00	0.00	(1,340.00)	126.80
201-4000-01-4014 Reconnects	6,500	500.00	5,515.00	0.00	985.00	84.85
201-4000-01-4630 Bank Fees collected	500	0.00	420.00	0.00	80.00	84.00
201-4000-01-4710 Water Impact Fees	300,000	20,952.00	286,344.00	0.00	13,656.00	95.45
TOTAL Fines and Fees	338,000	24,696.20	324,829.31	0.00	13,170.69	96.10
Charges for Services						
201-4000-06-4010 Water Billings	1,734,386	157,081.62	1,363,681.63	0.00	370,704.37	78.63
201-4000-06-4011 Water Conection/Tap Fee	80,000	3,405.80	161,206.60	0.00	(81,206.60)	201.51
201-4000-06-4015 Bulk Water	1,500	0.00	0.00	0.00	1,500.00	0.00
201-4000-06-4019 Billing Adjustments	0	114,996.88	162,162.78	0.00	(162,162.78)	0.00
201-4000-06-4020 Infrastructure Inspecti	250,000	0.00	154,760.04	0.00	95,239.96	61.90
TOTAL Charges for Services	2,065,886	275,484.30	1,841,811.05	0.00	224,074.95	89.15
Miscellaneous						
201-4000-09-4500 Interest Income	65,000	3,738.72	45,280.92	0.00	19,719.08	69.66
201-4000-09-4540 Other Income	2,000	3,122.09	7,047.52	0.00	(5,047.52)	352.38
TOTAL Miscellaneous	67,000	6,860.81	52,328.44	0.00	14,671.56	78.10
Contingency/FB						
TOTAL REVENUE	2,470,886	307,041.31	2,218,968.80	0.00	251,917.20	89.80

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

201-Water Fund

DEPARTMENT - Water % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
201-5201-01-5101 Salaries	324,008	25,479.05	231,291.84	0.00	92,716.16	71.38
201-5201-01-5105 Overtime	12,000	1,630.92	11,156.39	0.00	843.61	92.97
201-5201-01-5106 Longevity	450	0.00	450.00	0.00	0.00	100.00
201-5201-01-5107 TMRS Contribution	20,675	1,758.90	15,785.13	0.00	4,889.87	76.35
201-5201-01-5108 Payroll Tax Expense (me	4,835	373.75	3,485.70	0.00	1,349.30	72.09
201-5201-01-5109 Group Health Insurance	52,712	6,357.12	40,709.63	0.00	12,002.37	77.23
201-5201-01-5110 Workmens Comp TML	9,000	2,085.50	8,342.00	0.00	658.00	92.69
201-5201-01-5621 Travel/Training	5,500	473.11	4,367.60	0.00	1,132.40	79.41
TOTAL Personnel	429,180	38,158.35	315,588.29	0.00	113,591.71	73.53
Materials & Supplies						
201-5201-03-5050 Office Supplies	6,000	779.99	5,631.93	0.00	368.07	93.87
201-5201-03-5080 Gas & Oil	20,000	3,012.55	21,270.47	0.00	(1,270.47)	106.35
201-5201-03-5081 Uniforms	5,000	367.87	6,114.93	0.00	(1,114.93)	122.30
201-5201-03-5090 Postage	11,500	1,069.70	9,447.87	0.00	2,052.13	82.16
201-5201-03-5150 Printing	4,500	1,301.76	5,425.39	0.00	(925.39)	120.56
201-5201-03-5608 Rock, Sand & Gravel	1,000	0.00	5,200.00	0.00	(4,200.00)	520.00
201-5201-03-5630 Tools	6,000	563.55	5,652.98	0.00	347.02	94.22
201-5201-03-5903 Parts and Fittings	30,000	2,141.80	41,182.04	0.00	(11,182.04)	137.27
201-5201-03-5904 Chlorine	10,000	1,512.60	10,210.06	0.00	(210.06)	102.10
201-5201-03-5905 Meters	140,000	3,466.20	152,446.33	8,175.00	(20,621.33)	114.73
TOTAL Materials & Supplies	234,000	14,216.02	262,582.00	8,175.00	(36,757.00)	115.71
Repairs & Maintenance						
201-5201-04-5120 Building Maintenance	6,500	742.98	12,456.94	0.00	(5,956.94)	191.65
201-5201-04-5121 Equipment Maintenance	40,000	12,229.08	32,561.19	0.00	7,438.81	81.40
201-5201-04-5122 Vehicle Maintenance	8,000	32.00	9,967.90	0.00	(1,967.90)	124.60
201-5201-04-5902 Water System Maintenanc	300,000	22,047.45	113,795.32	0.00	186,204.68	37.93
TOTAL Repairs & Maintenance	354,500	35,051.51	168,781.35	0.00	185,718.65	47.61
Utilities						
201-5201-05-5616 Utilities - Electricity	90,000	0.00	95,410.68	0.00	(5,410.68)	106.01
201-5201-05-5617 Utilities - Gas	4,000	198.68	2,813.77	0.00	1,186.23	70.34
201-5201-05-5618 Utilities - Telephone	7,000	572.67	5,262.09	0.00	1,737.91	75.17
201-5201-05-5619 Utilities - Water/Sewer	1,200	0.00	761.11	0.00	438.89	63.43
TOTAL Utilities	102,200	771.35	104,247.65	0.00	(2,047.65)	102.00
Contract Services						
201-5201-06-5240 Drug testing/background	200	0.00	200.50	0.00	(0.50)	100.25
201-5201-06-5620 Legal & Professional	38,650	3,408.93	10,603.97	0.00	28,046.03	27.44
201-5201-06-5766 Consultant - engineerin	60,000	3,294.00	11,014.62	0.00	48,985.38	18.36
TOTAL Contract Services	98,850	6,702.93	21,819.09	0.00	77,030.91	22.07
Fees & Other Services						
201-5201-07-5190 Insurance - TML	9,000	2,225.42	8,709.23	0.00	290.77	96.77
201-5201-07-5220 Advertising & Notices	750	0.00	0.00	0.00	750.00	0.00
201-5201-07-5260 Dues & Memberships	1,500	0.00	1,100.55	0.00	399.45	73.37

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

201-Water Fund

DEPARTMENT - Water % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
201-5201-07-5261 Permits-TCEQ	6,087	0.00	6,087.15	0.00	(0.15)	100.00
201-5201-07-5262 UTRW membership	2,800	0.00	3,041.00	0.00	(241.00)	108.61
201-5201-07-5624 Equipment Rental	6,000	0.00	3,897.03	0.00	2,102.97	64.95
201-5201-07-5665 Technology	8,250	1,330.03	5,445.03	0.00	2,804.97	66.00
201-5201-07-5666 Bank fees	366	0.00	365.92	0.00	0.08	99.98
201-5201-07-5901 Lab Fees	20,000	100.00	19,507.20	0.00	492.80	97.54
201-5201-07-5906 Groundwater Pumpage Fee	15,000	3,877.65	10,961.31	0.00	4,038.69	73.08
201-5201-07-5909 AMR Annual Fees	6,000	0.00	1,893.22	0.00	4,106.78	31.55
TOTAL Fees & Other Services	75,753	7,533.10	61,007.64	0.00	14,745.36	80.53
Debt Service						
201-5201-98-5801 2016 Bond Principal	215,000	0.00	215,000.00	0.00	0.00	100.00
201-5201-98-5866 2016 Bond Interest	122,300	0.00	62,225.00	0.00	60,075.00	50.88
201-5201-98-5867 2023 CO Bond Principal	60,000	0.00	60,000.00	0.00	0.00	100.00
201-5201-98-5868 2023 CO Bond Interest	317,706	0.00	159,303.13	0.00	158,402.87	50.14
TOTAL Debt Service	715,006	0.00	496,528.13	0.00	218,477.87	69.44
Contingency/FB						
201-5201-99-4090 Administrative fee	98,640	8,220.00	82,200.00	0.00	16,440.00	83.33
201-5201-99-5902 Capital - equipment	10,000	0.00	0.00	13,200.00	(3,200.00)	132.00
201-5201-99-9900 Depreciation expense	450,000	0.00	0.00	0.00	450,000.00	0.00
TOTAL Contingency/FB	558,640	8,220.00	82,200.00	13,200.00	463,240.00	17.08
TOTAL Water	2,568,129	110,653.26	1,512,754.15	21,375.00	1,033,999.85	59.74
TOTAL EXPENSES	2,568,129	110,653.26	1,512,754.15	21,375.00	1,033,999.85	59.74
REVENUE OVER/(UNDER) EXPENSES	(97,243)	196,388.05	706,214.65	(21,375.00)	(782,082.65)	704.26-

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

202-Sewer Fund

FINANCIAL SUMMARY % OF YEAR COMPLETED: 83.33

	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
REVENUE SUMMARY						
GENERAL REVENUE						
Fines and Fees	308,000	24,768.38	335,308.99	0.00	(27,308.99)	108.87
Charges for Services	1,088,560	93,716.02	811,486.70	0.00	277,073.30	74.55
Miscellaneous	40,000	3,734.27	36,505.33	0.00	3,494.67	91.26
TOTAL GENERAL REVENUE	1,436,560	122,218.67	1,183,301.02	0.00	253,258.98	82.37
TOTAL REVENUE	1,436,560	122,218.67	1,183,301.02	0.00	253,258.98	82.37
EXPENSE SUMMARY						
Sewer						
Personnel	318,292	31,656.73	269,513.03	0.00	48,778.97	84.67
Materials & Supplies	53,900	6,968.95	58,381.13	0.00	(4,481.13)	108.31
Repairs & Maintenance	180,000	11,680.62	201,893.92	7,250.00	(29,143.92)	116.19
Utilities	159,500	8,964.41	175,740.31	0.00	(16,240.31)	110.18
Contract Services	36,200	11,543.47	30,028.23	0.00	6,171.77	82.95
Fees & Other Services	58,301	3,709.03	31,457.36	0.00	26,843.64	53.96
Contingency/FB	98,906	0.00	98,905.07	53,378.70	(53,377.77)	153.97
TOTAL Sewer	905,099	74,523.21	865,919.05	60,628.70	(21,448.75)	102.37
TOTAL EXPENSES	905,099	74,523.21	865,919.05	60,628.70	(21,448.75)	102.37
REVENUE OVER/(UNDER) EXPENSES	531,461	47,695.46	317,381.97	(60,628.70)	274,707.73	48.31

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

202-Sewer Fund

% OF YEAR COMPLETED: 83.33

REVENUES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Fines and Fees						
202-4000-01-4021 Late Penalties - Sewer	8,000	978.38	10,178.99	0.00	(2,178.99)	127.24
202-4000-01-4710 Sewer Impact Fees	300,000	23,790.00	325,130.00	0.00	(25,130.00)	108.38
TOTAL Fines and Fees	308,000	24,768.38	335,308.99	0.00	(27,308.99)	108.87
Charges for Services						
202-4000-06-4011 Sewer Connection/Tap Fe	10,000	0.00	1,700.00	0.00	8,300.00	17.00
202-4000-06-4020 Sewer Billings	1,078,560	93,716.02	808,036.70	0.00	270,523.30	74.92
202-4000-06-4022 Lift Station	0	0.00	1,750.00	0.00	(1,750.00)	0.00
TOTAL Charges for Services	1,088,560	93,716.02	811,486.70	0.00	277,073.30	74.55
Miscellaneous						
202-4000-09-4500 Interest Income	40,000	3,734.27	36,505.33	0.00	3,494.67	91.26
TOTAL Miscellaneous	40,000	3,734.27	36,505.33	0.00	3,494.67	91.26
Contingency/FB						
TOTAL REVENUE	1,436,560	122,218.67	1,183,301.02	0.00	253,258.98	82.37

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

202-Sewer Fund

DEPARTMENT - Sewer % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
202-5202-01-5101 Salaries	230,000	20,078.42	185,497.22	0.00	44,502.78	80.65
202-5202-01-5105 Overtime	12,000	3,067.13	21,252.27	0.00	(9,252.27)	177.10
202-5202-01-5106 Longevity	1,050	0.00	1,100.00	0.00	(50.00)	104.76
202-5202-01-5107 Retirement - TMRS	17,176	1,504.45	13,510.18	0.00	3,665.82	78.66
202-5202-01-5108 Payroll Tax Expense (me	4,055	333.15	3,120.02	0.00	934.98	76.94
202-5202-01-5109 Group Health Insurance	42,260	5,109.22	33,228.26	0.00	9,031.74	78.63
202-5202-01-5110 Workers Comp TML	6,751	1,564.36	6,257.44	0.00	493.56	92.69
202-5202-01-5621 Travel/training	5,000	0.00	5,547.64	0.00	(547.64)	110.95
TOTAL Personnel	318,292	31,656.73	269,513.03	0.00	48,778.97	84.67
Materials & Supplies						
202-5202-03-5050 Office Supplies	6,000	103.60	2,508.69	0.00	3,491.31	41.81
202-5202-03-5080 Gas & Oil	14,000	2,609.63	13,870.62	0.00	129.38	99.08
202-5202-03-5081 Uniforms	3,500	1,187.59	3,789.87	0.00	(289.87)	108.28
202-5202-03-5090 Postage	300	0.00	295.30	0.00	4.70	98.43
202-5202-03-5150 Printing	600	0.00	0.00	0.00	600.00	0.00
202-5202-03-5607 Rock, Sand & Gravel	4,000	0.00	7,384.15	0.00	(3,384.15)	184.60
202-5202-03-5608 Chemicals Purchased	10,000	945.00	9,629.59	0.00	370.41	96.30
202-5202-03-5630 Tools	1,500	0.00	5,552.51	0.00	(4,052.51)	370.17
202-5202-03-5903 Parts and Fittings	3,000	610.57	3,159.90	0.00	(159.90)	105.33
202-5202-03-5904 Chlorine	11,000	1,512.56	12,190.50	0.00	(1,190.50)	110.82
TOTAL Materials & Supplies	53,900	6,968.95	58,381.13	0.00	(4,481.13)	108.31
Repairs & Maintenance						
202-5202-04-5120 Building Maintenance	5,000	0.00	8,154.14	0.00	(3,154.14)	163.08
202-5202-04-5121 Equipment Maintenance	30,000	3,614.39	33,655.27	0.00	(3,655.27)	112.18
202-5202-04-5122 Vehicle Maintenance	5,000	703.76	6,975.44	0.00	(1,975.44)	139.51
202-5202-04-5902 Sewer System Maintenanc	55,000	1,511.03	40,208.99	7,250.00	7,541.01	86.29
202-5202-04-5903 WWTP Maintenance	85,000	5,851.44	112,900.08	0.00	(27,900.08)	132.82
TOTAL Repairs & Maintenance	180,000	11,680.62	201,893.92	7,250.00	(29,143.92)	116.19
Utilities						
202-5202-05-5616 Utilities - Electricity	42,500	353.94	41,709.01	0.00	790.99	98.14
202-5202-05-5618 Utilities - Telephone	7,000	884.95	7,336.38	0.00	(336.38)	104.81
202-5202-05-5619 Utilities - Water/Sewer	100,000	7,725.52	123,390.68	0.00	(23,390.68)	123.39
202-5202-05-5621 Utilities - Sludge Disp	10,000	0.00	3,304.24	0.00	6,695.76	33.04
TOTAL Utilities	159,500	8,964.41	175,740.31	0.00	(16,240.31)	110.18
Contract Services						
202-5202-06-5240 Drug testing/background	200	0.00	200.00	0.00	0.00	100.00
202-5202-06-5620 Legal & Professional	6,000	0.00	1,871.24	0.00	4,128.76	31.19
202-5202-06-5766 Consultant - engineerin	30,000	11,543.47	27,956.99	0.00	2,043.01	93.19
TOTAL Contract Services	36,200	11,543.47	30,028.23	0.00	6,171.77	82.95
Fees & Other Services						
202-5202-07-5190 Insurance - TML	15,000	3,709.03	14,515.38	0.00	484.62	96.77
202-5202-07-5260 Dues & Memberships	2,601	0.00	2,600.55	0.00	0.45	99.98

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

202-Sewer Fund

DEPARTMENT - Sewer % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
202-5202-07-5261 Permits-TCEQ	4,700	0.00	0.00	0.00	4,700.00	0.00
202-5202-07-5624 Equipment Rental	15,000	0.00	3,516.29	0.00	11,483.71	23.44
202-5202-07-5665 Technology	6,000	0.00	3,750.00	0.00	2,250.00	62.50
202-5202-07-5901 Lab Fees	15,000	0.00	7,075.14	0.00	7,924.86	47.17
TOTAL Fees & Other Services	58,301	3,709.03	31,457.36	0.00	26,843.64	53.96
Debt Service						
Contingency/FB						
202-5202-99-5902 Capital - equipment	98,906	0.00	98,905.07	53,378.70	(53,377.77)	153.97
TOTAL Contingency/FB	98,906	0.00	98,905.07	53,378.70	(53,377.77)	153.97
TOTAL Sewer	905,099	74,523.21	865,919.05	60,628.70	(21,448.75)	102.37
TOTAL EXPENSES	905,099	74,523.21	865,919.05	60,628.70	(21,448.75)	102.37
REVENUE OVER/(UNDER) EXPENSES	531,461	47,695.46	317,381.97	(60,628.70)	274,707.73	48.31

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

205-Solid Waste Fund

FINANCIAL SUMMARY % OF YEAR COMPLETED: 83.33

	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
REVENUE SUMMARY						
GENERAL REVENUE						
Charges for Services	2,263,208	305,633.13	1,772,734.03	0.00	490,473.97	78.33
TOTAL GENERAL REVENUE	2,263,208	305,633.13	1,772,734.03	0.00	490,473.97	78.33
TOTAL REVENUE	2,263,208	305,633.13	1,772,734.03	0.00	490,473.97	78.33
EXPENSE SUMMARY						
Solid Waste						
Fees & Other Services	2,263,208	176,222.33	1,772,914.07	0.00	490,293.93	78.34
TOTAL Solid Waste	2,263,208	176,222.33	1,772,914.07	0.00	490,293.93	78.34
TOTAL EXPENSES	2,263,208	176,222.33	1,772,914.07	0.00	490,293.93	78.34
REVENUE OVER/(UNDER) EXPENSES	0	129,410.80	(180.04)	0.00	180.04	0.00

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

205-Solid Waste Fund

% OF YEAR COMPLETED: 83.33

REVENUES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Charges for Services						
205-4000-06-4025 Garbage Billings	2,263,208	305,633.13	1,772,734.03	0.00	490,473.97	78.33
TOTAL Charges for Services	2,263,208	305,633.13	1,772,734.03	0.00	490,473.97	78.33
Miscellaneous						
Contingency/FB						
TOTAL REVENUE	2,263,208	305,633.13	1,772,734.03	0.00	490,473.97	78.33

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

205-Solid Waste Fund

DEPARTMENT - Solid Waste % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Materials & Supplies						
Fees & Other Services						
205-5205-07-5666 Mustang Collection Fees	95,000	15,367.53	76,538.15	0.00	18,461.85	80.57
205-5205-07-5931 Franchise Fees 15%	280,000	0.00	216,499.03	0.00	63,500.97	77.32
205-5205-07-5941 Republic Waste	1,888,208	160,854.80	1,479,876.89	0.00	408,331.11	78.37
TOTAL Fees & Other Services	2,263,208	176,222.33	1,772,914.07	0.00	490,293.93	78.34
Contingency/FB						
TOTAL Solid Waste	2,263,208	176,222.33	1,772,914.07	0.00	490,293.93	78.34
TOTAL EXPENSES	2,263,208	176,222.33	1,772,914.07	0.00	490,293.93	78.34
REVENUE OVER/(UNDER) EXPENSES	0	129,410.80	(180.04)	0.00	180.04	0.00

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

301-Debt Service Fund

FINANCIAL SUMMARY % OF YEAR COMPLETED: 83.33

	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
REVENUE SUMMARY						
GENERAL REVENUE						
Taxes	1,321,000	11,279.22	1,347,943.24	0.00	(26,943.24)	102.04
Miscellaneous	15,000	2,270.42	27,228.87	0.00	(12,228.87)	181.53
TOTAL GENERAL REVENUE	1,336,000	13,549.64	1,375,172.11	0.00	(39,172.11)	102.93
TOTAL REVENUE	1,336,000	13,549.64	1,375,172.11	0.00	(39,172.11)	102.93
EXPENSE SUMMARY						
Debt Service						
Fees & Other Services	4,000	0.00	3,500.00	0.00	500.00	87.50
Debt Service	1,372,229	0.00	1,080,683.02	0.00	291,545.98	78.75
TOTAL Debt Service	1,376,229	0.00	1,084,183.02	0.00	292,045.98	78.78
TOTAL EXPENSES	1,376,229	0.00	1,084,183.02	0.00	292,045.98	78.78
REVENUE OVER/(UNDER) EXPENSES	(40,229)	13,549.64	290,989.09	0.00	(331,218.09)	723.33-

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

301-Debt Service Fund

% OF YEAR COMPLETED: 83.33

REVENUES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Taxes						
301-4000-02-4100 Property Taxes	1,321,000	11,279.22	1,347,943.24	0.00	(26,943.24)	102.04
TOTAL Taxes	1,321,000	11,279.22	1,347,943.24	0.00	(26,943.24)	102.04
Miscellaneous						
301-4000-09-4500 Interest Income	15,000	2,270.42	27,228.87	0.00	(12,228.87)	181.53
TOTAL Miscellaneous	15,000	2,270.42	27,228.87	0.00	(12,228.87)	181.53
Contingency/FB						
TOTAL REVENUE	1,336,000	13,549.64	1,375,172.11	0.00	(39,172.11)	102.93

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

301-Debt Service Fund

DEPARTMENT - Debt Service % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Fees & Other Services						
301-5301-07-5870 Agent Fees	4,000	0.00	3,500.00	0.00	500.00	87.50
TOTAL Fees & Other Services	4,000	0.00	3,500.00	0.00	500.00	87.50
Debt Service						
301-5301-98-5850 2020 Time Warrant Princ	36,000	0.00	36,000.00	0.00	0.00	100.00
301-5301-98-5851 2020 Time Warrant Inter	9,708	0.00	4,962.00	0.00	4,746.00	51.11
301-5301-98-5852 2006 CO Principal	40,000	0.00	0.00	0.00	40,000.00	0.00
301-5301-98-5853 2006 CO Interest	7,380	0.00	3,690.00	0.00	3,690.00	50.00
301-5301-98-5860 2013 GO Refunding Princ	57,000	0.00	57,000.00	0.00	0.00	100.00
301-5301-98-5861 2013 GO Refunding Inter	4,169	0.00	4,019.47	0.00	149.53	96.41
301-5301-98-5864 2019 Time Warrant Princ	98,000	0.00	98,000.00	0.00	0.00	100.00
301-5301-98-5865 2019 Time Warrant Inter	14,250	0.00	7,582.85	0.00	6,667.15	53.21
301-5301-98-5866 2020 GO Refunding Prini	558,000	0.00	558,000.00	0.00	0.00	100.00
301-5301-98-5867 2020 GO Refunding Inter	12,872	0.00	7,928.70	0.00	4,943.30	61.60
301-5301-98-5868 2022 CO Public Safety P	70,000	0.00	70,000.00	0.00	0.00	100.00
301-5301-98-5869 2022 CO Public Safety I	464,850	0.00	233,300.00	0.00	231,550.00	50.19
301-5301-98-5899 Bond Issue Costs	0	0.00	200.00	0.00	(200.00)	0.00
TOTAL Debt Service	1,372,229	0.00	1,080,683.02	0.00	291,545.98	78.75
Contingency/FB						
TOTAL Debt Service	1,376,229	0.00	1,084,183.02	0.00	292,045.98	78.78
TOTAL EXPENSES	1,376,229	0.00	1,084,183.02	0.00	292,045.98	78.78
REVENUE OVER/(UNDER) EXPENSES	(40,229)	13,549.64	290,989.09	0.00	(331,218.09)	723.33-

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

401-Special Revenue Fund

FINANCIAL SUMMARY % OF YEAR COMPLETED: 83.33

	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
REVENUE SUMMARY						
GENERAL REVENUE						
Fines and Fees	13,000	1,320.44	15,895.63	0.00	(2,895.63)	122.27
Taxes	2,000	2,186.78	8,989.18	0.00	(6,989.18)	449.46
Grants	1,250	0.00	4,127.56	0.00	(2,877.56)	330.20
Miscellaneous	500	206.44	1,935.86	0.00	(1,435.86)	387.17
TOTAL GENERAL REVENUE	16,750	3,713.66	30,948.23	0.00	(14,198.23)	184.77
TOTAL REVENUE	16,750	3,713.66	30,948.23	0.00	(14,198.23)	184.77
EXPENSE SUMMARY						
Officers Training Fund						
Personnel	3,000	0.00	2,380.00	0.00	620.00	79.33
Contract Services	3,500	3,700.00	3,700.00	0.00	(200.00)	105.71
Fees & Other Services	4,000	0.00	3,525.00	0.00	475.00	88.13
TOTAL Officers Training Fund	10,500	3,700.00	9,605.00	0.00	895.00	91.48
Seizure						
Contract Services	0	0.00	375.00	0.00	(375.00)	0.00
TOTAL Seizure	0	0.00	375.00	0.00	(375.00)	0.00
Court Technology						
Court Security						
Personnel	2,050	0.00	0.00	0.00	2,050.00	0.00
TOTAL Court Security	2,050	0.00	0.00	0.00	2,050.00	0.00
TOTAL EXPENSES	12,550	3,700.00	9,980.00	0.00	2,570.00	79.52
REVENUE OVER/(UNDER) EXPENSES	4,200	13.66	20,968.23	0.00	(16,768.23)	499.24

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

401-Special Revenue Fund

% OF YEAR COMPLETED: 83.33

REVENUES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Fines and Fees						
401-4000-01-4310 Court Security Fee	3,000	722.98	4,796.46	0.00	(1,796.46)	159.88
401-4000-01-4421 Child Safety Fees	8,000	0.00	7,146.63	0.00	853.37	89.33
401-4000-01-4710 Court Technology Fee	2,000	597.46	3,952.54	0.00	(1,952.54)	197.63
TOTAL Fines and Fees	13,000	1,320.44	15,895.63	0.00	(2,895.63)	122.27
Taxes						
401-4000-02-4170 Hotel/Motel Tax	2,000	2,186.78	8,989.18	0.00	(6,989.18)	449.46
TOTAL Taxes	2,000	2,186.78	8,989.18	0.00	(6,989.18)	449.46
Grants						
401-4000-03-4701 NCTCOG/State Comp/LEOSE	1,250	0.00	4,127.56	0.00	(2,877.56)	330.20
TOTAL Grants	1,250	0.00	4,127.56	0.00	(2,877.56)	330.20
Miscellaneous						
401-4000-09-4500 Interest Income	500	206.44	1,935.86	0.00	(1,435.86)	387.17
TOTAL Miscellaneous	500	206.44	1,935.86	0.00	(1,435.86)	387.17
Contingency/FB						
TOTAL REVENUE	16,750	3,713.66	30,948.23	0.00	(14,198.23)	184.77

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

401-Special Revenue Fund

DEPARTMENT - Officers Training Fund % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
401-5401-01-5621 Travel/training	3,000	0.00	2,380.00	0.00	620.00	79.33
TOTAL Personnel	3,000	0.00	2,380.00	0.00	620.00	79.33
Materials & Supplies						
Contract Services						
401-5401-06-5677 Child Safety - Child Ad	3,500	3,700.00	3,700.00	0.00	(200.00)	105.71
TOTAL Contract Services	3,500	3,700.00	3,700.00	0.00	(200.00)	105.71
Fees & Other Services						
401-5401-07-5665 Court Technology	4,000	0.00	3,525.00	0.00	475.00	88.13
TOTAL Fees & Other Services	4,000	0.00	3,525.00	0.00	475.00	88.13
Public Safety						
Contingency/FB						
TOTAL Officers Training Fund	10,500	3,700.00	9,605.00	0.00	895.00	91.48

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

401-Special Revenue Fund

DEPARTMENT - Seizure % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Materials & Supplies						
Contract Services						
401-5402-06-5620 Seizure - Legal & Profe	0	0.00	375.00	0.00	(375.00)	0.00
TOTAL Contract Services	0	0.00	375.00	0.00	(375.00)	0.00
Fees & Other Services						
TOTAL Seizure	0	0.00	375.00	0.00	(375.00)	0.00

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

401-Special Revenue Fund

DEPARTMENT - Court Technology % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Debt Service						
Contingency/FB						

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

401-Special Revenue Fund

DEPARTMENT - Court Security % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
401-5404-01-5101 Salaries	2,000	0.00	0.00	0.00	2,000.00	0.00
401-5404-01-5108 Payroll Tax Expense (me	50	0.00	0.00	0.00	50.00	0.00
TOTAL Personnel	2,050	0.00	0.00	0.00	2,050.00	0.00
Contingency/FB						
TOTAL Court Security	2,050	0.00	0.00	0.00	2,050.00	0.00
TOTAL EXPENSES	12,550	3,700.00	9,980.00	0.00	2,570.00	79.52
REVENUE OVER/(UNDER) EXPENSES	4,200	13.66	20,968.23	0.00	(16,768.23)	499.24

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

402-TIRZ Jackson Ridge

FINANCIAL SUMMARY % OF YEAR COMPLETED: 83.33

	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
REVENUE SUMMARY						
GENERAL REVENUE						
Taxes	900,000	0.00	881,484.60	0.00	18,515.40	97.94
Miscellaneous	6,000	2,248.00	16,932.03	0.00	(10,932.03)	282.20
TOTAL GENERAL REVENUE	906,000	2,248.00	898,416.63	0.00	7,583.37	99.16
TOTAL REVENUE	906,000	2,248.00	898,416.63	0.00	7,583.37	99.16
EXPENSE SUMMARY						
Seizure Fund						
Fees & Other Services	900,000	625,943.55	625,943.55	0.00	274,056.45	69.55
TOTAL Seizure Fund	900,000	625,943.55	625,943.55	0.00	274,056.45	69.55
TOTAL EXPENSES	900,000	625,943.55	625,943.55	0.00	274,056.45	69.55
REVENUE OVER/(UNDER) EXPENSES	6,000	(623,695.55)	272,473.08	0.00	(266,473.08)	4,541.22

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

402-TIRZ Jackson Ridge

% OF YEAR COMPLETED: 83.33

REVENUES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Taxes						
402-4000-02-4100 Property Taxes	900,000	0.00	881,484.60	0.00	18,515.40	97.94
TOTAL Taxes	900,000	0.00	881,484.60	0.00	18,515.40	97.94
Grants						
Donations						
Miscellaneous						
402-4000-09-4500 Interest Income	6,000	2,248.00	16,932.03	0.00	(10,932.03)	282.20
TOTAL Miscellaneous	6,000	2,248.00	16,932.03	0.00	(10,932.03)	282.20
Contingency/FB						
TOTAL REVENUE	906,000	2,248.00	898,416.63	0.00	7,583.37	99.16

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

402-TIRZ Jackson Ridge

DEPARTMENT - Seizure Fund % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Materials & Supplies						
Fees & Other Services						
402-5402-07-5665 Jackson Ridge PID TIRZ	900,000	625,943.55	625,943.55	0.00	274,056.45	69.55
TOTAL Fees & Other Services	900,000	625,943.55	625,943.55	0.00	274,056.45	69.55
TOTAL Seizure Fund	900,000	625,943.55	625,943.55	0.00	274,056.45	69.55
TOTAL EXPENSES	900,000	625,943.55	625,943.55	0.00	274,056.45	69.55
REVENUE OVER/(UNDER) EXPENSES	6,000	(623,695.55)	272,473.08	0.00	(266,473.08)	4,541.22

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

403-Impact Fees

FINANCIAL SUMMARY % OF YEAR COMPLETED: 83.33

	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
REVENUE SUMMARY						
GENERAL REVENUE						
Miscellaneous	10,000	1,846.22	17,919.85	0.00	(7,919.85)	179.20
TOTAL GENERAL REVENUE	10,000	1,846.22	17,919.85	0.00	(7,919.85)	179.20
TOTAL REVENUE	10,000	1,846.22	17,919.85	0.00	(7,919.85)	179.20
EXPENSE SUMMARY						
MCTF						
Contract Services	0	580.00	2,210.00	0.00	(2,210.00)	0.00
TOTAL MCTF	0	580.00	2,210.00	0.00	(2,210.00)	0.00
TOTAL EXPENSES	0	580.00	2,210.00	0.00	(2,210.00)	0.00
REVENUE OVER/(UNDER) EXPENSES	10,000	1,266.22	15,709.85	0.00	(5,709.85)	157.10

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

403-Impact Fees

% OF YEAR COMPLETED: 83.33

REVENUES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Fines and Fees						
Miscellaneous						
403-4000-09-4500 Interest Income	10,000	1,846.22	17,919.85	0.00	(7,919.85)	179.20
TOTAL Miscellaneous	10,000	1,846.22	17,919.85	0.00	(7,919.85)	179.20
Contingency/FB						
TOTAL REVENUE	10,000	1,846.22	17,919.85	0.00	(7,919.85)	179.20

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

403-Impact Fees

DEPARTMENT - MCTF % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Contract Services						
403-5403-06-5766 CONSULTING ENGINEERING	0	0.00	1,630.00	0.00	(1,630.00)	0.00
403-5403-06-5767 Consulting Eng - Street	0	580.00	580.00	0.00	(580.00)	0.00
TOTAL Contract Services	0	580.00	2,210.00	0.00	(2,210.00)	0.00
Fees & Other Services						
Contingency/FB						
TOTAL MCTF	0	580.00	2,210.00	0.00	(2,210.00)	0.00
TOTAL EXPENSES	0	580.00	2,210.00	0.00	(2,210.00)	0.00
REVENUE OVER/(UNDER) EXPENSES	10,000	1,266.22	15,709.85	0.00	(5,709.85)	157.10

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

404-Development Fees

FINANCIAL SUMMARY % OF YEAR COMPLETED: 83.33

	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
REVENUE SUMMARY						
GENERAL REVENUE						
Fines and Fees	0	14,706.00	200,982.00	0.00	(200,982.00)	0.00
Permits	1,100,000	167,567.00	977,311.00	0.00	122,689.00	88.85
Miscellaneous	260,000	45,959.21	440,668.40	0.00	(180,668.40)	169.49
TOTAL GENERAL REVENUE	1,360,000	228,232.21	1,618,961.40	0.00	(258,961.40)	119.04
TOTAL REVENUE	1,360,000	228,232.21	1,618,961.40	0.00	(258,961.40)	119.04
EXPENSE SUMMARY						
MCSF						
Contract Services	840,000	1,288.58	313,959.13	183,582.36	342,458.51	59.23
TOTAL MCSF	840,000	1,288.58	313,959.13	183,582.36	342,458.51	59.23
TOTAL EXPENSES	840,000	1,288.58	313,959.13	183,582.36	342,458.51	59.23
REVENUE OVER/(UNDER) EXPENSES	520,000	226,943.63	1,305,002.27	(183,582.36)	(601,419.91)	215.66

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

404-Development Fees

% OF YEAR COMPLETED: 83.33

REVENUES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Fines and Fees						
404-4000-01-4310 Street Impact Fees	0	14,706.00	200,982.00	0.00	(200,982.00)	0.00
TOTAL Fines and Fees	0	14,706.00	200,982.00	0.00	(200,982.00)	0.00
Charges for Services						
Permits						
404-4000-07-4200 Development Fees	100,000	1,346.00	13,073.00	0.00	86,927.00	13.07
404-4000-07-4210 Street Fee	200,000	2,637.00	65,925.00	0.00	134,075.00	32.96
404-4000-07-4700 Fire Services Fund	600,000	136,234.00	388,013.00	0.00	211,987.00	64.67
404-4000-07-4710 Park Development Fees	200,000	27,350.00	510,300.00	0.00	(310,300.00)	255.15
TOTAL Permits	1,100,000	167,567.00	977,311.00	0.00	122,689.00	88.85
Miscellaneous						
404-4000-09-4500 Interest Income	260,000	45,959.21	440,668.40	0.00	(180,668.40)	169.49
TOTAL Miscellaneous	260,000	45,959.21	440,668.40	0.00	(180,668.40)	169.49
Contingency/FB						
TOTAL REVENUE	1,360,000	228,232.21	1,618,961.40	0.00	(258,961.40)	119.04

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

404-Development Fees

DEPARTMENT - MCSF % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
Contract Services						
404-5404-06-5912 Capital Expenditure - P	840,000	1,288.58	268,573.54	174,042.36	397,384.10	52.69
404-5404-06-5913 Capital Expenditure - F	0	0.00	45,385.59	9,540.00	(54,925.59)	0.00
TOTAL Contract Services	840,000	1,288.58	313,959.13	183,582.36	342,458.51	59.23
Public Safety						
Contingency/FB						
TOTAL MCSF	840,000	1,288.58	313,959.13	183,582.36	342,458.51	59.23
TOTAL EXPENSES	840,000	1,288.58	313,959.13	183,582.36	342,458.51	59.23
REVENUE OVER/(UNDER) EXPENSES	520,000	226,943.63	1,305,002.27	(183,582.36)	(601,419.91)	215.66

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

405-Grant Fund

FINANCIAL SUMMARY % OF YEAR COMPLETED: 83.33

	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
REVENUE SUMMARY						
GENERAL REVENUE						
Miscellaneous	50,000	4,915.57	52,923.10	0.00	(2,923.10)	105.85
USDOJ PD Vests	0	0.00	924.68	0.00	(924.68)	0.00
Grant Revenue	956,956	0.00	447,853.00	0.00	509,103.00	46.80
TOTAL GENERAL REVENUE	1,006,956	4,915.57	501,700.78	0.00	505,255.22	49.82
TOTAL REVENUE	1,006,956	4,915.57	501,700.78	0.00	505,255.22	49.82
EXPENSE SUMMARY						
Grants						
Contract Services	100,000	0.00	0.00	0.00	100,000.00	0.00
CDBG Water lines	906,956	52,079.08	630,895.52	69,037.17	207,023.31	77.17
TOTAL Grants	1,006,956	52,079.08	630,895.52	69,037.17	307,023.31	69.51
TOTAL EXPENSES	1,006,956	52,079.08	630,895.52	69,037.17	307,023.31	69.51
REVENUE OVER/(UNDER) EXPENSES	0	(47,163.51)	(129,194.74)	(69,037.17)	198,231.91	0.00

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

405-Grant Fund

% OF YEAR COMPLETED: 83.33

REVENUES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Charges for Services						
Miscellaneous						
405-4000-09-4500 Interest Income	50,000	4,915.57	52,923.10	0.00	(2,923.10)	105.85
TOTAL Miscellaneous	50,000	4,915.57	52,923.10	0.00	(2,923.10)	105.85
Tocker Foundation-Libry						
USDOJ PD Vests						
405-4000-82-4126 Opioid Grant Proceeds	0	0.00	924.68	0.00	(924.68)	0.00
TOTAL USDOJ PD Vests	0	0.00	924.68	0.00	(924.68)	0.00
CJD Video,Computers						
CDBG Water Lines						
Grant Revenue						
405-4000-85-4123 CLFRF Proceeds	700,000	0.00	190,896.60	0.00	509,103.40	27.27
405-4000-85-4125 TDA Water/Sewer Grant	256,956	0.00	256,956.40	0.00	(0.40)	100.00
TOTAL Grant Revenue	956,956	0.00	447,853.00	0.00	509,103.00	46.80
Contingency/FB						
TOTAL REVENUE	1,006,956	4,915.57	501,700.78	0.00	505,255.22	49.82

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

405-Grant Fund

DEPARTMENT - Grants % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Contract Services						
405-5405-06-5620 ENGINEERING	100,000	0.00	0.00	0.00	100,000.00	0.00
TOTAL Contract Services	100,000	0.00	0.00	0.00	100,000.00	0.00
Miscellaneous						
Tocker Foundation Libry						
USDOJ PD Vests						
CJD Video,Computers						
CDBG Water lines						
405-5405-84-5121 TxDot Grant	0	0.00	88,147.19	0.00	(88,147.19)	0.00
405-5405-84-5122 CDBG water lines	306,956	10,829.39	143,912.19	0.00	163,043.81	46.88
405-5405-84-5123 ARPA Pump Station Gener	600,000	41,249.69	398,836.14	69,037.17	132,126.69	77.98
TOTAL CDBG Water lines	906,956	52,079.08	630,895.52	69,037.17	207,023.31	77.17
Contingency/FB						
TOTAL Grants	1,006,956	52,079.08	630,895.52	69,037.17	307,023.31	69.51
TOTAL EXPENSES	1,006,956	52,079.08	630,895.52	69,037.17	307,023.31	69.51
REVENUE OVER/(UNDER) EXPENSES	0	(47,163.51)	(129,194.74)	(69,037.17)	198,231.91	0.00

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

406-Holding Acct Dev Agreemts

FINANCIAL SUMMARY % OF YEAR COMPLETED: 83.33

	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
REVENUE SUMMARY						
GENERAL REVENUE						
Charges for Services	0	5,000.00	225,000.00	0.00	(225,000.00)	0.00
Miscellaneous	0	6.85	66.46	0.00	(66.46)	0.00
TOTAL GENERAL REVENUE	0	5,006.85	225,066.46	0.00	(225,066.46)	0.00
TOTAL REVENUE	0	5,006.85	225,066.46	0.00	(225,066.46)	0.00
EXPENSE SUMMARY						
Development Agreements						
Contract Services	0	17,607.23	347,451.51	0.00	(347,451.51)	0.00
TOTAL Development Agreements	0	17,607.23	347,451.51	0.00	(347,451.51)	0.00
TOTAL EXPENSES	0	17,607.23	347,451.51	0.00	(347,451.51)	0.00
REVENUE OVER/(UNDER) EXPENSES	0	(12,600.38)	(122,385.05)	0.00	122,385.05	0.00

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

406-Holding Acct Dev Agreemts

% OF YEAR COMPLETED: 83.33

REVENUES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Charges for Services						
406-4000-06-5408 PSA - High Point Ranch	0	0.00	100,000.00	0.00	(100,000.00)	0.00
406-4000-06-5414 HPR - Lennar	0	0.00	50,000.00	0.00	(50,000.00)	0.00
406-4000-06-5415 Duck Point MM Aubrey	0	0.00	50,000.00	0.00	(50,000.00)	0.00
406-4000-06-5416 ARCK Development (Knuck	0	0.00	10,000.00	0.00	(10,000.00)	0.00
406-4000-06-5417 Aubrey Hts PSA	0	0.00	10,000.00	0.00	(10,000.00)	0.00
406-4000-06-5422 Hidden Lake	0	5,000.00	5,000.00	0.00	(5,000.00)	0.00
TOTAL Charges for Services	0	5,000.00	225,000.00	0.00	(225,000.00)	0.00
Miscellaneous						
406-4000-09-4500 Interest Income	0	6.85	66.46	0.00	(66.46)	0.00
TOTAL Miscellaneous	0	6.85	66.46	0.00	(66.46)	0.00
TOTAL REVENUE	0	5,006.85	225,066.46	0.00	(225,066.46)	0.00

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

406-Holding Acct Dev Agreemts

DEPARTMENT - Development Agreements % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Contract Services						
406-5406-06-5620 Arrow Brooke Dev Agreem	0	0.00	3,019.27	0.00	(3,019.27)	0.00
406-5406-06-5622 Dev Agreement - Meadows	0	4,294.41	4,294.41	0.00	(4,294.41)	0.00
406-5406-06-5720 Silverado (Regatta) Dev	0	405.91	28,223.73	0.00	(28,223.73)	0.00
406-5406-06-5723 DA - Aubrey Plant/N/S	0	(4,534.21)	28,050.99	0.00	(28,050.99)	0.00
406-5406-06-5724 DA - High Pointe Ranch	0	0.00	187,119.06	0.00	(187,119.06)	0.00
406-5406-06-5725 Keenland Addition	0	0.00	8,147.97	0.00	(8,147.97)	0.00
406-5406-06-5728 DA - RIBBONWOOD	0	0.00	15,173.07	0.00	(15,173.07)	0.00
406-5406-06-5729 Sweet Cow Holdings LLC	0	8,339.91	9,327.71	0.00	(9,327.71)	0.00
406-5406-06-6450 Sandbrock Dev Agreement	0	0.00	6,058.17	0.00	(6,058.17)	0.00
406-5406-06-6460 Duck Point MM Aubrey	0	4,226.23	30,743.33	0.00	(30,743.33)	0.00
406-5406-06-6462 Pecan Creek Residential	0	0.00	1,717.50	0.00	(1,717.50)	0.00
406-5406-06-6463 HPR - Lennar	0	0.00	11,622.93	0.00	(11,622.93)	0.00
406-5406-06-6465 DA Lennar Loyd Ranch	0	0.00	5,652.34	0.00	(5,652.34)	0.00
406-5406-06-6470 DA US 377 Project Alpha	0	2,392.27	4,698.27	0.00	(4,698.27)	0.00
406-5406-06-6471 Blackjack 4Star PSA	0	939.37	1,896.92	0.00	(1,896.92)	0.00
406-5406-06-6472 ARCK Development (Knuck	0	0.00	162.50	0.00	(162.50)	0.00
406-5406-06-6474 Hidden Lake	0	1,543.34	1,543.34	0.00	(1,543.34)	0.00
TOTAL Contract Services	0	17,607.23	347,451.51	0.00	(347,451.51)	0.00
TOTAL Development Agreements	0	17,607.23	347,451.51	0.00	(347,451.51)	0.00
TOTAL EXPENSES	0	17,607.23	347,451.51	0.00	(347,451.51)	0.00
REVENUE OVER/(UNDER) EXPENSES	0	(12,600.38)	(122,385.05)	0.00	122,385.05	0.00

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

501-Capital Projects Fund

FINANCIAL SUMMARY % OF YEAR COMPLETED: 83.33

	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
REVENUE SUMMARY						
GENERAL REVENUE						
Penalties & Interest	726,414	79,013.00	791,583.49	0.00	(65,169.49)	108.97
Charges for Services	0	10,000,000.00	10,000,000.00	0.00	(10,000,000.00)	0.00
Miscellaneous	9,108,336	0.00	5,708,335.65	0.00	3,400,000.35	62.67
Contingency/FB	15,273,623	1,733.19	1,733.19	0.00	15,271,889.81	0.01
TOTAL GENERAL REVENUE	25,108,373	10,080,746.19	16,501,652.33	0.00	8,606,720.67	65.72
TOTAL REVENUE	25,108,373	10,080,746.19	16,501,652.33	0.00	8,606,720.67	65.72
EXPENSE SUMMARY						
Capital Projects						
Capital	13,000	0.00	0.00	0.00	13,000.00	0.00
Contract Services	592,415	2,627.50	44,995.71	2,063.00	545,356.29	7.94
Miscellaneous	24,982,621	753,261.58	10,515,474.27	1,422,232.95	13,044,913.78	47.78
Debt Service	203,337	0.00	203,337.00	0.00	0.00	100.00
TOTAL Capital Projects	25,791,373	755,889.08	10,763,806.98	1,424,295.95	13,603,270.07	47.26
TOTAL EXPENSES	25,791,373	755,889.08	10,763,806.98	1,424,295.95	13,603,270.07	47.26
REVENUE OVER/(UNDER) EXPENSES	(683,000)	9,324,857.11	5,737,845.35	(1,424,295.95)	(4,996,549.40)	631.56-

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

501-Capital Projects Fund

% OF YEAR COMPLETED: 83.33

REVENUES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Penalties & Interest						
501-4000-05-4500 Interest Income	726,414	79,013.00	791,583.49	0.00	(65,169.49)	108.97
TOTAL Penalties & Interest	726,414	79,013.00	791,583.49	0.00	(65,169.49)	108.97
Charges for Services						
501-4000-06-4500 Developer Contrib ABP L	0	10,000,000.00	10,000,000.00	0.00	(10,000,000.00)	0.00
TOTAL Charges for Services	0	10,000,000.00	10,000,000.00	0.00	(10,000,000.00)	0.00
Miscellaneous						
501-4000-09-4900 Bond proceeds	8,925,000	0.00	5,525,000.00	0.00	3,400,000.00	61.90
501-4000-09-4901 Premium on Sale of Bond	183,336	0.00	183,335.65	0.00	0.35	100.00
TOTAL Miscellaneous	9,108,336	0.00	5,708,335.65	0.00	3,400,000.35	62.67
Contingency/FB						
501-4000-99-4091 Transfers In	14,271,544	1,733.19	1,733.19	0.00	14,269,810.81	0.01
501-4000-99-4092 Capital Carryforward	1,002,079	0.00	0.00	0.00	1,002,079.00	0.00
TOTAL Contingency/FB	15,273,623	1,733.19	1,733.19	0.00	15,271,889.81	0.01
TOTAL REVENUE	25,108,373	10,080,746.19	16,501,652.33	0.00	8,606,720.67	65.72

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

501-Capital Projects Fund

DEPARTMENT - Capital Projects % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Capital						
501-5501-02-5641 Park Development	13,000	0.00	0.00	0.00	13,000.00	0.00
TOTAL Capital	13,000	0.00	0.00	0.00	13,000.00	0.00
Contract Services						
501-5501-06-5765 IT Projects	92,415	2,627.50	44,995.71	2,063.00	45,356.29	50.92
501-5501-06-5766 Engineering	500,000	0.00	0.00	0.00	500,000.00	0.00
TOTAL Contract Services	592,415	2,627.50	44,995.71	2,063.00	545,356.29	7.94
Miscellaneous						
501-5501-09-5633 Capital Public Safety E	631,257	0.00	100,000.00	0.00	531,257.00	15.84
501-5501-09-5650 Capital Public Safety 2	6,044,149	353,035.67	3,438,548.69	0.00	2,605,600.31	56.89
501-5501-09-5651 Capital Vehicle Replace	1,606,516	(8,506.78)	1,846,585.24	517,410.32	(757,479.56)	147.15
501-5501-09-5652 Capital Project 38	3,400,000	0.00	0.00	0.00	3,400,000.00	0.00
501-5501-09-5656 2023 PH 1 Offsights	3,134,698	0.00	1,112,237.68	839,941.00	1,182,519.32	62.28
501-5501-09-5657 Capital Modular Buildin	291,582	0.00	291,582.00	0.00	0.00	100.00
501-5501-09-5658 CO 2024 FS#2	5,708,336	112,779.25	750,986.67	0.00	4,957,349.33	13.16
501-5501-09-5659 Council Chambers 2023	932,025	21,350.09	696,798.32	0.00	235,226.68	74.76
501-5501-09-5660 HW 377 Utility Relocate	0	0.00	50,659.07	0.00	(50,659.07)	0.00
501-5501-09-5689 Street Projects	1,065,902	67,130.88	1,119,828.43	0.00	(53,926.43)	105.06
501-5501-09-5690 Admin Projects	436,349	0.00	8,823.73	0.00	427,525.27	2.02
501-5501-09-5901 Water System Expansion	733,086	107,025.89	471,724.48	0.00	261,361.52	64.35
501-5501-09-5950 Sewer System Expansion	998,721	100,446.58	627,699.96	64,881.63	306,139.41	69.35
TOTAL Miscellaneous	24,982,621	753,261.58	10,515,474.27	1,422,232.95	13,044,913.78	47.78
Debt Service						
501-5501-98-5899 Bond Issue Costs	203,337	0.00	203,337.00	0.00	0.00	100.00
TOTAL Debt Service	203,337	0.00	203,337.00	0.00	0.00	100.00
Contingency/FB						
TOTAL Capital Projects	25,791,373	755,889.08	10,763,806.98	1,424,295.95	13,603,270.07	47.26
TOTAL EXPENSES	25,791,373	755,889.08	10,763,806.98	1,424,295.95	13,603,270.07	47.26
REVENUE OVER/(UNDER) EXPENSES	(683,000)	9,324,857.11	5,737,845.35	(1,424,295.95)	(4,996,549.40)	631.56-

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

701-MDD

FINANCIAL SUMMARY % OF YEAR COMPLETED: 83.33

	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
REVENUE SUMMARY						
GENERAL REVENUE						
Taxes	940,000	90,213.58	901,111.20	0.00	38,888.80	95.86
Miscellaneous	145,010	13,163.54	130,484.34	0.00	14,525.66	89.98
TOTAL GENERAL REVENUE	1,085,010	103,377.12	1,031,595.54	0.00	53,414.46	95.08
TOTAL REVENUE	1,085,010	103,377.12	1,031,595.54	0.00	53,414.46	95.08
EXPENSE SUMMARY						
MDD						
Personnel	138,465	11,131.32	105,796.37	0.00	32,668.63	76.41
Materials & Supplies	8,500	0.00	5,808.57	0.00	2,691.43	68.34
Repairs & Maintenance	20,000	475.80	12,681.84	0.00	7,318.16	63.41
Utilities	595	76.02	668.62	0.00	(73.62)	112.37
Contract Services	148,200	7,386.00	25,231.44	0.00	122,968.56	17.03
Fees & Other Services	51,850	3,285.17	35,666.54	0.00	16,183.46	68.79
Contingency/FB	215,000	1,250.00	12,500.00	0.00	202,500.00	5.81
TOTAL MDD	582,610	23,604.31	198,353.38	0.00	384,256.62	34.05
TOTAL EXPENSES	582,610	23,604.31	198,353.38	0.00	384,256.62	34.05
REVENUE OVER/(UNDER) EXPENSES	502,400	79,772.81	833,242.16	0.00	(330,842.16)	165.85

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

701-MDD

% OF YEAR COMPLETED: 83.33

REVENUES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Taxes						
701-4000-02-4130 Sales Taxes	940,000	90,213.58	901,111.20	0.00	38,888.80	95.86
TOTAL Taxes	940,000	90,213.58	901,111.20	0.00	38,888.80	95.86
Grants						
Miscellaneous						
701-4000-09-4500 Interest Income	145,000	11,663.54	122,300.56	0.00	22,699.44	84.35
701-4000-09-4550 Proceeds for Property P	0	0.00	3,828.94	0.00	(3,828.94)	0.00
701-4000-09-4730 Property Rental Income	10	1,500.00	4,354.84	0.00	(4,344.84)	3,548.40
TOTAL Miscellaneous	145,010	13,163.54	130,484.34	0.00	14,525.66	89.98
Contingency/FB						
TOTAL REVENUE	1,085,010	103,377.12	1,031,595.54	0.00	53,414.46	95.08

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

701-MDD

DEPARTMENT - MDD % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
701-5176-01-5101 Salaries	105,000	8,076.92	78,783.03	0.00	26,216.97	75.03
701-5176-01-5106 Longevity	50	0.00	0.00	0.00	50.00	0.00
701-5176-01-5107 TMRS Contribution	6,828	525.00	5,120.89	0.00	1,707.11	75.00
701-5176-01-5108 Payroll Tax Expense (me	1,523	110.82	1,055.98	0.00	467.02	69.34
701-5176-01-5109 Group Health Insurance	9,864	1,622.90	10,204.00	0.00	(340.00)	103.45
701-5176-01-5110 Workmens Comp TML	200	46.35	185.37	0.00	14.63	92.69
701-5176-01-5621 Travel/training	15,000	749.33	10,447.10	0.00	4,552.90	69.65
TOTAL Personnel	138,465	11,131.32	105,796.37	0.00	32,668.63	76.41
Capital						
Materials & Supplies						
701-5176-03-5050 Office Supplies	3,500	0.00	2,626.09	0.00	873.91	75.03
701-5176-03-5060 Promotional Materials	5,000	0.00	3,182.48	0.00	1,817.52	63.65
TOTAL Materials & Supplies	8,500	0.00	5,808.57	0.00	2,691.43	68.34
Repairs & Maintenance						
701-5176-04-5120 Building Maintenance	20,000	475.80	12,681.84	0.00	7,318.16	63.41
TOTAL Repairs & Maintenance	20,000	475.80	12,681.84	0.00	7,318.16	63.41
Utilities						
701-5176-05-5618 Telephone	595	76.02	668.62	0.00	(73.62)	112.37
TOTAL Utilities	595	76.02	668.62	0.00	(73.62)	112.37
Contract Services						
701-5176-06-5240 Drug screening/backgrou	200	0.00	0.00	0.00	200.00	0.00
701-5176-06-5620 Legal & Professional	40,000	2,561.00	16,477.58	0.00	23,522.42	41.19
701-5176-06-5764 Special Services	3,000	400.00	400.00	0.00	2,600.00	13.33
701-5176-06-7862 Maps	5,000	0.00	351.36	0.00	4,648.64	7.03
701-5176-06-7863 Strategic Plan	100,000	4,425.00	8,002.50	0.00	91,997.50	8.00
TOTAL Contract Services	148,200	7,386.00	25,231.44	0.00	122,968.56	17.03
Fees & Other Services						
701-5176-07-5190 Insurance - TML	850	210.18	822.55	0.00	27.45	96.77
701-5176-07-5260 Dues & Memberships	13,000	900.00	11,025.00	0.00	1,975.00	84.81
701-5176-07-5665 Technology/Promotional	25,000	114.99	18,339.89	0.00	6,660.11	73.36
701-5176-07-5667 Marketing and Advertisi	13,000	2,060.00	5,479.10	0.00	7,520.90	42.15
TOTAL Fees & Other Services	51,850	3,285.17	35,666.54	0.00	16,183.46	68.79
Miscellaneous						
Contingency/FB						
701-5176-99-4091 Administrative fee	15,000	1,250.00	12,500.00	0.00	2,500.00	83.33
701-5176-99-5700 Grant Match	50,000	0.00	0.00	0.00	50,000.00	0.00
701-5176-99-5750 Economic Incentives	150,000	0.00	0.00	0.00	150,000.00	0.00
TOTAL Contingency/FB	215,000	1,250.00	12,500.00	0.00	202,500.00	5.81
TOTAL MDD	582,610	23,604.31	198,353.38	0.00	384,256.62	34.05

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

701-MDD

DEPARTMENT - MDD % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
TOTAL EXPENSES	582,610	23,604.31	198,353.38	0.00	384,256.62	34.05
REVENUE OVER/(UNDER) EXPENSES	502,400	79,772.81	833,242.16	0.00	(330,842.16)	165.85

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

801-Employee Benefit Trust

FINANCIAL SUMMARY % OF YEAR COMPLETED: 83.33

	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
REVENUE SUMMARY						
GENERAL REVENUE						
Miscellaneous	1,166,500	114,289.61	976,139.04	0.00	190,360.96	83.68
TOTAL GENERAL REVENUE	1,166,500	114,289.61	976,139.04	0.00	190,360.96	83.68
TOTAL REVENUE	1,166,500	114,289.61	976,139.04	0.00	190,360.96	83.68
EXPENSE SUMMARY						
Insurance Premiums						
Personnel	1,166,500	105,232.68	1,003,133.73	0.00	163,366.27	86.00
TOTAL Insurance Premiums	1,166,500	105,232.68	1,003,133.73	0.00	163,366.27	86.00
TOTAL EXPENSES	1,166,500	105,232.68	1,003,133.73	0.00	163,366.27	86.00
REVENUE OVER/(UNDER) EXPENSES	0	9,056.93	(26,994.69)	0.00	26,994.69	0.00

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

801-Employee Benefit Trust

% OF YEAR COMPLETED: 83.33

REVENUES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Miscellaneous						
801-4000-09-4430 Employer Insurance Prem	904,000	92,700.32	758,662.78	0.00	145,337.22	83.92
801-4000-09-4440 Employee Insurance Prem	250,000	20,107.52	204,505.49	0.00	45,494.51	81.80
801-4000-09-4480 Flex Spending Account	8,000	1,048.80	9,489.90	0.00	(1,489.90)	118.62
801-4000-09-4500 Interest Income	4,500	432.97	3,480.87	0.00	1,019.13	77.35
TOTAL Miscellaneous	1,166,500	114,289.61	976,139.04	0.00	190,360.96	83.68
TOTAL REVENUE	1,166,500	114,289.61	976,139.04	0.00	190,360.96	83.68

REVENUE & EXPENSE REPORT (UNAUDITED)

AS OF: JULY 31ST, 2024

801-Employee Benefit Trust

DEPARTMENT - Insurance Premiums % OF YEAR COMPLETED: 83.33

EXPENSES	CURRENT BUDGET	CURRENT PERIOD	YEAR TO DATE ACTUAL	TOTAL ENCUMBERED	BUDGET BALANCE	% YTD BUDGET
Personnel						
801-5000-01-4090 Administrative Fee	1,500	118.00	1,312.00	0.00	188.00	87.47
801-5000-01-5111 Health Insurance	997,000	87,349.62	827,437.24	0.00	169,562.76	82.99
801-5000-01-5112 Dental Insurance	70,000	6,717.94	62,560.54	0.00	7,439.46	89.37
801-5000-01-5113 Vision Insurance	10,000	908.79	9,446.64	0.00	553.36	94.47
801-5000-01-5115 Life Insurance	50,000	7,094.63	68,863.94	0.00	(18,863.94)	137.73
801-5000-01-5117 Voluntary Policies	15,000	1,101.88	12,187.80	0.00	2,812.20	81.25
801-5000-01-5118 Flex Spending	8,000	942.62	9,937.47	0.00	(1,937.47)	124.22
801-5000-01-5119 New Benefits	8,000	869.20	7,650.60	0.00	349.40	95.63
801-5000-01-5120 Careflight/PHI	7,000	130.00	3,737.50	0.00	3,262.50	53.39
TOTAL Personnel	1,166,500	105,232.68	1,003,133.73	0.00	163,366.27	86.00
TOTAL Insurance Premiums	1,166,500	105,232.68	1,003,133.73	0.00	163,366.27	86.00
TOTAL EXPENSES	1,166,500	105,232.68	1,003,133.73	0.00	163,366.27	86.00
REVENUE OVER/(UNDER) EXPENSES	0	9,056.93	(26,994.69)	0.00	26,994.69	0.00

Balance Sheet by Fund

(Unaudited)

July 2024

BALANCE SHEET

AS OF: JULY 31ST, 2024

101-General Fund

ACCOUNT #	ACCOUNT DESCRIPTION	BALANCE		
ASSETS				
======				
101-11-000-00	General Fund Cash	345,311.97		
101-11-000-10	Cash on hand - Court drawer	200.00		
101-11-000-84	Claim on Cash General	5,046,924.09		
101-11-000-90	Investment Account	5,456,180.42		
101-11-013-20	Taxes Receivable	15,134.54		
101-11-013-33	Allowance for Taxes	(4,211.95)		
101-11-013-37	Sales Tax Receivable	357,944.13		
101-11-015-00	Court Fees Receivable	437,291.24		
101-11-015-50	Allowance for Court Fees	(270,400.15)		
101-11-021-00	Prepaids	1,445,048.00		
101-11-050-00	Inventory	7,941.00		
101-13-000-80	Due from other funds EBT	50,000.00		
101-19-000-00	Net Pension Asset	84,712.00		
			12,972,075.29	
	TOTAL ASSETS			12,972,075.29
				==========
LIABILITIES				
==========				
101-21-010-00	Accounts Payable Pooled	287,395.89		
101-21-010-01	Accounts Payable-General Fund	12,606.70		
101-21-010-14	Deferred Revenue Taxes	10,922.59		
101-21-010-15	Deferred Revenue Court	166,891.39		
101-21-010-17	Deferred Pension Inflows	146,888.00		
101-21-010-18	Net Pension Liability	100,153.00		
101-21-010-19	Deferred Pension Outflows	(244,985.00)		
101-21-015-40	Child Support Payable	461.28		
101-21-021-51	Unapplied Credit Liability A/R	300.00		
101-21-022-10	Wages Payable	11,057.03		
101-21-023-20	Comm Ctr rental deposits	770.01		
101-21-023-30	Parks rental deposits	(150.00)		
101-21-023-40	Collection fees payable-MVBA	809.36		
101-21-023-41	Credit Card Fees Payable	(5,065.52)		
101-21-023-50	Court Cash Bonds	443.30		
101-21-023-70	OMNI fee - court	(234.98)		
	TOTAL LIABILITIES		488,263.05	
EQUITY				
======				
101-31-033-00	Fund Balance General Fund	8,316,430.41		
101-31-033-80	Net Pension Obligation	82,656.00		
	TOTAL BEGINNING EQUITY	8,399,086.41		
	TOTAL REVENUE	16,765,617.94		
	TOTAL EXPENSES	12,680,892.11		
	TOTAL REVENUE OVER/(UNDER) EXPENSES	4,084,725.83		
	TOTAL EQUITY & REV. OVER/(UNDER) EXP.		12,483,812.24	
	TOTAL LIABILITIES, EQUITY & REV.OVER/(UNDER) EXP.			12,972,075.29
				==========

BALANCE SHEET

AS OF: JULY 31ST, 2024

201-Water Fund

ACCOUNT #	ACCOUNT DESCRIPTION	BALANCE		
ASSETS				
======				
201-11-000-00	Water Fund Cash	115,041.86		
201-11-000-10	Cash Drawer	200.00		
201-11-000-84	Claim on Cash Water	1,456,213.41		
201-11-000-90	Investment Account	75,721.25		
201-11-000-91	Water Impact Fees	627,736.04		
201-11-012-73	Cash in bank - Water Bond S16	1,238.36		
201-11-013-00	Accounts receivable - UB	167,926.76		
201-11-013-21	Accounts Receivable - Unbilled	74,348.52		
201-11-013-22	Allowance for Uncollect Water	(26,613.04)		
201-11-050-00	Inventory	186,333.80		
201-12-016-10	Land	83,058.00		
201-12-016-30	Water System	11,615,601.20		
201-12-016-50	Machinery and Equipment	672,941.53		
201-12-016-60	Vehicles	363,127.54		
201-12-016-67	Office Equipment	43,133.09		
201-12-016-80	Buildings and improvements	112,282.54		
201-12-017-00	Accumulated Depreciation	(5,980,941.93)		
201-13-000-00	Due from other funds	368,290.00		
201-19-000-00	Net Pension Asset	46,800.00		
			10,002,438.93	
	TOTAL ASSETS			10,002,438.93
				==========
LIABILITIES				
==========				
201-21-010-00	Accounts Payable Pooled	35,753.64		
201-21-010-05	Unapplied Credits	6,271.48		
201-21-010-17	Deferred Pension Inflows	38,700.00		
201-21-010-18	Net Pension Liability	13,500.00		
201-21-010-19	Deferred Pension Outflows	(29,200.00)		
201-21-010-20	Deferred OPEB Outflows	(1,800.00)		
201-21-021-10	Accrued Vacation Payable- wate	4,071.98		
201-21-021-20	Accrued Interest Payable	15,918.75		
201-21-021-90	SALES TAX COLLECTED	649.32		
201-21-023-41	Credit Card Fees Payable	10,651.04		
201-21-027-00	Bond Premium	203,036.00		
201-21-029-10	Bonds Payable - Series 2016	4,220,000.00		
201-21-029-80	Customer Deposits	169,091.32		
201-21-029-81	Customer Refunds Payable	6,303.26		
201-23-901-00	Due to Payroll Fund	(3,102.78)		
201-23-999-00	Water Impact Fees	30,489.00		
	TOTAL LIABILITIES		4,720,333.01	
EQUITY				
======				
201-31-033-02	Fund balance - Water/Sewer	4,096,638.80		
201-31-033-10	Developer Contributions	470,033.47		
201-31-033-80	Net Pension Benefit Obligation	9,219.00		
	TOTAL BEGINNING EQUITY	4,575,891.27		

BALANCE SHEET

AS OF: JULY 31ST, 2024

201-Water Fund

ACCOUNT #	ACCOUNT DESCRIPTION	BALANCE		
	TOTAL REVENUE	2,218,968.80		
	TOTAL EXPENSES	1,512,754.15		
	TOTAL REVENUE OVER/(UNDER) EXPENSES	706,214.65		
	TOTAL EQUITY & REV. OVER/(UNDER) EXP.		5,282,105.92	
	TOTAL LIABILITIES, EQUITY & REV.OVER/(UNDER) EXP.			10,002,438.93

BALANCE SHEET

AS OF: JULY 31ST, 2024

202-Sewer Fund

ACCOUNT #	ACCOUNT DESCRIPTION	BALANCE		
ASSETS				
======				
202-11-000-84	Claim on Cash Sewer	(7,857,104.36)		
202-11-000-91	Sewer Impact Fees	817,494.57		
202-11-013-01	Accounts Receivable - UB	83,706.14		
202-11-013-21	Accounts Receivable - Unbilled	38,511.13		
202-11-013-22	Allowance for Doubtful Account	(13,265.75)		
202-11-050-00	Inventory	7,353.00		
202-12-016-40	Sewer System	14,475,405.67		
			7,552,100.40	
	TOTAL ASSETS			7,552,100.40
				==========
LIABILITIES				
==========				
202-21-010-00	Accounts Payable Pooled	24,684.49		
202-21-021-10	Accrued Vacation Payable	15,151.63		
202-21-028-80	Bonds Payable - Series 2013	107,000.00		
202-23-000-00	Due to other funds	114,820.00		
202-23-901-00	Due to Payroll Fund	(13,116.03)		
202-23-999-00	Sewer Impact Fees	38,342.00		
	TOTAL LIABILITIES		286,882.09	
EQUITY				
======				
202-31-033-00	Fund Balance	5,529,767.70		
202-31-033-10	Developer Contributions	679,017.91		
202-31-033-50	Restricted for Sewer Impact	739,050.73		
	TOTAL BEGINNING EQUITY	6,947,836.34		
	TOTAL REVENUE	1,183,301.02		
	TOTAL EXPENSES	865,919.05		
	TOTAL REVENUE OVER/(UNDER) EXPENSES	317,381.97		
	TOTAL EQUITY & REV. OVER/(UNDER) EXP.		7,265,218.31	
	TOTAL LIABILITIES, EQUITY & REV.OVER/(UNDER) EXP.			7,552,100.40
				==========

BALANCE SHEET

AS OF: JULY 31ST, 2024

205-Solid Waste Fund

ACCOUNT #	ACCOUNT DESCRIPTION	BALANCE		
ASSETS				
======				
205-11-000-84	Claim on Cash Garbage	(239,249.43)		
205-11-013-00	Accounts Receivable - UB	50,137.15		
205-11-013-10	Accounts receivable	95,878.23		
205-11-013-21	Accounts Receivable - Unbilled	26,340.33		
205-11-013-22	Allowance for Doubtful Account	(9,746.74)		
			(76,640.46)	
	TOTAL ASSETS			(76,640.46)
				==========
LIABILITIES				
==========				
205-21-010-00	Accounts Payable Pooled	160,854.80		
205-21-021-90	Sales Tax Payable	19,389.65		
205-23-000-00	Due to other funds	16,219.00		
	TOTAL LIABILITIES		196,463.45	
EQUITY				
======				
205-31-033-00	Fund Balance	(272,923.87)		
	TOTAL BEGINNING EQUITY	(272,923.87)		
	TOTAL REVENUE	1,772,734.03		
	TOTAL EXPENSES	1,772,914.07		
	TOTAL REVENUE OVER/(UNDER) EXPENSES	(180.04)		
	TOTAL EQUITY & REV. OVER/(UNDER) EXP.		(273,103.91)	
	TOTAL LIABILITIES, EQUITY & REV.OVER/(UNDER) EXP.			(76,640.46)
				==========

BALANCE SHEET

AS OF: JULY 31ST, 2024

301-Debt Service Fund

ACCOUNT #	ACCOUNT DESCRIPTION	BALANCE		
ASSETS				
======				
301-11-000-00	Debt Service Cash	379,254.07		
301-11-000-84	Claim on Cash Debt Service	(26,872.51)		
301-11-000-90	Investment Account	71,611.19		
301-11-013-00	Property Taxes Receivable	13,595.83		
301-11-013-10	Allowance for Uncollect Taxes	(5,771.27)		
301-13-000-00	Due from other funds	114,820.00		
			546,637.31	
	TOTAL ASSETS			546,637.31
				==========
LIABILITIES				
==========				
301-21-029-90	Deferred Taxes-I&S	7,824.56		
	TOTAL LIABILITIES		7,824.56	
EQUITY				
======				
301-31-033-01	Fund Balance - Restricted	247,823.66		
	TOTAL BEGINNING EQUITY	247,823.66		
	TOTAL REVENUE	1,375,172.11		
	TOTAL EXPENSES	1,084,183.02		
	TOTAL REVENUE OVER/(UNDER) EXPENSES	290,989.09		
	TOTAL EQUITY & REV. OVER/(UNDER) EXP.		538,812.75	
	TOTAL LIABILITIES, EQUITY & REV.OVER/(UNDER) EXP.			546,637.31
				==========

BALANCE SHEET

AS OF: JULY 31ST, 2024

401-Special Revenue Fund

ACCOUNT #	ACCOUNT DESCRIPTION	BALANCE		
ASSETS				
401-11-000-00	Special Revenue Cash	46,090.05		
401-11-000-84	Claim on Cash Special Revenue	22,332.58		
			68,422.63	
	TOTAL ASSETS			68,422.63
LIABILITIES				
EQUITY				
401-31-033-02	Fund Balance - Child Safety	4,021.19		
401-31-033-04	Fund Balance - Court Security	6,920.50		
401-31-033-05	Fund Balance - PD Officers Tra	32,743.78		
401-31-033-06	Fund Balance - Seizure Funds	3,228.17		
401-31-033-07	FUND BALANCE HOT	540.76		
	TOTAL BEGINNING EQUITY	47,454.40		
	TOTAL REVENUE	30,948.23		
	TOTAL EXPENSES	9,980.00		
	TOTAL REVENUE OVER/(UNDER) EXPENSES	20,968.23		
	TOTAL EQUITY & REV. OVER/(UNDER) EXP.		68,422.63	
	TOTAL LIABILITIES, EQUITY & REV.OVER/(UNDER) EXP.			68,422.63

BALANCE SHEET

AS OF: JULY 31ST, 2024

402-TIRZ Jackson Ridge

ACCOUNT #	ACCOUNT DESCRIPTION	BALANCE		
ASSETS				
402-11-000-00	TIRZ Cash	279,780.00		
402-11-000-84	Claim on Cash TIRZ	518,732.58		
			798,512.58	
	TOTAL ASSETS			798,512.58
LIABILITIES				
EQUITY				
402-31-033-06	Fund balance - TIRZ Fund	526,039.50		
	TOTAL BEGINNING EQUITY	526,039.50		
	TOTAL REVENUE	898,416.63		
	TOTAL EXPENSES	625,943.55		
	TOTAL REVENUE OVER/(UNDER) EXPENSES	272,473.08		
	TOTAL EQUITY & REV. OVER/(UNDER) EXP.		798,512.58	
	TOTAL LIABILITIES, EQUITY & REV.OVER/(UNDER) EXP.			798,512.58

BALANCE SHEET

AS OF: JULY 31ST, 2024

403-Impact Fees

ACCOUNT #	ACCOUNT DESCRIPTION	BALANCE		
ASSETS				
403-11-000-00	Impact Fees Cash	412,187.72		
403-11-000-84	Claim on Cash Impact Fees	(18,923.28)		
			393,264.44	
	TOTAL ASSETS			393,264.44
LIABILITIES				
403-21-010-00	Accounts Payable Pooled	580.00		
	TOTAL LIABILITIES		580.00	
EQUITY				
403-31-033-20	Restricted FB- Street Impact	376,974.59		
	TOTAL BEGINNING EQUITY	376,974.59		
	TOTAL REVENUE	17,919.85		
	TOTAL EXPENSES	2,210.00		
	TOTAL REVENUE OVER/(UNDER) EXPENSES	15,709.85		
	TOTAL EQUITY & REV. OVER/(UNDER) EXP.		392,684.44	
	TOTAL LIABILITIES, EQUITY & REV.OVER/(UNDER) EXP.			393,264.44

BALANCE SHEET

AS OF: JULY 31ST, 2024

404-Development Fees

ACCOUNT #	ACCOUNT DESCRIPTION	BALANCE		
ASSETS				
======				
404-11-000-00	Development Fees Cash	259.02		
404-11-000-50	Investment Acct-Park Fees	2,254,439.17		
404-11-000-60	Investment acct-Fire Station	4,398,356.54		
404-11-000-70	Investment Acct-Street Fees	3,093,138.10		
404-11-000-84	Claim on Cash Development Fees	1,102,087.36		
404-11-000-90	Investment Account	432,889.49		
			11,281,169.68	
	TOTAL ASSETS			11,281,169.68
				==========
LIABILITIES				
==========				
404-21-010-00	Accounts Payable Pooled	98,749.04		
	TOTAL LIABILITIES		98,749.04	
EQUITY				
======				
404-31-033-00	Fund Balance	9,877,418.37		
	TOTAL BEGINNING EQUITY	9,877,418.37		
	TOTAL REVENUE	1,618,961.40		
	TOTAL EXPENSES	313,959.13		
	TOTAL REVENUE OVER/(UNDER) EXPENSES	1,305,002.27		
	TOTAL EQUITY & REV. OVER/(UNDER) EXP.		11,182,420.64	
	TOTAL LIABILITIES, EQUITY & REV.OVER/(UNDER) EXP.			11,281,169.68
				==========

BALANCE SHEET

AS OF: JULY 31ST, 2024

405-Grant Fund

ACCOUNT #	ACCOUNT DESCRIPTION	BALANCE		
ASSETS				
======				
405-11-000-00	Grant Fund Cash	1,084,251.59		
405-11-000-84	Claim on Cash Grants	(416,703.06)		
			667,548.53	
	TOTAL ASSETS			667,548.53
				==========
LIABILITIES				
==========				
405-21-010-00	Account Payable Pooled	52,079.08		
405-21-021-60	Unearned Revenue - Grants	1,023,214.40		
	TOTAL LIABILITIES		1,075,293.48	
EQUITY				
======				
405-31-033-04	Fund Balance - Grant Fund	(278,550.21)		
	TOTAL BEGINNING EQUITY	(278,550.21)		
	TOTAL REVENUE	501,700.78		
	TOTAL EXPENSES	630,895.52		
	TOTAL REVENUE OVER/(UNDER) EXPENSES	(129,194.74)		
	TOTAL EQUITY & REV. OVER/(UNDER) EXP.		(407,744.95)	
	TOTAL LIABILITIES, EQUITY & REV.OVER/(UNDER) EXP.			667,548.53
				==========

BALANCE SHEET

AS OF: JULY 31ST, 2024

406-Holding Acct Dev Agreemts

ACCOUNT #	ACCOUNT DESCRIPTION	BALANCE		
ASSETS				
======				
406-11-000-00	Developer Cash Holdings	1,529.03		
406-11-000-84	Claim on Cash Holding	489,141.48		
			490,670.51	
	TOTAL ASSETS			490,670.51
				==========
LIABILITIES				
==========				
406-21-010-00	Accounts Payable Pooled	17,607.23		
406-23-000-00	Due to Other Funds	368,290.00		
	TOTAL LIABILITIES		385,897.23	
EQUITY				
======				
406-31-033-00	Fund Balance	227,158.33		
	TOTAL BEGINNING EQUITY	227,158.33		
	TOTAL REVENUE	225,066.46		
	TOTAL EXPENSES	347,451.51		
	TOTAL REVENUE OVER/(UNDER) EXPENSES	(122,385.05)		
	TOTAL EQUITY & REV. OVER/(UNDER) EXP.		104,773.28	
	TOTAL LIABILITIES, EQUITY & REV.OVER/(UNDER) EXP.			490,670.51
				==========

BALANCE SHEET

AS OF: JULY 31ST, 2024

501-Capital Projects Fund

ACCOUNT #	ACCOUNT DESCRIPTION	BALANCE		
ASSETS				
======				
501-11-000-00	Capital Projects Cash	1,172.20		
501-11-000-55	Vehicle Replacement Fund	79,692.88		
501-11-000-58	Cash - Tax Notes	374,175.26		
501-11-000-59	Cash - CO 2022 Public Safety	5,831,117.59		
501-11-000-60	Cash - CO 2023 Keeneland Ph1	4,889,584.83		
501-11-000-61	Cash - CO 2024 Station 2	5,334,075.66		
501-11-000-62	ABP LLC Cash Escrow	10,000,000.00		
501-11-000-84	Claim on Cash Capital Projects	1,929,474.50		
501-11-008-38	Cash - Water Bond S16	543,967.12		
			28,983,260.04	
	TOTAL ASSETS			28,983,260.04
				==========
LIABILITIES				
==========				
501-21-010-00	Accounts Payable Pooled	315,600.34		
501-23-999-00	Impact Fees - Streets	33,317.26		
	TOTAL LIABILITIES		348,917.60	
EQUITY				
======				
501-31-033-03	Restricted FB - Contruction	22,896,497.09		
	TOTAL BEGINNING EQUITY	22,896,497.09		
	TOTAL REVENUE	16,501,652.33		
	TOTAL EXPENSES	10,763,806.98		
	TOTAL REVENUE OVER/(UNDER) EXPENSES	5,737,845.35		
	TOTAL EQUITY & REV. OVER/(UNDER) EXP.		28,634,342.44	
	TOTAL LIABILITIES, EQUITY & REV.OVER/(UNDER) EXP.			28,983,260.04
				==========

BALANCE SHEET

AS OF: JULY 31ST, 2024

701-MDD

ACCOUNT #	ACCOUNT DESCRIPTION	BALANCE		
ASSETS				
======				
701-11-000-00	MDD Cash	811,209.97		
701-11-000-90	Investment Account	1,611,933.70		
701-11-013-37	Sales Tax Receivable	159,278.70		
701-12-015-00	Land	696,835.95		
701-12-015-10	Buildings and improvements	340,267.04		
701-12-017-00	Accumulated Depreciation	(43,317.00)		
			3,576,208.36	
	TOTAL ASSETS			3,576,208.36
				==========
LIABILITIES				
==========				
701-21-010-00	Accounts Payable Pooled	7,609.60		
	TOTAL LIABILITIES		7,609.60	
EQUITY				
======				
701-31-040-10	Fund Balance - MDD	2,735,356.60		
	TOTAL BEGINNING EQUITY	2,735,356.60		
	TOTAL REVENUE	1,031,595.54		
	TOTAL EXPENSES	198,353.38		
	TOTAL REVENUE OVER/(UNDER) EXPENSES	833,242.16		
	TOTAL EQUITY & REV. OVER/(UNDER) EXP.		3,568,598.76	
	TOTAL LIABILITIES, EQUITY & REV.OVER/(UNDER) EXP.			3,576,208.36
				==========

BALANCE SHEET

AS OF: JULY 31ST, 2024

801-Employee Benefit Trust

ACCOUNT #	ACCOUNT DESCRIPTION	BALANCE		
ASSETS				
======				
801-11-000-00	Employee Benefit Trust Cash	57,521.36		
801-11-000-84	Claim on Cash EBT	(62,190.41)		
			(4,669.05)	
	TOTAL ASSETS			(4,669.05)
				==========
LIABILITIES				
==========				
801-21-010-13	Accounts Payable	60.00		
801-23-000-00	Due to other funds	50,000.00		
	TOTAL LIABILITIES		50,060.00	
EQUITY				
======				
801-31-033-00	Fund Balance	(27,734.36)		
	TOTAL BEGINNING EQUITY	(27,734.36)		
	TOTAL REVENUE	976,139.04		
	TOTAL EXPENSES	1,003,133.73		
	TOTAL REVENUE OVER/(UNDER) EXPENSES	(26,994.69)		
	TOTAL EQUITY & REV. OVER/(UNDER) EXP.		(54,729.05)	
	TOTAL LIABILITIES, EQUITY & REV.OVER/(UNDER) EXP.			(4,669.05)
				==========

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Approve the transfer of ownership of a 2017 Ford Explorer and a 2019 Chevrolet Tahoe from the City of Aubrey to the Town of Providence Village due to established vehicle replacement criteria and authorize the Police Department to execute title transfer documents on behalf of the City of Aubrey.

Staff Contact
Richard Brooks, Police Chief
rbrooks@aubreytx.gov
940-365-2601

Summary

- 2017 Ford Explorer Texas License Plate 1334544 VIN 1FM5K8AR3HGD14090 with 129,905 miles
- 2019 Chevrolet Tahoe Texas License Plate 1371558 VIN 1GNLC2DEC1KR148419 with 128,140 miles
- These vehicles were purchased by the Town of Providence Village.
- One vehicle is seven (7) years old
- One vehicle is five (5) years old
- These vehicles are currently stripped of all police equipment and are no longer serviceable patrol vehicles.

Financial Summary
None

Staff Recommended Motion
Approve

Conditions
N/A

AUBREY TEXAS 1867

Police Department

To: Richard Brooks, Chief of Police

From: Jeremy Johnson, Assistant Chief of Police

Date: August 1, 2024

Ref: Unit 3 and 2119

As you are aware, Aubrey Police Department patrol unit 3 is being replaced this year and the replacement is currently being built. This vehicle is beyond its service life and should not be used for patrol purposes due to the high mileage. The current mileage is 129,905. It has been stripped of the equipment that we need to re-use and the graphics have been removed.

Unit 3 is a 2017 Ford Explorer bearing Texas exempt tag 1334544 and vehicle identification number 1FM5K8AR3HGD14090.

Unit 2119 is also being replaced this year and the replacement is currently being built. This vehicle is beyond its service life and should not be used for patrol purposes due to the high mileage. The current mileage is 128,140. It has been stripped of the equipment that we need to re-use and the graphics have been removed.

Unit 2119 is a 2019 Chevrolet Tahoe bearing Texas exempt tag 1371558 and vehicle identification number 1GNLCDEC1KR148419.

Both of these vehicle belong to the Town of Providence Village and once approved, they will be transferred to the Town of Providence Village to dispose of.

Respectfully submitted,

Jeremy B Johnson
Assistant Chief of Police

108 E. Elm St. Aubrey, TX 76227
Office: (940) 365-2601
pd@aubreytx.gov

AUBREY 1867 TEXAS

Police Department

Denton County Tax Assessor/Collector
Michelle French
1505 E. McKinney St.
Denton, Texas 76209

To whom it may concern,

Please allow this letter to serve as authorization for Lieutenant Chance Alexander to sign as the seller/agent for the Aubrey Police Department in reference to the Assignment of Title for the 2017 Ford Explorer bearing vehicle identification number 1FM5K8AR3HGD14090 and the 2019 Chevrolet Tahoe bearing vehicle identification number1GNLCDEC1KR148419.

Sincerely.

Richard D. Brooks
Chief of Police

108 E. Elm St. Aubrey, TX 76227
Office: (940) 365-2601
pd@aubreytx.gov

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Authorize 2017 Ford Explorer and 2014 Chevrolet Tahoe to be disposed of by public auction and authorize the Police Department to execute necessary documents on behalf of the City of Aubrey.

Staff Contact
Richard Brooks, Police Chief
rbrooks@aubreytx.gov
940-365-2601

Summary

- 2017 Ford Explorer Texas License Plate 1334542 VIN 1FM5K8AR7HGD14089 with 150,250 miles
- 2014 Chevrolet Tahoe Texas License Plate 1154153 VIN 1GNLC2E02ER134060 with 140,962 miles
- These vehicles were purchased by the City of Aubrey.
- One vehicle is seven (7) years old
- One vehicle is ten (10) years old
- These vehicles are currently stripped of all police equipment and are no longer serviceable patrol vehicles.

Financial Summary
N/A

Staff Recommended Motion
Approve

Conditions
N/A

AUBREY TEXAS 1867

Police Department

To: Richard Brooks, Chief of Police

From: Jeremy Johnson, Assistant Chief of Police

Date: August 1, 2024

Ref: Unit 2 and 371

As you are aware, Aubrey Police Department patrol units 2 and 371 have been decommissioned for some time now but were being used as administration cars. Both vehicles are beyond their service life and should not be retained or maintained.

Unit 2 is a 2017 Ford Explorer bearing Texas exempt tag 1334542 and vehicle identification number 1FM5K8AR7HGD14089 with 150,250 miles.

Unit 371 is a 2014 Chevrolet Tahoe bearing Texas exempt tag 1154153 and vehicle identification number 1GNLC2E02ER134060 with 140,962 miles.

Both of these vehicles belong to the City of Aubrey and once approved by the council for disposal, they will be sold at auction.

Respectfully submitted,

Jeremy B Johnson
Assistant Chief of Police

108 E. Elm St. Aubrey, TX 76227
Office: (940) 365-2601
pd@aubreytx.gov

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Resolution 977-24 accepting a dedication of approximately 0.47 acre tract of real property situated in the F. Trevino Survey, abstract No 1243, City of Aubrey, Denton County, Texas for Municipal use, and authorizes the Mayor to execute necessary documents.

Staff Contact
Leanne Wilson, Director of Public Works and Development Services
lwilson@aubreytx.gov

Summary
This dedication is for Block A, Lot 2X of the Aubery Creek Estates Phase 1 Subdivision. The lot is located at the end of Coleman Street. This lot was designated as the location of a sewer lift station during the development stage of this subdivision. All improvements have been completed, and the sewer lift station has been in service for a few years and is being maintained by the city. Pacesetter Homes, LLC is transferring the property in the form of a Deed Without Warranty.

Financial Summary
NA

Staff Recommended Motion
Approve

Conditions
N/A

EXHIBIT A

RESOLUTION NO. 977-24

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF AUBREY, TEXAS ACCEPTING A SPECIAL WARRANTY DONATION DEED CONVEYING AN APPROXIMATE .0472 ACRE TRACT OF LAND BEING IDENTIFIED AS LOT 2X, BLOCK A, AUBREY CREEK ESTATES PHASE 1, RECORDED ON MAY 5, 2020 AS DOCUMENT NUMBER 2020-134 OF THE PLAT RECORDS OF DENTON, COUNTY TEXAS FROM PACESETTER HOMES, LLC TO THE CITY OF AUBREY FOR GENERAL MUNICIPAL PURPOSES, AUTHORIZING THE CITY SECRETARY TO FILE THE DEED WITH DENTON COUNTY REAL PROPERTY RECORDS, AND PROVIDING AN EFFECTIVE DATE.

WHEREAS, Pacesetter Homes, LLC desires to donate an approximate .0472 acre tract of land being identified as Lot 2X, Block A, Aubrey Creek Estates Phase 1, recorded on May 5, 2020 as Document Number 2020-134 of the Plat Records of Denton, County Texas (the "Property") to use for municipal purposes which may include but are not limited to amenities for the general public; and

WHEREAS, the Property is the subject of a voluntary annexation proceeding requested by Dosti Partners; and

WHEREAS, the City of Aubrey, Texas desires to accept the donation of Property for public use and maintenance and finds that the acceptance of the Property will serve the health, safety and welfare of the public.

NOW THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF AUBREY, TEXAS:

SECTION 1. The recitals set forth above are true and correct and are incorporated as if fully set forth herein.

SECTION 2. The City Council hereby accepts from Pacesetter Homes, LLC, the donation of the Property as described in the Special Warranty Donation Deed, attached hereto as **Exhibit A** and incorporated herein, and directs the City Secretary to file the deed with Denton County Real Property Records.

SECTION 3. That this Resolution shall become effective from and after its passage.

EXHIBIT A

PASSED AND APPROVED BY THE CITY COUNCIL OF THE CITY OF AUBREY, TEXAS, THIS 25TH DAY OF JULY, 2024.

APPROVED:

_____
Chris Rich, Mayor

ATTEST:

_____
Jenny Hicks, City Secretary

APPROVED AS TO FORM:

_____
Patricia A. Adams, City Attorney

Exhibit A

NOTICE OF CONFIDENTIALITY RIGHTS: IF YOU ARE A NATURAL PERSON, YOU MAY REMOVE OR STRIKE ANY OR ALL OF THE FOLLOWING INFORMATION FROM ANY INSTRUMENT THAT TRANSFERS AN INTEREST IN REAL PROPERTY BEFORE IT IS FILED FOR RECORD IN THE PUBLIC RECORDS: YOUR SOCIAL SECURITY NUMBER OR YOUR DRIVER'S LICENSE NUMBER.

SPECIAL WARRANTY DEDICATION DEED

THE STATE OF TEXAS §
§ **KNOW ALL MEN BY THESE PRESENTS:**
COUNTY OF DENTON §

That Pacesetter Homes, LLC, a Texas limited liability company (hereinafter called "**Grantor**"), for the consideration more specifically described hereinbelow, has **GRANTED, GIVEN and CONVEYED** and by these presents does **GRANT, GIVE and CONVEY**, unto the CITY OF AUBREY, TEXAS (hereinafter called "**Grantee**"), whose mailing address is 107 S. Main Street, Aubrey, Texas 76227, and its successors and assigns, that certain tract or parcel of land situated in the County of Denton, State of Texas, described as follows, to wit: an approximate .0472 acre tract of land, being identified as Lot 2X, Block A, Aubrey Creek Estates Phase 1, recorded on May 5, 2020 as Document Number 2020-134 of the Plat Records of Denton, County Texas as described and depicted in **Exhibit A**, attached hereto and incorporated herein for all purposes (the "**Property**").

CONSIDERATION. This conveyance is a dedication from Grantor to Grantee in consideration of Grantor's desire for Grantee to develop, use, and operate the Property for municipal purposes which could include but are not limited to amenities for the general public or as determined necessary by Grantee for Grantee to provide utility or other public services.

This conveyance is made by Grantor and accepted by Grantee subject to: (a) all easements, restrictions, covenants, agreements, encumbrances and other matters that are either of record or are otherwise disclosed by any such matters of record, to the extent the same are validly existing and applicable to the Property on or about the date of this Deed; (b) all matters that would be disclosed by a current and accurate ALTA/ACSM Land Title survey of the Property, prepared and certified on or about the date of this Deed, and (c) and any zoning laws and regulations and ordinances of municipal and other governmental authorities, if any, affecting the Property (the "**Permitted Exceptions**").

TO HAVE AND TO HOLD the Property, together with all and singular the rights and appurtenances thereto in anywise belonging, unto said Grantee, its successors and assigns, forever, and Grantor does hereby bind itself, its successors and assigns, to WARRANT AND FOREVER DEFEND all and singular the Property, unto the said Grantee, its successors and assigns, against every person whomsoever lawfully claiming or to claim the same or any part thereof, by, through, or under Grantor, but not otherwise, subject however to the Permitted Exceptions.

GRANTEE ACKNOWLEDGES AND AGREES THAT GRANTOR HAS NOT

MADE, AND GRANTOR HEREBY SPECIFICALLY DISCLAIMS, ANY REPRESENTATION OR WARRANTY OF ANY KIND, ORAL OR WRITTEN, EXPRESS OR IMPLIED, OR ARISING BY OPERATION OF LAW, WITH RESPECT TO THE PROPERTY TO BE CONVEYED HEREUNDER, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OR REPRESENTATIONS AS TO HABITABILITY, MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE EXCEPT FOR AND OTHER THAN THE WARRANTY OF TITLE CONTAINED IN THIS DEED, ZONING, PHYSICAL OR ENVIRONMENTAL CONDITION, UTILITIES, VALUATION, THE COMPLIANCE OF THE PROPERTY WITH GOVERNMENTAL LAWS, OR ANY OTHER MATTER OR THING REGARDING THE PROPERTY. GRANTEE AGREES TO ACCEPT THE PROPERTY AND ACKNOWLEDGES THAT THE CONVEYANCE OF THE PROPERTY AS PROVIDED FOR HEREIN IS MADE BY GRANTOR ON AN "AS IS, WHERE IS, AND WITH ALL FAULTS" BASIS. GRANTEE ACKNOWLEDGES THAT GRANTEE HAS MADE ITS OWN INDEPENDENT INVESTIGATION OF THE PROPERTY. THE PROVISIONS OF THIS PARAGRAPH SHALL SURVIVE THE EXECUTION HEREOF BY GRANTOR AND THE RECORDATION HEREOF IN THE OFFICIAL PUBLIC RECORDS OF DENTON COUNTY, TEXAS.

GRANTEE'S AGREEMENT TO, AND ACKNOWLEDGMENT OF, THE VARIOUS MATTERS SPECIFIED IN THIS SPECIAL WARRANTY DEDICATION DEED INCLUDING, WITHOUT LIMITATION, THE OWNERSHIP AND MAINTENANCE OF THE PROPERTY BY THE UNDERSIGNED, SHALL BE CONCLUSIVELY EVIDENCED BY GRANTEE'S ACCEPTANCE HEREOF.

[The remainder of this page is intentionally left blank]

EXECUTED, this the _____ day of _____, 2024.

GRANTOR:

Pacesetter Homes, LLC,
a Texas limited liability company

By: _____

Name: _____

Title: _____

ACKNOWLEDGMENT

THE STATE OF _____ §
§
COUNTY OF _____ §

This Instrument was acknowledged before me on the _____ day of _____, 2024, by _____, known to me to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that he executed the same in his capacity as _____ of Pacesetter Homes, LLC, a Texas limited liability company, on behalf of said company, for the purposes and consideration therein expressed.

GIVEN UNDER MY HAND AND SEAL OF OFFICE, on this ___ day of _____, 2024.

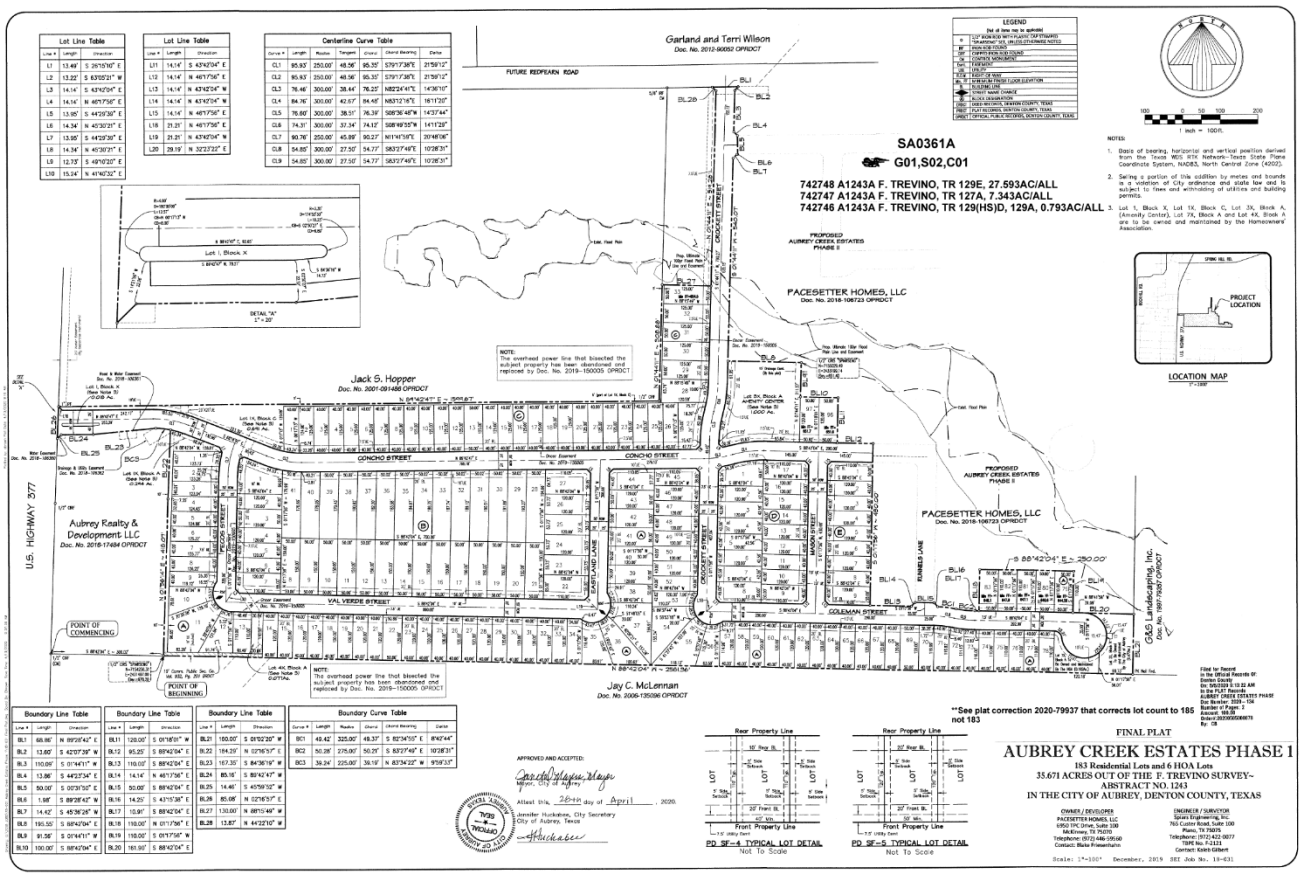
(Seal)

_____
Notary Public Signature

AFTER RECORDING PLEASE RETURN TO:
City of Aubrey
107 S. Main Street
Aubrey, Texas 76227

Exhibit A

Being Lot 2X, Block A, Aubrey Creek Estates Phase 1, recorded as Document Number 2020-134 of the Plat Records of Denton, County Texas. (An approximate 0.472 acre tract)



City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Approve a Professional Engineering Services Agreement with Birkhoff, Hendricks and Carter for a Stormwater Master Plan and Stormwater Utility District Rate Study, in the amount not to exceed $110,000, and authorize the City Manager to execute the agreement.

Staff Contact
Leanne Wilson, Director of Public Works and Development Services
lwilson@aubreytx.gov

Summary
This project is broken down into three parts.

Part 1A: The Overall Stormwater Master Plan
This plan will generate a general guide to stormwater discharges and infrastructure sizing at the major roadway crossings, as indicated on the City's Master Thoroughfare Plan. The project limits are bounded by the now current Extraterritorial Jurisdiction. Based on the estimated sizing of the stormwater infrastructure, a Stormwater Capital Improvement Plan (CIP) will be developed. This master plan is a general guide to overall stormwater design and an aid to developing the Capital Improvements Plan.

Part 1B: The Downtown Drainage Study
This study provides a more focused look at existing drainage infrastructure in the downtown study area. The size and capacity of existing street pipe and box culverts and open drainage channels will be inventoried and compared to the acceptable design storm frequency stormwater run-off rates. Recommendations for storm drainage system improvements required to convey the acceptable design storm frequency will be evaluated and a Downtown Stormwater System CIP will be developed.

Part 2: Utility District Rate Study
The study will analyze, develop and prepare a Municipal Drainage Utility District Rate Analysis in accordance with the requirements of the Texas Municipal Drainage Utility System Act, Texas Local Government Code Chapter 552. For the purpose of this study, the Stormwater Utility District Service Area is established only for the current City Limits.

Financial Summary
This project was presented and approved in the 2024 capital budget.

Staff Recommended Motion
Approve

Conditions
N/A

PROFESSIONAL ENGINEERING SERVICES AGREEMENT

THIS AGREEMENT is made and entered into by and between the **City of Aubrey, Texas**, hereinafter referred to as "City", and **Birkhoff, Hendricks & Carter, L.L.P.**, hereinafter referred to as "Engineer", to be effective from and after the date as provided herein.

The City desires to engage the services of the Engineer to complete engineering evaluation and report for the:

Project A: **2024 Stormwater Master Plan**
Project B: **Stormwater Utility District Rate Study**

hereinafter referred to as the "Project"; and the Engineer desires to render such engineering services for the City under the terms and conditions provided herein. That for and in consideration of the covenants contained herein, and for the mutual benefits to be obtained hereby, the parties hereto agree as follows:

I. Employment of the Engineer

The City hereby agrees to retain the Engineer to perform professional engineering services in connection with the Project; Engineer agrees to perform such services in accordance with the terms and condition of this Agreement.

II. Scope of Services

The parties agree that Engineer shall perform such services as expressly set forth and described in Exhibit “A”, which is attached hereto and thereby made a part of this Agreement. The parties understand and agree that deviations or modifications, in the form of written changes may be authorized from time to time by the City. Engineer shall have no further obligations or responsibilities for the project except as agreed to in writing. Engineer’s services and work product are intended for the sole use and benefit of Client and are non-intended to create any third party rights or benefits, or for any use by any other entity or person for any other purpose.

Engineer shall perform his or her professional engineering services with the professional skill and care ordinarily provided by competent engineers practicing in North Central Texas and under the same or

similar circumstances and professional license. Professional services shall be performed as expeditiously as is prudent, considering the ordinary professional skill and care of a competent engineer.

III. Schedule of Work

The Engineer agrees to commence services immediately upon execution of this Agreement, and to proceed diligently with said service, except for delays beyond the reasonable control of Engineer, to completion, as described in the Completion Schedule attached hereto as Exhibit "B" and thereby made a part of this Agreement.

IV. Compensation and Method of Payment

The parties agree that Engineer shall be compensated for all services provided pursuant to this Agreement in the amount and manner described and set forth in the Payment Schedule attached hereto as Exhibit "C" and thereby made a part of this Agreement. Engineer further agrees that it will prepare and present such monthly progress reports and itemized statements as are described in said Exhibit "C". City agrees to pay invoices upon receipt. Statement for services shall include a line for previous payments, contract amount, and amount due current invoice.

V. Information To Be Provided By The City

The City agrees to furnish, prior to commencement of work, all information requested by Engineer that is available to the City.

VI. Insurance

Engineer agrees to procure and maintain for the duration of the contract Professional Liability Insurance ($3,000,000), Worker's Compensation, General Liability and Automobile Insurance.

VII. Assignment and Subletting

The Engineer agrees that neither this Agreement nor the services to be performed hereunder will be assigned or sublet without the prior written consent of the City. The Engineer further agrees that the assignment or subletting of any portion or feature of the work or materials required in the performance of this Agreement shall not relieve the Engineer from its full obligations to the City as provided by this Agreement.

VIII. Contract Termination

The parties agree that City or the Engineer shall have the right to terminate this Agreement without cause upon thirty (30) days written notice to the other. In the event of such termination without cause, Engineer shall deliver to City all finished or unfinished documents, data, studies, surveys, drawings, maps, models, reports, photographs or other items prepared by Engineer in connection with this Agreement. Engineer shall be entitled to compensation for any and all services completed to the satisfaction of City in accordance with the provisions of this Agreement prior to termination.

IX. Engineer's Opinion of Cost

The parties recognize and agree that any and all opinions of cost prepared by Engineer in connection with the Project represent the best judgment of Engineer as a design professional familiar with the construction industry, but that the Engineer does not guarantee that bids solicited or received in connection with the Project will not vary from the opinion by the Engineer.

X. Construction

On projects that include construction, the Owner recognizes that the Contractor and Subcontractors will be solely in control of the Project site and exclusively responsible for construction means, methods, scheduling, sequencing, jobsite safety, safety programs, and compliance with all construction documents and directions from Owner or Building Officials. Construction contracts are between the Client and the Construction Contractor. Consultant shall not be responsible for construction related damages, losses, costs, or claims; except only to the extent caused by Consultant's sole negligence.

XI. Ownership of Documents

Original drawings, specifications and reports are the property of the Engineer; however, the Project is the property of the City. City shall be furnished with such reproductions of drawings, specifications and reports. Upon completion of the services or any earlier termination of this Agreement under Article VIII, Engineer will revise drawings to reflect changes made during construction as reported by the City and contractor, and will furnish the City with one set of construction record drawings in accordance with terms provided in Exhibit "A" – Engineering Services.

All deliverables shall be furnished, as an additional service, at any other time requested by the City when such deliverables are available in the Engineer's record keeping system.

XII. Complete Contract

This Agreement, including the exhibits hereto numbered "A" through "C" constitutes the entire agreement by and between the parties regarding the subject matter hereof, and supersedes all prior or contemporaneous written or oral understanding. This agreement may only be amended, supplemented, modified or canceled by a duly executed written agreement.

XIII. Mailing of Notices

Unless instructed otherwise in writing, Engineer agrees that all notices or communications to City permitted or required under this Agreement shall be addressed to City at the following address:

Ms. Leanne Wilson
Director of Public Works
City of Aubrey, TX
107 Main Street
Aubrey, TX 76227
(910) 440-9343
Email: lwilson@aubreytx.gov

City agrees that all notices or communications to Engineer permitted or required under this Agreement shall be addressed to Engineer at the following address:

Gary C. Hendricks, P.E., R.P.L.S.
Birkhoff, Hendricks & Carter, L.L.P.
11910 Greenville Ave., #600
Dallas, Texas 75243
Phone: (214) 361-7900
Email: ghendricks@bhcllp.com

All notices or communications required to be given in writing by one party or the other shall be considered as having been given to the addressee on the date such notice or communication is posted by the sending party.

XIV. Texas Board of Professional Engineers & Land Surveying Contact Information

Recipients of professional land surveying services under this agreement may direct complaints regarding such services to the Texas Board of Professional Engineers & Land Surveyors, 1917 South Interstate 35, Austin, Texas 78741, Phone (512) 440-7723.

XV. Contract Amendments

This Agreement may be amended only by the mutual agreement of the parties expressed in writing.

XVI. Effective Date

This Agreement shall be effective from and after execution by both parties hereto, with originals in the hand of both parties.

WITNESS OUR HANDS AND SEALS on the date indicated below.

CITY OF AUBREY, TEXAS
A Texas Home-Rule Municipal Corporation

By: _____
Charles Kreidler, City Manager

Date: _____

ATTEST:

By: _____

BIRKHOFF, HENDRICKS & CARTER, L.L.P.
A Texas Limited Liability Partnership
Texas Board of Professional Engineers & Land Surveys
Engineering Firm No. 526 Land Surveying Firm No. 100318-06

Gary C. Hendricks, P.E., R.P.L.S.
Digitally signed by Gary C. Hendricks, P.E., R.P.L.S.
DN: C=US, E=ghendricks@bhcllp.com, O="Birkhoff, Hendricks & Carter, LLP", CN="Gary C. Hendricks, P.E., R.P.L.S."
Location: Dallas, TX
Reason: I am the author of this document
Contact Info: 214.769.5705
Date: 2024.08.06 10:23:01-05'00'

By: _____
Gary C. Hendricks, P.E., R.P.L.S.

Date: August 6, 2024

Reviewed By: _____
Andrew Mata, P.E., Alt. Managing Partner

EXHIBIT "A"

ENGINEERING SERVICES

Project A: **2024 Stormwater Master Plan**

Project B: **Stormwater Utility District Rate Study**

A. 2024 Stormwater Master Plan

General Project Description:

This project includes the preparation of a Stormwater Master Plan for the City of Aubrey in Two (2) parts as follow:

Part A.1: Overall Stormwater Master Plan

The Overall Stormwater Master Plan will generate a general guide to Stormwater discharges and infrastructure sizing at the major roadway crossings, as indicated on the City's Master Thoroughfare Plan. The project limits are bounded by the now current Extraterritorial Jurisdiction. The specific geographic limits of the general study are shown in **Exhibit A.1.** Based on the estimated sizing of the Stormwater infrastructure, a Stormwater Capital Improvement Plan (CIP) will be developed. This master plan is a general guide to overall Stormwater design and an aid to developing the Capital Improvements Plan. It does not replace the need for detailed engineering design at the time of construction for public or private improvements.

Part A.2: Downtown Drainage Study

The Downtown Drainage Study provides a more focused look at existing drainage infrastructure in the downtown study area as shown in **Exhibit A.2.** Size and capacity of existing street pipe and box culverts and open drainage channels will be inventoried and compared to the acceptable design storm frequency Stormwater run-off rates. Recommendations for storm drainage system improvements required to convey the acceptable design storm frequency will be evaluated and a Downtown Stormwater System CIP will be developed.

Scope of Services (Part A.1 and A.2)

1. Project initiation meeting

   Meet with necessary City staff including public works, planning, finance, parks and recreation, fire, police and management to:

a. Outline existing Stormwater infrastructure needs and determine areas of concern within the City.
b. Establish project schedule and milestones.
c. Gather necessary initial information from the City Staff.

2. Utilizing NCTCOG aerial contours and USGS maps, identify Major and Minor Drainage Basins
   a. For the Downtown Drainage Study, conduct field evaluations to determine drainage basins for existing roadway culverts and open drainage channels.
3. Prepare a Drainage Area Maps for both Parts A.1 and A.2.
4. Quantification of the existing Stormwater discharge rates and design Stormwater run-off for each basin. City's current Master Thoroughfare plan will be referenced to determine the ultimate configuration of the roadway at the proposed drainage crossing.
5. Estimate storm sewer size for fully developed flows for the purposes of generating opinions of probable construction cost. These estimations do not replace the requirement of a complete engineering evaluation and design by a Professional Engineer at the time that the specific storm drainage entity is to be constructed.
6. Prepare preliminary engineering for areas of drainage concern identified by the City that are in addition to storm sewer sizing at thoroughfare crossings (i.e. erosion rehabilitation, flood study, etc.). Purpose of preliminary engineering will be to develop preliminary scope and opinion of probable construction cost.
7. Develop Capital Improvement Plan for the Overall Stormwater Master Plan (Part A.1) and the Downtown Drainage Study (Part A.2), including conceptual level project budgets and overall project map.
8. Prepare and deliver Stormwater Master Plan report outlining the resources utilized, presenting recommendations on the drainage system capital improvement plan. Five (5) hard copy sets and one electronic file version of the report will be submitted for review at the 90% complete stage; Fifteen (15) hard copy seta and one electronic file version of the Final Report will delivered at the 100% stage after city review and comments.
9. Four (4) meetings with City staff are included as follows:
   a. Project initiation meeting with City staff
   b. Capital Improvement Plan Review Meeting with Public Works Staff
   c. 60% review meeting – Stormwater basins, flows, preliminary estimates
   d. 90% review meeting – Stormwater CIP and Mapping

Exhibit A.1 – Overall Stormwater Master Plan Study Area

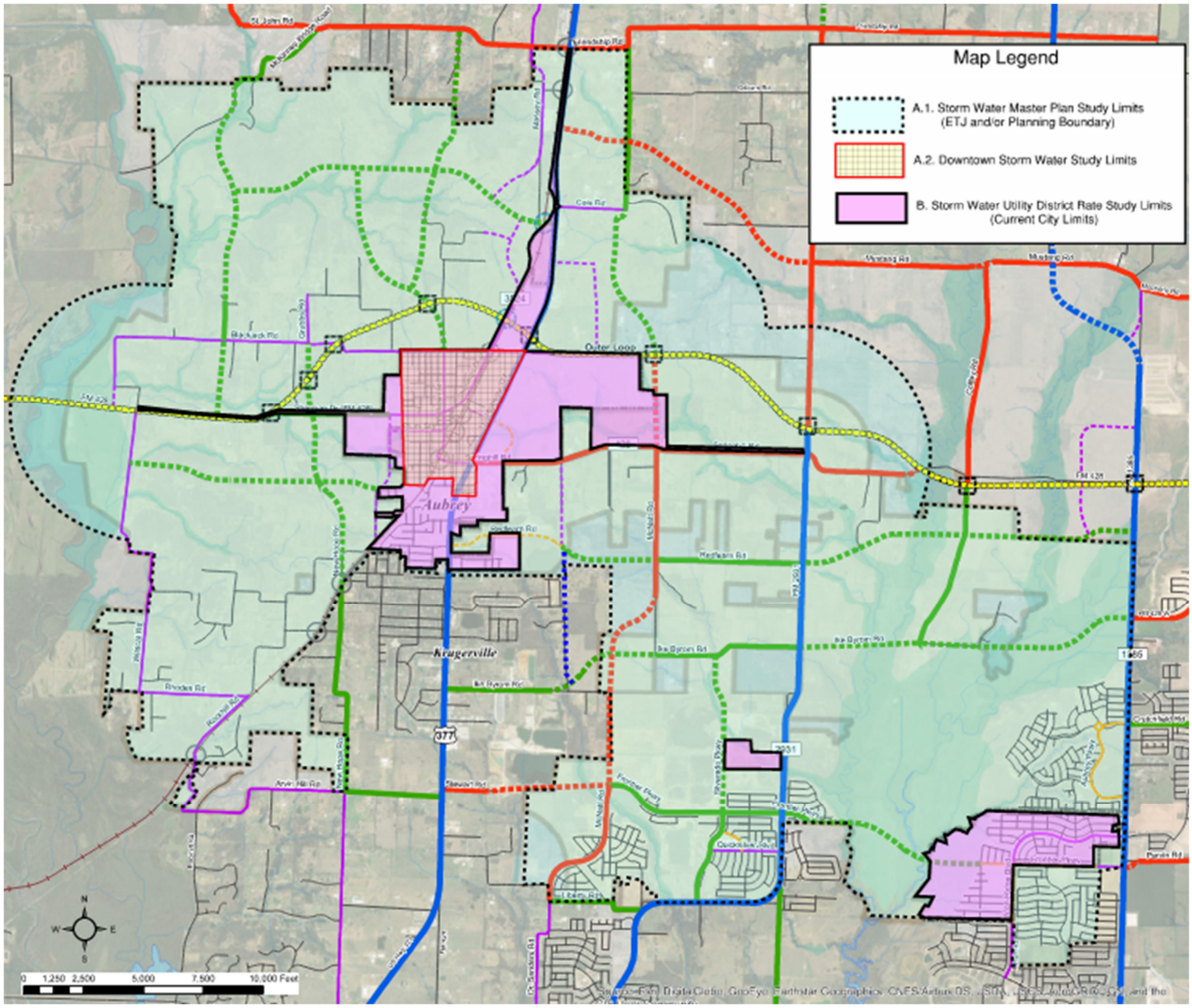
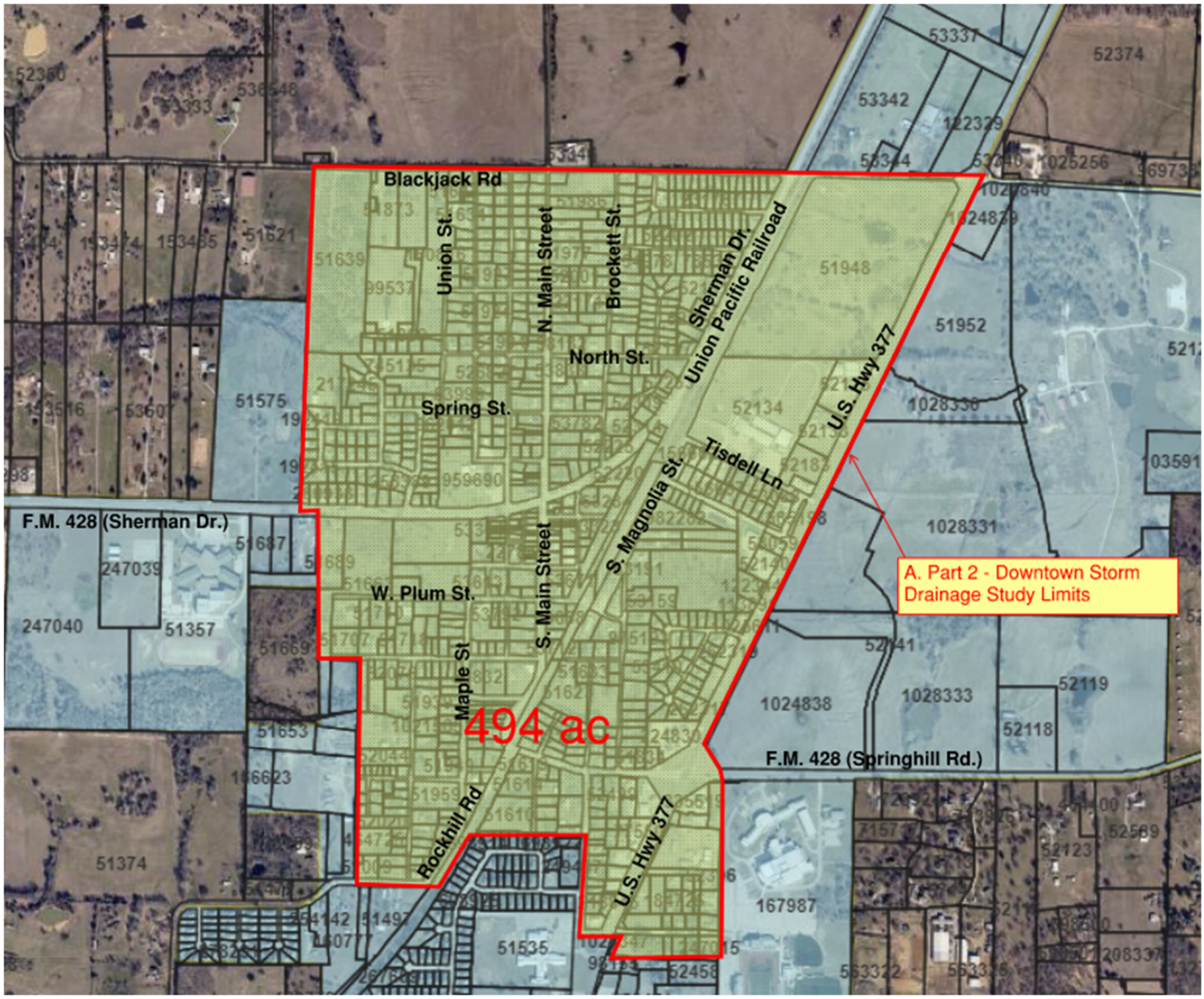


Exhibit A.2 – Downtown Stormwater Master Plan Study Area



B. Stormwater Utility District Rate Study

General Project Description:

Analyze, develop and prepare a Municipal Drainage Utility District Rate Analysis in accordance with the requirement of the Texas Municipal Drainage Utility System Act, Texas Local Government Code Chapter 552. For the purpose of this Study, the Stormwater Utility District Service Area is established as the now current City Limits. Exhibit A.1 shows the study limits for this scope of service.

Scope of Services

1. Reviewing the existing zoning and land use data to quantify existing and future land uses.
2. Reviewing the City's Comprehensive Plan and consider elements of the Plan in conjunction with the Stormwater CIP. The 10-year residential and non-residential growth projections provided by the City of Aubrey will be utilized in the rate analysis.
3. Meeting with the City of Aubrey Director of Finance to identify options for long-term financing and implementation of the Stormwater CIPs identified in Part A above.
4. Determining the drainage system annual operation and maintenance. Efforts include:
    a. Meet with the City Director of Public Works and Director of Finance to develop an annual five (5) year storm drainage system operation and maintenance budget. Items necessary to operate and maintain the functionality of the City's Stormwater System include, but are not limited to:
        i. Stormwater Management Plan annual inspection cost (if any)
        ii. Personnel cost associated with Stormwater management including:
            1. General management cost
            2. Floodplain administration cost
            3. Public Works personnel cost
        iii. Channel cleaning and maintenance
        iv. Mowing of drainage channels and roadway ditches
        v. Street Sweeping/Cleaning
        vi. Annual Stormwater system repairs and maintenance cost
        vii. Legal Consultation and/or outside management fees

5. Develop standardized user fee category and equivalency tabulation. The equivalency tabulation will be based on normally acceptable Stormwater run-off coefficients based on each user fee category established, or as directed by the City:
    i. Single Family Residential
    ii. Multifamily Residential
    iii. Non-Residential
    iv. Undeveloped land
6. Stormwater Utility Fee Rate
    a. Analyze and develop up to three (3) options for the Stormwater utility rate structures for each rate categories.
    b. The Stormwater utility rate structure(s) will be based on the annualized cost of implementing the storm capital improvement plan plus the annualized cost of operation and maintenance for the Stormwater utility system.
7. Include a report in the Stormwater Master Plan outlining the resources utilized, presenting estimates for annual operation and maintenance cost, system funding assumptions, user fee categories and equivalency tables, and the recommended rate options.
8. Three (3) meetings with City staff are included as follows:
    a. Meeting with Directors of Public Works and Finance for CIP funding options and Annual Operation and Maintenance needs.
    b. 60% review meeting –Finance Options, rate categories, rate structure options
    c. One (1) public hearing on the proposed Stormwater utility rate structure.\

C. Implementation Support

After completion of the Part B. Stormwater Utility District Rate Study and adoption of the Stormwater Utility District creation ordinance, it is anticipated City staff may need support in integrating the Stormwater Utility Rate and fee structure into the City's current billing system. This scope of services provides broadbase support for implementation as identified by the City. Examples of these support services may include:

1. Calculation of impervious areas for non-residential developments and water meters
2. Graphic information system support identifying both residential and non-residential water meter addresses and the impervious areas associated with each.
3. Other engineering, administrative and mapping support services as may be required by City Staff for implementation of the Stormwater Utility District adopted fee structure.

D. Terms and Conditions For Electronic File Transfers

Electronic files are transmitted on the terms and conditions below:

By opening, accessing, copying or otherwise using the transmitted electronic files, these terms and conditions are accepted by the user.

A. The electronic files are compatible with the following software packages operating on a PC using Windows operating systems:
   - Autocad Civil 3D 2021 , Civil 3D 2017
   - Innovyse InfoWater Pro 3.0 with ESRI Arc Pro 2.7
   - Innovyze InfoSewer Pro 7.6 with ESRI Arc Map 10.5
   - MS Office 365
   - Bluebeam Revu (PDF) Ver 10 - Ver 2020

B. Birkhoff, Hendricks & Carter, L.L.P. does not make any warranty as to the compatibility of these files beyond the specified release of the above stated software.

C. Because data stored on electronic media can deteriorate undetected or be modified, Birkhoff, Hendricks & Carter, L.L.P. will not be held liable for completeness or correctness of electronic media.

D. The electronic files are instruments of our service. Where there is a conflict between the hard copy drawings and the electronic files, Birkhoff, Hendricks & Carter, L.L.P.'s hard copy file will govern in all cases.

E. Electronic files may only be modified in accordance with the Texas Engineering Practice Act for modifying another Engineer's design.

E. Exclusions

The intent of this scope of services is to include only the services specifically listed herein and none others. Services specifically excluded from this scope of services include, but are not necessarily limited to the following:

1) Development or preparation of the Municipal Drainage Utility District ordinance.

2) Legal Advice or Attorney Fees

3) Fees for advertising the public notices.

4) Fiduciary responsibility to the Client.

5) Consulting services by others not included in Scope of Services.

6) Integration of Drainage Fee structure into the City's Utility Billing System

7) Annual Audits of the Municipal Drainage Utility District revenues and expenditures

F. City Provided Items

The City of Aubrey agrees to provide the following information and task:

1) Existing Zoning and Land Use Plan

2) Current Comprehensive Plan

3) Ten (10) year residential and non-residential growth projections

4) Assistance in developing annual Stormwater operation and maintenance cost.

EXHIBIT "B"

COMPLETION SCHEDULE

Notice to Proceed	At City's Direction
Part A.1 – Overall Stormwater Master Plan:.....	12 weeks after Notice to Proceed
Part A.2 – Downtown Drianage Study.....	16 weeks after Notice ot Proceed
Part B – Stormwater Utility District Rate Study:.....	4 Months after completion of Part A.2.
Part C – Implementation Support	As needed by the City

EXHIBIT "C"

PAYMENT SCHEDULE

Lump Sum Amounts

For the scope of services described in **Parts A.1, A.2 and B**, the engineer shall be compensated on a lump sum basis in the following amounts:

Part A.1 – Overall Storm Drainage Master Plan:	$30,000
Part A.2 – Downtown Area Drainage Study:	$45,000
Part B: - Stormwater Utility Rate Study:	$25,000
Total Lump Sum Fee Amount:	**$100,000**

Hourly Fee Amounts

For the scope of services described in **Part C**, the engineers shall be based on actual salary cost times a multiplier of 2.40 with expenses billed at actual invoice amount times 1.15. Automobile mileage for special services will be invoiced at $0.50 per mile. On that basis, we suggest the City budget the amount shown below:

Part C: - Implementation Support:	$10,000

The maximum overall fee established herein shall not be exceed **$110,000** without written authorization from the City, based on increased scope of services.

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Approve a Professional Engineering Services Agreement with Birkhoff, Hendricks and Carter for the Dane Street Roadway Improvements and City Hall Parking Lot, in the amount not to exceed $129,800, and authorize the City Manager to execute the agreement.

Staff Contact
Leanne Wilson, Director of Public Works and Development Services
lwilson@aubreytx.gov

Summary
This project is for the completion of the Dane Street (Faulkner) Water improvement Project. In exchange for the ROW dedications, Aubrey previously agreed to improve the roadway in front of the station once the construction of the site was completed. Additionally, this project includes the construction of a parking lot at city hall.

BHC will prepare construction plans and specifications for the concrete pavement construction of Dane Street, consisting of approximately 2,140 square yards of 6-inch reinforced concrete pavement and street appurtenances, including concrete sidewalk from Union Street to the end of Dane Street. The scope also consists of replacing the existing 6-inch sanitary sewer line along Dane Street (the Dane Street waterline will be constructed with the City's W5 waterline project by others). The scope also consists of including design plans and specifications for the reinforced concrete parking behind City Hall and the Police Department. It is expected the Dane Street and Parking Lot will be constructed as a single project.

Financial Summary
Street capital funds are available for this project.

Staff Recommended Motion
Approve

Conditions
N/A

PROFESSIONAL ENGINEERING SERVICES AGREEMENT

THIS AGREEMENT is made and entered into by and between the **City of Aubrey, Texas**, hereinafter referred to as "City", and **Birkhoff, Hendricks & Carter, L.L.P.**, hereinafter referred to as "Engineer", to be effective from and after the date as provided herein.

The City desires to engage the services of the Engineer to complete engineering the **Dane Street Improvements and Police Department Parking Lot**, hereinafter referred to as the "Project"; and the Engineer desires to render such engineering design services for the City under the terms and conditions provided herein. That for and in consideration of the covenants contained herein, and for the mutual benefits to be obtained hereby, the parties hereto agree as follows:

I. Employment of the Engineer

The City hereby agrees to retain the Engineer to perform professional engineering services in connection with the Project; Engineer agrees to perform such services in accordance with the terms and condition of this Agreement.

II. Scope of Services

The parties agree that Engineer shall perform such services as expressly set forth and described in Exhibit "A", which is attached hereto and thereby made a part of this Agreement. The parties understand and agree that deviations or modifications, in the form of written changes may be authorized from time to time by the City. Engineer shall have no further obligations or responsibilities for the project except as agreed to in writing. Engineer's services and work product are intended for the sole use and benefit of the City and are non-intended to create any third-party rights or benefits, or for any use by any other entity or person for any other purpose.

Engineer shall perform his or her professional engineering services with the professional skill and care ordinarily provided by competent engineers practicing in North Central Texas and under the same or similar circumstances and professional license. Professional services shall be performed as expeditiously as is prudent, considering the ordinary professional skill and care of a competent engineer.

III. Schedule of Work

The Engineer agrees to commence services immediately upon execution of this Agreement, and to proceed diligently with said service, except for delays beyond the reasonable control of Engineer, to completion, as described in the Completion Schedule attached hereto as Exhibit "B" and thereby made a part of this Agreement.

IV. Compensation and Method of Payment

The parties agree that Engineer shall be compensated for all services provided pursuant to this Agreement in the amount and manner described and set forth in the Payment Schedule attached hereto as Exhibit "C" and thereby made a part of this Agreement. Engineer further agrees that it will prepare and present such monthly progress reports and itemized statements as are described in said Exhibit "C". City agrees to pay invoices within 30 days of receipt. Statement for services shall include a line for previous payments, contract amount, and amount due current invoice.

V. Information To Be Provided By The City

The City agrees to furnish, prior to commencement of work, all information pertinent to this project requested by Engineer that is available to the City.

VI. Insurance

Engineer agrees to procure and maintain for the duration of the contract Professional Liability Insurance ($3,000,000), Worker's Compensation, General Liability and Automobile Insurance.

VII. Assignment and Subletting

The Engineer agrees that neither this Agreement nor the services to be performed hereunder will be assigned or sublet without the prior written consent of the City. The Engineer further agrees that the assignment or subletting of any portion or feature of the work or materials required in the performance of this Agreement shall not relieve the Engineer from its full obligations to the City as provided by this Agreement.

VIII. Contract Termination

The parties agree that City or the Engineer shall have the right to terminate this Agreement without cause upon thirty (30) days written notice to the other. In the event of such termination without cause,

Engineer shall deliver to City all finished or unfinished documents, data, studies, surveys, drawings, maps, models, reports, photographs or other items prepared by Engineer in connection with this Agreement. Engineer shall be entitled to compensation for any and all services completed to the satisfaction of City in accordance with the provisions of this Agreement prior to termination.

IX. Engineer's Opinion of Cost

The parties recognize and agree that any and all opinions of cost prepared by Engineer in connection with the Project represent the best judgment of Engineer as a design professional familiar with the construction industry, but that the Engineer does not guarantee that bids solicited or received in connection with the Project will not vary from the opinion by the Engineer.

X. Construction

On projects that include construction, the Owner recognizes that the Contractor and Subcontractors will be solely in control of the Project site and exclusively responsible for construction means, methods, scheduling, sequencing, jobsite safety, safety programs, and compliance with all construction documents and directions from Owner or Building Officials. Construction contracts are between the City and the Construction Contractor. Engineer shall not be responsible for construction related damages, losses, costs, or claims; except only to the extent caused by Engineer's sole negligence.

XI. Ownership of Documents

Original drawings, specifications and reports are the property of the Engineer; however, the Project is the property of the City. City shall be furnished with such reproductions of drawings, specifications and reports. Upon completion of the services or any earlier termination of this Agreement under Article VIII, Engineer will revise drawings to reflect changes made during construction as reported by the City and contractor and will furnish the City with one set of construction record drawings in accordance with terms provided in Exhibit "A" – Engineering Services.

All deliverables shall be furnished as an additional service, at any other time requested by the City when such deliverables are available in the Engineer's record keeping system.

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This Agreement, including the exhibits hereto numbered "A" through "C" constitutes the entire agreement by and between the parties regarding the subject matter hereof, and supersedes all prior or

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Ms. Leanne Wilson
Director of Public Works
City of Aubrey, TX
107 Main Street
Aubrey, TX 76227
(910) 440-9343
Email: lwilson@aubreytx.gov

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Andrew Mata Jr., P.E.
Birkhoff, Hendricks & Carter, L.L.P.
11910 Greenville Ave., #600
Dallas, Texas 75243
Phone: (214) 361-7900
Email: amata@bhcllp.com

All notices or communications required to be given in writing by one party or the other shall be considered as having been given to the addressee on the date such notice or communication is posted by the sending party.

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XV. Contract Amendments

This Agreement may be amended only by the mutual agreement of the parties expressed in writing.

XVI. Effective Date

This Agreement shall be effective from and after execution by both parties hereto, with originals in the hand of both parties.

WITNESS OUR HANDS AND SEALS on the date indicated below.

CITY OF AUBREY, TEXAS
A Texas Home-Rule City

By: _____

Date: _____

ATTEST

By: _____

BIRKHOFF, HENDRICKS & CARTER, L.L.P.
A Texas Limited Liability Partnership
Texas Board of Professional Engineers and Land Surveyors
Engineering Firm No. 526, Land Surveyors Firm No. 100318-00

By: _____
Andrew Mata Jr., P.E.
Partner

Date: 7/10/2024

Reviewed By: _____

EXHIBIT "A"

ENGINEERING SERVICES

DANE STREET IMPROVEMNTS AND

POLICE DEPARTMENT PARKING LOT

General Description

Prepare construction plans and specifications for the concrete pavement construction of Dane Street, consisting of approximately 2,140 square yards of 6-inch reinforced concrete pavement and street appurtenances, including concrete sidewalk from Union Street to the End of Dane Street. The scope also consists of replacing the existing 6-inch sanitary sewer line along Dane Street (the Dane Street waterline will be constructed with the City's W5 waterline project by others).

The scope also consist of including design plans and specifications for the reinforced concrete parking long behind City Hall and the Police Department. It is expected the Dane Street and Parking Lot will be constructed as a single project.

Dane Street Location Map

Police Department Parking Lot Location Map

BASIC SERVICES

I. DESIGN PHASE

A. Plot existing topographic features including pavement & utilities on (11 inch x 17 inch) plan and profile sheets (1inch=40 feet horizontal and 1”=10’ vertical).

B. Plot Utility Locations and information identified by Dig TESS and from Pot-Hole survey to include the south side of the street.

C. Prepare plan and profile drawings for street horizontal and vertical layout of the roadway reconstruction showing existing and proposed top of curb for Dane Street to Union Street. Set proposed grade at the top of the curb. Design a cul-de-sac at the end of the street.

D. Prepare plan and profile drawings for an 8-inch sanitary sewer line.

E. Walk project site with City staff.

F. Prepare street cross-sections on 50-foot intervals, and at driveway approaches cross sections.

G. Prepare typical roadway section for the new pavement.

H. Prepare a demolition plans, phasing plan, and erosion control plan.

I. Delineate the drainage basins and calculate the storm water flow rates based on the City’s drainage design manual criteria for 100-year storm events. Analyze existing drainage infrastructure and recommend improvements.

J. Prepare construction plan and profile sheets for the storm sewer drainage improvements.

K. Complete the construction plans for the Police Department parking lot.

L. Prepare parking lot control plan and grading plan.

M. Revise Plans as information of utilities are identified and from coordination with Franchise Utility Companies.

N. Formulate Opinion of Probable Construction Estimate and submit for 60%, 90% and final plan submittal stage of the design phase.

O. Preparation of Specifications and Contract Documents based on the City's Specifications and NCTCOG Standard Specifications.

P. Submit hardcopy of Preliminary Plans at 60%, and 90% to the City for review. Submit Specifications at 60%, and 90% submittal for review. Each submittal shall include two (2) copies of the construction plans in 11" x 17" white paper, and two (2) copies of the specifications in 8-1/2" x 11" white paper.

Q. Revise Plan Set based on City and Utility Company comments.

R. Meet with City staff to discuss City comments for the 30%, 60% and 90% submittals.

S. Incorporate City review comments into each design phase and into final design phase.

T. Include review and inspection by the Texas Department of License and Regulation (TDLR) sidewalk inspector for sidewalk and ADA conformance.

U. Finalize Standard Details

V. Finalize Plans and Specifications.

W. Correspondences will be completed electronically except for delivery of hardcopy preliminary and final plan submittals.

II. BIDDING PHASE

A. Assist the City Staff in advertising the project in two separate bids (one for the parking lot and one for the Dane Street).

B. Provide the City an electronic copy of the Notice to Bidders for their use in publishing the project in the local newspaper.

C. Upload bidding documents potential bidders, their suppliers and other parties on CivCast online website.

D. Attend City's Pre-Bid Conference (if required by the City).

E. Prepare Addenda if needed to answer questions by bidders and to make changes to the plans and specifications. The addenda will be signed, sealed, and date by the Engineer. Upload the addenda to CivCast.

F. Attend Bid Opening, assist the City during opening of bids, and provide bidding summary sheets.

G. Complete tabulation of bids received and provide to City and contractors who submitted bids with a PDF copy.

H. Obtain past work history from low bidder and formulate opinion from information received and provide the City a recommendation for award of construction contract as a PDF copy.

III. CONSTRUCTION PHASE

A. Conform the final plans and specifications into the Conformed Construction Set, including the addenda items.

B. Print four (4) copies of the conformed plans in 11" x 17" white paper, and four (4) copies of the specifications in 8-1/2" x 11" white paper.

C. Attend pre-construction conference, including preparing an agenda.

D. Review shop drawings and other submittal information which the Contractor submits. This review is for the benefit of the Owner and covers only general conformance with information given by the Contract Documents. The contractor is to review and stamp their approval on submittals prior to submitting them to the Engineer. Review by the Engineer does not relieve the Contractor of any responsibilities, safety measures or the necessity to construct a complete and workable facility in accordance with the Contract Documents. Shop drawings to be distributed electronically.

E. Attend coordination meetings with contractor, quality control personnel, and City representatives to discuss strategy, problem areas, progress, and any required coordination (up to six meetings).

F. Provide written responses to requests for information or clarification to City or Contractor.

G. Prepare and process routine change orders for this project as they pertain to the original scope of work.

H. Prepare monthly pay request from information obtained from the City's Inspector and make recommendation for payment.

I. Accompany the City during their final inspection of the project, generator testing, and prepare a punch list of incomplete work items.

IV. ADDITIONAL SERVICES

A. Design and Construction Surveys with the street Right-of-Way. Locate topographic features including mailboxes, lead walks, exposed sprinkler heads, property corners (if available), trees, fire hydrants, valves, power poles, driveways, water meters, inlets, and other features within the street and within 20 feet of the ROW. Attempt to locate property corners along row as part of topographic survey. Contact DIGTESS prior to survey and request locates for utilities. Shoot paint marks and flags that are set as a result of the request to DIGTESS.

B. Provide a geotechnical report with up to three (3) soil borings, evaluation and pavement recommendations. The Geotechnical evaluation and report will be performed by our sub-consultant Henley Johnston and Associates.

C. Printing of preliminary plans, final plans, and specifications for distribution to prospective bidders and the successful contractor.

D. Prepare Record Drawings utilizing on-site representative and Contractor construction record information from the as-built plant. Provide the record drawing plans in electronic .PDF format.

V. EXCLUSIONS

The intent of this scope of services is to include only the services specifically listed herein. Services specifically excluded from this scope of services include, but are not necessarily limited to the following:

A. Environmental impact statements and assessments.

B. Fees for permits or advertising.

C. Certification that work is in accordance with plans and specifications.

D. Trench safety designs.

E. Quality control and testing services during construction.

F. Services in connection with condemnation hearings.

G. Phasing of Contractor's work.

H. On-site safety precautions, programs and responsibility.

I. Revisions and/or change orders as a result of revisions after completion of original design (unless to correct error on plans).

J. Title searches, Right-of-Way and Easement Plats and Descriptions

K. Fiduciary Responsibility to the City.

EXHIBIT "B"

COMPLETION SCHEDULE

DANE STREET IMPROVEMENTS AND

POLICE DEPARTMENT PARKING LOT

Notice to Proceed (NTP)	July 25, 2024
Perform Field Surveys	August 9, 2024
Submit 30% Preliminary Plans to City for Review	September 13, 2024
Receive 30% Plans Review Comments from City	September 27, 2024
Submit 60% Preliminary Plans to City for Review	November 22, 2024
Receive 60% Review Comments from City	December 13, 2024
Submit 90% Preliminary Plans to City for Review	January 31, 2025
Receive 90% Review Comments from City	February 14, 2025
Complete Final Plans	March 14, 2025
Bidding	At City's Direction
Construction	270 Calendar Days

EXHIBIT "C"

PAYMENT SCHEDULE

DANE STREET IMPROVEMENTS AND

POLICE DEPARTMENT PARKING LOT

Payment for basic engineering services described under Parts I through III shall be based on a lump sum basis in the following amount:

Basic Services:

I. Design Phase $87,600

II Bidding Phase (2 bids) $7,000.00

III Construction Administration Phase $16,800

Total Basic Services $111,400.00

Payment for Additional Services described under Part IV shall be on the basis of salary cost times a multiplier of 2.45 for time expended on the task. Field survey crew shall be based on $195.00 per hour, inclusive of all equipment rentals and software licensing; plus, mileage charge at the IRS established rate. Expenses shall be at invoice cost times a multiplier of 1.15.

The following is a summary of the estimated charges for the various elements of the proposed additional services:

IV Additional Services:

Design and Construction Survey $6,400.00

Geotechnical Report $9,000.00

Reproduction $1,500.00

Record Drawings $1,500.00

Total Additional Services $18,400.00

TOTAL CONTRACT NOT TO EXCEED $129,800.00

The maximum overall fee established herein shall not be exceeded without written authorization from the City, based on increased scope of services. Payment invoices are to be prepared and emailed on a monthly basis, based on percentage complete for the basic services, and on actual hour expenditures for the Additional Services. Payment is due within 30 days of receipt of invoice.

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Approval of Ordinance 864-24 amending Chapter 9, “Personnel”, Article 9.01 of the Code of Ordinances regarding the City’s participation in Texas Municipal Retirement Benefits by authorizing annually accruing Updated Service Credits and annually accruing cost of living adjustment; and providing an effective date.

Staff Contact
Shaena Williams, Human Resources
swilliams@aubreytx.gov
940-440-9343

Summary
This item is the approval of an ordinance regarding the City of Aubrey's Texas Municipal Retriment Benefits plan, authorizing a 50% annually accruing Updated Service Credits and 50% annually accruing annuity increase, also referred to as a cost of living adjustment, for retirees and their beneficiaries, effective January 1, 2025.

Financial Summary
The city's contribution rate will be 10.65% resulting in an annual $1,191,008 contribution.

Staff Recommended Motion
Approve

Conditions
N/A

AN ORDINANCE REGARDING THE CITY OF AUBREY'S TEXAS MUNICIPAL RETIREMENT SYSTEM BENEFITS AUTHORIZING: (1) ANNUALLY ACCRUING UPDATED SERVICE CREDITS; AND (2) ANNUALLY ACCRUING ANNUITY INCREASES, ALSO REFERRED TO AS COST OF LIVING ADJUSTMENTS (COLAS) FOR RETIREES AND THEIR BENEFICIARIES.

Whereas, the City of Aubrey, Texas (the "City"), elected to participate in the Texas Municipal Retirement System (the "System" or "TMRS") pursuant to Subtitle G of Title 8, Texas Government Code, as amended (which subtitle is referred to as the "TMRS Act"); and

Whereas, each person who is or becomes an employee of the City on or after the effective date of the City's participation in the System in a position that normally requires services of 1,000 hours or more per year ("Employee") shall be a member of the System ("Member") as a condition of their employment; and

Whereas, the City Council finds that it is in the public interest to: (1) in accordance with TMRS Act §853.404 and §854.203(h), authorize annually accruing Updated Service Credits; and (2) in accordance with TMRS Act §854.203 and §853.404, authorize annually accruing annuity increases, also referred to as cost of living adjustments ("COLAs") for retirees and their beneficiaries, now:

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF AUBREY, TEXAS:

Section 1. Authorization of Annually Accruing Updated Service Credits.

(a) As authorized by TMRS Act §854.203(h) and §853.404, and on the terms and conditions set out in TMRS Act §§853.401 through 853.404, the City authorizes each Member of the System who on the first day of January of the calendar year immediately preceding the January 1 on which the Updated Service Credits will take effect (i) has current service credit or prior service credit in the System by reason of service to the City, (ii) has at least 36 months of credited service with the System, and (iii) is a TMRS-contributing Employee of the City, to receive "Updated Service Credit," as that term is defined and calculated in accordance with TMRS Act §853.402.

(b) The Updated Service Credit authorized and provided under this Ordinance shall be **50%** of the "base Updated Service Credit" of the TMRS Member calculated as provided in TMRS Act §853.402.

(c) If the City previously adopted an ordinance authorizing Updated Service Credit for unforfeited prior service credit and/or current service credit with another System participating municipality (also known as "Transfer USC"), the calculations and adjustments set forth in TMRS Act §853.601 apply to any such prior Transfer USC.

(d) Each Updated Service Credit authorized and provided by this Ordinance shall replace any Updated Service Credit, prior service credit, special prior service credit, or antecedent service credit previously authorized for part of the same service.

(e) The initial Updated Service Credit authorized by this Section shall be effective on January 1 immediately following the year in which this Ordinance is approved, subject to receipt by the System prior to such January 1 and approval by the Board of Trustees ("Board") of the System. Pursuant to TMRS Act §853.404, the authorization and grant of Updated Service Credits in this Section shall be effective on January 1 of each subsequent year, using the same percentage of the "base Updated Service Credit" stated in Subsection (b) in computing Updated Service Credits for each future year, provided that, as to

such subsequent year, the actuary for the System has made the determination set forth in TMRS Act §853.404(d), until this Ordinance ceases to be in effect as provided in TMRS Act §853.404(e).

Section 2. Authorization of Annual Increases in Retirement Annuities, or COLAs.

(a) On the terms and conditions set out in TMRS Act §854.203 and §853.404, the City authorizes and provides for payment of the increases described by this Section to the annuities paid to retired City Employees and beneficiaries of deceased City retirees (such increases also called COLAs). An annuity increased under this Section replaces any annuity or increased annuity previously granted to the same person.

(b) The amount of the annuity increase under this Section is computed as the sum of the prior service and current service annuities on the effective date of retirement of the person on whose service the annuities are based, multiplied by **50%** of the percentage change in Consumer Price Index for All Urban Consumers, from December of the year immediately preceding the effective date of the person's retirement to the December that is 13 months before the effective date of the increase under this Section.

(c) An increase in an annuity that was reduced because of an option selection is reducible in the same proportion and in the same manner that the original annuity was reduced.

(d) If a computation under this Section does not result in an increase in the amount of an annuity, the amount of the annuity will not be changed under this Section.

(e) The amount by which an increase under this Section exceeds all previously granted increases to an annuitant is an obligation of the City and of its account in the benefit accumulation fund of the System.

(f) The initial increase in annuities authorized by this Section shall be effective on January 1 immediately following the year in which this Ordinance is approved, subject to receipt by the System prior to such January 1 and approval by the System's Board. Pursuant to TMRS Act §853.404, an increase in retirement annuities shall be made on January 1 of each subsequent year, provided that, as to such subsequent year, the actuary for the System has made the determination set forth in TMRS Act §853.404(d), until this Ordinance ceases to be in effect as provided in TMRS Act §853.404(e).

Passed and approved _____, 20_____.

ATTEST: **APPROVED:**

_____ _____

City Secretary Mayor

Comparison of Alternate Plan Design(s)

FOR CITIES

2025 Rates • Aubrey

August 1, 2024

Plan Provisions	Current	Option 1
Employee Contribution Rate	7%	7%
City Matching Ratio	2 to 1	2 to 1
Updated Service Credit (USC)	None	50% (Repeating)
Transfer USC *	No	No
COLA	None	50% (Repeating)
Retroactive COLA	No	Yes
Retirement Eligibility Any Age	20 years	20 years
Vesting	5 years	5 years
Supplemental Death Benefit	Actives + Retirees	Actives + Retirees
Contribution Rates	**2025**	**2025**
Normal Cost Rate	6.00%	8.77%
Prior Service Rate	-0.15%	1.75%
Retirement Rate	**5.85%**	**10.52%**
Supplemental Death Rate	0.13%	0.13%
Total Contribution Rate	**5.98%**	**10.65%**
Unfunded Actuarial Liability	$-265,431	$1,718,454
Funded Ratio	103.4%	82.6%
Benefit Increase Amortization Period	20 years	20 years
Stat Max	13.50%	13.50%
Retirement Rate Exceeds Stat Max	No	No

* As of the December 31, 2023 valuation date, there were 26 employees with service in other TMRS cities eligible for transfer USC.

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Approve a Permanent Sanitary Sewer Easement Acquisition for the Aubrey Blackjack Sewer Improvement Project.

Staff Contact
Leanne Wilson, Director of Public Works and Development Services
lwilson@aubreytx.gov

Summary
Aubrey Blackjack Partners, LLC is dedicating approximately 600 square feet of land situated in the Franciso Trevino, Abstract No. 1243, along Spring Hill adjacent to the Highpointe Ranch Development for a sanitary sewer easement.

Financial Summary
NA

Staff Recommended Motion
Approve

Conditions
N/A

EXHIBIT "A"

"SANITARY SEWER EASEMENT"

Being 600 square feet of land situated in the Francisco Trevino Survey, Abstract No. 1243, City of Aubrey, Denton County, Texas, being a portion of a tract of land described in deed to Aubrey Blackjack Partners, LLC, according to the deed filed in Document No. 2021-213816, Official Records of Denton County, Texas (O.R.D.C.T.) and being more particularly described by metes and bounds as follows:

COMMENCING at a 5/8 inch iron rod with cap stamped "KHA" found along the North Right-of-Way line of F.M. Highway No. 428, (80-foot Right-of-Way) also being the Southeast corner of said Aubrey Blackjack tract, and being the Southwest corner of a tract of land described in deed to KLLB AIV, LLC, according to the deed filed in Document No. 2023-97316, O.R.D.C.T., and along the South line of an Existing City of Aubrey Water /Wastewater Easement, according to the deed filed in Document No. 2022-63141, O.R.D.C.T.;

THENCE N 00°12'17" W, along the East line of said Aubrey Blackjack tract and the West line of said KLLB AIV, LLC. tract, a distance of 50.00 feet to the North line of said Existing Water / Wastwater Easement and the **POINT OF BEGINNING** at the Southeast corner of Sanitary Sewer Easement herein described;

THENCE S 89°47'44" W, along the South line of Sanitary Sewer Easement herein described and the North line of said Existing Water / Wastewater Easement, a distance of 59.98 feet to the West line of said Aubrey Blackjack tract and the East line of a tract of land described in deed to Highpointe Corner, LLC., according to deed filed in Document No. 2023-42434, O.R.D.C.T. to the Southwest corner of Sanitary Sewer Easement;

THENCE N 00°12'17" W, along the West line of said Aubrey Blackjack partners, LLC., and the East line of said Highpointe Corner tract, a distance of 10.00 feet to the Northwest corner of Sanitary Sewer Easement;

THENCE N 89°47'44" E, along the North line of Sanitary Sewer Easement herein described, a distance of 59.98 feet to the East line of said Aubrey Blackjack tract and the West line of said KLLB AIV tract, to the Northeast corner of Sanitary Sewer Easement;

THENCE S 0°12'17" E, along the East line of said Aubrey Blackjack tract and West line of said KLLB AIV tract, a distance of 10.00 feet to the **POINT OF BEGINNING** of the hereinafter described tract and containing 600 square feet or 0.014-acres of land.

1. Bearings of lines shown hereon refer to Grid North of the Texas Coordinate System of 1983 (North Central Zone; NAD83(CORS96) Epoch 2002.00) as derived locally from AllTerra CentralSystems Continuously Operating Reference Stations (CORS) via Real Time Kinematic (RTK) methods. An average Combination Factor of 1.000150630 was used to scale grid coordinates and distances to surface.

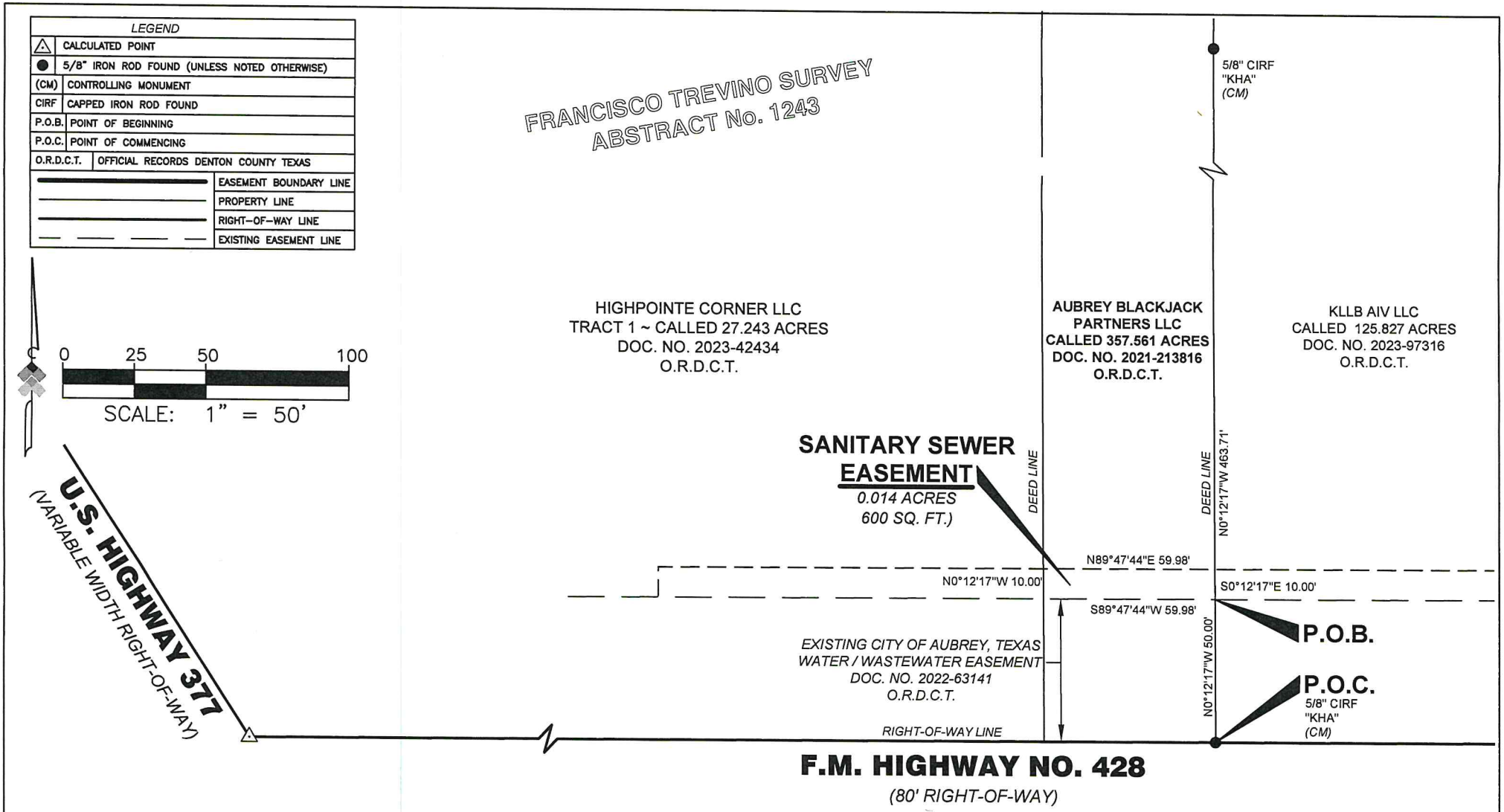
2. Integral parts of this survey:
   a. Legal Description
   b. Sketch

STATE OF TEXAS
REGISTERED
TIMOTHY A. FROST
5316
PROFESSIONAL
LAND SURVEYOR

Timothy A. Frost, R.P.L.S.
Texas Registration No. 5316

Date: 7-30-2024

LEGEND	
△	CALCULATED POINT
●	5/8" IRON ROD FOUND (UNLESS NOTED OTHERWISE)
(CM)	CONTROLLING MONUMENT
CIRF	CAPPED IRON ROD FOUND
P.O.B.	POINT OF BEGINNING
P.O.C.	POINT OF COMMENCING
O.R.D.C.T.	OFFICIAL RECORDS DENTON COUNTY TEXAS
	EASEMENT BOUNDARY LINE
	PROPERTY LINE
	RIGHT-OF-WAY LINE
	EXISTING EASEMENT LINE



NOTES:

1. Bearings of lines shown hereon are referenced to Grid North of the Texas Coordinate System of 1983 (North Central Zone 4202: NAD83 (2011) Epoch 2010) as derived locally from RTK Network continuously operating reference stations (CORS) via real time kinematic (RTK) survey methods. The distances shown hereon represent surface values using a surface adjustment factor of 1.000150630 to scale from grid to surface.
2. This Exhibit was prepared without the benefit of a current Title Commitment, or Encumbrance Report. Additional easements, rights-of-way and/or other matters of record may affect this tract that are not shown hereon.
3. A Legal Description of even date herewith accompanies this Easement Exhibit. See Exhibit "A".

STATE OF TEXAS
REGISTERED
TIMOTHY A. FROST
5316
PROFESSIONAL
LAND SURVEYOR

Timothy A. Frost 7-30-2024
TIMOTHY A. FROST, RPLS NO. 5316 DATE

tnp
teague nall and perkins
3200 S. Interstate 35E, Suite 1129
Denton, Texas 76210
940.383.4177 / www.tnpinc.com
TBPELS FIRM 10011601

EXHIBIT "B"
SANITARY SEWER EASEMENT

BEING 0.014 ACRES (600 SQ. FT.) OF LAND SITUATED
IN THE FRANCISCO TREVINO SURVEY, ABSTRACT NO. 1243
DENTON COUNTY, TEXAS

HUC22533

I:\Projects\HUC22533\Sur-C3D\cad\survey\Easements\ABJ.dwg

STATE OF TEXAS §
§ **KNOW ALL MEN BY THESE PRESENTS**
COUNTY OF DENTON §

GRANTOR: **Aubrey Blackjack Partners, LLC**

GRANTOR'S MAILING ADDRESS (including County):

GRANTEE: **CITY OF AUBREY**

GRANTEE'S MAILING ADDRESS (including County):
107 SOUTH MAIN STREET
AUBREY, DENTON COUNTY, TX 76227

Consideration: Ten Dollars ($10.00) and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged.

Easement Property: The tract of land described in Exhibit A attached hereto and incorporated herein by reference for all purposes.

Easement Purpose: For the sole purpose(s) of surveying and engineering, constructing, installing, maintaining, testing, accessing, repairing, removing or replacing water and sanitary sewer pipelines and appurtenances, including manholes, blow offs, air vacuum/release valves, and similar appurtenances, communication facilities such as fiber optic cables, wiring and appurtenances.

Grant of Easement: Grantor, for the Consideration hereof, GRANTS, BARGAINS, SELLS AND COVEYS to Grantee, its successors, and assigns a permanent and perpetual easement over, on, and across the Easement Property for the Easement Purpose, together with all and singular the rights and appurtenances thereto in any way belong to Grantor (collectively, the "Easement"), to have and to hold the Easement to Grantee and Grantee's, successors, and assigns forever, together, together with the right of ingress and egress over Grantor's adjacent land to and from the Easement Property in connection with the exercise of Grantee's rights hereunder.

Grantee shall hold a dominant and superior right of use and easement in the Easement Property as follows:

1. Grantor shall make no use or authorize others to make use of the Easement Property which, in Grantee's sole discretion, would unreasonably interfere with the nature, purposes, scope, and intent of the

Easement Purpose conveyed herein, including but not limited to, drilling excavating activities, impoundment of water or placement or construction of permanent structures including but not limited to buildings, poles, signs, masonry walls, masonry fences and retaining walls withing the Easement Property.

2. Grantor Reserves the right to put or place, or authorize others to put or place utility lines (excluding utility poles), drainage pipes and swales, roads and fences upon or within the Easement Property. Said utility lines, drainage pipes and swales, roads and fences may only be placed within the Easement Property upon express written approval by Grantee or Grantor's engineering plans and specifications. All utility lines, drainage pipes, and swales, roads and fences must cross the Easement Property at an angle of at least 45 degrees or more to the center line of the Easement Property. Installed fences will require gates adequate to allow access along the Easement Property by Grantee. Grantor shall not have the right, or the authority to authorize others, to us the Easement Property for any purpose which would cause the continuing utility operations of Grantee to being violation of any state, federal, or municipal law, ordinance, or regulations.

3. Granto shall make no changes affecting the topography or elevation within the Easement Property by more than (1) foot without the express written approval of the Grantee.

4. Grantor reserves the right to place landscaping, sprinkler systems, ornamental trees, and similar improvements within the Easement Property. Grantee may remove and keep removed any trees, structures or improvements that Grantee deems, in Grantee's sole discretion, to interfere with the purposes of the Easement granted herein.

5. Any improvements, landscaping, sprinkler systems and ornamental trees placed on the Easement Property by Grantor may be removed or destroyed by Grantee to the extent that it is reasonably necessary, in Grantee's sole discretion, for Grantee's installing, maintaining, removing or replacing any of the water line, sanitary sewer or related facilities, but only, except in cases of emergencies, after prior written notice to Grantor.

6. Grantee covenants and agrees to restore the natural surface of the Easement Property and any adjacent lands disturbed by Grantee, to a condition comparable to that which existed prior to the entry and construction, demolition, removal or other disturbance. All permitted paving, fencing, and gates on such property shall be restored by Grantee to their original condition as found before construction, demolition or removal by Grantee. Grantee is not, however, responsible to restore any

unauthorized improvements, sprinklers, ornamental trees or landscaping within the Easement Property.

The term “Grantor” as used herein means all and singular and include Grantor’s successors and assigns. The term “Grantee” as used herein means all and singular writing simultaneously with any assignment by Grantee of this instrument or any interest herein, and each successor and assign of Grantee shall assume all of Grantee’s obligations under this instrument, including, without limitation, the foregoing notice obligation.

Grantor represents that (a) Grantor has full and unencumbered fee simple title to and in the easement estates herein granted: subject and limited as a foresaid. (b) Grantor has the right to execute this instrument. And (c) there are no liens existing against the Easement Property.

[SIGNATURES APPEAR ON THE FOLLOWING PAGE]

SIGNED this _____ day of _____, 2024

GRANTOR: Aubrey Blackjack Partners, LLC

_____
By:

THE STATE OF TEXAS §
§
COUNTY OF _____ §

BEFORE ME, the undersigned authority, on this day personally appeared _____ known to me to be one of the persons whose names are subscribed to the foregoing instrument; he/she acknowledged to me that he/she is the _____ and duly authorized representative of **Aubrey Blackjack Partners, LLC**, and that he/she executed said instrument for the purpose and consideration therein express and in the capacity therein stated.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this _____ day of _____, 20__.

_____
Notary Public in and for the State of Texas

ACCEPTANCE BY GRANTEE:

GRANTEE: **City of Aubrey, Texas**

_____
By: Chris Rich, Mayor, City of Aubrey

THE STATE OF TEXAS §
§
COUNTY OF _____ §

BEFORE ME, the undersigned authority, on this day personally appeared _____ known to me to be one of the persons whose names are subscribed to the foregoing instrument; he/she acknowledged to me that he/she is the _____ and duly authorized representative of **City of Aubrey**, and that he/she executed said instrument for the purpose and consideration therein express and in the capacity therein stated.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this _____ day of _____, 20__.

_____
Notary Public in and for the State of Texas

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Approve a Permanent Sanitary Sewer Easement Acquisition for the KLLB AIV Sewer Improvement Project.

Staff Contact
Leanne Wilson, Director of Public Works and Development Services
lwilson@aubreytx.gov

Summary
KLLB AIV is dedicating approximately 1,086 square feet of land situated in the Franciso Trevino, Abstract No. 1243, along Spring Hill adjacent to the Highpointe Ranch Development for a sanitary sewer easement.

Financial Summary
NA

Staff Recommended Motion
Approve

Conditions
N/A

EXHIBIT "A"

"SANITARY SEWER EASEMENT"

Being 1086 square feet of land situated in the Francisco Trevino Survey, Abstract No. 1243, City of Aubrey, Denton County, Texas, being a portion of a tract of land described in deed to KLLB AIV, LLC., according to the deed filed in Document No. 2023-97316, Official Records of Denton County, Texas (O.R.D.C.T.) and being more particularly described by metes and bounds as follows:

COMMENCING at a 5/8 inch iron rod with cap stamped "KHA" found along the North Right-of-Way line of F.M. Highway No. 428, (80-foot Right-of-Way) also being the Southeast corner of a tract of land described in deed to Aubrey Blackjack Partners LLC, according to said Document No. 2021-213816, O.R.D.C.T, and being the Southwest corner of said KLLB AIV, LLC tract and along the South line of an Existing City of Aubrey Water / Wastewater Easement, according to the deed filed in Document No. 2022-63141, O.R.D.C.T.;

THENCE N 00°12'17" W, along the West line of said KLLB AIV, LLC. tract and the East line of said Aubrey Blackjack tract, a distance of 50.00 feet to the North line of said Existing Water / Wastewater Easement, and the **POINT OF BEGINNING,** at the Southwest corner of Sanitary Sewer Easement herein described;

THENCE N 00°12'17" W, along the West line of said KLLB AIV tract and the East line of said Aubrey Blackjack tract, a distance of 10.00 feet to the Northwest corner of Sanitary Sewer Easement herein described;

THENCE N 89°47'44" E, along the North line of Sanitary Sewer Easement herein described, a distance of 108.61 feet to the Northeast corner of Sanitary Sewer Easement;

THENCE S 00°12'17" E, along the East line of Sanitary Sewer Easement herein described, a distance of 10.00, to the Southeast corner of this Sanitary Sewer Easement along the North line of said Existing Water / Wastwater Easement;

THENCE S 89°47'44" W, along the South line of Sanitary Sewer Easement herein described and the North line of said Existing Water / Wastewater Easement, a distance of 108.61 feet to the **POINT OF BEGINNING** of the hereinafter described tract and containing 1086 square feet or 0.025-acres of land.

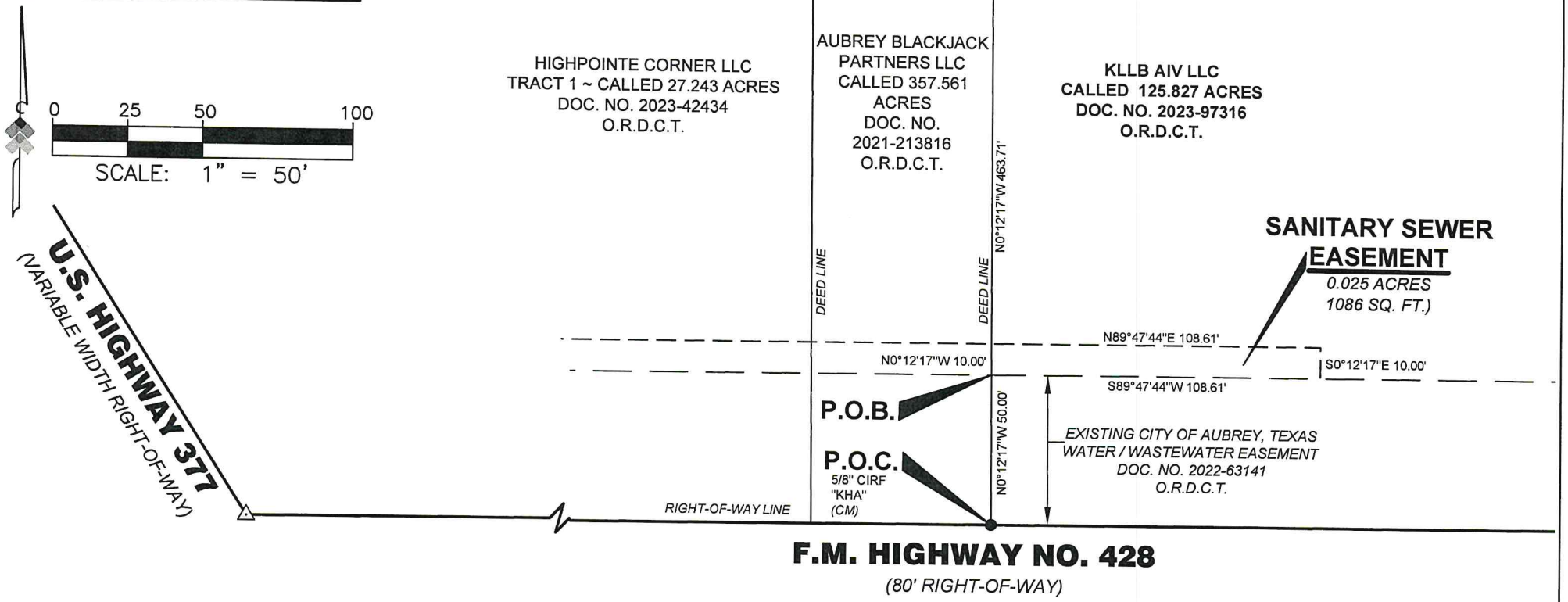
1. Bearings of lines shown hereon refer to Grid North of the Texas Coordinate System of 1983 (North Central Zone; NAD83(CORS96) Epoch 2002.00) as derived locally from AllTerra Central Continuously Operating Reference Stations (CORS) via Real Time Kinematic (RTK) methods. An average Combination Factor of 1.000150630 was used to scale grid coordinates and distances to surface.

2. Integral parts of this survey:
   a. Legal Description
   b. Sketch

Timothy A. Frost, R.P.L.S.
Texas Registration No. 5316

Date: 7-30-2024

LEGEND	
△	CALCULATED POINT
●	5/8" IRON ROD FOUND (UNLESS NOTED OTHERWISE)
(CM)	CONTROLLING MONUMENT
CIRF	CAPPED IRON ROD FOUND
P.O.B.	POINT OF BEGINNING
P.O.C.	POINT OF COMMENCING
O.R.D.C.T.	OFFICIAL RECORDS DENTON COUNTY TEXAS
	EASEMENT BOUNDARY LINE
	PROPERTY LINE
	RIGHT-OF-WAY LINE
	EXISTING EASEMENT LINE



NOTES:

1. Bearings of lines shown hereon are referenced to Grid North of the Texas Coordinate System of 1983 (North Central Zone 4202: NAD83 (2011) Epoch 2010) as derived locally from RTK Network continuously operating reference stations (CORS) via real time kinematic (RTK) survey methods. The distances shown hereon represent surface values using a surface adjustment factor of 1.000150630 to scale from grid to surface.
2. This Exhibit was prepared without the benefit of a current Title Commitment, or Encumbrance Report. Additional easements, rights-of-way and/or other matters of record may affect this tract that are not shown hereon.
3. A Legal Description of even date herewith accompanies this Easement Exhibit. See Exhibit "A".

teague nall and perkins
3200 S. Interstate 35E, Suite 1129
Denton, Texas 76210
940.383.4177 / www.tnpinc.com
TBPELS FIRM 10011601

STATE OF TEXAS
REGISTERED
TIMOTHY A. FROST
5316
PROFESSIONAL
LAND SURVEYOR

Timothy A. Frost 7-30-2024

TIMOTHY A. FROST, RPLS NO. 5316 DATE

EXHIBIT "B"
SANITARY SEWER EASEMENT

BEING 0.025 ACRES (1086 SQ. FT.) OF LAND SITUATED
IN THE FRANCISCO TREVINO SURVEY, ABSTRACT NO. 1243
DENTON COUNTY, TEXAS

HUC22533

STATE OF TEXAS §
§ **KNOW ALL MEN BY THESE PRESENTS**
COUNTY OF DENTON §

GRANTOR: **KLLB AIV, LLC**

GRANTOR'S MAILING ADDRESS (including County):

GRANTEE: **CITY OF AUBREY**

GRANTEE'S MAILING ADDRESS (including County):
107 SOUTH MAIN STREET
AUBREY, DENTON COUNTY, TX 76227

Consideration: Ten Dollars ($10.00) and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged.

Easement Property: The tract of land described in Exhibit A attached hereto and incorporated herein by reference for all purposes.

Easement Purpose: For the sole purpose(s) of surveying and engineering, constructing, installing, maintaining, testing, accessing, repairing, removing or replacing water and sanitary sewer pipelines and appurtenances, including manholes, blow offs, air vacuum/release valves, and similar appurtenances, communication facilities such as fiber optic cables, wiring and appurtenances.

Grant of Easement: Grantor, for the Consideration hereof, GRANTS, BARGAINS, SELLS AND COVEYS to Grantee, its successors, and assigns a permanent and perpetual easement over, on, and across the Easement Property for the Easement Purpose, together with all and singular the rights and appurtenances thereto in any way belong to Grantor (collectively, the "Easement"), to have and to hold the Easement to Grantee and Grantee's, successors, and assigns forever, together, together with the right of ingress and egress over Grantor's adjacent land to and from the Easement Property in connection with the exercise of Grantee's rights hereunder.

Grantee shall hold a dominant and superior right of use and easement in the Easement Property as follows:

1. Grantor shall make no use or authorize others to make use of the Easement Property which, in Grantee's sole discretion, would unreasonably interfere with the nature, purposes, scope, and intent of the

Easement Purpose conveyed herein, including but not limited to, drilling excavating activities, impoundment of water or placement or construction of permanent structures including but not limited to buildings, poles, signs, masonry walls, masonry fences and retaining walls withing the Easement Property.

2. Grantor Reserves the right to put or place, or authorize others to put or place utility lines (excluding utility poles), drainage pipes and swales, roads and fences upon or within the Easement Property. Said utility lines, drainage pipes and swales, roads and fences may only be placed within the Easement Property upon express written approval by Grantee or Grantor's engineering plans and specifications. All utility lines, drainage pipes, and swales, roads and fences must cross the Easement Property at an angle of at least 45 degrees or more to the center line of the Easement Property. Installed fences will require gates adequate to allow access along the Easement Property by Grantee. Grantor shall not have the right, or the authority to authorize others, to us the Easement Property for any purpose which would cause the continuing utility operations of Grantee to being violation of any state, federal, or municipal law, ordinance, or regulations.

3. Granto shall make no changes affecting the topography or elevation within the Easement Property by more than (1) foot without the express written approval of the Grantee.

4. Grantor reserves the right to place landscaping, sprinkler systems, ornamental trees, and similar improvements within the Easement Property. Grantee may remove and keep removed any trees, structures or improvements that Grantee deems, in Grantee's sole discretion, to interfere with the purposes of the Easement granted herein.

5. Any improvements, landscaping, sprinkler systems and ornamental trees placed on the Easement Property by Grantor may be removed or destroyed by Grantee to the extent that it is reasonably necessary, in Grantee's sole discretion, for Grantee's installing, maintaining, removing or replacing any of the water line, sanitary sewer or related facilities, but only, except in cases of emergencies, after prior written notice to Grantor.

6. Grantee covenants and agrees to restore the natural surface of the Easement Property and any adjacent lands disturbed by Grantee, to a condition comparable to that which existed prior to the entry and construction, demolition, removal or other disturbance. All permitted paving, fencing, and gates on such property shall be restored by Grantee to their original condition as found before construction, demolition or removal by Grantee. Grantee is not, however, responsible to restore any

unauthorized improvements, sprinklers, ornamental trees or landscaping within the Easement Property.

The term “Grantor” as used herein means all and singular and include Grantor’s successors and assigns. The term “Grantee” as used herein means all and singular writing simultaneously with any assignment by Grantee of this instrument or any interest herein, and each successor and assign of Grantee shall assume all of Grantee’s obligations under this instrument, including, without limitation, the foregoing notice obligation.

Grantor represents that (a) Grantor has full and unencumbered fee simple title to and in the easement estates herein granted: subject and limited as a foresaid. (b) Grantor has the right to execute this instrument. And (c) there are no liens existing against the Easement Property.

[SIGNATURES APPEAR ON THE FOLLOWING PAGE]

SIGNED this _____ day of _____, 2024

GRANTOR: KLLB AIV, LLC

_____
By:

THE STATE OF TEXAS §
§
COUNTY OF _____ §

BEFORE ME, the undersigned authority, on this day personally appeared _____ known to me to be one of the persons whose names are subscribed to the foregoing instrument; he/she acknowledged to me that he/she is the _____ and duly authorized representative of **KLLB AIV, LLC**, and that he/she executed said instrument for the purpose and consideration therein express and in the capacity therein stated.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this _____ day of _____, 20__.

_____
Notary Public in and for the State of Texas

ACCEPTANCE BY GRANTEE:

GRANTEE: **City of Aubrey, Texas**

_____
By: Chris Rich, Mayor, City of Aubrey

THE STATE OF TEXAS §
§
COUNTY OF _____ §

BEFORE ME, the undersigned authority, on this day personally appeared _____ known to me to be one of the persons whose names are subscribed to the foregoing instrument; he/she acknowledged to me that he/she is the _____ and duly authorized representative of **City of Aubrey**, and that he/she executed said instrument for the purpose and consideration therein express and in the capacity therein stated.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this _____ day of _____, 20__.

_____
Notary Public in and for the State of Texas

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Approve a Permanent Sanitary Sewer Easement Acquisition for the Highpointe Corner Sewer Improvement Project.

Staff Contact
Leanne Wilson, Director of Public Works and Development Services
lwilson@aubreytx.gov

Summary
Highpointe Corner, LLC is dedicating approximately 1,348 square feet of land situated in the Franciso Trevino, Abstract No. 1243, along Spring Hill adjacent to the Highpointe Ranch Development for a sanitary sewer easement.

Financial Summary
NA

Staff Recommended Motion
Approve

Conditions
N/A

STATE OF TEXAS §
§ **KNOW ALL MEN BY THESE PRESENTS**
COUNTY OF DENTON §

GRANTOR: **Highpointe Corner, LLC**

GRANTOR'S MAILING ADDRESS (including County):

GRANTEE: **CITY OF AUBREY**

GRANTEE'S MAILING ADDRESS (including County):
107 SOUTH MAIN STREET
AUBREY, DENTON COUNTY, TX 76227

Consideration: Ten Dollars ($10.00) and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged.

Easement Property: The tract of land described in Exhibit A attached hereto and incorporated herein by reference for all purposes.

Easement Purpose: For the sole purpose(s) of surveying and engineering, constructing, installing, maintaining, testing, accessing, repairing, removing or replacing water and sanitary sewer pipelines and appurtenances, including manholes, blow offs, air vacuum/release valves, and similar appurtenances, communication facilities such as fiber optic cables, wiring and appurtenances.

Grant of Easement: Grantor, for the Consideration hereof, GRANTS, BARGAINS, SELLS AND COVEYS to Grantee, its successors, and assigns a permanent and perpetual easement over, on, and across the Easement Property for the Easement Purpose, together with all and singular the rights and appurtenances thereto in any way belong to Grantor (collectively, the "Easement"), to have and to hold the Easement to Grantee and Grantee's, successors, and assigns forever, together, together with the right of ingress and egress over Grantor's adjacent land to and from the Easement Property in connection with the exercise of Grantee's rights hereunder.

Grantee shall hold a dominant and superior right of use and easement in the Easement Property as follows:

1. Grantor shall make no use or authorize others to make use of the Easement Property which, in Grantee's sole discretion, would unreasonably interfere with the nature, purposes, scope, and intent of the

Easement Purpose conveyed herein, including but not limited to, drilling excavating activities, impoundment of water or placement or construction of permanent structures including but not limited to buildings, poles, signs, masonry walls, masonry fences and retaining walls withing the Easement Property.

2. Grantor Reserves the right to put or place, or authorize others to put or place utility lines (excluding utility poles), drainage pipes and swales, roads and fences upon or within the Easement Property. Said utility lines, drainage pipes and swales, roads and fences may only be placed within the Easement Property upon express written approval by Grantee or Grantor's engineering plans and specifications. All utility lines, drainage pipes, and swales, roads and fences must cross the Easement Property at an angle of at least 45 degrees or more to the center line of the Easement Property. Installed fences will require gates adequate to allow access along the Easement Property by Grantee. Grantor shall not have the right, or the authority to authorize others, to use the Easement Property for any purpose which would cause the continuing utility operations of Grantee to being violation of any state, federal, or municipal law, ordinance, or regulations.

3. Grantor shall make no changes affecting the topography or elevation within the Easement Property by more than (1) foot without the express written approval of the Grantee.

4. Grantor reserves the right to place landscaping, sprinkler systems, ornamental trees, and similar improvements within the Easement Property. Grantee may remove and keep removed any trees, structures or improvements that Grantee deems, in Grantee's sole discretion, to interfere with the purposes of the Easement granted herein.

5. Any improvements, landscaping, sprinkler systems and ornamental trees placed on the Easement Property by Grantor may be removed or destroyed by Grantee to the extent that it is reasonably necessary, in Grantee's sole discretion, for Grantee's installing, maintaining, removing or replacing any of the water line, sanitary sewer or related facilities, but only, except in cases of emergencies, after prior written notice to Grantor.

6. Grantee covenants and agrees to restore the natural surface of the Easement Property and any adjacent lands disturbed by Grantee, to a condition comparable to that which existed prior to the entry and construction, demolition, removal or other disturbance. All permitted paving, fencing, and gates on such property shall be restored by Grantee to their original condition as found before construction, demolition or removal by Grantee. Grantee is not, however, responsible to restore any

unauthorized improvements, sprinklers, ornamental trees or landscaping within the Easement Property.

7. Grantee agrees Grantor may utilize utilities installed within the Easement Property. Utilization of utilities is subject to available capacity of the utility systems and review and approval of construction documents by Grantee.

The term “Grantor” as used herein means all and singular and include Grantor’s successors and assigns. The term “Grantee” as used herein means all and singular writing simultaneously with any assignment by Grantee of this instrument or any interest herein, and each successor and assign of Grantee shall assume all of Grantee’s obligations under this instrument, including, without limitation, the foregoing notice obligation.

Grantor represents that (a) Grantor has full and unencumbered fee simple title to and in the easement estates herein granted: subject and limited as a foresaid. (b) Grantor has the right to execute this instrument. And (c) there are no liens existing against the Easement Property.

[SIGNATURES APPEAR ON THE FOLLOWING PAGE]

SIGNED this _____ day of _____, 2024

GRANTOR: Highpointe Corner LLC

_____
By:

THE STATE OF TEXAS §
§
COUNTY OF _____ §

BEFORE ME, the undersigned authority, on this day personally appeared _____ known to me to be one of the persons whose names are subscribed to the foregoing instrument; he/she acknowledged to me that he/she is the _____ and duly authorized representative of **Highpointe Corner, LLC**, and that he/she executed said instrument for the purpose and consideration therein express and in the capacity therein stated.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this _____ day of _____, 20__.

_____
Notary Public in and for the State of Texas

ACCEPTANCE BY GRANTEE:

GRANTEE: **City of Aubrey, Texas**

_____
By: Chris Rich, Mayor, City of Aubrey

THE STATE OF TEXAS §
§
COUNTY OF _____ §

BEFORE ME, the undersigned authority, on this day personally appeared _____ known to me to be one of the persons whose names are subscribed to the foregoing instrument; he/she acknowledged to me that he/she is the _____ and duly authorized representative of **City of Aubrey**, and that he/she executed said instrument for the purpose and consideration therein express and in the capacity therein stated.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this _____ day of _____, 20__.

_____
Notary Public in and for the State of Texas

EXHIBIT "A"

"SANITARY SEWER EASEMENT"

Being 1,348 square feet of land situated in the Francisco Trevino Survey, Abstract No. 124, City of Aubrey, Denton County, Texas, being a portion of a tract of land described in deed to Highpointe Corner, LLC, according to the deed filed in Document No. 2023-42434, Official Records of Denton County, Texas (O.R.D.C.T.) and being more particularly described by metes and bounds as follows:

COMMENCING at a 5/8 inch iron rod with cap stamped "KHA" found along the North Right-of-Way line of F.M. Highway No. 428, (80-foot Right-of-Way) also being the Southeast corner of a tract of land described in deed to Aubrey Blackjack Partners LLC, according to the deed filed in Document No. 2021-213816, O.R.D.C.T. and being the Southwest corner of a tract of land described in deed to KLLB AIV, LLC, according to the deed filed in Document No.2023-97316, O.R.D.C.T., and along the South line of an Existing City of Aubrey Water /Wastewater Easement, according to the deed filed in Document No.2022-63141, O.R.D.C.T.;

THENCE S 89°47'44" W, along the South line of Aubrey Blackjack tract and the North Right-of-Way line of F.M. Highway No. 428, and the South line of Water / Wastewater Easement, a distance of 59.98 feet to the Southwest corner of said Aubrey Blackjack tract and the Southeast corner of said Highpointe tract;

THENCE N 0°12'17" W, along the East line of said Highpointe tract and the West line of said Aubrey Blackjack tract, a distance of 50.00 feet to the North line of Existing Water / Wastewater Easement and at the Southeast corner of Sanitary Sewer Easement herein described, and the **POINT OF BEGINNING** of the hereafter described tract of land;

THENCE S 89°47'44" W, along the South line of Sanitary Sewer Easement hereafter described and the North line of Existing Water / Wastewater Easement, a distance of 134.79 feet to the Southwest corner of Sanitary Sewer Easement;

THENCE N 0°12'16" W, along the of West line of Sanitary Sewer Easement hereafter described, a distance of 10.00 feet to the Northwest corner of Sanitary Sewer Easement;

THENCE N 89°47'44" E, along the North line of said Sanitary Sewer Easement hereafter described, a distance of 134.79 feet to the Northeast corner of Sanitary Sewer Easement along the East line of said Highpointe tract and the West line of said Aubrey Blackjack tract;

THENCE N 0°12'17" W, along the East line of said Highpointe tract and the West line of said Aubrey Blackjack tract, a distance of 10.00 feet to the **POINT OF BEGINNING** of the hereinafter described tract and containing 1348 square feet or 0.031-acres of land.

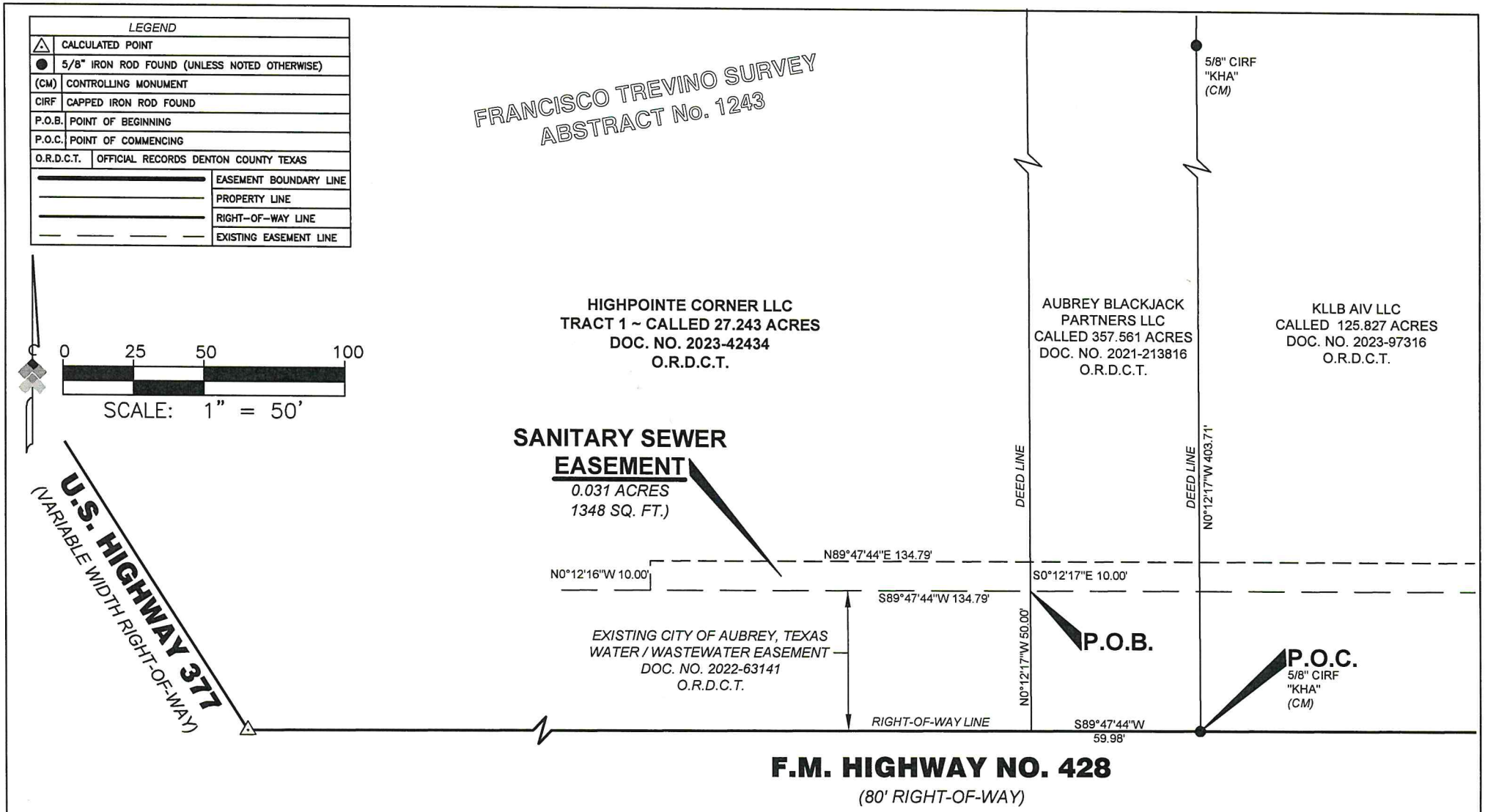
1. Bearings of lines shown hereon refer to Grid North of the Texas Coordinate System of 1983 (North Central Zone; NAD83(CORS96) Epoch 2002.00) as derived locally from Western Data Systems Continuously Operating Reference Stations (CORS) via Real Time Kinematic (RTK) methods. An average Combination Factor of 1.0001459134 was used to scale grid coordinates and distances to surface.

2. Integral parts of this survey:
   a. Legal Description
   b. Sketch

Timothy A. Frost, R.P.L.S.
Texas Registration No. 5316

Date: 7-30-2024

LEGEND	
△	CALCULATED POINT
●	5/8" IRON ROD FOUND (UNLESS NOTED OTHERWISE)
(CM)	CONTROLLING MONUMENT
CIRF	CAPPED IRON ROD FOUND
P.O.B.	POINT OF BEGINNING
P.O.C.	POINT OF COMMENCING
O.R.D.C.T.	OFFICIAL RECORDS DENTON COUNTY TEXAS
	EASEMENT BOUNDARY LINE
	PROPERTY LINE
	RIGHT-OF-WAY LINE
	EXISTING EASEMENT LINE



NOTES:

1. Bearings of lines shown hereon are referenced to Grid North of the Texas Coordinate System of 1983 (North Central Zone 4202: NAD83 (2011) Epoch 2010) as derived locally from RTK Network continuously operating reference stations (CORS) via real time kinematic (RTK) survey methods. The distances shown hereon represent surface values using a surface adjustment factor of 1.000150630 to scale from grid to surface.
2. This Exhibit was prepared without the benefit of a current Title Commitment, or Encumbrance Report. Additional easements, rights-of-way and/or other matters of record may affect this tract that are not shown hereon.
3. A Legal Description of even date herewith accompanies this Easement Exhibit. See Exhibit "A".

teague nall and perkins
3200 S. Interstate 35E, Suite 1129
Denton, Texas 76210
940.383.4177 / www.tnpinc.com
TBPELS FIRM 10011601

STATE OF TEXAS REGISTERED TIMOTHY A. FROST 5316 PROFESSIONAL LAND SURVEYOR

TIMOTHY A. FROST, RPLS NO. 5316 DATE 7-30-2024

EXHIBIT "B"
SANITARY SEWER EASEMENT

BEING 0.031 ACRES (1348 SQ. FT.) OF LAND SITUATED
IN THE FRANCISCO TREVINO SURVEY, ABSTRACT NO. 1243
DENTON COUNTY, TEXAS

HUC22533

I:\Projects\HUC22533\Sur-C3D\cad\survey\Easements\HIGHPOINT.dwg

STATE OF TEXAS §
§ **KNOW ALL MEN BY THESE PRESENTS**
COUNTY OF DENTON §

GRANTOR: **Highpointe Corner, LLC**

GRANTOR'S MAILING ADDRESS (including County):

GRANTEE: **CITY OF AUBREY**

GRANTEE'S MAILING ADDRESS (including County):
107 SOUTH MAIN STREET
AUBREY, DENTON COUNTY, TX 76227

Consideration: Ten Dollars ($10.00) and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged.

Easement Property: The tract of land described in Exhibit A attached hereto and incorporated herein by reference for all purposes.

Easement Purpose: For the sole purpose(s) of surveying and engineering, constructing, installing, maintaining, testing, accessing, repairing, removing or replacing water and sanitary sewer pipelines and appurtenances, including manholes, blow offs, air vacuum/release valves, and similar appurtenances, communication facilities such as fiber optic cables, wiring and appurtenances.

Grant of Easement: Grantor, for the Consideration hereof, GRANTS, BARGAINS, SELLS AND COVEYS to Grantee, its successors, and assigns a permanent and perpetual easement over, on, and across the Easement Property for the Easement Purpose, together with all and singular the rights and appurtenances thereto in any way belong to Grantor (collectively, the "Easement"), to have and to hold the Easement to Grantee and Grantee's, successors, and assigns forever, together, together with the right of ingress and egress over Grantor's adjacent land to and from the Easement Property in connection with the exercise of Grantee's rights hereunder.

Grantee shall hold a dominant and superior right of use and easement in the Easement Property as follows:

1. Grantor shall make no use or authorize others to make use of the Easement Property which, in Grantee's sole discretion, would unreasonably interfere with the nature, purposes, scope, and intent of the

Easement Purpose conveyed herein, including but not limited to, drilling excavating activities, impoundment of water or placement or construction of permanent structures including but not limited to buildings, poles, signs, masonry walls, masonry fences and retaining walls withing the Easement Property.

2. Grantor Reserves the right to put or place, or authorize others to put or place utility lines (excluding utility poles), drainage pipes and swales, roads and fences upon or within the Easement Property. Said utility lines, drainage pipes and swales, roads and fences may only be placed within the Easement Property upon express written approval by Grantee or Grantor's engineering plans and specifications. All utility lines, drainage pipes, and swales, roads and fences must cross the Easement Property at an angle of at least 45 degrees or more to the center line of the Easement Property. Installed fences will require gates adequate to allow access along the Easement Property by Grantee. Grantor shall not have the right, or the authority to authorize others, to use the Easement Property for any purpose which would cause the continuing utility operations of Grantee to being violation of any state, federal, or municipal law, ordinance, or regulations.

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6. Grantee covenants and agrees to restore the natural surface of the Easement Property and any adjacent lands disturbed by Grantee, to a condition comparable to that which existed prior to the entry and construction, demolition, removal or other disturbance. All permitted paving, fencing, and gates on such property shall be restored by Grantee to their original condition as found before construction, demolition or removal by Grantee. Grantee is not, however, responsible to restore any

unauthorized improvements, sprinklers, ornamental trees or landscaping within the Easement Property.

7. Grantee agrees Grantor may utilize utilities installed within the Easement Property. Utilization of utilities is subject to available capacity of the utility systems and review and approval of construction documents by Grantee.

The term “Grantor” as used herein means all and singular and include Grantor’s successors and assigns. The term “Grantee” as used herein means all and singular writing simultaneously with any assignment by Grantee of this instrument or any interest herein, and each successor and assign of Grantee shall assume all of Grantee’s obligations under this instrument, including, without limitation, the foregoing notice obligation.

Grantor represents that (a) Grantor has full and unencumbered fee simple title to and in the easement estates herein granted: subject and limited as a foresaid. (b) Grantor has the right to execute this instrument. And (c) there are no liens existing against the Easement Property.

[SIGNATURES APPEAR ON THE FOLLOWING PAGE]

SIGNED this _____ day of _____, 2024

GRANTOR: Highpointe Corner LLC

_____
By:

THE STATE OF TEXAS §
§
COUNTY OF _____ §

BEFORE ME, the undersigned authority, on this day personally appeared _____ known to me to be one of the persons whose names are subscribed to the foregoing instrument; he/she acknowledged to me that he/she is the _____ and duly authorized representative of **Highpointe Corner, LLC**, and that he/she executed said instrument for the purpose and consideration therein express and in the capacity therein stated.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this _____ day of _____, 20__.

_____
Notary Public in and for the State of Texas

ACCEPTANCE BY GRANTEE:

GRANTEE: **City of Aubrey, Texas**

_____
By: Chris Rich, Mayor, City of Aubrey

THE STATE OF TEXAS §
§
COUNTY OF _____ §

BEFORE ME, the undersigned authority, on this day personally appeared _____ known to me to be one of the persons whose names are subscribed to the foregoing instrument; he/she acknowledged to me that he/she is the _____ and duly authorized representative of **City of Aubrey**, and that he/she executed said instrument for the purpose and consideration therein express and in the capacity therein stated.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this _____ day of _____, 20__.

_____
Notary Public in and for the State of Texas

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Approving the City Manager to enter into a professional services agreement with Westwood Consulting for a Downtown Farmers Market concept plan in the amount of $24,500.

Staff Contact
Christine Gossett, MDD Executive Director
cgossett@aubreytx.gov
940-440-9343

Summary
Consider and take action on approving the City Manager to enter into a professional services agreement with Westwood Consulting for a Downtown Farmers Market concept plan in the amount of $24,500.

In the July meeting of the Aubrey MDD Board, the board approved the MDD Executive Director to enter into a professional services agreement with Westwood Consulting for a Downtown Farmers' Market concept plan, which would include probable construction costs in an amount not to exceed $25,000. The design plans for a Farmers' Market would include, but not be limited to, a parking area, spaces for vendors, small covered platform, electrical outlets/utilities infrastructure, fencing and pad sites for food trucks.

The MDD Board has discussed the need for a market and vendor activities downtown and this project would get the City one step closer toward the development of a market. Markets also serve as business catalysts, as well as business incubators for local entrepreneurs.

Staff recommends approving a professional services agreement with Westwood since they have worked on other parks improvement plans for Aubrey.

Financial Summary
The agreement proposal is $24,500 and will be paid for by the Aubrey MDD.

Staff Recommended Motion
Approve

Conditions

Westwood

August 8, 2024 (Revised)
Project No.: 0057671.00

Mr. Charles Kreidler
City Manager
CITY OF AUBREY
107 S. Main Street
Aubrey, Texas 76227

Re: Professional Landscape Architecture Services
AUBREY COMMUNITY MARKET & GARDEN - PHASE 1
Aubrey, Texas

Dear Mr. Kreidler:

Westwood Professional Services, Inc. is pleased to submit this proposal to provide professional landscape architecture services relating to the referenced project. It is our understanding the project consists of providing overall conceptual design master plan for a new Community Market and Garden Center for the City of Aubrey downtown.

Based on our preliminary discussions and the information received to date, our perception of the project is described in the attached documents:

- General Conditions of Agreement;
- Exhibit A – Scope of Services;
- Exhibit B – Compensation and Method of Payment;
- Exhibit C – Insurance; and
- Exhibit D – Schedule
- Exhibit E – Site Exhibit

Westwood Professional Services, Inc. is pleased to have this opportunity to submit this proposal and look forward to working with you on this project. If the proposed agreement is acceptable to you as presented, please execute one copy of the agreement form and return one original copy to our office. If you have any questions or would like any additional information, please do not hesitate to call us at your convenience.

Sincerely,

Tricia A. Woliver, P.L.A.

TAW/aew
0057671.00R2

General Conditions of Agreement **Westwood Professional Services, Inc.**

This document, together with the attached **Scope of Work and Fee Proposal ("Proposal") for the Aubrey Community Market & Garden – Phase 1 Project** dated **August 8, 2024** (the "Project"), is an agreement (the "Agreement") between **the City of Aubrey** ("Client"), located at 107 S. Main Street, Aubrey, Texas 76227 and **Westwood Professional Services, Inc.,** ("Westwood"), located at **118 N. Ohio Street, Celina, Texas 75009.**

1.01 Basic Agreement

Westwood shall provide, or cause to be provided, the services set forth in this Agreement and as described in the accompanying Scope of Services and Compensation exhibits (the "Services") and shall provide drawings, specifications, plans, work product, and any deliverables as described in this Agreement and the Proposal (the "Deliverables"). Westwood may engage consultants to assist in the performance of the Services.

2.01 Scope of Services

Westwood shall perform the Professional Consultant services (hereinafter referred to as the "Services") for the Project as set forth in Exhibit "A" (the "Scope of Services"), which is attached and made a part hereof, in accordance with the terms of this Agreement. All designs, drawings, specifications, documents, and other work products of Westwood, whether in hard copy or in electronic form, are Instruments of Service for this Project, whether the Project is completed or not. Reuse, change, or alteration by Client or by others acting through or on behalf of Client of any such Instruments of Service without the written permission of Westwood will be at Client's sole risk.

3.01 Payment Procedures

Westwood shall be compensated by payment of fees as set forth in Exhibit B (the "Compensation and Method of Payment") which is attached and incorporated herein including any subsequent amendments thereto.

Preparation of Invoices. Westwood will prepare a monthly invoice in accordance with Westwood's standard invoicing practices and submit the invoice to Client.

Payment of Invoices. Invoices are due and payable within thirty (30) days of receipt. If Client fails to make any payment due Westwood for Services and expenses within thirty (30) days after the date of Westwood's invoice, Westwood may, without liability, after giving seven (7) days written notice to Client, suspend Services under this Agreement until Westwood has been paid in full all amounts due for Services, expenses, and other related charges. Westwood has the right to employ such persons or professional service providers on a consultant basis to mitigate its damages.

Client shall provide written notification to Westwood within fifteen (15) days of receipt of the invoice should Client object to all or any part of charges appearing on the invoice. Such written notice shall set forth, at a minimum, the specific portion of the invoice disputed, the amount disputed, and the alleged factual and legal basis for the dispute. The portion of the invoice not in dispute shall be paid by Client within thirty (30) days receipt of said invoice.

Payment for Services. Client shall pay Westwood as follows:

A. If the work is agreed to on an hourly basis, an amount equal to the cumulative hours charged to the Project by each of Westwood's employees multiplied by the hourly rates for each employee for all services performed on the Project, plus reimbursable expenses and Westwood's consultant's charges, if any.

B. If work is agreed to on a lump sum basis, invoice amounts shall be an amount equal to the percent of each task's completion multiplied by the lump sum of the task, plus reimbursable expenses and Westwood's consultant's charges, if any.

4.01 Additional Services

If authorized by Client in writing, or if required because of changes in the Project, Westwood may furnish services in addition to those set forth in the Scope of Work and Fee Proposal.

Client shall pay Westwood for such additional services an amount equal to the cumulative hours charged to the Project by each class of Westwood's employees multiplied by the rates for each applicable billing class, plus reimbursable expenses and Westwood's consultants' charges, if any.

5.01 Termination

This Agreement may be terminated for cause:

A. By either party upon thirty (30) days written notice in the event of failure by the other party to perform in accordance with the Agreement's terms through no fault of the terminating party. Notwithstanding the foregoing, this Agreement will not terminate as a result of a failure to perform in accordance with the Agreement if the party receiving a notice of failure to perform begins within seven (7) days of receipt of such notice to correct its failure and proceeds diligently to cure such failure within thirty (30) days of receipt of notice; provided, however, that if and to the extent such failure cannot be reasonably cured within such thirty (30) day period, and if such party has diligently attempted to cure the same and thereafter continues diligently to cure the same, then the cure period provided for herein shall extend up to, but in no case more than, sixty (60) days after the date of receipt of the notice.

B. By Westwood:

1) Upon seven (7) days written notice if Westwood believes that Westwood is being requested by Client to furnish or perform services contrary to Westwood's responsibilities as a licensed professional; or

2) Upon seven (7) days written notice if Westwood's Services for the Project are delayed or suspended for more than ninety (90) days for reasons beyond Westwood's control.

Westwood shall have no liability to Client as a result of such termination in this paragraph.

The terminating party under paragraphs 5.01.A or 5.01.B, may set the effective date of termination at a time up to thirty (30) days later than otherwise provided to allow Westwood to demobilize personnel and equipment from the Project site to complete tasks providing value which would otherwise be lost, to prepare notes as to the status of completed and uncompleted tasks, and to assemble Project materials in orderly files. Westwood shall be compensated for the time required to complete such tasks.

6.01 Successors, Assigns, and Beneficiaries

Client and Westwood are each hereby bound, and the partners, successors, executors, administrators, and legal representatives of Client and Westwood are hereby bound to the other party to this Agreement and to the partners, successors, executors, administrators, and legal representatives (and said assigns) of such other party, in respect of all covenants, agreements, and obligations of this Agreement.

Neither Client nor Westwood may assign, sublet, or transfer any rights under or interest (including, but without limitation, moneys that are due or may become due) in this Agreement without the written consent of the other, except to the extent that any assignment, subletting, or transfer is mandated or required by law. Unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under this Agreement.

7.01 General Considerations

A. The standard of care for all professional consulting and related services performed or furnished by Westwood under this Agreement will be the care and skill ordinarily used by members of Westwood's profession practicing under similar circumstances at the same time and in the same locality. Except as expressly set forth in Paragraph 6.01B, Westwood makes no warranties, express or implied, under this Agreement or otherwise, in connection with Westwood's Services and Deliverables. Westwood and its consultants may use or rely upon the design services of Client and others, including, but not limited to, contractors, manufacturers, and suppliers.

B. If Client notifies Westwood of a deficiency, or if Westwood determines there is a deficiency, within sixty (60) days after delivery of a Deliverable to Client, as Client's sole and exclusive remedy, Westwood shall correct such deficiencies without additional compensation except to the extent such action is directly attributable to deficiencies in Client-furnished information.

C. Client shall be responsible for, and Westwood may rely upon, the accuracy and completeness of all requirements, programs, instructions, reports, data, and other information furnished by Client to Westwood pursuant to this Agreement. Westwood may use such requirements, reports, data, and information in performing or furnishing services under this Agreement.

D. Westwood neither guarantees the performance of any third party, including contractors, using the Deliverables or Services nor assumes responsibility for any third party's failure to furnish and perform any work that uses the Deliverables or Services.

E. Westwood shall not be responsible for the acts or omissions of any contractor(s), subcontractor(s) or supplier(s), or of any of the contractor's agents or employees or any other persons (except Westwood's own employees) furnishing or performing any of the contractor's work; or for any decision made on interpretations or clarifications of Deliverables without consultation and advice of Westwood.

F. It is understood and agreed that if Westwood's services under this Agreement do not include construction phase services, and that such services will be provided by Client, then Client assumes all responsibility for interpretation of Deliverables and for construction observation or review and waives any claims against Westwood that may be in any way connected thereto.

G. Westwood shall be the owner of all right, title, and interest in and to any and all Deliverables, together with any and all related rights of copyright, patent, trade secret, trademark and service mark, and all other proprietary rights of any kind whatsoever. Subject to the provisions herein and upon Westwood's receipt of full payment therefore, Westwood hereby grants to Client, and Client accepts: (i) a nonexclusive, nontransferable, without the right to sublicense, royalty-free license to use the Deliverables for the sole purpose of constructing the Project: and (ii) the right to reproduce applicable portions of the Deliverables for Client's contractors, consultants, and suppliers solely for use in construction of the Project, provided Client reproduces on such copies the copyright notice and other proprietary legends that were on the original Deliverable. Deliverables are not intended or represented to be suitable and are not licensed to Client for reuse by Client or others on extensions of the Project or on any other project. Upon termination of this Agreement by Westwood pursuant to paragraph 4.01, the license granted herein shall terminate. Any unauthorized use of the Deliverables will be at Client's sole risk and without liability to Westwood or to Westwood's consultants.

H. This Agreement is to be governed by the laws of the State in which the Project is located.

I. All express indemnifications or limitations of liability included in this Agreement will survive its completion or termination for any reason.

J. Any provision or part of the Agreement held to be void or unenforceable under any laws or regulations shall be deemed stricken and all remaining provisions shall continue to be valid and binding upon Client and Westwood.

K. Nothing contained herein shall be construed to mean that Westwood and Client are engaging in a joint venture or partnership.

L. Westwood shall maintain insurances during the term of this Agreement as indicated in the attached **Exhibit C** to this Agreement.

M. If either party hereto shall commence any action or proceeding against the other in connection with the terms, conditions, or obligations under this Agreement, the prevailing party shall be entitled to recovery of its reasonable attorney's fees and costs incurred herein.

N. In the event the terms of these General Conditions conflict with the Proposal or other contract documents, these General Conditions shall control.

8.01 Hazardous Environmental Conditions

The parties acknowledge this Agreement does not include any services related to a Hazardous Environmental Condition. Such conditions include, but are not limited to the presence of asbestos, PCB's, petroleum, hazardous substances or waste, and radioactive materials. If Westwood or any other party encounters a Hazardous Environmental Condition, Westwood may, at its option and without liability for consequential or any other damages, suspend performance of Services on the portion of the Project affected thereby until Client: (i) retains appropriate specialist consultants or contractors to identify and, as appropriate, abate, remediate, or remove the Hazardous Environmental Condition; and (ii) warrants that the site is in full compliance with applicable Laws and Regulations.

9.01 Allocation of Risks

A. To the fullest extent permitted by law, Westwood shall indemnify and hold harmless Client, Client's officers, directors, partners, and employees from and against any and all costs, losses, and damages (including but not limited to all fees and reasonable charges of consultants, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) to the extent caused in whole or in part by the negligent acts or omissions, intentional tort or failure to pay a subconsultant of Westwood or Westwood's officers, directors, partners, employees, and Westwood's consultants in the performance and furnishing of Westwood's services under this Agreement.

B. To the fullest extent permitted by the laws of the State of Texas, Client shall indemnify and hold harmless Westwood, Westwood's officers, directors, partners, employees, and Westwood's consultants from and against any and all claims, demands, costs, losses, and damages (including but not limited to all fees and charges of consultants, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) and liabilities that Westwood may incur or suffer which arise out of or relate to: (i) the negligent acts or omissions of Client or Client's officers, directors, partners, employees, and Client's consultants with respect to this Agreement or the Project; and (ii) Client's breach of or failure to perform any of its obligations of this Agreement or a Proposal.

C. To the fullest extent permitted by laws of the State of Texas, and to the extent a claimant is not otherwise barred from recovery, Westwood's total liability to Client and anyone claiming by, through, or under Client for any cost, loss, or damages shall not exceed Westwood's respective percentage of responsibility for sch cost, loss, or damage. Westwood shall not be liable for any incidental, consequential, indirect, or punitive damages arising out of this Agreement or Westwood's provision of the Services or the Deliverables, even if Westwood has been advised of the possibilities of such damages. In no event shall Westwood's total liability in connection with this Agreement exceed the amounts paid by Client to Westwood under this Agreement.

10.1 Force Majeure

An event of "Force Majeure" occurs when an event beyond the control of the Party claiming Force Majeure prevents such Party from fulfilling its obligations. An event of Force Majeure includes, without limitation, floods, hurricanes and other adverse weather, war, riot, civil disorder, acts of terrorism, disease, epidemic, strikes and labor disputes, actions or inactions of government or other authorities, law enforcement actions, curfews, closure of transportation systems or other unusual travel difficulties, or inability to provide a safe working environment for employees.

In the event of Force Majeure, the obligations of Westwood to perform Services shall be suspended for the duration of the event of Force Majeure. In such event, Westwood shall be compensated for time expended and expenses incurred during the event of Force Majeure and the schedule shall be extended by a like number of days as the event of Force Majeure. If Services are suspended for thirty (30) days or more, Westwood may, in its sole discretion, upon five (5) days prior written notice, terminate this Agreement or the affected Work Order, or both. In the case of such termination, in addition to the compensation and time extension set forth above, Westwood shall be compensated for all reasonable termination expenses.

11.01 Coronavirus Pandemic Impact

Client acknowledges and agrees that due to the dynamic and fluid nature of the coronavirus pandemic (COVID-19) (the "Coronavirus Pandemic"), Westwood may face uncertainty regarding its ability to perform the work contemplated by the Agreement in accordance with the schedule and contracted price. As a result of the Coronavirus Pandemic, the schedule, and related scope and fee, provided in the Agreement may be impacted due to issues outside of Westwood's control including, but not limited to, the following: (a) shortages in labor (including employees and consultants); (b) direction or guidance from any applicable governmental authority or applicable law that renders Westwood's or it's subconsultants' performance impossible, impracticable, or contrary to such direction or guidance; (c) delays in governmental approvals; and (d) other causes beyond Westwood's reasonable control, regardless of whether such impacts are direct or indirect.

If due to the impacts of the Coronavirus Pandemic, Westwood determines in good faith and in Westwood's sole discretion, that it is not feasible for Westwood or its subconsultants to perform the work in accordance with the schedule Westwood shall promptly notify Client and the parties shall cooperate in good faith to negotiate equitable adjustments to the schedule and/or contract price. Notwithstanding anything to the contrary set forth in this Agreement, including any related work or change order, Westwood shall not be liable to Client for any damages (actual, direct, consequential, incidental, punitive, liquidated, or nominal) as a result of delays or cost adjustments in connection with the Coronavirus Pandemic.

12.01 Right of Entry

To the extent securing a right of entry is not part of the Services, Client grants to Westwood, and, if the Project site is not owned by Client, warrants that permission has been granted for, a right of entry from time to time by Westwood, its employees, agents and subcontractors, upon the Project site for the purpose of providing the Services. Client recognizes that the use of investigative equipment and practices may unavoidably alter the existing site conditions and affect the environment in the area being studied, despite, the use of reasonable care. Client shall indemnify and hold Westwood harmless from claims for damages caused in part by reasons of Westwood's provision of Services.

13.01 No Third Party Rights

This Agreement shall not create any rights or benefits to parties other than Client and Westwood. No third party shall have the right to rely on Westwood's Deliverables or opinions rendered in connection with the Services without the written consent of Westwood and the third party's agreement to be bound to the same conditions and limitations as Client.

14.01 Total Agreement

This Agreement, together with any attached documents, constitutes the entire Agreement between Client and Westwood and supersedes all prior written or oral understandings regarding this subject. This Agreement may only be amended, supplemented, or modified by a mutually executed written instrument.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, effective on the latest date indicated below.

CLIENT:
City of Aubrey

By: _____

Name: _____
(PRINT/TYPE)

Title:_____

Date Signed: _____

Address/Contact for giving notices:

_____

_____

_____

_____

_____

WESTWOOD:
Westwood Professional Services, Inc.

By: _____

Name: _____
(PRINT/TYPE)

Title: _____

Date Signed: _____

Address/Contact for giving notices:

Westwood Professional Services, Inc.

C/O General Counsel

2805 North Dallas Parkway, Suite 150

Plano, Texas 75093

Email: legal@westwoodps.com

Exhibits:
- A Scope of Services
- B Compensation & Method of Payment
- C Insurance
- D Schedule

EXHIBIT 'A' – SCOPE OF SERVICES

AUBREY COMMUNITY MARKET & GARDEN - PHASE 1

PROJECT DESCRIPTION:

The project consists of providing professional landscape architecture services for conceptual designs for an approximately 4.2 acre new community market center that includes new entry drive and signage, parking, spaces for vendors, a small covered platform, electrical, fencing, food truck pad sites, and improvements to the adjacent community garden and associated landscape and irrigation improvements. The project site located along Sherman Drive and Sycamore Street in Downtown Aubrey, Texas as shown in Exhibit "E" (PROJECT). The project will be divided into two phases as described shown and described in Exhibit B.

BASIC SERVICES:

Landscape Architecture Assumptions & Exclusions
Below are shown the assumptions and qualifiers for the landscape architecture scope of work found herein.

1. Assumptions:
    - Area of work is as shown in "Exhibit E" attached.
    - Project budget is unknown.
    - The Project site has been surveyed and the survey will be provided by the City.
    - Phase 1 of this project shall include the overall conceptual plan phase with design alternatives and revisions as described below.
    - The construction documentation, bidding, construction administration and special engineering services shall be performed under a different phase and scope of work.
    - Community engagement will be not be required aside from review and approval with City staff and staff from the Municipal Development District.
2. Exclusions:
    - Presentations, documents, or plans required for "Special Exceptions", Variances or Zoning changes required by the architectural or civil design solutions chosen by the Owner.
    - Field identification or location of trees. The landscape architect assumes that the tree survey provided by the owner/civil will have the pertinent information.
    - Multiple design alternatives beyond those described herein, or significant site plan revisions following acceptance at each given phase of review documents.
    - Water feature.
    - Irrigation systems utilizing reclaimed water that require pumps, filters and associated controls. This can be provided as an additional service if needed.
    - Site signage for buildings and vehicular circulation.
    - LEED pursuit.
    - Site walls over 36" height and/or with surcharge.
    - Regular owner/Contractor (OAC) project coordination meetings during construction.

A. Project Management and Coordination

1. Manage the Team:
   - Lead, manage and direct design team activities.
   - Ensure quality control is practiced in performance of the work.
   - Communicate internally among team members.
   - Allocate team resources.
2. Communications and Reporting:
   - Attend a pre-design project kickoff meeting with Client staff to confirm and clarify scope, understand Client objectives, and ensure economical and functional designs that meet Client requirements.
   - Conduct review meetings with the Client at the end of each design phase.
   - Prepare and submit monthly invoices in the format acceptable to the Client.
   - Prepare and submit monthly progress reports.

B. Conceptual Design

The Conceptual Design shall be submitted to Client per the approved Project Schedule. The purpose of the conceptual design is for Westwood to:

- Study the project.
- Identify and develop up to three (3) alternatives.
- Present (through the defined deliverables) these alternatives to the Client.
- Recommend the alternatives that successfully address the design problem.
- Obtain the Client's endorsement of the selected concept.
- Selected concept shall have up to three revision to final concept that Westwood shall take to Construction Documentation in the next phase of the project currently not included in this scope.
- Any additional elements requested by the Client beyond those approved in the Conceptual Design Phase shall be provide with Additional Services.

Westwood will develop the conceptual design of the infrastructure as follows.

1. Data Collection:
   - In addition to data obtained from the Client, Westwood will research proposed improvements in conjunction with any other planned future improvements known by the Client that may influence the project.
   - Westwood will also identify and seek to obtain data for existing conditions that may impact the project including but not limited to; utilities, agencies (TxDOT and USCOE), Client Master Plans, and property ownership as available from the Tax Assessor's office.
   - The data collection efforts will also include conducting special coordination meetings with affected property owners and businesses as necessary to develop the design.
2. The Conceptual Design Package shall include the following:
   - Graphic exhibits and written summary of alternative design concepts, with supporting precedent images and supporting hardscape and plant material images to assist in selection of the rationale for selecting the recommended design concept.

- Westwood shall provide one final plan view rendering of the selected design concept. 3D rendering
- Proposed phasing of any construction that is included in this project documented in both the project schedule and narrative form.
- Documentation of key design decisions.
- Conceptual opinion of probable construction cost.

C. Direct Expenses

1. Included in this item are usual and customary expenses normally incurred during performance of the services described. These expenses could include courier delivery charges, copies of existing engineering plans and/or maps, printing and reproduction (either in-house or by reproduction company) and mileage.

END OF EXHIBIT 'A'

EXHIBIT 'B' – COMPENSATION AND METHOD OF PAYMENT

AUBREY COMMUNITY MARKET & GARDEN – PHASE 1

COMPENSATION:

For all professional services included in EXHIBIT 'A', Scope of Services, Westwood shall be compensated a lump sum fee of $24,500.00 as summarized below. The total lump sum fee shall be considered full compensation for the services described in EXHIBIT 'A', including all labor materials, supplies, and equipment necessary to deliver the services.

Phase 1 Basic Services	
A. Project Management, Coordination (PH1)	$ 4,500.00
B. Conceptual Design (30% Submittal)	$18,500.00
C. Direct Expenses	$ 1,500.00
TOTAL	**$24,500.00**

METHOD OF PAYMENT:

Westwood shall be paid monthly payments as described in Article 3 of the AGREEMENT. The cumulative sum of such monthly partial fee payments shall not exceed the total current project budget including all approved Amendments. Each invoice shall be verified as to its accuracy and compliance with the terms of this Agreement by an officer of Westwood.

Monthly statements for reimbursable services performed by sub consultants will be based upon the actual cost to Westwood plus ten percent (10%). Direct expenses for services such as printing, express mail, fees, mileage and other direct expenses that are incurred during the progress of the project will be billed at 1.1 times Westwood's cost.

END OF EXHIBIT 'B'

EXHIBIT C – INSURANCE

A. *Insurance.* Westwood shall, during the life of this Agreement, maintain the following insurances:

1. Commercial General Liability (occurrence form not less than):
   $2,000,000 General Liability
   $2,000,000 Products and Completed Operations Aggregate
   $1,000,000 Personal and Advertising Injury
   $1,000,000 Each Occurrence
   $10,000 Medical Expense

2. Commercial Automobile Liability (all scheduled auto, hired and non-owned autos):
   $1,000,000 Combined Single Limit

3. Umbrella
   $5,000,000 Aggregate
   $5,000,000 Each Occurrence

4. Workers Compensation
   $1,000,000 Each Accident
   $1,000,000 Policy Limit
   $1,000,000 Each Employee

Professional Liability Errors and Omissions Insurance. Westwood shall carry Professional Liability Errors and Omissions insurance with limited contractual liability in the amount of $2,000,000 per claim and in the aggregate for the duration of this Agreement.

END OF EXHIBIT 'C'

EXHIBIT 'D' – SCHEDULE

AUBREY COMMUNITY MARKET & GARDEN

Activity	Estimated Duration (weeks)	Estimated Completion After N.T.P.
Notice-To-Proceed		-
Conceptual Design Alternatives	6	10 Weeks
Client Review	2	12 Weeks
Revisions to Selected Concept Alternative	3	15 Weeks
Client Review	2	17 Weeks
Finalize Selected Conceptual Plan	4	21 Weeks

Westwood is not responsible for delays beyond its control.

END OF EXHIBIT 'D'

EXHIBIT E to Agreement between the City of Aubrey, Texas ("Client") and Westwood Professional Services, Inc., ("Westwood") for Consulting Services

EXHIBIT 'E' – SITE EXHIBIT

AUBREY COMMUNITY MARKET & GARDEN – PHASE 1

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Approve a Professional Engineering Services Agreement Amendment with Mead & Hunt for the design of the Wastewater Treatment Plant Expansion in the amount of $64,027, and authorize the City Manager to execute necessary documents.

Staff Contact
Leanne Wilson, Director of Public Works and Development Services
lwilson@aubreytx.gov

Summary
This amendment is for additional services needed during the detailed scope, final plan review and development of the bid package.

The additions and modifications included:

1. Addition of Landscaping at O&M Building and Entry Gate - Design and submittal review of landscaping and irrigation using plant water around the O&M Building and at the entry gate. AWR Designs has been contracted to complete the landscaping design.
2. Modifications to System Architecture and Network Interfaces - System architecture and network interface modifications to accommodate SCADAPacks and Ethernet cabling recommended by system integrator.
3. Addition of Site Security - Implementing powering video surveillance and access control.
4. Addition of Demolition of Existing Facilities - Preparation of construction drawings depicting demolition of select existing facilities.
5. Addition of Sampling Equipment Procurement and associated Canopies - Obtaining proposal for sampling equipment and coordination with electrical for powering and controlling the sampling equipment and structural for canopy design.
6. Addition of Chemical Procurement - Developing procurement documents for sodium hypochlorite, aluminum coagulant and polymer for dewatering.

The fee for the additions and modifications is $64,027, increasing the original agreement to a total of $2,088,655. Staff recommends approval of the amendment.

Financial Summary
This project is being funded through the sewer capital fund and will be reimbursable with the 2024 Bond.

Staff Recommended Motion
Approve

Conditions
N/A

August 12, 2024

Leanne Wilson
Director of Public Works and Development
City of Aubrey
107 S. Main Street
Aubrey, TX 76227

Subject: WWTP Expansion to 2.25 MGD
Amendment No. 2

Dear Leanne:

We appreciate the opportunity to submit Amendment No. 2 including scope additions and modifications identified through detailed design to the Wastewater Treatment Plant (WWTP) Expansion to 2.25 million gallons per day (MGD) project.

Attached please find a scope and fee summary for scope additions and modifications in the following areas –

- Addition of Landscaping at O&M Building and Entry Gate – Design and submittal review of landscaping and irrigation using plant water around the O&M Building and at the entry gate. AWR Designs has been contracted to complete the landscaping design.
- Modifications to System Architecture and Network Interfaces – System architecture and network interface modifications to accommodate SCADAPacks and Ethernet cabling recommended by system integrator.
- Addition of Site Security – Implementing powering video surveillance and access control.
- Addition of Demolition of Existing Facilities – Preparation of construction drawings depicting demolition of select existing facilities.
- Addition of Sampling Equipment Procurement and associated Canopies – Obtaining proposal for sampling equipment and coordination with electrical for powering and controlling the sampling equipment and structural for canopy design.
- Addition of Chemical Procurement – Developing procurement documents for sodium hypochlorite, aluminum coagulant and polymer for dewatering.

These scope additions and modifications total $ 64,027. The following table summarizes the previously contracted fees and the proposed scope additions and modifications.

Task No.	Task Description	Contracted Fee	Scope Additions and Modifications
Task I	Preliminary Design	$ 199,659	--
Task II	Permit Amendment Application	$ 39,940	--
Task III	Treatment Plant Detailed Design	$ 1,074,772	$ 63,642
Task IV	Advertisement and Bid Phase Services	$ 73,182	--
Task V	Construction Phase Services	$ 392,352	$ 385
Task VI	Maintenance Building Detailed Design	$ 229,676	--
Task VII	O&M Manual	$ 79,074	--
TOTAL		**$ 2,088,655**	**$ 64,027**

Please reach out for additional information on these scope additions and modifications or with any other questions or concerns.

We appreciate the City's assistance with this important WWTP expansion project.

Sincerely,

MEAD & HUNT, Inc.

Charlotte G. Smith

Charlotte G. Smith, P.E.
Senior Project Manager

Accepted by: City of Aubrey

By: _____
Charles Kreidler, City Manager

Date: _____

Attachment: Scope Additions and Modifications Summary Table

City of Aubrey

Wastewater Treatment Plant Expansion

Permitting, Design and Construction Administration

Task **Scope Additions and Modifications**

Labor Summary		Labor Category & Projected Hours					Labor Subtotal	Subconsultant Subtotal
Subtask	Description	Principal	Sr. Proj. Mgr.	Grad. Engineer	Technician	Admin / Intern		
DETAILED DESIGN								
A1	Landscaping and irrigation design meeting Aubrey ordinance requirements for commercial buildings at O&M Building and Entry Gate by AWR Designs.		6		4		$ 1,756	$ 2,650
A2	System architecture and network interface modifications to accommodate SCADAPacks and Ethernet cabling recommended by system integrator.		6				$ 1,350	$ 22,800
A3	Implementing and powering video surveillance and access control.		8				$ 1,800	$ 17,880
A4	Preparation of construction drawings depicting demolition of select existing facilities.		6	6	16		$ 3,880	$ -
A5	Obtaining scope proposal for sampling equipment and coordination with electrical for powering and controlling the sampling equipment and structural for canopy design.		6	2	6		$ 2,261	$ -
A6	Developing procurement documents for sodium hypochlorite, aluminum coagulant and polymer for dewatering.	1	12	16			$ 5,356	$ -
CONSTRUCTION PHASE SERVICES								
C1	Landscaping and irrigation submittal review.						$ -	$ 350
	Subtotals						**$ 16,488**	**$ 43,680**
				Subconsultants Total with 10% Multiplier				$ 48,048
				Total Professional Services Fee				**$ 64,536**

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
An Ordinance approving a settlement between the Atmos Cities Steering Committee ("ACSC") and Atmos Energy Corp., Mid-Tex Division, regarding the company's 2024 rate review mechanism filings, and adopting tariffs that reflect the rate adjustments.

Staff Contact
Charles Kreidler, City Manager
kreidler@aubreytx.gov
940-440-9343

Summary

The City, along with 181 other Mid-Texas cities served by Atmos Energy Corporation, Mid-Tex Division ("Atmos Mid-Tex" or "Company"), is a member of the Atmos Cities Steering Committee ("ACSC"). In 2007, ACSC and Atmos Mid-Tex settled a rate application filed by the Company pursuant to Section 104.301 of the Texas Utilities Code for an interim rate adjustment commonly referred to as a GRIP filing (arising out of the Gas Reliability Infrastructure Program legislation). That settlement created a substitute rate review process, referred to as Rate Review Mechanism ("RRM"), as a substitute for future filings under the GRIP statute.

Since 2007, there have been several modifications to the original RRM Tariff. The most recent iteration of an RRM Tariff was reflected in an ordinance adopted by ACSC members in 2018. On or about April 1, 2024, the Company filed a rate request pursuant to the RRM Tariff adopted by ACSC members. The Company claimed that its cost-of-service in a test year ending December 31, 2023, entitled it to additional system-wide revenues of $196.8 million.

Application of the standards set forth in ACSC's RRM Tariff reduces the Company's request to $182.5 million, $132.6 million of which would be applicable to ACSC members. After reviewing the filing and conducting discovery, ACSC's consultants concluded that the system-wide deficiency under the RRM regime should be $149.6 million instead of the claimed $182.5 million.

After several settlement meetings, the parties have agreed to settle the case for $164.7 million. This is a reduction of $32.1 million to the Company's initial request. This includes payment of ACSC's expenses. The Effective Date for new rates is October 1, 2024. ACSC members should take action approving the Resolution/Ordinance before September 30, 2024.

RATE TARIFFS

Atmos generated rate tariffs attached to the Resolution/Ordinance that will generate $164.7 million in additional revenues. Atmos also prepared a Proof of Revenues supporting the settlement figures. ACSC consultants have agreed that Atmos' Proof of Revenues is accurate.

BILL IMPACT

The impact of the settlement on average residential rates is an increase of $5.52 on a monthly basis, or 6.84%. The increase for average commercial usage will be $13.39 or 3.44%. Atmos provided bill impact comparisons containing these figures.

SUMMARY OF ACSC'S OBJECTION TO THE UTILITIES CODE SECTION 104.301 GRIP PROCESS

ACSC strongly opposed the GRIP process because it constitutes piecemeal ratemaking by ignoring declining expenses and increasing revenues while rewarding the Company for increasing capital investment on an annual basis. The GRIP process does not allow any review of the reasonableness of capital investment and does not allow cities to participate in the Railroad Commission's review of annual GRIP filings or allow recovery of Cities' rate case expenses. The Railroad Commission undertakes a mere administrative review of GRIP filings (instead of a full hearing) and rate increases go into effect without any material adjustments. In ACSC's view, the GRIP process unfairly raises customers' rates without any regulatory oversight. In contrast, the RRM process has allowed for a more comprehensive rate review and annual evaluation of expenses and revenues, as well as capital investment.

RRM SAVINGS OVER GRIP

While residents outside municipal limits must pay rates governed by GRIP, there are some cities served by Atmos Mid-Tex that chose to remain under GRIP rather than adopt RRM. Additionally, the City of Dallas adopted a variation of RRM which is referred to as DARR. When new rates become effective on October 1, 2024, ACSC residents will maintain an economic monthly advantage over GRIP and DARR rates.

Comparison to Other Mid-Tex Rates (Residential)

	Average Bill	Compared to RRM Cities
RRM Cities:	$48.19	-
DARR:	$54.30	$6.11
ATM Cities:	$49.59	$1.40
Environs:	$49.53	$1.34

Note: ATM Cities and Environs rates are as-filed. Also note that DARR uses a test year ending in September rather than December.

EXPLANATION OF "BE IT RESOLVED" PARAGRAPHS:

1. This section approves all findings in the Resolution/Ordinance.
2. This section adopts the RRM rate tariffs and finds the adoption of the new rates to be just, reasonable, and in the public interest.
3. This section makes it clear that Cities may challenge future costs associated with gas leaks.
4. This section finds that existing rates are unreasonable. Such finding is a necessary predicate to establishment of new rates. The new tariffs will permit Atmos Mid-Tex to recover an additional $164.7 million on a system-wide basis.
5. This section approves an exhibit that establishes a benchmark for pensions and retiree medical benefits to be used in future rate cases or RRM filings.
6. This section requires the Company to reimburse the City for expenses associated with review of the RRM filing, settlement discussions, and adoption of the Resolution/Ordinance approving new rate tariffs.
7. This section repeals any resolution or ordinance that is inconsistent with the Resolution/Ordinance.
8. This section finds that the meeting was conducted in compliance with the Texas Open Meetings Act, Texas Government Code, Chapter 551.
9. This section is a savings clause, which provides that if any section is later found to be unconstitutional or invalid, that finding shall not affect, impair, or invalidate the remaining provisions of this Resolution/Ordinance. This section further directs that the remaining provisions of the Resolution/Ordinance are to be interpreted as if the offending section or clause never existed.
10. This section provides for an effective date upon passage.
11. This section directs that a copy of the signed Resolution/Ordinance be sent to a representative of the Company and legal counsel for ACSC.

CONCLUSION

The Legislature's GRIP process allowed gas utilities to receive annual rate increases associated with capital investments. The RRM process has proven to result in a more efficient and less costly (both from a consumer rate impact perspective and from a ratemaking perspective) than the GRIP process. Given Atmos Mid-Tex's claim that its historic cost of service should entitle it to recover $196.8 million in additional system-wide revenues, the RRM settlement at $164.7 million for ACSC members reflects substantial savings to ACSC cities. Settlement at $164.7 million is fair and reasonable. The ACSC Executive Committee consisting of city employees of 18 ACSC members urges all ACSC members to pass the Resolution/Ordinance before September 30, 2024. New rates become effective October 1, 2024.

Financial Summary

Staff Recommended Motion

Conditions
N/A

ORDINANCE NO. ___

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF AUBREY TEXAS, APPROVING A NEGOTIATED SETTLEMENT BETWEEN THE ATMOS CITIES STEERING COMMITTEE ("ACSC") AND ATMOS ENERGY CORP., MID-TEX DIVISION REGARDING THE COMPANY'S 2024 RATE REVIEW MECHANISM FILING; DECLARING EXISTING RATES TO BE UNREASONABLE; ADOPTING TARIFFS THAT REFLECT RATE ADJUSTMENTS CONSISTENT WITH THE NEGOTIATED SETTLEMENT; FINDING THE RATES TO BE SET BY THE ATTACHED SETTLEMENT TARIFFS TO BE JUST AND REASONABLE AND IN THE PUBLIC INTEREST; APPROVING AN ATTACHMENT ESTABLISHING A BENCHMARK FOR PENSIONS AND RETIREE MEDICAL BENEFITS; REQUIRING THE COMPANY TO REIMBURSE ACSC'S REASONABLE RATEMAKING EXPENSES; DETERMINING THAT THIS ORDINANCE WAS PASSED IN ACCORDANCE WITH THE REQUIREMENTS OF THE TEXAS OPEN MEETINGS ACT; ADOPTING A SAVINGS CLAUSE; DECLARING AN EFFECTIVE DATE; AND REQUIRING DELIVERY OF THIS ORDINANCE TO THE COMPANY AND THE ACSC'S LEGAL COUNSEL.

WHEREAS, the City of Aubrey, Texas ("City") is a gas utility customer of Atmos Energy Corp., Mid-Tex Division ("Atmos Mid-Tex" or "Company"), and a regulatory authority with an interest in the rates, charges, and services of Atmos Mid-Tex; and

WHEREAS, the City is a member of the Atmos Cities Steering Committee ("ACSC"), a coalition of similarly situated cities served by Atmos Mid-Tex ("ACSC Cities") that have joined together to facilitate the review of, and response to, natural gas issues affecting rates charged in the Atmos Mid-Tex service area; and

WHEREAS, ACSC and the Company worked collaboratively to develop a Rate Review Mechanism ("RRM") tariff that allows for an expedited rate review process by ACSC Cities as a substitute to the Gas Reliability Infrastructure Program ("GRIP") process instituted by the Legislature, and that will establish rates for the ACSC Cities based on the system-wide cost of serving the Atmos Mid-Tex Division; and

WHEREAS, the current RRM tariff was adopted by the City in a rate ordinance in 2018; and

WHEREAS, on about April 1, 2024, Atmos Mid-Tex filed its 2024 RRM rate request with ACSC Cities based on a test year ending December 31, 2023; and

WHEREAS, ACSC coordinated its review of the Atmos Mid-Tex 2024 RRM filing through its Executive Committee, assisted by ACSC's attorneys and consultants, to resolve issues identified in the Company's RRM filing; and

WHEREAS, the Executive Committee, as well as ACSC's counsel and consultants, recommend that ACSC Cities approve an increase in base rates for Atmos Mid-Tex of $164.7 million on a system-wide basis with an Effective Date of October 1, 2024; and

WHEREAS, ACSC agrees that Atmos plant-in-service is reasonable; and

WHEREAS, with the exception of approved plant-in-service, ACSC is not foreclosed from future reasonableness evaluation of costs associated with incidents related to gas leaks; and

WHEREAS, the attached tariffs (Attachment 1) implementing new rates are consistent with the recommendation of the ACSC Executive Committee, are agreed to by the Company, and are just, reasonable, and in the public interest; and

WHEREAS, the settlement agreement sets a new benchmark for pensions and retiree medical benefits (Attachment 2); and

WHEREAS, the RRM Tariff contemplates reimbursement of ACSC's reasonable expenses associated with RRM applications.

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF AUBREY, TEXAS:

SECTION 1. That the findings set forth in this Ordinance are hereby in all things approved.

SECTION 2. That, without prejudice to future litigation of any issue identified by ACSC, the City Council finds that the settled amount of an increase in revenues of $164.7 million on a system-wide basis represents a comprehensive settlement of gas utility rate issues affecting the rates, operations, and services offered by Atmos Mid-Tex within the municipal limits arising from Atmos Mid-Tex's 2024 RRM filing, is in the public interest, and is consistent with the City's authority under Section 103.001 of the Texas Utilities Code.

SECTION 3. That despite finding Atmos Mid-Tex's plant-in-service to be reasonable, ACSC is not foreclosed in future cases from evaluating the reasonableness of costs associated with incidents involving leaks of natural gas.

SECTION 4. That the existing rates for natural gas service provided by Atmos Mid-Tex are unreasonable. The new tariffs attached hereto and incorporated herein as Attachment 1, are just and reasonable, and are designed to allow Atmos Mid-Tex to recover annually an additional $164.7 million on a system-wide basis, over the amount allowed under currently approved rates. Such tariffs are hereby adopted.

SECTION 5. That the ratemaking treatment for pensions and retiree medical benefits in Atmos Mid-Tex's next RRM filing shall be as set forth on Attachment 2, attached hereto and incorporated herein.

SECTION 6. That Atmos Mid-Tex shall reimburse the reasonable ratemaking expenses of ACSC in processing the Company's 2024 RRM filing.

SECTION 7. That to the extent any resolution or ordinance previously adopted by the Council is inconsistent with this Ordinance, it is hereby repealed.

SECTION 8. That the meeting at which this Ordinance was approved was in all things conducted in strict compliance with the Texas Open Meetings Act, Texas Government Code, Chapter 551.

SECTION 9. That if any one or more sections or clauses of this Ordinance is adjudged to be unconstitutional or invalid, such judgment shall not affect, impair, or invalidate the remaining provisions of this Ordinance, and the remaining provisions of the Ordinance shall be interpreted as if the offending section or clause never existed.

SECTION 10. That consistent with the City Ordinance that established the RRM process, this Ordinance shall become effective from and after its passage with rates authorized by attached tariffs to be effective for bills rendered on or after October 1, 2024.

SECTION 11. That a copy of this Ordinance shall be sent to Atmos Mid-Tex, care of Chris Felan, Vice President of Rates and Regulatory Affairs Mid-Tex Division, Atmos Energy Corporation, 5420 LBJ Freeway, Suite 1862, Dallas, Texas 75240, and to Thomas Brocato, General Counsel to ACSC, at Lloyd Gosselink Rochelle & Townsend, P.C., 816 Congress Avenue, Suite 1900, Austin, Texas 78701.

DULY PASSED AND APPROVED BY THE CITY COUNCIL OF THE CITY OF AUBREY, TEXAS, BY A VOTE OF ____ TO ____, ON THIS THE 22ND DAY OF AUGUST 2024.

_____
Chris Rich, Mayor

ATTEST:

_____
Jenny Hicks, City Secretary

APPROVED AS TO FORM:

_____
Patricia Adams, City Attorney

MID-TEX DIVISION
ATMOS ENERGY CORPORATION

RATE SCHEDULE:	**R – RESIDENTIAL SALES**	
APPLICABLE TO:	**ALL CUSTOMERS IN THE MID-TEX DIVISION UNDER THE RRM TARIFF**	
EFFECTIVE DATE:	**Bills Rendered on or after 10/01/2024**	

Application
Applicable to Residential Customers for all natural gas provided at one Point of Delivery and measured through one meter.

Type of Service
Where service of the type desired by Customer is not already available at the Point of Delivery, additional charges and special contract arrangements between Company and Customer may be required prior to service being furnished.

Monthly Rate
Customer's monthly bill will be calculated by adding the following Customer and Ccf charges to the amounts due under the riders listed below:

Charge	Amount
Customer Charge per Bill	$ 22.95 per month
Rider CEE Surcharge	$ 0.05 per month[1]
Total Customer Charge	$ 23.00 per month
Commodity Charge – All Ccf	$0.58974 per Ccf

Gas Cost Recovery: Plus an amount for gas costs and upstream transportation costs calculated in accordance with Part (a) and Part (b), respectively, of Rider GCR.

Weather Normalization Adjustment: Plus or Minus an amount for weather normalization calculated in accordance with Rider WNA.

Franchise Fee Adjustment: Plus an amount for franchise fees calculated in accordance with Rider FF. Rider FF is only applicable to customers inside the corporate limits of any incorporated municipality.

Tax Adjustment: Plus an amount for tax calculated in accordance with Rider TAX.

Surcharges: Plus an amount for surcharges calculated in accordance with the applicable rider(s).

Agreement
An Agreement for Gas Service may be required.

Notice
Service hereunder and the rates for services provided are subject to the orders of regulatory bodies having jurisdiction and to the Company's Tariff for Gas Service.

[1]Reference Rider CEE - Conservation and Energy Efficiency as approved in GUD 10170. Surcharge billing effective July 1, 2024.

MID-TEX DIVISION
ATMOS ENERGY CORPORATION

RATE SCHEDULE:	**C – COMMERCIAL SALES**	
APPLICABLE TO:	**ALL CUSTOMERS IN THE MID-TEX DIVISION UNDER THE RRM TARIFF**	
EFFECTIVE DATE:	**Bills Rendered on or after 10/01/2024**	

Application
Applicable to Commercial Customers for all natural gas provided at one Point of Delivery and measured through one meter and to Industrial Customers with an average annual usage of less than 30,000 Ccf.

Type of Service
Where service of the type desired by Customer is not already available at the Point of Delivery, additional charges and special contract arrangements between Company and Customer may be required prior to service being furnished.

Monthly Rate
Customer's monthly bill will be calculated by adding the following Customer and Ccf charges to the amounts due under the riders listed below:

Charge	Amount
Customer Charge per Bill	$ 81.75 per month
Rider CEE Surcharge	$ 0.00 per month[1]
Total Customer Charge	$ 81.75 per month
Commodity Charge – All Ccf	$ 0.19033 per Ccf

Gas Cost Recovery: Plus an amount for gas costs and upstream transportation costs calculated in accordance with Part (a) and Part (b), respectively, of Rider GCR.

Weather Normalization Adjustment: Plus or Minus an amount for weather normalization calculated in accordance with Rider WNA.

Franchise Fee Adjustment: Plus an amount for franchise fees calculated in accordance with Rider FF. Rider FF is only applicable to customers inside the corporate limits of any incorporated municipality.

Tax Adjustment: Plus an amount for tax calculated in accordance with Rider TAX.

Surcharges: Plus an amount for surcharges calculated in accordance with the applicable rider(s).

Agreement
An Agreement for Gas Service may be required.

Notice
Service hereunder and the rates for services provided are subject to the orders of regulatory bodies having jurisdiction and to the Company's Tariff for Gas Service.

Presumption of Plant Protection Level
For service under this Rate Schedule, plant protection volumes are presumed to be 10% of normal, regular, historical usage as reasonably calculated by the Company in its sole discretion. If a customer believes it needs to be modeled at an alternative plant protection volume, it should contact the company at mdtx-div-plantprotection@atmosenergy.com.

[1] Reference Rider CEE - Conservation and Energy Efficiency as approved in GUD 10170. Surcharge billing effective July 1, 2024.
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MID-TEX DIVISION
ATMOS ENERGY CORPORATION

RATE SCHEDULE:	**I – INDUSTRIAL SALES**	
APPLICABLE TO:	**ALL CUSTOMERS IN THE MID-TEX DIVISION UNDER THE RRM TARIFF**	
EFFECTIVE DATE:	**Bills Rendered on or after 10/01/2024**	

Application
Applicable to Industrial Customers with a maximum daily usage (MDU) of less than 200 MMBtu per day for all natural gas provided at one Point of Delivery and measured through one meter. Service for Industrial Customers with an MDU equal to or greater than 200 MMBtu per day will be provided at Company's sole option and will require special contract arrangements between Company and Customer.

Type of Service
Where service of the type desired by Customer is not already available at the Point of Delivery, additional charges and special contract arrangements between Company and Customer may be required prior to service being furnished.

Monthly Rate
Customer's monthly bill will be calculated by adding the following Customer and MMBtu charges to the amounts due under the riders listed below:

Charge	Amount
Customer Charge per Meter	$ 1,587.75 per month
First 0 MMBtu to 1,500 MMBtu	$ 0.6553 per MMBtu
Next 3,500 MMBtu	$ 0.4799 per MMBtu
All MMBtu over 5,000 MMBtu	$ 0.1029 per MMBtu

Gas Cost Recovery: Plus an amount for gas costs and upstream transportation costs calculated in accordance with Part (a) and Part (b), respectively, of Rider GCR.

Franchise Fee Adjustment: Plus an amount for franchise fees calculated in accordance with Rider FF. Rider FF is only applicable to customers inside the corporate limits of any incorporated municipality.

Tax Adjustment: Plus an amount for tax calculated in accordance with Rider TAX.

Surcharges: Plus an amount for surcharges calculated in accordance with the applicable rider(s).

Curtailment Overpull Fee
Upon notification by Company of an event of curtailment or interruption of Customer's deliveries, Customer will, for each MMBtu delivered in excess of the stated level of curtailment or interruption, pay Company 200% of the midpoint price for the Katy point listed in *Platts Gas Daily* published for the applicable Gas Day in the table entitled "Daily Price Survey."

Replacement Index
In the event the "midpoint" or "common" price for the Katy point listed in *Platts Gas Daily* in the table entitled "Daily Price Survey" is no longer published, Company will calculate the applicable imbalance fees utilizing a daily price index recognized as authoritative by the natural gas industry and most closely approximating the applicable index.

MID-TEX DIVISION
ATMOS ENERGY CORPORATION

RATE SCHEDULE:	**I – INDUSTRIAL SALES**	
APPLICABLE TO:	**ALL CUSTOMERS IN THE MID-TEX DIVISION UNDER THE RRM TARIFF**	
EFFECTIVE DATE:	**Bills Rendered on or after 10/01/2024**	

Agreement
An Agreement for Gas Service may be required.

Notice
Service hereunder and the rates for services provided are subject to the orders of regulatory bodies having jurisdiction and to the Company's Tariff for Gas Service.

Special Conditions
In order to receive service under Rate I, Customer must have the type of meter required by Company. Customer must pay Company all costs associated with the acquisition and installation of the meter.

Presumption of Plant Protection Level
For service under this Rate Schedule, plant protection volumes are presumed to be 10% of normal, regular, historical usage as reasonably calculated by the Company in its sole discretion. If a customer believes it needs to be modeled at an alternative plant protection volume, it should contact the company at mdtx-div-plantprotection@atmosenergy.com.

MID-TEX DIVISION
ATMOS ENERGY CORPORATION

RATE SCHEDULE:	**T – TRANSPORTATION**	
APPLICABLE TO:	**ALL CUSTOMERS IN THE MID-TEX DIVISION UNDER THE RRM TARIFF**	
EFFECTIVE DATE:	**Bills Rendered on or after 10/01/2024**	

Application
Applicable, in the event that Company has entered into a Transportation Agreement, to a customer directly connected to the Atmos Energy Corp., Mid-Tex Division Distribution System (Customer) for the transportation of all natural gas supplied by Customer or Customer's agent at one Point of Delivery for use in Customer's facility.

Type of Service
Where service of the type desired by Customer is not already available at the Point of Delivery, additional charges and special contract arrangements between Company and Customer may be required prior to service being furnished.

Monthly Rate
Customer's bill will be calculated by adding the following Customer and MMBtu charges to the amounts and quantities due under the riders listed below:

Charge	Amount
Customer Charge per Meter	$ 1,587.75 per month
First 0 MMBtu to 1,500 MMBtu	$ 0.6553 per MMBtu
Next 3,500 MMBtu	$ 0.4799 per MMBtu
All MMBtu over 5,000 MMBtu	$ 0.1029 per MMBtu

Upstream Transportation Cost Recovery: Plus an amount for upstream transportation costs in accordance with Part (b) of Rider GCR.

Retention Adjustment: Plus a quantity of gas as calculated in accordance with Rider RA.

Franchise Fee Adjustment: Plus an amount for franchise fees calculated in accordance with Rider FF. Rider FF is only applicable to customers inside the corporate limits of any incorporated municipality.

Tax Adjustment: Plus an amount for tax calculated in accordance with Rider TAX.

Surcharges: Plus an amount for surcharges calculated in accordance with the applicable rider(s).

Imbalance Fees
All fees charged to Customer under this Rate Schedule will be charged based on the quantities determined under the applicable Transportation Agreement and quantities will not be aggregated for any Customer with multiple Transportation Agreements for the purposes of such fees.

Monthly Imbalance Fees
Customer shall pay Company the greater of (i) $0.10 per MMBtu, or (ii) 150% of the difference per MMBtu between the highest and lowest "midpoint" price for the Katy point listed in *Platts Gas Daily* in the table entitled "Daily Price Survey" during such month, for the MMBtu of Customer's monthly Cumulative Imbalance, as defined in the applicable Transportation Agreement, at the end of each month that exceeds 10% of Customer's receipt quantities for the month.

MID-TEX DIVISION
ATMOS ENERGY CORPORATION

RATE SCHEDULE:	**T – TRANSPORTATION**	
APPLICABLE TO:	**ALL CUSTOMERS IN THE MID-TEX DIVISION UNDER THE RRM TARIFF**	
EFFECTIVE DATE:	**Bills Rendered on or after 10/01/2024**	

Curtailment Overpull Fee
Upon notification by Company of an event of curtailment or interruption of Customer's deliveries, Customer will, for each MMBtu delivered in excess of the stated level of curtailment or interruption, pay Company 200% of the midpoint price for the Katy point listed in *Platts Gas Daily* published for the applicable Gas Day in the table entitled "Daily Price Survey."

Replacement Index
In the event the "midpoint" or "common" price for the Katy point listed in *Platts Gas Daily* in the table entitled "Daily Price Survey" is no longer published, Company will calculate the applicable imbalance fees utilizing a daily price index recognized as authoritative by the natural gas industry and most closely approximating the applicable index.

Agreement
A transportation agreement is required.

Notice
Service hereunder and the rates for services provided are subject to the orders of regulatory bodies having jurisdiction and to the Company's Tariff for Gas Service.

Special Conditions
In order to receive service under Rate T, customer must have the type of meter required by Company. Customer must pay Company all costs associated with the acquisition and installation of the meter.

MID-TEX DIVISION
ATMOS ENERGY CORPORATION

RIDER:	**WNA – WEATHER NORMALIZATION ADJUSTMENT**	
APPLICABLE TO:	**ALL CUSTOMERS IN THE MID-TEX DIVISION UNDER THE RRM TARIFF**	
EFFECTIVE DATE:	**Bills Rendered on or after 10/01/2024**	

Provisions for Adjustment

The Commodity Charge per Ccf (100 cubic feet) for gas service set forth in any Rate Schedules utilized by the cities of the Mid-Tex Division service area for determining normalized winter period revenues shall be adjusted by an amount hereinafter described, which amount is referred to as the "Weather Normalization Adjustment." The Weather Normalization Adjustment shall apply to all temperature sensitive residential and commercial bills based on meters read during the revenue months of November through April. The five regional weather stations are Abilene, Austin, Dallas, Waco, and Wichita Falls.

Computation of Weather Normalization Adjustment

The Weather Normalization Adjustment Factor shall be computed to the nearest one-hundredth cent per Ccf by the following formula:

$$WNAF_i = R_i \frac{(HSF_i \times (NDD-ADD))}{(BL_i + (HSF_i \times ADD))}$$

Where

i = any particular Rate Schedule or billing classification within any such particular Rate Schedule that contains more than one billing classification

$WNAF_i$ = Weather Normalization Adjustment Factor for the ith rate schedule or classification expressed in cents per Ccf

R_i = Commodity Charge rate of temperature sensitive sales for the ith schedule or classification.

HSF_i = heat sensitive factor for the ith schedule or classification divided by the average bill count in that class

NDD = billing cycle normal heating degree days calculated as the simple ten-year average of actual heating degree days.

ADD = billing cycle actual heating degree days.

Bl_i = base load sales for the ith schedule or classification divided by the average bill count in that class

The Weather Normalization Adjustment for the jth customer in ith rate schedule is computed as:

$$WNA_i = WNAF_i \times q_{ij}$$

Where q_{ij} is the relevant sales quantity for the jth customer in ith rate schedule.

MID-TEX DIVISION
ATMOS ENERGY CORPORATION

RIDER:	**WNA – WEATHER NORMALIZATION ADJUSTMENT**	
APPLICABLE TO:	**ALL CUSTOMERS IN THE MID-TEX DIVISION UNDER THE RRM TARIFF**	
EFFECTIVE DATE:	**Bills Rendered on or after 10/01/2024**	

Base Use/Heat Use Factors

	Residential		Commercial	
Weather Station	Base use Ccf	Heat use Ccf/HDD	Base use Ccf	Heat use Ccf/HDD
Abilene	9.52	0.1526	88.98	0.7485
Austin	8.87	0.1343	213.30	0.9142
Dallas	12.38	0.2024	185.59	1.0974
Waco	8.71	0.1219	130.62	0.7190
Wichita Falls	10.20	0.1394	117.78	0.6435

Weather Normalization Adjustment (WNA) Report

On or before June 1 of each year, the company posts on its website at atmosenergy.com/mtx-wna, in Excel format, a *Weather Normalization Adjustment (WNA) Report* to show how the company calculated its WNAs factor during the preceding winter season. Additionally, on or before June 1 of each year, the company files one hard copy and an Excel version of the *WNA Report* with the Railroad Commission of Texas' Gas Services Division, addressed to the Director of that Division.

ATMOS ENERGY CORP., MID-TEX DIVISION
MID-TEX RATE REVIEW MECHANISM
PENSIONS AND RETIREE MEDICAL BENEFITS FOR CITIES APPROVAL
TEST YEAR ENDING DECEMBER 31, 2023

		Shared Services		Mid-Tex Direct			
Line No.	Description	Pension Account Plan	Post-Employment Benefit Plan	Pension Account Plan	Post-Employment Benefit Plan	Supplemental Executive Benefit Plan	Adjustment Total
	(a)	(b)	(c)	(d)	(e)	(f)	(g)
1	Proposed Benefits Benchmark - Fiscal Year 2024 Willis Towers Watson Report as adjusted	$ 1,402,365	$ (1,146,665)	$ 2,186,549	$ (4,070,086)	$ 278,107	
2	Allocation Factor	45.93%	45.93%	82.00%	82.00%	100.00%	
3	Proposed Benefits Benchmark Costs Allocated to Mid-Tex (Ln 1 x Ln 2)	$ 644,172	$ (526,717)	$ 1,792,929	$ (3,337,394)	$ 278,107	
4	O&M and Capital Allocation Factor	100.00%	100.00%	100.00%	100.00%	100.00%	
5	Proposed Benefits Benchmark Costs to Approve (Ln 3 x Ln 4)	$ 644,172	$ (526,717)	$ 1,792,929	$ (3,337,394)	$ 278,107	$ (1,148,903)
6							
7	O&M Expense Factor (WP_F-2.3, Ln 2)	81.70%	81.70%	38.85%	38.85%	11.24%	
8							
9	Summary of Costs to Approve:						
10	Total Pension Account Plan	$ 526,315		$ 696,536			$ 1,222,851
11	Total Post-Employment Benefit Plan		$ (430,349)		$ (1,296,547)		(1,726,896)
12	Total Supplemental Executive Benefit Plan					$ 31,256	31,256
13	Total (Ln 10 + Ln 11 + Ln 12)	$ 526,315	$ (430,349)	$ 696,536	$ (1,296,547)	$ 31,256	$ (472,789)

ATMOS ENERGY CORP., MID-TEX DIVISION
MID-TEX RATE REVIEW MECHANISM
AVERAGE BILL COMPARISON - BASE RATES
TEST YEAR ENDING DECEMBER 31, 2023

Line No.	Description							Current	Proposed	Change Amount	Change Percent
	(a)							(b)	(c)	(d)	(e)
1	**Rate R @ 42.8 Ccf**										
2	Customer charge							$ 22.25			
3	Consumption charge	42.8	CCF	X	$	0.48567	=	20.79			
4	Rider GCR Part A	42.8	CCF	X	$	0.27958	=	11.97			
5	Rider GCR Part B	42.8	CCF	X	$	0.47494	=	20.33			
6	Subtotal							$ 75.34			
7	Rider FF & Rider TAX		$ 75.34	X		0.07196	=	5.42			
8	Total							$ 80.76			
9											
10	Customer charge								$ 22.95		
11	Consumption charge	42.8	CCF	X	$	0.58974	=		25.24		
12	Rider GCR Part A	42.8	CCF	X	$	0.27958	=		11.97		
13	Rider GCR Part B	42.8	CCF	X	$	0.47494	=		20.33		
14	Subtotal								$ 80.49		
15	Rider FF & Rider TAX		$ 80.49	X		0.07196	=		5.79		
16	Total								$ 86.28	$ 5.52	6.84%
17											

ATMOS ENERGY CORP., MID-TEX DIVISION
MID-TEX RATE REVIEW MECHANISM
AVERAGE BILL COMPARISON - BASE RATES
TEST YEAR ENDING DECEMBER 31, 2023

Line No.	Description							Current	Proposed	Change Amount	Change Percent
	(a)							(b)	(c)	(d)	(e)
18	**Rate C @ 363.6 Ccf**										
19	Customer charge							$ 72.00			
20	Consumption charge	363.6	CCF	X	$	0.18280	=	66.47			
21	Rider GCR Part A	363.6	CCF	X	$	0.27958	=	101.67			
22	Rider GCR Part B	363.6	CCF	X	$	0.33806	=	122.93			
23	Subtotal							$ 363.07			
24	Rider FF & Rider TAX		$ 363.07	X		0.07196	=	26.13			
25	Total							$ 389.20			
26											
27	Customer charge								$ 81.75		
28	Consumption charge	363.6	CCF	X	$	0.19033	=		69.21		
29	Rider GCR Part A	363.6	CCF	X	$	0.27958	=		101.67		
30	Rider GCR Part B	363.6	CCF	X	$	0.33806	=		122.93		
31	Subtotal								$ 375.56		
32	Rider FF & Rider TAX		$ 375.56	X		0.07196	=		27.03		
33	Total								$ 402.59	$ 13.39	3.44%
34											

ATMOS ENERGY CORP., MID-TEX DIVISION
MID-TEX RATE REVIEW MECHANISM
AVERAGE BILL COMPARISON - BASE RATES
TEST YEAR ENDING DECEMBER 31, 2023

Line No.	Description							Current	Proposed	Change Amount	Change Percent
	(a)							(b)	(c)	(d)	(e)
35	**Rate I @ 1335 MMBTU**										
36	Customer charge							$ 1,382.00			
37	Consumption charge	1,335	MMBTU	X	$	0.7484	=	998.94			
38	Consumption charge	0	MMBTU	X	$	0.5963	=	-			
39	Consumption charge	0	MMBTU	X	$	0.2693	=	-			
40	Rider GCR Part A	1,335	MMBTU	X	$	2.7303	=	3,644.33			
41	Rider GCR Part B	1,335	MMBTU	X	$	0.7337	=	979.37			
42	Subtotal							$ 7,004.64			
43	Rider FF & Rider TAX		$ 7,004.64	X		0.07196	=	504.08			
44	Total							$ 7,508.72			
45											
46	Customer charge								$ 1,587.75		
47	Consumption charge	1,335	MMBTU	X	$	0.6553	=		874.67		
48	Consumption charge	0	MMBTU	X	$	0.4799	=		-		
49	Consumption charge	0	MMBTU	X	$	0.1029	=		-		
50	Rider GCR Part A	1,335	MMBTU	X	$	2.7303	=		3,644.33		
51	Rider GCR Part B	1,335	MMBTU	X	$	0.7337	=		979.37		
52	Subtotal								$ 7,086.12		
53	Rider FF & Rider TAX		$ 7,086.12	X		0.07196	=		509.94		
54	Total								$ 7,596.06	$ 87.34	1.16%
55											

ATMOS ENERGY CORP., MID-TEX DIVISION
MID-TEX RATE REVIEW MECHANISM
AVERAGE BILL COMPARISON - BASE RATES
TEST YEAR ENDING DECEMBER 31, 2023

Line No.	Description							Current	Proposed	Change Amount	Change Percent
	(a)							(b)	(c)	(d)	(e)
56	**Rate T @ 4645 MMBTU**										
57	Customer charge							$ 1,382.00			
58	Consumption charge	1,500	MMBTU	X	$	0.5684	=	852.60			
59	Consumption charge	3,145	MMBTU	X	$	0.4163	=	1,309.08			
60	Consumption charge	0	MMBTU	X	$	0.0893	=	-			
61	Rider GCR Part B	4,645	MMBTU	X	$	0.7337	=	3,407.90			
62	Subtotal							$ 6,951.58			
63	Rider FF & Rider TAX		$ 6,951.58	X		0.07196	=	500.26			
64	Total							$ 7,451.84			
65											
66	Customer charge								$ 1,587.75		
67	Consumption charge	1,500	MMBTU	X	$	0.6553	=		982.95		
68	Consumption charge	3,145	MMBTU	X	$	0.4799	=		1,509.08		
69	Consumption charge	0	MMBTU	X	$	0.1029	=		-		
70	Rider GCR Part B	4,645	MMBTU	X	$	0.7337	=		3,407.90		
71	Subtotal								$ 7,487.68		
72	Rider FF & Rider TAX		$ 7,487.68	X		0.07196	=		538.84		
73	Total								$ 8,026.52	$ 574.68	7.71%

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Approve disposal of computers replaced during the capital replacement program.

Staff Contact
Jenny Hicks, City Secretary
jhicks@aubreytx.gov
940-440-9343

Summary
The following computers were replaced during the capital replacement project and are being decommissioned. They will be disposed of via electronics recycling.

Aubrey

LC Name :	Equipment Type :	Make/Model :	S/N :
AUBPD-WKS09	PC	Lenovo/Ideacentre	MJ09SH3P
AUBPD-WKS10	PC	DELL/OPTIPLEX-3010	S.TAG: 33NVQW1
ACH-WTR-PC	PC	DELL/OPTIPLEX-5050	S.TAG: 71R1YM2
AUBPD-WKS08	PC	DELL/OPTIPLEX-3020	S.TAG: 8CLQ432
AUBPD-WKS06	PC	Lenovo/Ideacentre	R304RYXX
AUBPD-WKS03	PC	DELL/Inspiron	8XNXCH2
AUBPD-WKS02	PC	DELL/Precision T1700	S.TAG: 2YT0B42

Financial Summary
N/A

Staff Recommended Motion
Approve

Conditions
N/A

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Approve a Professional Engineering Services Agreement with Westwood Professional Services, Inc. for Trivedi Park, Phase I, in the amount not to exceed $99,900, and authorize the City Manager to execute the agreement.

Staff Contact
Leanne Wilson, Director of Public Works and Development Services
lwilson@aubreytx.gov

Summary
This service agreement includes professional civil engineering, land surveying and landscape architecture services for Trevedi Park. The project consists of the design of an approximate 24 acre park with a pond and amenities and the design of approximately 2,100 linear feet of the first two lanes of McNatt Road from the intersection of McNatt Road and Spring Hill Road to the north property line.

This Project is Phase I of the overall conceptual plan phase, overall field survey and basic data collection. Westwood will identify and develop two design alternatives and provide up to three revisions to the selected design.

As recommended by the Parks and Recreation Board at their August 6, 2024, regular meeting, items to consider in the design include:

- Nature Trails
- Pavilion and Outdoor Cooking Area
- Splash Pad
- Sports Field or Court
- Disc Golf
- Fishing Pier
- Exercise Stations
- Restrooms
- Parking

The property is heavily wooded, providing for natural shade. The northern end of the property is reserved for a water pump station and the southern end neighbors a future proposed general retail development.

Financial Summary
This project was approved in the 2024 Budget and is funded through Park Development Fees.

Staff Recommended Motion
Approve

Conditions
N/A

Westwood

July 31, 2024 (Revised)
Project No.: 0050797.00

Ms. Leanne Wilson
Director of Public Works and Development Services
CITY OF AUBREY
107 South Main Street
Aubrey, Texas 76227

Re: Professional Civil Engineering, Land Surveying & Landscape Architecture Services
TRIVEDI PARK – PHASE 1
Aubrey, Denton County, Texas

Dear Ms. Wilson:

Westwood Professional Services, Inc. is pleased to submit this proposal to provide professional civil engineering, land surveying and landscape architecture services relating to the referenced project. It is our understanding the project consists of a 24.75 acre park located at 1817 Spring Hill Road in Aubrey, Texas.

Based on our preliminary discussions and the information received to date, our perception of the project is described in the attached documents:

- General Conditions of Agreement;
- Exhibit A – Scope of Services;
- Exhibit B – Compensation and Method of Payment;
- Exhibit C – Insurance;
- Exhibit D – Schedule; and
- Exhibit E – Limits of Work

Westwood Professional Services, Inc. is pleased to have this opportunity to submit this proposal and look forward to working with you on this project. If the proposed agreement is acceptable to you as presented, please execute one copy of the agreement form and return one original copy to our office. If you have any questions or would like any additional information, please do not hesitate to call us at your convenience.

Sincerely,

Tricia A. Woliver, P.L.A.

TAW/jmc

General Conditions of Agreement **Westwood Professional Services, Inc.**

This document, together with the attached **Scope of Work and Fee Proposal ("Proposal") for the Trivedi Park – Phase 1 Project** dated July 31, 2024 (the "Project"), is an agreement (the "Agreement") between **City of Aubrey** ("Client"), located at 107 South Main Street, Aubrey, Texas 76227 and **Westwood Professional Services, Inc.,** ("Westwood"), located at **118 N. Ohio Street, Celina, Texas 75009.**

1.01 Basic Agreement

Westwood shall provide, or cause to be provided, the services set forth in this Agreement and as described in the accompanying Scope of Services and Compensation exhibits (the "Services") and shall provide drawings, specifications, plans, work product, and any deliverables as described in this Agreement and the Proposal (the "Deliverables"). Westwood may engage consultants to assist in the performance of the Services.

2.01 Scope of Services

Westwood shall perform the Professional Consultant services (hereinafter referred to as the "Services") for the Project as set forth in Exhibit "A" (the "Scope of Services"), which is attached and made a part hereof, in accordance with the terms of this Agreement. All designs, drawings, specifications, documents, and other work products of Westwood, whether in hard copy or in electronic form, are Instruments of Service for this Project, whether the Project is completed or not. Reuse, change, or alteration by Client or by others acting through or on behalf of Client of any such Instruments of Service without the written permission of Westwood will be at Client's sole risk.

3.01 Payment Procedures

Westwood shall be compensated by payment of fees as set forth in Exhibit B (the "Compensation and Method of Payment") which is attached and incorporated herein including any subsequent amendments thereto.

Preparation of Invoices. Westwood will prepare a monthly invoice in accordance with Westwood's standard invoicing practices and submit the invoice to Client.

Payment of Invoices. Invoices are due and payable within thirty (30) days of receipt. If Client fails to make any payment due Westwood for Services and expenses within thirty (30) days after the date of Westwood's invoice, Westwood may, without liability, after giving seven (7) days written notice to Client, suspend Services under this Agreement until Westwood has been paid in full all amounts due for Services, expenses, and other related charges. Westwood has the right to employ such persons or professional service providers on a consultant basis to mitigate its damages.

Client shall provide written notification to Westwood within fifteen (15) days of receipt of the invoice should Client object to all or any part of charges appearing on the invoice. Such written notice shall set forth, at a minimum, the specific portion of the invoice disputed, the amount disputed, and the alleged factual and legal basis for the dispute. The portion of the invoice not in dispute shall be paid by Client within thirty (30) days receipt of said invoice.

Payment for Services. Client shall pay Westwood as follows:

A. If the work is agreed to on an hourly basis, an amount equal to the cumulative hours charged to the Project by each of Westwood's employees multiplied by the hourly rates for each employee for all services performed on the Project, plus reimbursable expenses and Westwood's consultant's charges, if any.

B. If work is agreed to on a lump sum basis, invoice amounts shall be an amount equal to the percent of each task's completion multiplied by the lump sum of the task, plus reimbursable expenses and Westwood's consultant's charges, if any.

4.01 Additional Services

If authorized by Client in writing, or if required because of changes in the Project, Westwood may furnish services in addition to those set forth in the Scope of Work and Fee Proposal.

Client shall pay Westwood for such additional services an amount equal to the cumulative hours charged to the Project by each class of Westwood's employees multiplied by the rates for each applicable billing class, plus reimbursable expenses and Westwood's consultants' charges, if any.

5.01 Termination

This Agreement may be terminated for cause:

A. By either party upon thirty (30) days written notice in the event of failure by the other party to perform in accordance with the Agreement's terms through no fault of the terminating party. Notwithstanding the foregoing, this Agreement will not terminate as a result of a failure to perform in accordance with the Agreement if the party receiving a notice of failure to perform begins within seven (7) days of receipt of such notice to correct its failure and proceeds diligently to cure such failure within thirty (30) days of receipt of notice; provided, however, that if and to the extent such failure cannot be reasonably cured within such thirty (30) day period, and if such party has diligently attempted to cure the same and thereafter continues diligently to cure the same, then the cure period provided for herein shall extend up to, but in no case more than, sixty (60) days after the date of receipt of the notice.

B. By Westwood:

1) Upon seven (7) days written notice if Westwood believes that Westwood is being requested by Client to furnish or perform services contrary to Westwood's responsibilities as a licensed professional; or

2) Upon seven (7) days written notice if Westwood's Services for the Project are delayed or suspended for more than ninety (90) days for reasons beyond Westwood's control.

Westwood shall have no liability to Client as a result of such termination in this paragraph.

The terminating party under paragraphs 5.01.A or 5.01.B, may set the effective date of termination at a time up to thirty (30) days later than otherwise provided to allow Westwood to demobilize personnel and equipment from the Project site to complete tasks providing value which would otherwise be lost, to prepare notes as to the status of completed and uncompleted tasks, and to assemble Project materials in orderly files. Westwood shall be compensated for the time required to complete such tasks.

6.01 Successors, Assigns, and Beneficiaries

Client and Westwood are each hereby bound, and the partners, successors, executors, administrators, and legal representatives of Client and Westwood are hereby bound to the other party to this Agreement and to the partners, successors, executors, administrators, and legal representatives (and said assigns) of such other party, in respect of all covenants, agreements, and obligations of this Agreement.

Neither Client nor Westwood may assign, sublet, or transfer any rights under or interest (including, but without limitation, moneys that are due or may become due) in this Agreement without the written consent of the other, except to the extent that any assignment, subletting, or transfer is mandated or required by law. Unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under this Agreement.

7.01 General Considerations

A. The standard of care for all professional consulting and related services performed or furnished by Westwood under this Agreement will be the care and skill ordinarily used by members of Westwood's profession practicing under similar circumstances at the same time and in the same locality. Except as expressly set forth in Paragraph 6.01B, Westwood makes no warranties, express or implied, under this Agreement or otherwise, in connection with Westwood's Services and Deliverables. Westwood and its consultants may use or rely upon the design services of Client and others, including, but not limited to, contractors, manufacturers, and suppliers.

B. If Client notifies Westwood of a deficiency, or if Westwood determines there is a deficiency, within sixty (60) days after delivery of a Deliverable to Client, as Client's sole and exclusive remedy, Westwood shall correct such deficiencies without additional compensation except to the extent such action is directly attributable to deficiencies in Client-furnished information.

C. Client shall be responsible for, and Westwood may rely upon, the accuracy and completeness of all requirements, programs, instructions, reports, data, and other information furnished by Client to Westwood pursuant to this Agreement. Westwood may use such requirements, reports, data, and information in performing or furnishing services under this Agreement.

D. Westwood neither guarantees the performance of any third party, including contractors, using the Deliverables or Services nor assumes responsibility for any third party's failure to furnish and perform any work that uses the Deliverables or Services.

E. Westwood shall not be responsible for the acts or omissions of any contractor(s), subcontractor(s) or supplier(s), or of any of the contractor's agents or employees or any other persons (except Westwood's own employees) furnishing or performing any of the contractor's work; or for any decision made on interpretations or clarifications of Deliverables without consultation and advice of Westwood.

F. It is understood and agreed that if Westwood's services under this Agreement do not include construction phase services, and that such services will be provided by Client, then Client assumes all responsibility for interpretation of Deliverables and for construction observation or review and waives any claims against Westwood that may be in any way connected thereto.

G. Westwood shall be the owner of all right, title, and interest in and to any and all Deliverables, together with any and all related rights of copyright, patent, trade secret, trademark and service mark, and all other proprietary rights of any kind whatsoever. Subject to the provisions herein and upon Westwood's receipt of full payment therefore, Westwood hereby grants to Client, and Client accepts: (i) a nonexclusive, nontransferable, without the right to sublicense, royalty-free license to use the Deliverables for the sole purpose of constructing the Project: and (ii) the right to reproduce applicable portions of the Deliverables for Client's contractors, consultants, and suppliers solely for use in construction of the Project, provided Client reproduces on such copies the copyright notice and other proprietary legends that were on the original Deliverable. Deliverables are not intended or represented to be suitable and are not licensed to Client for reuse by Client or others on extensions of the Project or on any other project. Upon termination of this Agreement by Westwood pursuant to paragraph 4.01, the license granted herein shall terminate. Any unauthorized use of the Deliverables will be at Client's sole risk and without liability to Westwood or to Westwood's consultants.

H. This Agreement is to be governed by the laws of the State in which the Project is located.

I. All express indemnifications or limitations of liability included in this Agreement will survive its completion or termination for any reason.

J. Any provision or part of the Agreement held to be void or unenforceable under any laws or regulations shall be deemed stricken and all remaining provisions shall continue to be valid and binding upon Client and Westwood.

K. Nothing contained herein shall be construed to mean that Westwood and Client are engaging in a joint venture or partnership.

L. Westwood shall maintain insurances during the term of this Agreement as indicated in the attached **Exhibit C** to this Agreement.

M. If either party hereto shall commence any action or proceeding against the other in connection with the terms, conditions, or obligations under this Agreement, the prevailing party shall be entitled to recovery of its reasonable attorney's fees and costs incurred herein.

N. In the event the terms of these General Conditions conflict with the Proposal or other contract documents, these General Conditions shall control.

8.01 Hazardous Environmental Conditions

The parties acknowledge this Agreement does not include any services related to a Hazardous Environmental Condition. Such conditions include, but are not limited to the presence of asbestos, PCB's, petroleum, hazardous substances or waste, and radioactive materials. If Westwood or any other party encounters a Hazardous Environmental Condition, Westwood may, at its option and without liability for consequential or any other damages, suspend performance of Services on the portion of the Project affected thereby until Client: (i) retains appropriate specialist consultants or contractors to identify and, as appropriate, abate, remediate, or remove the Hazardous Environmental Condition; and (ii) warrants that the site is in full compliance with applicable Laws and Regulations.

9.01 Allocation of Risks

A. To the fullest extent permitted by law, Westwood shall indemnify and hold harmless Client, Client's officers, directors, partners, and employees from and against any and all costs, losses, and damages (including but not limited to all fees and reasonable charges of consultants, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) to the extent caused in whole or in part by the negligent acts or omissions, intentional tort or failure to pay a subconsultant of Westwood or Westwood's officers, directors, partners, employees, and Westwood's consultants in the performance and furnishing of Westwood's services under this Agreement.

B. To the fullest extent permitted by the laws of the State of Texas, Client shall indemnify and hold harmless Westwood, Westwood's officers, directors, partners, employees, and Westwood's consultants from and against any and all claims, demands, costs, losses, and damages (including but not limited to all fees and charges of consultants, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) and liabilities that Westwood may incur or suffer which arise out of or relate to: (i) the negligent acts or omissions of Client or Client's officers, directors, partners, employees, and Client's consultants with respect to this Agreement or the Project; and (ii) Client's breach of or failure to perform any of its obligations of this Agreement or a Proposal.

C. To the fullest extent permitted by laws of the State of Texas, and to the extent a claimant is not otherwise barred from recovery, Westwood's total liability to Client and anyone claiming by, through, or under Client for any cost, loss, or damages shall not exceed Westwood's respective percentage of responsibility for sch cost, loss, or damage. Westwood shall not be liable for any incidental, consequential, indirect, or punitive damages arising out of this Agreement or Westwood's provision of the Services or the Deliverables, even if Westwood has been advised of the possibilities of such damages. In no event shall Westwood's total liability in connection with this Agreement exceed the amounts paid by Client to Westwood under this Agreement.

10.1 Force Majeure

An event of "Force Majeure" occurs when an event beyond the control of the Party claiming Force Majeure prevents such Party from fulfilling its obligations. An event of Force Majeure includes, without limitation, floods, hurricanes and other adverse weather, war, riot, civil disorder, acts of terrorism, disease, epidemic, strikes and labor disputes, actions or inactions of government or other authorities, law enforcement actions, curfews, closure of transportation systems or other unusual travel difficulties, or inability to provide a safe working environment for employees.

In the event of Force Majeure, the obligations of Westwood to perform Services shall be suspended for the duration of the event of Force Majeure. In such event, Westwood shall be compensated for time expended and expenses incurred during the event of Force Majeure and the schedule shall be extended by a like number of days as the event of Force Majeure. If Services are suspended for thirty (30) days or more, Westwood may, in its sole discretion, upon five (5) days prior written notice, terminate this Agreement or the affected Work Order, or both. In the case of such termination, in addition to the compensation and time extension set forth above, Westwood shall be compensated for all reasonable termination expenses.

11.01 Coronavirus Pandemic Impact

Client acknowledges and agrees that due to the dynamic and fluid nature of the coronavirus pandemic (COVID-19) (the "Coronavirus Pandemic"), Westwood may face uncertainty regarding its ability to perform the work contemplated by the Agreement in accordance with the schedule and contracted price. As a result of the Coronavirus Pandemic, the schedule, and related scope and fee, provided in the Agreement may be impacted due to issues outside of Westwood's control including, but not limited to, the following: (a) shortages in labor (including employees and consultants); (b) direction or guidance from any applicable governmental authority or applicable law that renders Westwood's or it's subconsultants' performance impossible, impracticable, or contrary to such direction or guidance; (c) delays in governmental approvals; and (d) other causes beyond Westwood's reasonable control, regardless of whether such impacts are direct or indirect.

If due to the impacts of the Coronavirus Pandemic, Westwood determines in good faith and in Westwood's sole discretion, that it is not feasible for Westwood or its subconsultants to perform the work in accordance with the schedule Westwood shall promptly notify Client and the parties shall cooperate in good faith to negotiate equitable adjustments to the schedule and/or contract price. Notwithstanding anything to the contrary set forth in this Agreement, including any related work or change order, Westwood shall not be liable to Client for any damages (actual, direct, consequential, incidental, punitive, liquidated, or nominal) as a result of delays or cost adjustments in connection with the Coronavirus Pandemic.

12.01 Right of Entry

To the extent securing a right of entry is not part of the Services, Client grants to Westwood, and, if the Project site is not owned by Client, warrants that permission has been granted for, a right of entry from time to time by Westwood, its employees, agents and subcontractors, upon the Project site for the purpose of providing the Services. Client recognizes that the use of investigative equipment and practices may unavoidably alter the existing site conditions and affect the environment in the area being studied, despite, the use of reasonable care. Client shall indemnify and hold Westwood harmless from claims for damages caused in part by reasons of Westwood's provision of Services.

13.01 No Third Party Rights

This Agreement shall not create any rights or benefits to parties other than Client and Westwood. No third party shall have the right to rely on Westwood's Deliverables or opinions rendered in connection with the Services without the written consent of Westwood and the third party's agreement to be bound to the same conditions and limitations as Client.

14.01 Total Agreement

This Agreement, together with any attached documents, constitutes the entire Agreement between Client and Westwood and supersedes all prior written or oral understandings regarding this subject. This Agreement may only be amended, supplemented, or modified by a mutually executed written instrument.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, effective on the latest date indicated below.

CLIENT:
City of Aubrey

By: _____

Name: _____
(PRINT/TYPE)

Title:_____

Date Signed: _____

Address/Contact for giving notices:

_____

_____

_____

_____

_____

WESTWOOD:
Westwood Professional Services, Inc.

By: _____

Name: _____
(PRINT/TYPE)

Title: _____

Date Signed: _____

Address/Contact for giving notices:

Westwood Professional Services, Inc.

C/O General Counsel

2805 North Dallas Parkway, Suite 150

Plano, Texas 75093

Email: legal@westwoodps.com

Exhibits:
A Scope of Services
B Compensation & Method of Payment
C Insurance
D Schedule
E – Project Limits

EXHIBIT 'A' – SCOPE OF SERVICES

TRIVEDI PARK - PHASE 1
1817 SPRING HILL ROAD

PROJECT DESCRIPTION:

The project consists of design of a 24.75 acre park with a pond and amenities as shown on the concept plan dated July 2023 and the design of approximately 2,100 linear feet of the first two lanes of McNatt Road from the intersection of McNatt Road and Spring Hill Road to the north property line of the subject tract. (PROJECT). Phase 1 of this project shall include the overall conceptual plan phase, overall field survey and basic data collection. The construction documentation, bidding, construction administration and special engineering services shall be performed under different phases and scope of work.

BASIC SERVICES:

A. Project Management, Coordination & Permitting

1. Manage the Team:
   - Lead, manage and direct design team activities.
   - Ensure quality control is practiced in performance of the work.
   - Communicate internally among team members.
   - Allocate team resources.

2. Communications and Reporting:
   - Attend a pre-design project kickoff meeting with Client staff to confirm and clarify scope, understand Client objectives, and ensure economical and functional designs that meet Client requirements.
   - Conduct review meetings with the Client at the end of each design phase.
   - Prepare and submit monthly invoices in the format acceptable to the Client.
   - Prepare and submit monthly progress reports.
   - Prepare and submit baseline Project Schedule initially and Project Schedule updates.
   - Coordinate with other agencies and entities as necessary for the design of the proposed infrastructure and provide and obtain information needed to prepare the design.
   - With respect to coordination with permitting authorities, Westwood shall communicate with permitting authorities such that their regulatory requirements are appropriately reflected in the designs. Westwood shall work with regulatory authorities to obtain approval of the designs, and make changes necessary to meet their requirements.

3. Utility Clearance:
   - Westwood will consult with the Client, public utilities, private utilities and government agencies to determine the approximate location of above and underground utilities, and other facilities (current and future) that have an impact or influence on the project. Westwood will design Client facilities to avoid or minimize conflicts with existing utilities, and where known and possible consider potential future utilities in designs.
   - Westwood will provide plans to and coordinate with utility owners related to the relocation efforts of franchise utilities that remain in conflict with the proposed construction.

B. Conceptual Design (30% Submittal)

The Conceptual Design shall be submitted to Client per the approved Project Schedule. The purpose of the conceptual design is for Westwood to:

- Study the project.
- Identify and develop up to two (2) alternatives.
- Present these alternatives to the Client.
- Recommend the alternatives that successfully address the design problem.
- Obtain the Client's endorsement of the selected concept.
- Selected concept shall have up to three (3) revisions to final concept that Westwood shall take to Construction Documentation in Phase 3 of the project.
- Any additional elements requested by the Client beyond those approved in the Conceptual Design Phase shall be provide with Additional Services.

Westwood will develop the conceptual design of the infrastructure as follows.

1. Data Collection:
   - In addition to data obtained from the Client, Westwood will research proposed improvements in conjunction with any other planned future improvements known by the Client that may influence the project.
   - Westwood will also identify and seek to obtain data for existing conditions that may impact the project including but not limited to; utilities, agencies (TxDOT and USCOE), Client Master Plans, and property ownership as available from the Tax Assessor's office.
   - The data collection efforts will also include conducting special coordination meetings with affected property owners and businesses as necessary to develop the design.

2. The Conceptual Design Package shall include the following:
   - Graphic exhibits and written summary of alternative design concepts, with supporting precedent images and supporting hardscape and plant material images, to assist in selection of the recommended design concept.
   - Westwood shall provide one final plan view rendering of the selected design concept (3D rendering).
   - Proposed phasing of any construction that is included in this project documented in both the project schedule and narrative form.
   - Documentation of key design decisions.
   - Conceptual opinion of probable construction cost.

C. Direct Expenses

1. Included in this item are usual and customary expenses normally incurred during performance of the services described. These expenses could include courier delivery charges, copies of existing engineering plans and/or maps, printing and reproduction (either in-house or by reproduction company) and mileage.

D. Field Survey

Westwood will perform an on the ground survey of the property under the direct supervision of a Registered Professional Land Surveyor. Limits of survey are for approximately 25 acres shown on the attached Exhibit "E"

Included in this item:

- Location of permanent improvements within the project limits (structures and improvements extending past the stated limits will be surveyed only to the extent of said limits and not in their entirety). Permanent improvements included buildings, structures, fences, pavements and other man-made, unmovable objects.
- Spot elevations at 50-foot intervals and significant grade breaks.
- Contours at one-foot intervals.
- Paving elevations on, and immediately adjacent to, the site.
- Locations, common name and trunk diameter of trees over 6 inches in caliper of the outline of heavily wooded areas.
- Location of visible utilities and appurtenances.
- Location and sixes of underground utilities based on available record information.
- Westwood will graphically plot, if any, the Special Flood Hazard Area from the Flood Insurance Rate Map (FIRM), for this area.
- Graphical depiction of site boundaries adjacent to the survey area based upon the current deed or plat. If the site is platted, we will graphically show easements defined on the plat. This depiction is approximate and the work does not include boundary research or review of found monumentation.

Not included in this item:

- Species names of trees.
- Trees less than 6 inches in diameter.
- Boundary surveying.
- Research or review of easements that may affect the subject tract.
- Subsurface utility engineering services.

E. Waters of the United States Delineation with Preliminary Jurisdictional Determination Report

Westwood Professional Services (Westwood) will conduct a delineation of potential waters of the U.S. While on-site, Westwood biologists will also assess the likelihood of state- and federal-listed species occurrence based on the habitats within the site. The delineation will be conducted in accordance with U.S. Army Corps of Engineers (USACE) guidance, including the 1987 manual, the Great Plains Regional Supplement, and other pertinent guidance. The delineation would be conducted via pedestrian surveys on the subject tract to identify potential waters of the U.S.

A Trimble GPS unit will be used to map all potential waters of the U.S. For streams, the centerline will be mapped using GPS where possible, and the ordinary high-water mark (OHWM) will be recorded regularly. For open-water features such as ponds, the OHWM will also be recorded as a continuous line. For wetlands, the wetland-upland boundary will be established, and that line will be mapped as a continuous line. Datasheets will be completed for potential wetlands and adjacent uplands, along with field notes documenting observations. A map will be produced using GIS, showing the potentially jurisdictional water features. This map can be provided to the Client/Client's Engineer in either GIS or CAD format for use in their planning efforts.

The information gathered during the site visit will be incorporated into a Preliminary Jurisdictional Determination (PJD) report, which could subsequently be submitted to the USACE for verification and Section 404 permitting if that proves necessary as a result of proposed project plans. The PJD report will be prepared in accordance with Section 404 of the Clean Water Act and current USACE guidance.

Assumptions:

- No Section 404 permitting or coordination with the U.S. Army Corps of Engineers is provided under this scope of services. If permitting ultimately proves necessary, those services could be performed under a separate scope and fee.
- No testing of existing stream flow rates, groundwater testing, or services of other specialized consultants are included in this scope of services. However, those services could be performed at standard hourly rates upon request.
- No civil engineering/design efforts are included in this scope of services. However, those services could be performed at standard hourly rates upon request.
- Access to the site will be granted by the owner upon acceptance of the scope of work.

F. Data Collection:

Westwood will obtain the available hydrologic and hydraulic models and any previous flood studies related to Pecan Creek Tributaries 7 and 7.5 located in the City of Aubrey. We will obtain publicly available LiDAR Point Cloud data for the site. We will visit the site to review existing conditions.

Included in this item:

- Obtain available models;
- Obtain LiDAR Point Cloud data; and
- Site visit.

G. Cultural Resources Assessment

A cultural resources desktop assessment will be conducted to evaluate the site in accordance with Section 106 of the National Historic Preservation Act (NHPA), and Antiquities Code of Texas as appropriate. This work will be performed through our archeological sub-consultant. A letter report summarizing the findings of the desktop cultural assessment and recommendation for additional work if necessary. Please note: A site visit is not included and will not be conducted for the purpose of the cultural resource review: should a regulatory agency require a site visit and/or work beyond a desktop review, an intensive level investigation may be necessary.

Included in this item:

- Desktop review of Cultural Resources;
- Submittal to Texas Historical Commission for Concurrence.

Not included in this item:

- Coordination beyond concurrence letter;
- Field investigation;
- Excavation and test pits.

Services not included in this contract:

- *Construction inspection services*
- *As-built surveys of constructed improvements*
- *Public hearings or City Council/Commission meetings*
- *Utility coordination meeting(s) to start relocation process with affected franchise utilities*
- *Reset property corner monumentation disturbed or removed during or after construction*
- *Required application and permitting fees (LOMR) or special insurance premiums are not included*
- *Phase II Environmental Site Assessments*
- *Storm Water Pollution Prevention Plans (SWPPP)*
- *Floodplain studies and permitting not specifically noted herein*
- *Zoning change assistance*
- *Parking studies*
- *Demolition Plan*
- *Retaining wall design over 36-inches in height or with surcharge*
- *Design of screening walls, transformer or generator pads*
- *Signage Plan*
- *Off-site roadway, drainage, and utility extensions/improvements*
- *LEED pursuit*
- *Construction staking*
- *Presentations, documents, or plans required for "Special Exceptions", Variances or Zoning changes.*
- *Field identification or location of trees. The landscape architect assumes that the tree survey will have the pertinent information.*
- *Multiple design alternatives beyond those described herein, or significant site plan revisions following acceptance at each given phase of review documents.*
- *Irrigation systems utilizing reclaimed water that require pumps, filters and associated controls. This can be provided as an additional service if needed.*
- *Signs for buildings and vehicular circulation.*
- *Regular owner/Architect/Contractor (OAC) project coordination meetings during construction.*

END OF EXHIBIT 'A'

EXHIBIT 'B' – COMPENSATION AND METHOD OF PAYMENT

TRIVEDI PARK - PHASE 1
1817 SPRING HILL ROAD

COMPENSATION:

For all professional services included in EXHIBIT 'A', Scope of Services, Westwood shall be compensated a lump sum fee of $99,900.00 as summarized below. The total lump sum fee shall be considered full compensation for the services described in EXHIBIT 'A', including all labor materials, supplies, and equipment necessary to deliver the services.

Phase 1 Basic Services		
A.	Project Management, Coordination & Permitting	$3,000.00
B.	Conceptual Design (30% Submittal) (ENTIRE SITE)	$57,900.00
C.	Direct Expenses	$1,000.00
D.	Field Survey (ENTIRE SITE)	$ 19,500.00
E.	Waters of the United States Delineation with Preliminary Jurisdictional Determination Report	$ 9,000.00
F.	Data Collection	$ 4,000.00
G.	Cultural Resources Assessment	$ 5,500.00
TOTAL		**$99,900.00**

METHOD OF PAYMENT:

Westwood shall be paid monthly payments as described in Article 3 of the AGREEMENT. The cumulative sum of such monthly partial fee payments shall not exceed the total current project budget including all approved Amendments. Each invoice shall be verified as to its accuracy and compliance with the terms of this Agreement by an officer of Westwood.

Monthly statements for reimbursable services performed by sub consultants will be based upon the actual cost to Westwood plus ten percent (10%). Direct expenses for services such as printing, express mail, fees, mileage and other direct expenses that are incurred during the progress of the project will be billed at 1.1 times Westwood's cost.

END OF EXHIBIT 'B'

EXHIBIT C – INSURANCE

A. *Insurance.* Westwood shall, during the life of this Agreement, maintain the following insurances:

1. Commercial General Liability (occurrence form not less than):
   $2,000,000 General Liability
   $2,000,000 Products and Completed Operations Aggregate
   $1,000,000 Personal and Advertising Injury
   $1,000,000 Each Occurrence
   $10,000 Medical Expense

2. Commercial Automobile Liability (all scheduled auto, hired and non-owned autos):
   $1,000,000 Combined Single Limit

3. Umbrella
   $5,000,000 Aggregate
   $5,000,000 Each Occurrence

4. Workers Compensation
   $1,000,000 Each Accident
   $1,000,000 Policy Limit
   $1,000,000 Each Employee

Professional Liability Errors and Omissions Insurance. Westwood shall carry Professional Liability Errors and Omissions insurance with limited contractual liability in the amount of $2,000,000 per claim and in the aggregate for the duration of this Agreement.

END OF EXHIBIT 'C'

EXHIBIT 'D' – SCHEDULE

TRIVEDI PARK - PHASE 1
1817 SPRING HILL ROAD

Activity	Estimated Duration (weeks)	Estimated Completion After N.T.P.
Notice-To-Proceed		-
Field Survey	4	4 Weeks
Preliminary Jurisdictional Waters Delineation	8	12 Weeks
Cultural Resources Assessment	4	16 Weeks
Conceptual Design Alternatives	6	22 Weeks
Client Review	2	24 Weeks
Revisions to Selected Concept Alternative	3	27 Weeks
Client Review	2	29 Weeks
Finalize Selected Conceptual Plan	4	33 Weeks

Westwood is not responsible for delays beyond its control.

END OF EXHIBIT 'D'

EXHIBIT E
TRIVEDI PARK - PHASE 1
LIMIT OF WORK

FOR ILLUSTRATIVE PURPOSES ONLY

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Acceptance of the understanding of continuing services for City Auditor and authorizing the Mayor to execute said contract on behalf of the City.

Staff Contact
Mike English, Finance Director
menglish@aubreytx.gov
940-440-9343

Summary
This item is the approval of the Whitley Penn, LLP audit engagement letter for the audit of fiscal year 2024. This is the fourth year for Whitley Penn as the City's independent auditor. They are a capable firm and have demonstrated the skill and flexibility to efficiently manage our audits. They have also maintained consistency in their senior leadership, which has proven to be an excellent benefit to the city staff in managing the audits from our end. They are professional and reasonable in their approach to the audit and consistently make themselves available when needed.

Financial Summary
The annual audit fee is going up $5,000 from $55,000 to $60,000, which is considered reasonable given our growth primarily in PIDs (from 1 to 3) and the increased activity related to our CIP and VERF and other capital assets. These areas require substantial audit work (i.e., audit testing) in order to meet the audit guidelines required by Government Auditing Standards.

Staff Recommended Motion
Approve

Conditions
N/A

whitleypenn

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640 Taylor Street
Suite 2200
Fort Worth, Texas 76102
817.259.9100 Main

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August 14, 2024

To the Honorable Mayor, Members of
City Council and City Manager
City of Aubrey, Texas

You have requested that we audit the financial statements of the governmental activities, the business-type activities, the discretely presented component unit, each major fund, and the aggregate remaining fund information of City of Aubrey, Texas (the "City"), as of September 30, 2024, and for the year then ended, and the related notes to the financial statements, which collectively comprise the City's basic financial statements. In addition, we will audit the City's compliance over major federal award programs, if applicable, for the year ended September 30, 2024.

We are pleased to confirm our acceptance and our understanding of this audit engagement by means of this letter. Our audits will be conducted with the objectives of our expressing an opinion on each opinion unit and an opinion on compliance regarding the entity's major federal award programs. The objectives of our audit of the financial statements are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance but is not absolute assurance and therefore is not a guarantee that an audit conducted in accordance with auditing standards generally accepted in the United States of America (GAAS) and in accordance with *Government Auditing Standards* will always detect a material misstatement when it exists. Misstatements, including omissions, can arise from fraud or error and are considered material if there is a substantial likelihood that, individually or in the aggregate, they would influence the judgment made by a reasonable user based on the financial statements.

The objectives of our compliance audit are to obtain sufficient appropriate audit evidence to form an opinion and report at the level specified in the governmental audit requirement about whether the entity complied in all material respects with the applicable compliance requirements and identify audit and reporting requirements specified in the governmental audit requirement that are supplementary to GAAS and *Government Auditing Standards*, if any, and perform procedures to address those requirements.

Accounting principles generally accepted in the United States of America require that certain information be presented to supplement the basic financial statements. Such information, although not a part of the basic financial statements, is required by Governmental Accounting Standards Board, who considers it to be an essential part of financial reporting for placing the basic financial statements in an appropriate operational, economic, or historical context. As part of our engagement, we will apply certain limited procedures to the required supplementary information (RSI) in accordance with auditing standards generally accepted in the United States of America. These limited procedures will consist primarily of inquiries of management regarding their methods of measurement and presentation, and comparing the information for consistency with management's responses to our inquiries. We will not express an opinion or provide any form of assurance on the RSI. The following RSI is required by accounting principles generally accepted in the United States of America. This RSI will be subjected to certain limited procedures but will not be audited:

- Management's Discussion and Analysis;
- Budgetary Comparison Information – General Fund;
- Pension Information; and
- Other Post-employment Benefit Information

HLB WE ARE AN INDEPENDENT MEMBER OF THE GLOBAL ADVISORY AND ACCOUNTING NETWORK

Supplementary information other than RSI will accompany the City's basic financial statements. We will subject the following supplementary information to the auditing procedures applied in our audit of the basic financial statements and certain additional procedures, including comparing and reconciling the supplementary information to the underlying accounting and other records used to prepare the financial statements or to the financial statements themselves, and additional procedures in accordance with auditing standards generally accepted in the United States of America. We intend to provide an opinion on the following supplementary information in relation to the financial statements as a whole:

- Combining and individual fund financial statements and schedules; and
- Schedule of Expenditures of Federal Awards, if applicable

Also, the document we submit to you will include the following other additional information that will not be subjected to the auditing procedures applied in our audit of the financial statements:

- Introductory Section
- Statistical Section

Data Collection Form

Prior to the completion of our engagement, we will complete the sections of the Data Collection Form that are our responsibility. The form will summarize our audit findings, amounts and conclusions. It is management's responsibility to submit a reporting package including financial statements, schedule of expenditure of federal awards, summary schedule of prior audit findings and corrective action plan along with the Data Collection Form to the federal audit clearinghouse. The financial reporting package must be text searchable, unencrypted, and unlocked. Otherwise, the reporting package will not be accepted by the federal audit clearinghouse. We will assist you in the electronic submission and certification. You may request from us copies of our report for you to include with the reporting package submitted to pass-through entities.

The Data Collection Form is required to be submitted within the *earlier* of 30 days after receipt of our auditors' reports or nine months after the end of the audit period, unless specifically waived by a federal cognizant or oversight agency for audits. Data Collection Forms submitted untimely are one of the factors in assessing programs at a higher risk.

Auditor Responsibilities

We will conduct our audit in accordance with auditing standards generally accepted in the United States of America (U.S. GAAS), the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States of America; the audit requirements of Title 2 U.S. Code of Federal Regulations (CFR) Part 200, *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards* (Uniform Guidance). As part of an audit of financial statements in accordance with GAAS and in accordance with *Government Auditing Standards,* we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. However, we will communicate to you in writing concerning any significant deficiencies or material weaknesses in internal control relevant to the audit of the financial statements that we have identified during the audit.

- Evaluate the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluate the overall presentation of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.
- Conclude, based on the audit evidence obtained, whether there are conditions or events, considered in the aggregate, that raise substantial doubt about the City's ability to continue as a going concern for a reasonable period of time.

Because of the inherent limitations of an audit, together with the inherent limitations of internal control, an unavoidable risk that some material misstatements or noncompliance may not be detected exists, even though the audit is properly planned and performed in accordance with GAAS and *Government Auditing Standards* of the Comptroller General of the United States of America. Please note that the determination of abuse is subjective and *Government Auditing Standards* does not require auditors to detect abuse.

Our responsibility as auditors is limited to the period covered by our audit and does not extend to any other periods.

We will issue a written report upon completion of our audit of the City's basic financial statements. Circumstances may arise in which our report may differ from its expected form and content based on the results of our audit. Depending on the nature of these circumstances, it may be necessary for us to modify our opinions, add an emphasis-of-matter or other-matter paragraph(s) to our auditor's report, or if necessary, withdraw from the engagement. If our opinions on the basic financial statements are other than unmodified, we will discuss the reasons with you in advance. If, for any reason, we are unable to complete the audit or are unable to form or have not formed opinions, we may decline to express opinions or to issue a report as a result of this engagement.

In accordance with the requirements of *Government Auditing Standards*, we will also issue a written report describing the scope of our testing over internal control over financial reporting and over compliance with laws, regulations, and provisions of grants and contracts, including the results of that testing. However, providing an opinion on internal control and compliance over financial reporting will not be an objective of the audit and, therefore, no such opinion will be expressed.

Audit of Major Program Compliance

Our audit of the City's major federal award program(s) compliance will be conducted in accordance with the requirements of the Single Audit Act, as amended; and the Uniform Guidance, and will include tests of accounting records, a determination of major programs in accordance with the Uniform Guidance and other procedures we consider necessary to enable us to express such an opinion on major federal award program compliance and to render the required reports. We cannot provide assurance that an unmodified opinion on compliance will be expressed. Circumstances may arise in which it is necessary for us to modify our opinion or withdraw from the engagement.

The Uniform Guidance requires that we also plan and perform the audit to obtain reasonable assurance about whether material noncompliance with applicable laws and regulations, the provisions of contracts and grant agreements applicable to major federal award programs, and the applicable compliance requirements occurred, whether due to fraud or error, and express an opinion on the entity's compliance based on the audit. Reasonable assurance is a high level of assurance but is not absolute assurance and therefore is not a guarantee that an audit conducted in accordance with GAAS, *Government Auditing Standards*, and the Uniform Guidance will always detect material noncompliance when it exists. The risk of not detecting material noncompliance resulting from fraud is higher than for that resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control. Noncompliance with the compliance requirements is considered material if there is a substantial likelihood that, individually or in the aggregate, it would influence the judgment made by a reasonable user of the report on compliance about the entity's compliance with the requirements of the federal programs as a whole.

As part of a compliance audit in accordance with GAAS and in accordance with *Government Auditing Standards,* we exercise professional judgment and maintain professional skepticism throughout the audit. We also identify and assess the risks of material noncompliance, whether due to fraud or error, and design and perform audit procedures responsive to those risks.

Our procedures will consist of determining major federal programs and, performing the applicable procedures described in the U.S. Office of Management and Budget OMB Compliance Supplement for the types of compliance requirements that could have a direct and material effect on each of the entity's major programs, and performing such other procedures as we consider necessary in the circumstances. The purpose of those procedures will be to express an opinion on the entity's compliance with requirements applicable to each of its major programs in our report on compliance issued pursuant to the Uniform Guidance.

Also, as required by the Uniform Guidance, we will obtain an understanding of the entity's internal control over compliance relevant to the audit in order to design and perform tests of controls to evaluate the effectiveness of the design and operation of controls that we consider relevant to preventing or detecting material noncompliance with compliance requirements applicable to each of the entity's major federal award programs. Our tests will be less in scope than would be necessary to render an opinion on these controls and, accordingly, no opinion will be expressed in our report. However, we will communicate to you, regarding, among other matters, the planned scope and timing of the audit and any significant deficiencies and material weaknesses in internal control over compliance that we have identified during the audit.

We will issue a report on compliance that will include an opinion or disclaimer of opinion regarding the City's major federal programs, and a report on internal controls over compliance that will report any significant deficiencies and material weaknesses identified; however, such report will not express an opinion on internal control.

Management's Responsibilities

Our audit will be conducted on the basis that management and, when appropriate, those charged with governance acknowledge and understand that they have responsibility:

- For the preparation and fair presentation of the financial statements in accordance with accounting principles generally accepted in the United States of America;
- For the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error;
- For identifying, in its accounts, all federal awards received and expended during the period and the federal programs under which they were received;
- For maintaining records that adequately identify the source and application of funds for federally funded activities;
- For preparing the schedule of expenditures of federal awards (including notes and noncash assistance received) in accordance with the Uniform Guidance;
- For the design, implementation, and maintenance of internal control over federal awards that provides reasonable assurance that the entity is managing federal awards in compliance with federal statutes, regulations, and the terms and conditions of the federal awards;
- For identifying and ensuring that the entity complies with federal laws, statutes, regulations, rules, provisions of contracts or grant agreements, and the terms and conditions of federal award programs, and implementing systems designed to achieve compliance with applicable federal statutes, regulations, and the terms and conditions of federal award programs;
- For disclosing accurately, currently, and completely the financial results of each federal award in accordance with the requirements of the award
- For identifying and providing report copies of previous audits, attestation engagements, or other studies that directly relate to the objectives of the audit, including whether related recommendations have been implemented;
- For taking prompt action when instances of noncompliance are identified;
- For addressing the findings and recommendations of auditors, for establishing and maintaining a process to track the status of such findings and recommendations and taking corrective action on reported audit findings from prior periods and preparing a summary schedule of prior audit findings;
- For following up and taking corrective action on current year audit findings and preparing a corrective action plan for such findings;
- For submitting the reporting package and data collection form to the appropriate parties;

- For making the auditor aware of any significant contractor relationships where the contractor is responsible for program compliance;
- To provide us with:
  a) Access to all information of which management is aware that is relevant to the preparation and fair presentation of the financial statements, and relevant to federal award programs, such as records, documentation, and other matters;
  b) Additional information that we may request from management for the purpose of the audit; and
  c) Unrestricted access to persons within the City from whom we determine it necessary to obtain audit evidence.
- For adjusting the financial statements to correct material misstatements and confirming to us in the management representation letter that the effects of any uncorrected misstatements aggregated by us during the current engagement and pertaining to the current year period(s) under audit are immaterial, both individually and in the aggregate, to the financial statements as a whole;
- For acceptance of nonattest services, including identifying the proper party to oversee nonattest work;
- For maintaining adequate records, selecting and applying accounting principles, and safeguarding assets;
- For informing us of any known or suspected fraud affecting the entity involving management, employees with significant role in internal control and others where fraud could have a material effect on compliance;
- For the accuracy and completeness of all information provided;
- For taking reasonable measures to safeguard protected personally identifiable and other sensitive information; and
- For confirming your understanding of your responsibilities as defined in this letter to us in your management representation letter.

With regard to the supplementary information (including the schedule of expenditures of federal awards) referred to above, you acknowledge and understand your responsibility (a) for the preparation of the supplementary information in accordance with the applicable criteria such as the Uniform Guidance, (b) to provide us with the appropriate written representations regarding supplementary information, (c) to include our report on the supplementary information in any document that contains the supplementary information and that indicates that we have reported on such supplementary information, and (d) to present the supplementary information with the audited financial statements, or if the supplementary information will not be presented with the audited financial statements, to make the audited financial statements readily available to the intended users of the supplementary information no later than the date of issuance by you of the supplementary information and our report thereon.

As part of our audit process, we will request from management and, when appropriate, those charged with governance, written confirmation concerning representations made to us in connection with the audit.

We understand that your employees will prepare all confirmations we request and will locate any documents or invoices selected by us for testing.

If you intend to publish or otherwise reproduce the financial statements and make reference to our firm, you agree to provide us with printers' proofs or masters for our review and approval before printing. You also agree to provide us with a copy of the final reproduced material for our approval before it is distributed.

Nonattest Services

Nonattest services will include assistance with the preparation of financial statements, including government-wide journal entries and note disclosures, assistance with the preparation of the schedule of expenditures of federal award (SEFA), if applicable, and related notes, and assistance with the preparation of the data collection form and its submission to the Federal Audit Clearinghouse, if applicable. We will not assume management responsibilities on behalf of the City. However, we will provide advice and recommendations to assist management of the City in performing its responsibilities.

The City's management is responsible for (a) making all management decisions and performing all management functions; (b) assigning a competent individual to oversee the services; (c) evaluating the adequacy of the services performed; (d) evaluating and accepting responsibility for the results of the services performed; and (e) establishing and maintaining internal

controls, including monitoring ongoing activities. We will perform the services in accordance with applicable professional standards, including *Government Auditing Standards.*

Our responsibilities and limitations of the nonattest services are described below:

> The nonattest services are limited to the services we described above. Our firm, in its sole professional judgment, reserves the right to refuse to do any procedure or take any action that could be construed as making management decisions or assuming management responsibilities, including determining account coding and approving journal entries. Our firm will advise the City regarding these nonattest services, but the City must make all decisions with regard to those matters.

Fees and Timing

The timing of our audit will be scheduled for performance and completion as follows:

Document internal control and preliminary tests	December 2024
Mail Confirmations	October 2024
Perform year-end audit procedures	December 2024/January 2025
Issue audit reports	February/March 2025

We anticipate meeting these deadlines barring any delays.

Roger Tovar, CPA is the engagement partner for the audit services specified in this letter. His responsibilities include supervising Whitley Penn, LLP's services performed as part of this engagement and signing or authorizing another qualified firm representative to sign the audit report.

Our fee for the audit services will be based on the amount of time required and the difficulty of the work involved which we estimate to be $60,000 for the audit of the financial statements and report preparation and $5,000 for the audit of major federal award programs. Additionally, the City will be billed for expenses related to electronic confirmations. The fee estimate for the audit is based on anticipated cooperation from the City's personnel and the assumption that unexpected circumstances will not be encountered during the audit. If significant additional time is necessary, we will keep you informed of any problems we encounter and our fees will be adjusted accordingly.

Our invoices for these fees will be rendered each month as work progresses and are payable on presentation and payment is due in Tarrant County. You agree to pay reasonable attorney fees and collection costs incurred relating to collection of fees for services performed under the terms of this engagement. In accordance with Whitley Penn, LLP policy, work may be suspended if your account becomes 30 days or more past due and will not resume until your account is paid in full. In addition, invoices not paid in full by the last day of the month will be assessed interest at a rate of one percent per month. If we elect to terminate our services for nonpayment, our engagement will be deemed to have been complete even if we have not issued our report. You will be obligated to compensate us for all time expended and to reimburse us for all out-of-pocket expenditures through the date of termination. Our final auditors' report will be released upon final payment of any outstanding invoices.

You may request that we perform additional services not addressed in this engagement letter. If this occurs, we will communicate with you concerning the scope of the additional services and the estimated fees. We also may issue a separate engagement letter covering the additional services. In the absence of any other written communication from us documenting such additional services, our services will continue to be governed by the terms of this engagement letter.

We would like to make the following comments regarding the fee estimates:

1. Our fee estimates have not considered the effects of any changes to auditing standards and accounting principles, which may be promulgated by the AICPA, Congress, or any other regulatory body in the future and are unknown to us at this time. If significant additional time is necessary resulting in increased fees, we will endeavor to notify you of any such circumstances as they are assessed.
2. Our fee estimates are based on the assumption that we will be able to obtain internal control reports from the City's payroll service provider (where necessary), more commonly referred to as a SOC 1 Report and that we will be able to place reliance on these reports for internal control purposes in conjunction with the internal controls present in the administration of the City. Any weaknesses noted in the internal control may affect the nature, timing, and extent of our procedures and accordingly our fees will be adjusted to reflect such changes.
3. The City's personnel are responsible for the preparation of all items requested in the Prepared by Client ("PBC") listing and received by the date requested. Any delays caused by not preparing the items when requested may result in additional fees, as well as the possibility of postponing our fieldwork. The PBC listing will be provided to you during the planning process of the engagement.
4. Time incurred for audit adjustments identified during our audit and the related additional testing required has not been considered in our fee estimates. Prior to performing any additional testing, we will notify you of the exceptions and obtain approval for any additional fees which may be incurred.
5. Our fee estimates are based on all general ledger sub ledgers being reconciled to the general ledger balance and any adjustment necessary should be recorded to the general ledger prior to our fieldwork start date.

The scheduling of our professional staff requires complex models to balance the needs of our clients and the utilization of our people. Last minute client requested scheduling changes result in costly downtime due to our inability to make alternate arrangements for our professional staff. If after scheduling our work, you do not provide proper notice, which we consider to be one week, of your inability to meet the agreed-upon date(s) for any reason, or do not provide us with sufficient information required to complete the work in a timely manner, additional billings will be rendered for any downtime of our professional staff.

The ethics of our profession prohibit the rendering of professional services where the fee for such services is contingent, or has the appearance of being contingent, upon the results of such services. Accordingly, it is important that our bills be paid promptly when received. If a situation arises in which it may appear that our independence would be questioned because of significant unpaid bills, we may be prohibited from issuing our auditors' report.

In the unlikely event that differences concerning our services or fees should arise that are not resolved by mutual agreement, to facilitate judicial resolution and save time and expense of both parties, the City and Whitley Penn, LLP agree not to demand a trial by jury in any action, proceeding or counterclaim arising out of or relating to our services and fees for this engagement. Any controversy, dispute, or questions arising out of or in connection with this agreement or our engagement shall be determined by arbitration conducted in accordance with the rules of the American Arbitration Association, and any decision rendered by the American Arbitration Association shall be binding on both parties to this agreement. The costs of any arbitration shall be borne equally by the parties. Any and all claims in arbitration relating to or arising out of this contract/agreement shall be governed by the laws of Texas and to the extent any issue regarding the arbitration is submitted to a court, including the appointment of arbitrators or confirmation of an award, the District courts in Tarrant County shall have exclusive jurisdiction. Any action arising out of this agreement or the services provided shall be initiated within two years of the service provided.

This letter replaces and supersedes any previous proposals, correspondence and understanding, whether written or oral. The agreements contained in this engagement letter shall survive the completion or termination of this engagement. Our audit engagement ends on delivery of our audit report. Any follow-up services that might be required will be a separate, new engagement. The terms and conditions of that new engagement will be governed by a new, specific engagement letter for that service.

To ensure that Whitley Penn, LLP's independence is not impaired under the AICPA Code of Professional Conduct, you agree to inform the engagement partner before entering into any substantive employment discussions with any of our personnel.

Other Matters

During the course of the engagement, we may communicate with you or your personnel via fax or e-mail, and you should be aware that communication in those mediums contains a risk of misdirected or intercepted communications.

In the course of our services, our firm may transmit confidential information that you provided us to third parties in order to facilitate our services. As applicable, we require confidentiality agreements with all our service providers to maintain the confidentiality of your information and additionally the firm will take reasonable precautions to determine that our service providers have the appropriate procedures in place to prevent the unauthorized release of confidential information to others.

We will remain ultimately responsible for the work provided by any third-party service providers used under this agreement. By your signature below, you consent to having confidential information transmitted to entities outside the firm. Please feel free to inquire if you would like additional information regarding the transmission of confidential information to entities outside the firm.

Regarding the electronic dissemination of audited financial statements, including financial statements published electronically on your Internet website, you understand that electronic sites are a means to distribute information and, therefore, we are not required to read the information contained in these sites or to consider the consistency of other information in the electronic site with the original document.

Professional standards prohibit us from being the sole host and/or the sole storage for your financial and non-financial data. As such, it is your responsibility to maintain your original data and records and we cannot be responsible to maintain such original information. By signing this engagement letter, you affirm that you have all the data and records required to make your books and records complete.

In the event we are required by government regulation, required by subpoena or other legal process to produce information or our personnel for interviews or depositions in relation to a matter involving the City, the City will, so long as we are not a party or the focus of the proceeding or inquiry in which the information is sought, reimburse us for our professional time and expenses, as well as the fees and expenses of our counsel, incurred in responding to such requests.

The audit documentation for this engagement is the property of Whitley Penn, LLP and constitutes confidential information. However, we may be requested to make certain audit documentation available to your pass-through regulatory entity and federal agencies and the U.S. Government Accountability Office pursuant to authority given to it by law or regulation, or to peer reviewers. If requested, access to such audit documentation will be provided under the supervision Whitley Penn, LLP's personnel. Furthermore, upon request, we may provide copies of selected audit documentation to these agencies and regulators. The regulators and agencies may intend, or decide, to distribute the copies of information contained therein to others, including other governmental agencies.

The City may wish to include our report on these financial statements in an exempt offering document. The City agrees that the aforementioned auditor's report, or reference to our Firm, will not be included in such offering document without prior permission or consent. Any agreement to perform work in connection with an exempt offering document, including an agreement to provide permission or consent, will be a separate engagement letter. For exempt offerings for which we are not involved, you will clearly indicate that we were not involved with the contents of such offering document and a disclosure as shown below will be included in the exempt offering:

> "Whitley Penn, our independent auditor, has not been engaged to perform and has not performed, since the date of its report included herein, any procedures on the financial statements addressed in that report. Whitley Penn also has not performed any procedures relating to this offering document."

Further, we will be available during the year to consult with you on financial management and accounting matters of a routine nature.

During the course of the audit, we may observe opportunities for economy in, or improved controls over, your operations. We will bring such matters to the attention of the appropriate level of management, either orally or in writing.

We agree to retain our audit documentation or work papers for a period of at least 7 years from the date of our report.

You agree to inform us of facts that may affect the financial statements of which you may become aware during the period from the date of the auditor's report to the date the financial statements are issued.

At the conclusion of our audit engagement, we will communicate to the Honorable Mayor and Members of City Council the following significant findings from the audit:

- Our view about the qualitative aspects of the City's significant accounting practices;
- Significant difficulties, if any, encountered during the audit;
- Uncorrected misstatements, other than those we believe are trivial, if any;
- Disagreements with management, if any;
- Other findings or issues, if any, arising from the audit that are, in our professional judgment, significant and relevant to those charged with governance regarding their oversight of the financial reporting process;
- Material, corrected misstatements that were brought to the attention of management as a result of our audit procedures;
- Representations we requested from management;
- Management's consultations with other accountants, if any; and
- Significant issues, if any, arising from the audit that were discussed, or the subject of correspondence, with management.

In accordance with the requirements of *Government Auditing Standards*, we have attached a copy of our latest external peer review report of our firm for your consideration and files.

Please sign and return the attached copy of this letter to indicate your acknowledgment of, and agreement with, the arrangements for our audit of the financial statements and compliance over major federal award programs including our respective responsibilities.

We appreciate the opportunity to be your financial statement auditors and look forward to working with you and your staff.

Respectfully,

Whitley Penn LLP

Fort Worth, Texas

RESPONSE:

This letter correctly sets forth our understanding.

Acknowledged and agreed on behalf of City of Aubrey, Texas by:

Name: _____

Title: _____

Date: _____

CliftonLarsonAllen LLP
CLAconnect.com

REPORT ON THE FIRM'S SYSTEM OF QUALITY CONTROL

To the Partners of Whitley Penn LLP
and the National Peer Review Committee

We have reviewed the system of quality control for the accounting and auditing practice of Whitley Penn LLP (the firm) applicable to engagements not subject to PCAOB permanent inspection in effect for the year ended April 30, 2021. Our peer review was conducted in accordance with the Standards for Performing and Reporting on Peer Reviews established by the Peer Review Board of the American Institute of Certified Public Accountants (Standards).

A summary of the nature, objectives, scope, limitations of, and the procedures performed in a System Review as described in the standards may be found at www.aicpa.org/prsummary. The summary also includes an explanation of how engagements identified as not performed or reported in conformity with applicable professional standards, if any, are evaluated by a peer reviewer to determine a peer review rating.

Firm's Responsibility

The firm is responsible for designing a system of quality control and complying with it to provide the firm with reasonable assurance of performing and reporting in conformity with applicable professional standards in all material respects. The firm is also responsible for evaluating actions to promptly remediate engagements deemed as not performed or reported in conformity with professional standards, when appropriate, and for remediating weaknesses in its system of quality control, if any.

Peer Reviewer's Responsibility

Our responsibility is to express an opinion on the design of the system of quality control and the firm's compliance therewith based on our review.

Required Selections and Considerations

Engagements selected for review included engagements performed under *Government Auditing Standards* (including compliance audits under the Single Audit Act), audits of employee benefit plans, audits performed under the Federal Deposit Insurance Corporation Improvement Act (FDICIA), and an examination of a service organization (SOC 1 engagement).

As a part of our peer review, we considered reviews by regulatory entities as communicated by the firm, if applicable, in determining the nature and extent of our procedures.

A member of Nexia International

CLA is an independent member of Nexia International, a leading, global network of independent accounting and consulting firms. See nexia.com/member-firm-disclaimer for details.

Opinion

In our opinion, the system of quality control for the accounting and auditing practice of Whitley Penn LLP applicable to engagements not subject to PCAOB permanent inspection in effect for the year ended April 30, 2021, has been suitably designed and complied with to provide the firm with reasonable assurance of performing and reporting in conformity with applicable professional standards in all material respects. Firms can receive a rating of *pass*, *pass with deficiency(ies)*, or *fail*. Whitley Penn LLP has received a peer review rating of *pass*.

CliftonLarsonAllen LLP

CliftonLarsonAllen LLP

Phoenix, Arizona
October 6, 2021

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Consider and make a recommendation to City Council regarding an Ordinance approving the proposed amendment to the approved Amended Project Plan and Financing Plan for Tax Increment Reinvestment Zone Number One, City of Aubrey, Texas (the “zone”) resulting in the decrease of the participation rate pursuant to Chapter 311, Texas Tax Code.

Staff Contact
Mike English, Finance Director
menglish@aubreytx.gov
940-440-9343

Summary
Municap, the City’s PID and TIRZ administrator, has prepared the amendment to the approved Amended Project Plan and Financing Plan for the Tax Increment Reinvestment Zone No. 1, City of Aubrey, Texas. Chapter 311 of the Texas Tax Code requires that the TIRZ Board review the amendment and forward its recommendation to the City Council. The amendment provides for a decrease in the TIRZ #1 participation rate by the City of Aubrey from 45.2% to 38.75%. This Ordinance formalizes the previously approved change in the TIRZ #1 participation rate. Municap will be at the Council meeting to present this item and to address questions and/or concerns.

Financial Summary
Refunding the Jackson Ridge PID bonds reduced the amount of the debt service requirement and gave rise to savings to the City. Staff recommended, and Council approved a financing plan to split the savings 50/50 between the assessments to residences of the District and the City. The City's portion of the savings resulted in a reduction in the participation rate from 45.2% to 38.75%.

Staff Recommended Motion
Approve

Conditions
N/A

ORDINANCE NO. 866-24

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF AUBREY, TEXAS, CHANGING THE PARTICIPATION RATE OF THE TAX INCREMENT TAX INCREMENT REINVESTMENT ZONE NUMBER ONE, CITY OF AUBREY, TEXAS; APPROVING THE AMENDMENT TO THE APPROVED SECOND AMENDED PROJECT PLAN AND FINANCING PLAN FOR TAX INCREMENT TAX INCREMENT REINVESTMENT ZONE NUMBER ONE, CITY OF AUBREY, TEXAS; AUTHORIZING THE CITY CLERK TO DISTRIBUTE SUCH PLANS; CONTAINING FINDINGS AND PROVISIONS RELATED TO THE FOREGOING SUBJECTS; PROVIDING FOR SEVERABILITY; AND PROVIDING FOR THE EFFECTIVE DATE THEREOF.

WHEREAS, the City Council of the City of Aubrey ("City") pursuant to the provisions of Chapter 311, Texas Tax Code, created Tax Increment Reinvestment Zone Number One, City of Aubrey, Texas, (the "Zone"), by Ordinance 580-16, adopted November 17, 2015; and

WHEREAS, by Ordinance 628-17 adopted March 21, 2017, the City approved the Amended Project Plan and Financing Plan for the Tax Increment Reinvestment Zone Number One, City of Aubrey, Texas, for the purpose of updating the project costs and reducing the participation rate; and

WHEREAS, the Board of Directors of the Zone considered and adopted the Second Amended Project Plan and Financing Plan, which reduces the participation rate, and recommended the Amendment for approval by City Council; NOW THEREFORE,

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF AUBREY, TEXAS:

Section 1: The findings and recitals contained in the preamble of this ordinance are hereby found and declared to be true and correct and are adopted as part of this ordinance for all purposes.

Section 2: The City, acting under and in accordance with the provisions of Chapter 311, Texas Tax Code, including does hereby change the participation rate of the Tax Increment Reinvestment Zone Number One, City of Aubrey, Texas, as follows:

Participation rate for the City of Aubrey, Texas was decreased from 45.2% to 38.75%.

Section 3: The tax increment base for the enlarged Zone shall include the tax increment base established by the Ordinance creating the Zone.

Section 4: The Plan is hereby amended to reflect the new participation rate and is attached hereto as Exhibit “A” and incorporated herein for all intents and purposes. The Amendment is

determined to be feasible and is approved. The appropriate officials of the City are authorized to take all steps reasonably necessary to implement the Amendment.

Section 5: The City Clerk is directed to provide copies of the Amendment to each taxing unit levying ad valorem taxes in the Zone.

Section 6: If any provision, section, subsection, sentence, clause, or phrase of this ordinance, or the application of same to any person or set of circumstances is for any reason held to be unconstitutional, void, or invalid, the validity of the remaining portions of this ordinance or their application to other persons or sets of circumstances shall not be affected thereby, it being the intent of the City Council in adopting this ordinance that no portion hereof or provision or regulation contained herein shall become inoperative or fail by reason of any unconstitutionality, voidness, or invalidity of any other portion hereof, and all provisions of this ordinance are declared to be severable for that purpose.

Section 7: This ordinance shall take effect immediately from and after its passage by the City Council of the City of Aubrey.

INTRODUCED, READ AND PASSED by the affirmative vote of the City Council of the City of Aubrey this the 22nd day of August 2024.

_____
CHIS RICH, Mayor

_____
JENNY HICKS, City Secretary

_____
PATRICIA ADAMS, City Attorney

EXHIBIT A
AMENDED PROJECT PLAN AND FINANCING PLAN

TAX INCREMENT REINVESTMENT ZONE NO. 1

CITY OF AUBREY, TEXAS

SECOND AMENDED PROJECT PLAN
AND
FINANCING PLAN

AUGUST 15, 2024
AS AMENDED ON MARCH 21, 2017
AS AMENDED ON AUGUST 22, 2024

PREPARED BY:

MUNICAP, INC.
PUBLIC FINANCE

TAX INCREMENT REINVESTMENT ZONE NO. 1

CITY OF AUBREY, TEXAS

SECOND AMENDED PROJECT PLAN AND FINANCING PLAN

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1. INTRODUCTION

1.1. AUTHORITY AND PURPOSE

The City of Aubrey, Texas, a Texas home rule municipality (the "City"), has the authority under Chapter 311, Texas Tax Code, as amended (the "Act") to designate a contiguous or noncontiguous geographic area within the corporate limits of the City and within the extraterritorial jurisdiction of the City as a tax increment reinvestment zone to promote development or redevelopment of the area if the governing body of the City (the "City Council") determines that development or redevelopment would not occur solely through private investment in the reasonably foreseeable future, that the tax increment reinvestment zone is feasible, and that creation of the tax increment reinvestment zone is in the best interest of the City and the property in the tax increment reinvestment zone. The purpose of a tax increment reinvestment zone is to facilitate such development or redevelopment by financing the costs of public works, public improvements, programs, and other projects benefiting the tax increment reinvestment zone, plus other costs incidental to those expenditures, all of which costs are authorized by the Act.

1.2. ELIGIBILITY REQUIREMENTS

Except as provided in the Act, an area may be designated as a tax increment reinvestment zone if such area is predominantly open or undeveloped and, because of obsolete platting, deterioration of structures or site improvements, or other factors, substantially impairs or arrests the sound growth of the City. The City cannot, however, designate a zone if more than 30% of the property in the proposed zone, excluding property that is publicly owned, is "used for residential purposes" (defined by the Act as follows: "... property is used for residential purposes if it is occupied by a house having fewer than five living units ...") or if the total appraised value of taxable real property in the proposed zone and in existing reinvestment zones exceeds 50% of the total appraised value of taxable real property in the City and in industrial districts created by the City.

The Zone. By City Council action on November 17, 2015, the City created a tax increment reinvestment zone to be known as "Tax Increment Reinvestment Zone No. 1, City of Aubrey" (the "Zone" or "TIRZ") that includes approximately 421.7 acres depicted on **Exhibit A** and described on **Exhibit B** (the "Property"). The Property meets the eligibility requirements of the Act. The Property is undeveloped, and due to its size, location, and physical characteristics, development will not occur solely through private investment in the foreseeable future. The Property substantially impairs and arrests the sound growth of the City because it is predominately underdeveloped due to factors such as no public infrastructure and the need for economic incentives to attract development to the Zone for the purpose of providing long-term economic benefits including, but not limited to, increased real property tax base for all taxing units in the Zone, increased sales and use tax for the City and the State of Texas, and increased job opportunities for residents of the City and the region. If the public works, public improvements, programs, and other projects are financed as contemplated by the Amended Plan (hereinafter defined), the City envisions that the Property will be developed to take full advantage of the opportunity to bring to the City and to all of the region quality developments.

1.3. Preliminary Plan; Hearing

Before the City adopted the ordinance designating the Zone, the City Council prepared a preliminary reinvestment zone financing plan in accordance with the Act and, on November 17, 2015, held a public hearing on the creation of the proposed zone and its benefits to the City and to the Property, at which public hearing interested persons spoke for and against the creation of the Zone, the boundaries of the Zone, and the concept of tax increment financing, and at which hearing the owners of the Property (collectively the "Owners") were given a reasonable opportunity to protest the inclusion of the Property in the Zone. The requirement of the Act for a preliminary reinvestment zone financing plan was satisfied by the preliminary plan dated November 17, 2015, (the "Preliminary Plan"), the purpose of which is to describe, in general terms, the public works, public improvements, programs, and other projects that will be undertaken and financed by the Zone. A description of how such public works, improvements, programs, and projects are to be undertaken and financed will be determined by the Amended Plan and by the Development Agreement (both hereinafter defined), which require approval by the Board (hereinafter defined) and by the City Council.

1.4. Creation of the Zone

Subsequent to the above-referenced public hearing, the City Council adopted Ordinance No. 580-16 on November 17, 2015, (the "Creation Ordinance") in accordance with the Act creating the Zone after the City Council found that development or redevelopment of the Property would not occur solely through private investment in the reasonably foreseeable future, that the Zone is feasible, and that creation of the Zone is in the best interest of the City and the Property. The ordinance creating the Zone appointed a Board of Directors for the Zone initially consisting of six (6) members (the "Board").

1.5. Board Recommendations

Upon the creation of the Zone, the Board, during its March 21, 2017, meeting, reviewed the *Amended Project and Finance Plan for Tax Increment Reinvestment Zone No. 1, City of Aubrey* (the "Amended Plan"), and approved and recommended to the City Council the Amended Plan, pursuant to which the City will contribute a portion of the ad valorem tax increment (the "Tax Increment") attributable to new development in the Zone into a tax increment fund created by the City and segregated from all other funds of the City (the "TIRZ Fund") to the costs of public works, public improvements, programs, and other projects benefiting the Zone.

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1.6. Council Action

The City Council, taking into consideration the recommendations of the Board approved:

- The Amended Plan, pursuant to Ordinance No. 628-17, on March 21, 2017.

The City Council, taking into consideration the recommendations of the Board, is anticipated to consider and approve this Second Amended Project Plan and Financing Plan on August 22, 2024.

1.7. Summary of Results

As real property taxes are generated on an ad valorem basis from assessed values, it is first necessary to estimate the future assessed value resulting from the Zone. This plan provides assessed value information based on the following:

- The development is completed as proposed by CADG Comanche 248, LLC (the "Developer");
- The units are sold according to the development pace estimated by the Developer, as summarized in subsequent sections of this Amended Plan;
- Property values are projected to increase at 1.70 percent estimated annual rate of inflation through 2026; and
- The real property tax rate remains static at the fiscal year 2015 level in future years.
- The City is committed to 38.75% of the incremental revenues generated from the roperty.

In summary, the TIRZ financing analysis indicates that, assuming one point seven percent (1.7%) annual inflation through 2026-27 (and after completion of all phases), the Zone is estimated to have an incremental value of $547,170,014 million in 2026-27 after completion of all phases.

Table I-A below provides the projected total and incremental assessed value for the Zone in 2026-27. Refer to **Exhibit C**, attached hereto, for more information on the projected incremental value for each year.

Table I-A
Projected Assessed Values

Year	Projected Value	Base Value[1]	Incremental Value
2026-27	$547,368,779	($198,765)	$547,170,014

[1]The base value of $198,765 represents the 2021 base year value shown in comptroller report 50-806.

The assessed values displayed in Table 1-A above are the basis for estimating incremental real property taxes. The projected incremental taxes are shown in Table 1-B on the following page. The Property is anticipated to be fully built out by calendar year, and such fully built-out values are anticipated to be reflected in the 2026 property appraisal and the related incremental taxes will become fully available on taxes dues as of January 2026-27. The new proposed development could not occur without the Public Improvements (as defined herein) required to be constructed within the Zone. The total projected value of the new development at build-out as of January 1, 2027, is

$547,368,779 with an incremental value of $547,170,014. Table I-B illustrates the projected assessed value for taxes due as January 2027, assuming one point seven percent (1.7%) annual inflation.

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Table I-B
Projected Incremental Tax Revenue

Jurisdiction	Total Projected Appraised Value at Buildout as of January 1, 2027	Base Value[1]	Total Projected Incremental Appraised Value at Buildout as of January 1, 2027	Total Projected Incremental Tax Revenue as of January 31, 2027
City of Aubrey	$547,368,779	($198,765)	$547,170,014	$2,538,891

[1]The base value of $198,765 represents the 2021 base year value shown in comptroller report 50-806.

Refer to **Exhibit C** for projected tax increment revenues for each year.

The financing plan for the categories of public works and public improvements (the "Public Improvements") contemplates the issuance of special revenue bonds by the City secured by special assessments ("PID Assessments") levied on property within the Jackson Ridge Public Improvement District (the "PID"). The bonds secured by the PID Assessments are referred to as the Major Improvement Bonds and Phase 1 Bonds, collectively the "PID Bonds" and are estimated to total $23,255,000 in bond proceeds.

A portion of the total Public Improvement costs are proposed to be funded with the PID Bonds. As a result, real property tax increment revenues are intended to pay an equivalent portion of the debt service on the PID Bonds and will be applied as discussed more fully in the Jackson Ridge PID Service and Assessment Plan.

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2. Assessment and Tax Collection Procedures

2.1 Authority and Purpose

Pursuant to Texas Tax Code, all taxable property is appraised at its market value as of January 1 of each year. Each county in Texas is served by an appraisal district, which determines the value of all that county's taxable property. Generally, local governments that collect property taxes, such as counties, cities and school districts, are members of the appraisal district.

2.2 Methodology

The appraisal districts use different valuation methods depending on property type and circumstances. A brief description of these methods follows.

Cost Approach – As the name implies, the cost approach values property on the basis of the costs of development. The value of a structure is determined by estimating the cost to replace the building with a new structure and then subtracting depreciation. This method assumes the cost of replacing the existing building plus the value of the land equals market value. The steps in applying the cost approach include:

- Estimating the site value (land and site improvements) through review of comparable sales;
- Estimating the cost of replacing the existing building with one of similar usefulness (reflecting current building design and materials); and
- Deducting all sources of depreciation, including physical deterioration ("wear and tear" on a building) and functional and economic obsolescence. Functional obsolescence is the reduced ability of the building to perform the function it was originally designed and built for. Economic obsolescence refers to external forces that affect the ability of the building to continue to perform, such as changes in transportation corridors and new types of building design demanded by the market.

The cost approach is relied upon most often when the property being appraised is new or nearly new and income is not yet stabilized, where there are no comparable sales, or where the improvements are relatively unique or specialized.

Market Data Comparison Approach – The market data comparison approach is based on the premise that the value of a specific property is set by the price an informed purchaser would pay for a comparable property, offering similar desirability and usefulness. For instance, if recent sales of condominium units within the same building indicate an increase in market values, all assessed values for condominiums in the building will be reassessed to reflect this increase in market value. This requires an understanding and comparison of market variables, such as location, property size, physical features and economic factors. The process of identifying and analyzing comparable property sales is repeated until a satisfactory range of value indicators for the subject property is established and a final estimate of value is possible. The limitations of the sales comparison approach are that it requires recent sales data for

similar properties. The sales comparison approach is relied upon most often for appraising the sale of residential property and is most likely to be relevant for the proposed residential development in the TIRZ.

According to the Denton Central Appraisal District ("DCAD"), properties developed in new subdivisions are typically appraised based on the sales price of the new homes developed in the subdivisions using a market comparison approach to value.

Income Approach – The income approach to value is based on the premise that the value of a property is directly related to the income it will generate. The appraisal districts analyze both the property's ability to produce future income and its expenses, and based on projected new income, estimates the property's value. The appraiser develops a capitalization rate by analyzing the sales of similar income properties and determining the relationship between the sale price and net income.

The steps in applying the income capitalization approach are to determine the stabilized, net-operating income by:

- Estimating potential gross income from all sources;
- Deducting an allowance for vacancy and bad debts; and
- Deducting all direct and indirect operating expenses.

The resulting net operating income is capitalized by a market rate, which reflects the property type and effective date of valuation to produce an estimate of overall property value.

To determine the effective gross income, the appraiser estimates market rents by analyzing rents, both within the property being assessed and in comparable properties in the neighborhood, and making an allowance for vacancy and collection loss. Net operating income is estimated by deducting operating expenses.

The appraiser typically determines the capitalization rate by analyzing sales (comparing net operating income to sale price) in the same market for similar properties to determine the ratio of net operating income to sales price. The capitalization rate will vary depending on the attractiveness of a property as an investment, income risks and physical factors, among other factors. In the absence of sufficient sales data, the appraisal districts may use standard industry rates as generated by other sources to determine cap rates.

The income approach is relied upon most often when appraising properties that produce a rental income from single or multiple tenants. The capitalized value of the income stream provides an estimate of the market value of the property (land and improvements).

An appraisal district may use any of the three common methods to value property. The legislature also authorizes appraisal districts to use a method called mass appraisal to calculate the value of a large number of similar properties. According to Section 23.01(b) of the Texas Property Tax Code:

if the appraisal district determines the appraised value of a property using mass appraisal standards, the mass appraisal standards must comply with the Uniform Standards of Professional Appraisal Practice. The same or similar appraisal methods and techniques shall be used in appraising the same or similar kinds of property. However, each property shall be appraised based upon the individual characteristics that affect the property's market value, and all available evidence that is specific to the value of the property shall be taken into account in determining the property's market value.

2.3 APPEALS

According to the Denton County Appraisal District (the "DCAD"), property owners may utilize the DCAD appeal procedures if they have a concern about:

- the market or appraised value of the property;
- unequal appraisal of the property compared to other properties;
- the inclusion of the property on the appraisal roll;
- any exemptions that may apply to the property owner;
- the qualification for an agricultural or timber appraisal;
- the taxable status of the property;
- the local governments which should be taxing the property;
- the ownership of property;
- a change of use of land receiving special appraisal; and/or
- any action taken by the chief appraiser, DCAD or Appraisal Review Board ("ARB") that applies to and adversely affects the property.

If property owners cannot resolve their concern informally with the DCAD staff, they may have their cases heard by the ARB. The ARB is an independent board of citizens that review problems with appraisals or other concerns listed above. It has the power to order the DCAD to make the necessary changes to solve problems. If a property owner files a written request for an ARB hearing (called a notice of protest) on or before May 31 (or 30 days after the notice of appraised value was mailed to the property owner, whichever is later), the ARB will set the case for a hearing. The property owner will receive written notice of the time, date, and place of the hearing. After it decides the case, the ARB must send them a copy of its order by certified mail. If the property owner is not satisfied with the decision, it has the right to appeal. If it chooses to go to court, the property owner must start the process by filing a petition within 60 days of the date it receives the ARB's order. In certain cases, as an alternative to filing an appeal in district court, the property owner may file not later than the 45th day after it receives notice of the ARB order a request for binding arbitration with the DCAD. In certain cases, originating in certain counties, as an alternative to filing an appeal in district court, the property owner may appeal to the State Office of Administrative Hearings (SOAH). An appeal to SOAH is initiated by not later than the 30th day after the property owner receives notice of the ARB's order by filing with the chief appraiser of the DCAD a notice of appeal.

2.4 Taxation Procedures

The assessment and property tax process for each tax year includes the steps shown in Table II-A.

Table II-A
Property Tax Timeline

Date(s)	Event
January 1	CADs are required to appraise property on this date. A lien attaches to each taxable property to ensure property tax payment.
January 1 - April 30	CAD completes appraisals and processes applications for exemptions.
April - May	Appraisal districts send notices of appraised value.
May 1	Appraisal review board begins hearing protests from property owners.
July 1	Local taxing units may impose additional penalties for legal costs related to collecting unpaid taxes.
August - September	Local taxing units adopt tax rates.
October 1	Local taxing units (or county tax assessor-collector, acting on their behalf) begin sending tax bills to property owners.
January 1	Taxes due to local taxing units (or county tax assessor-collector, if acting on their behalf).
February 1	Local taxing units begin charging penalty and interest for unpaid tax bills.

2.5 Penalties and Interest

According to the Texas Comptroller, if taxes are not paid by January 31st, penalties and interest will accrue are shown in Table II-B.

Table II-B
Penalties and Interest

If Tax Paid In:	Penalty		Interest		Total
February	6%	+	1%	=	7%
March	7%	+	2%	=	9%
April	8%	+	3%	=	11%
May	9%	+	4%	=	13%
June	10%	+	5%	=	15%
July	12%	+	6%	=	18%

Penalties reach a maximum of 12% and interest of 1% is added each month after the due date. All real property accounts not paid in full by June 30th of the year in which they become delinquent will be referred to the delinquent tax attorney for enforced collection and will incur an additional penalty equal to 15% - 20% of the total taxes, penalties, and interest due.

(remainder of this page is intentionally left blank)

2.6 Historical Levy and Collection Summary

According to City records, on average 99.1 percent of real property taxes were collected for each fiscal year from 2008 to 2014, as shown below in Table 2-C.

Table II-C
Penalties and Interest

Year:	Total Tax Levy	Amount Collected	Percentage Collected
2008	$630,247	$626,213	99.36%
2009	$679,918	$671,011	98.69%
2010	$723,833	$698,209	96.46%
2011	$769,102	$769,025	99.99%
2012	$793,750	$793,274	99.94%
2013	$797,163	$795,728	99.82%
2014	$806,921	$804,581	99.71%

2.7 Tax Sale

According to the Denton County Tax Collector's website, tax sales are held once orders of sale are issued from the district courts in reference to tax judgments for delinquent taxes. Real property being sold as a result of a foreclosure to satisfy delinquent taxes is required by Texas law to be sold on the first Tuesday of the month. All counties have sales on the same day.

2.8 Tax Rates

Tax rates are set on an annual basis by the City. For fiscal year 2015, the real property tax rate in the City is $0.566997 per $100 of assessed value.

The City tax rates have fluctuated in past years. It is likely that the tax rate will continue to change overtime; for purposes of this study, however, it is assumed that the tax rate will remain at its current level in future years.

Table II-D on the following page provides historical tax rates from fiscal years 2008 to 2015.

(remainder of this page is intentionally left blank)

Table II-D
Historical Tax Rates 2015-2024

Fiscal Year	City Tax Rate Per $100 Assessed Value (M&O)	City Tax Rate Per $100 Assessed Value (I&S)	City Tax Rate Per $100 Assessed Value (Total)
2008-09			$0.526200
2009-10			$0.546600
2010-11			$0.546600
2011-12			$0.610400
2012-13	$0.163668	$0.466642	$0.630300
2013-14	$0.179585	$0.441545	$0.621100
2014-15	$0.185414	$0.403068	$0.588482
2015-16	$0.20269	$0.363728	$0.566997
2016-17	$0.223350	$0.338606	$0.561956
2017-18	$0.212891	$0.329158	$0.542049
2018-19	$0.220300	$0.321700	$0.542000
2019-20	$0.26860	$0.27300	$0.541600
2020-21	$0.29180	$0.24960	$0.541400
2021-22			$0.525000
2022-23			$0.464928
2023-24			$0.464000

Source City of Aubrey

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3. HISTORICAL APPRECIATION IN TAXABLE VALUES

Property values typically appreciate over time. The City total taxable assessed value (TAV) information from 2008 to 2015, as shown in the DCAD certified totals for tax years 2008 through 2015, indicate that the aggregate TAV for single family homes has increased from year to year except in 2010 and 2012.

Table III-A shows the average annual appreciation of assessed values in the City from 2008 to 2015. The percentage growth in any given year indicates the appreciation over the prior year and is not cumulative.

TABLE III-A
Historical Appreciation in Values

Year	Single Family (SF) Homes TAV	New construction SF Homes TAV	Net Existing SF Homes TAV	Growth %	Total SF Homes	Average Home Value	Growth %
2008	$91,940,563	$4,620,372	$87,320,191	N/A	849	$108,293	N/A
2009	$91,437,108	$2,262,741	$89,174,367	1.06%	863	$105,953	-1.09%
2010	$88,572,485	$1,850,802	$86,721,683	-1.38%	879	$100,765	-2.48%
2011	$90,034,204	$734,911	$89,299,293	1.48%	882	$102,080	0.65%
2012	$86,612,367	$609,030	$86,003,337	-1.86%	883	$98,089	-1.97%
2013	$88,761,867	$261,062	$88,500,805	1.44%	900	$98,624	0.27%
2014	$100,841,614	$2,910,484	$97,931,130	5.19%	945	$106,711	4.02%
2015	$120,148,922	$6,763,188	$113,385,734	7.60%	978	$122,852	7.30%
CAGR - 8 Yr	*3.40%*		*3.32%*			*1.59%*	
CAGR - 5 Yr	*5.94%*		*4.89%*			*3.77%*	
CAGR - 3 Yr	*10.62%*		*8.61%*			*7.60%*	

Source- Denton CAD certified totals for tax years 2004 through 2013.

Based on the annual appreciation rates shown in Table III-A, the compound annual growth rate of average home values from 2008 to 2015 is approximately 1.59 percent, the compound annual growth rate o f average home values from 2011 to 2015 is approximately 3.77 percent and the compound growth rate of average home values from 2013 to 2015 is equal to 7.6 percent. A future annual appreciation rate of 1.70 percent for all property, representing the initial estimated rate that falls within the range of CAGRs computed using the three different value estimation bases shown in Table III-A (total taxable assessed value of single family homes, total taxable assessed value of single family homes net of new construction value and average home values) has been used for this study to project future appreciated assessed values through 2026-27 after the estimated build out in 2024-25 and the estimated home values are held constant after 2026-27. Based on the historic trends outlined in this section, this rate is believed to be conservative.

4. PROJECT PLAN

3.1. PURPOSE

Pursuant to Ordinance No. 580-16 (the "TIRZ Ordinance"), the City created the Tax Increment Reinvestment Zone No. 1, City of Aubrey, Texas as a TIRZ under the provisions of Chapter 311 of the Texas Tax Code, as amended. The land within the TIRZ is comprised of approximately 421.7 acres and is coterminous with the land within the Jackson Ridge Public Improvement District (the "PID").

As more fully described in subsequent sections of this report, approximately 1,395 residential units are planned for the TIRZ. The City is planning to issue bonds for the purpose of financing public improvements necessary for the improvements in the PID.

Tax increment financing is a redevelopment and financing tool by which governments can provide financial assistance to fund infrastructure for eligible public and private redevelopment efforts within an officially designated area of the development. Increases in property tax revenues, which are generated primarily from new investment in the TIRZ, are allocated to pay debt service on debt issued to pay for such infrastructure costs within the TIRZ.

3.2. LOCATION

The TIRZ is approximately 49 miles from Dallas, Texas, and approximately 51 miles from Fort Worth, Texas. A map and metes and bounds of the TIRZ, as well as the corresponding proposed development, are included as Appendix A to this Plan.

3.2ECONOMIC AND DEMOGRAPHIC INFORMATION

According to the City website, the City is located on the Texas Lakes Trail, 15 miles north of Denton off U.S. Highway 377 and U.S. Highway 380, in Denton County. Aubrey serves as a gateway to beautiful Lake Ray Roberts and is closely located to major commercial outlays in Frisco, Denton and Lewisville. The City is less than an hour commute to DFW airport.

According to City-Data, the population of the City has grown by approximately 81.2 percent between 2000 and 2013 (City-Data.com/city/Aubrey-Texas). According to the City, the average unemployment rate of the City center was 4.9 percent, compared to 5.5 percent for the State of Texas and 5.3 percent nationally (City-Data.com/city/Aubrey-Texas; US United States Department of Labor, Bureau of Labor Statistics) for June 2014. The 2013 median household income for the City was $60,873 and the median home price was $125,686, compared to the 2013 median household income of $51,704 and the median home price of $132,000 for the State of Texas (City-Data.com/city/Aubrey-Texas).

3.3 PROPOSED DEVELOPMENT

The TIRZ is proposed to be developed as a residential development with 1,395 residential units and is proposed to include two types of single family residential lots. The TIRZ is anticipated to be developed with 269 60-foot lots and 1,126 50-foot lots to be developed in approximately three

phases. Table IV-A summarizes the projected development of the TIRZ. Detailed estimation of absorption for the development is provided on an annual basis on Appendix E attached hereto. Appendix A at the end of this section provides a site plan for the proposed development within the TIRZ.

Table IV-A
Description of Proposes Uses

Property Type	Estimated Completion	Quantity	Measurement
Single-Family - 60 Ft	2023	269	Units
Single-Family - 50 Ft	2024	1,130	Units
Total		1,399	

Table IV-B below shows the proposed residential development within Phase 1.

Table IV-B
Description of Proposes Uses

Property Type	Quantity	Measurement
Single-Family - 60 Ft	102	Units
Single-Family - 50 Ft	357	Units
Total	459	Units

Table IV-C below the proposed residential lot types within the remaining future phases.

Table IV-C
Description of Proposes Uses

Property Type	Quantity	Measurement
Single-Family - 60 Ft	167	Units
Single-Family - 50 Ft	769	Units
Total	940	Units

3.2. Proposed Changes to Ordinances, Plans, Codes, Rules and Regulations

Details regarding the Development Standards for the proposed development, which are included as Exhibit F to the Development Agreement between the Developer and the City, are shown as Appendix H to this plan.

3.3. Estimated Non-Project Costs

According to the project engineer, the total original estimated amount of improvements planned to be constructed for the development is $54,780,198. As shown in Table V-A of this Project and

Finance Plan, the total original estimated amount of Project Costs eligible for TIRZ incremental revenue financing is $13,183,721. The revised estimated amount of Project Costs eligible for TIRZ incremental revenue financing is $9,206,401. As a result, the total amount of public improvement costs that are not eligible for TIRZ incremental revenue financing ("Nonproject Costs") is estimated to be $41,596,477. Table IV-D shows a detailed list of these Nonproject Costs for public improvements as provided by the project engineer. The total cost of the development is estimated at $55 million.

Table IV-D
Estimated Nonproject Costs

Description	Total Estimated Costs
Improvements:	
Road Improvements	$14,039,410
Water distribution system improvements	$6,860,088
Sanitary sewer collection system improvements	$7,245,705
Storm drainage system improvements	$2,092,500
Other improvement costs including lot development	$12,645,365
Subtotal: Estimated improvement costs	$42,883,068
Soft costs including engineering and contingency	$4,245,815
Estimated bond issuance costs (details in Appendix B)	$7,651,314
Subtotal: estimated soft costs	*$11,897,129*
Grand Total Improvement + Soft Costs	**$54,780,198**
Less: Project costs	*($9,206,401)*
Total Nonproject Costs	**$45,573,797**

3.4. METHOD OF RELOCATION

The proposed development is being developed on vacant land. Accordingly, there are no persons to be relocated a s a result of implementing the plan.

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5. FINANCING PLAN

5.1. PROJECT COSTS

Section 311.002 of the Tax Increment Financing Act defines project costs as "the expenditures made or estimated to be made and monetary obligations incurred or estimated to be incurred by the municipality or county designating a reinvestment zone that are listed in the project plan as costs of public works, public improvements, programs, or other projects benefiting the zone, plus other costs incidental to those expenditures and obligations." Project costs include:

(A) capital costs, including the actual costs of the acquisition and construction of public works, public improvements, new buildings, structures, and fixtures; the actual costs of the acquisition, demolition, alteration, remodeling, repair, or reconstruction of existing buildings, structures, and fixtures; the actual costs of the remediation of conditions that contaminate public or private land or buildings; the actual costs of the preservation of the facade of a public or private building; the actual costs of the demolition of public or private buildings; and the actual costs of the acquisition of land and equipment and the clearing and grading of land;

(B)financing costs, including all interest paid to holders of evidences of indebtedness or other obligations issued to pay for project costs and any premium paid over the principal amount of the obligations because of the redemption of the obligations before maturity;

(C) real property assembly costs;

(D) professional service costs, including those incurred for architectural, planning, engineering, and legal advice and services;

(E) imputed administrative costs, including reasonable charges for the time spent by employees of the municipality or county in connection with the implementation of a project plan;

(F) relocation costs;

(G) organizational costs, including the costs of conducting environmental impact studies or other studies, the cost of publicizing the creation of the zone, and the cost of implementing the project plan for the zone;

(H) interest before and during construction and for one year after completion of construction, whether or not capitalized;

(I)the cost of operating the reinvestment zone and project facilities;

(J)the amount of any contributions made by the municipality or county from general revenue for the implementation of the project plan;

(K) the costs of school buildings, other educational buildings, other educational facilities, or other buildings owned by or on behalf of a school district, community college district, or other political subdivision of this state; and

(L) payments made at the discretion of the governing body of the municipality or county that the governing body finds necessary or convenient to the creation of the zone or to the implementation of the project plans for the zone.

The original estimated project costs for the development were $13,183,721 as presented in Table V-A below. The revised estimated project costs are also shown to be $9,206,401. The detailed project costs are presented in Appendix C of this plan.

Table IV-D
Estimated TIRZ Project Costs

Description	Total Estimated Costs
Water distribution system improvements	$3,692,625
Sewer collection system improvements	$4,055,122
Estimated soft costs including engineering	$968,015
Subtotal:	$8,715,762
Other bond issuance related costs (details in Appendix C)	$4,467,958
Total Estimated Project Costs	**$13,183,721**
Add: Roadway improvements	$2,747,598
Water distribution system improvements	$604,131
Sewer collection system improvements	$308,924
Less: Water improvements systems eliminated	($3,283,411)
Net sewer collection system improvements eliminated (including capacity fees)	($193,283)
Net professional fees related to eliminated projects	($70,194)
Developer funded excess improvements	($113,765)
MSUD Contract Payment offsets par amount	($2,794,820)
MSUD Lump sum payment offsets	($1,182,500)
Total Revised Estimated Project Costs	**$9,206,401**

Appendix D shows the estimated total bond debt service obligation related to the Project Costs. The total prorated bond net debt service related to the Project Costs and estimated TIRZ administration expenses in the total estimated amount of $25,216,804. The original plan to reimburse the Developer for payment of annual installments of assessments related to the Project Costs until the TIRZ increments are sufficient to cover such debt service in the total amount not to exceed $5,323,271has been eliminated. As a result, $25,216,804 represents the maximum amount of TIRZ increments projected to be available to meet City commitments as TIRZ contribution. See Appendix G for detailed calculations of these amounts.

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5.2. DESCRIPTION OF TIRZ PROJECTS

The public improvements to be financed as TIRZ Projects are described below. The estimated costs of the TIRZ Projects eligible for financing through TIRZ incremental revenues are shown in Table V-A. The costs shown are estimates and may be revised in the future, including the addition of such other improvements as deemed necessary to further improve the properties within the TIRZ.

Water Distribution System Improvements

Water Treatment System - This project is proposed to be annexed to the City. The City will be a customer city of the Upper Trinity Regional Water District (UTRWD) and will receive wholesale treated water through a major transmission line from the UTRWD Tom Harpool water treatment plant. Therefore, there are no water treatment plant upgrades required.

There is an existing 36-inch water transmission line located along the eastern boundary of the project. The proposed off-site improvements will consist of constructing a new delivery point/ meter station, a 0.5 MG Elevated Storage Tank, a 0.25 MG Ground Storage Tank, a 1.0 MGD Pump Station and approximately 3,700 linear feet of 12' water line. All of the proposed improvements will be located within the development.

Additional waterline improvements will include connection to the existing water-main, installation of associated 12" valves, fire hydrants, ductile iron fittings, erosion control, trench safety and testing. All water improvements will be constructed to City standards and specifications and all improvements will be owned and operated by the City. These improvements will benefit the entire project.

Updates related to the Water Distribution system Improvements:

The City and Mustang Special Utility District ("MSUD") entered into a Transfer and Service Agreement dated _____, 2017, wherein the City agreed that MSUD will be the retail water and wastewater service provider to the Winn Ridge (aka Jackson Ridge) Development (the "Development"). As a result, a portion of the water distribution system part of the TIRZ Projects are no longer necessary and will be replaced with connections to the existing MSUD water supply system to provide service to the Development.

The initial water distribution system improvements part of the TIRZ Projects consisted of constructing a new delivery point/metering station (MS), a 0.5 MG Elevated Storage Tank (EST), a 0.25 MG Ground Storage Tank (GST), a 1.0 MGD Pump Station (PS) and approximately 3,700 linear feet of 12-inch water line.

The new proposed water distribution system part of the TIRZ Projects consists of constructing two connections to the existing MSUD water system. One connection will be located near the main entrance along Byran Road and across the MSUD Elevated Storage Tank, and the other one will be located near the main entrance along FM 1385.

According to the project engineer, the new proposed system is a more efficient way to serve the Development by providing direct connections to the MSUD water system and eliminating the need to construct the water treatment facility consisting of a metering station, elevated and ground storage tanks and pump station. In addition, the new system will provide a "loop system" that allows the Development to receive water supply from two different locations. The "loop system" greatly enhances water distribution in case of emergencies and will also provide ways to increase circulation within the system, eliminating the potential of having stagnant water within the system. The cost savings from this water distribution system change are being reallocated to other TIRZ Projects benefiting the property in the TIRZ.

Water Treatment System – The Development will be a customer of the MSUD and will receive treated water through two "Points of Delivery" (POD); one located near MSUD Elevated Storage Tank along Byran Road and the other one located near the project entrance along FM 1385. Therefore, there are no water treatment plant upgrades required. In addition with MSUD now the water provided the system will now be looped from MSUD with the two connection points for water delivery, creating a backup to the system if issues arise at a POD. The cost savings from these water distribution system changes are being reallocated to other TIRZ Projects benefiting the property in the TIRZ.

There are existing 24-inch water transmission lines located along the Southern and Eastern boundaries of the project. The proposed TIRZ Projects will consist of constructing approximately 11,371 linear feet of various sized water lines. All of the proposed improvements will be located within the Development.

Additional waterline improvements will include connection to the existing water-mains, installation of associated valves, fire hydrants, ductile iron fittings, erosion control, trench safety and testing. All water improvements will be constructed to MSUD standards and specifications and all improvements will be owned and operated by the MSUD. These improvements will benefit the entire project.

Sanitary Sewer Improvements

Wastewater Treatment System - This project is proposed to be annexed to the City. The City will be a customer city of the Upper Trinity Regional Water District (UTRWD) and will receive wastewater collection services by constructing a 15-inch wastewater interceptor line or other necessary wastewater facilities to receive and wastewater treatment services from the UTRWD Riverbend wastewater treatment plant. UTRWD operates the Riverbend wastewater treatment plant that has a TCEQ permit to treat up to 5 million gallons per day (MGD). The UTRWD treatment plant permit with the TCEQ has excess capacity to serve the Jackson Ridge development. UTRWD is in the process of expanding the wastewater treatment plant to up to 4 MGD.

This project consist of approximately 10,570 linear feet of 15-inch sanitary sewer gravity line generally flowing southwesterly along the Little Elm Creek or other necessary wastewater and connecting to the Riverbend WWTP.

Cutoff valves, air release valves will be constructed in accordance with City and TCEQ regulations. The 15-inch gravity interceptor line will be designed to maintain the 3.0 fps minimum velocity. The line will be designed and constructed in accordance with City standards and specifications and will be owned and operated by the City. These improvements will benefit the entire project.

Updates related to the Sanitary Sewer Improvements:

Wastewater Treatment System – The original project contemplated a 15-inch wastewater interceptor line or necessary wastewater facilities to receive treatment services from the UTRWD Riverbend wastewater treatment plant, in which the Development would be a customer of the City. The Development will now be a customer of MSUD and will receive wastewater collection services by constructing a wastewater interceptor line and a lift station. Wastewater treatment services will be provided by MSUD through a contract with the UTRWD to treat MSUD wastewater at their Riverbend Wastewater Treatment Plant (WWTP). UTRWD operates the Riverbend WWTP which has a TCEQ permit to treat up to 5 million gallons per day (MGD). The UTRWD WWTP permit with the TCEQ has excess capacity to serve the Winn Ridge development. UTRWD is in the process of expanding the WWTP capacity to up to 4 MGD.

This updated project plan consists of approximately 8,072 linear feet of 15 and 18-inch sanitary sewer gravity line generally flowing southwesterly along the Little Elm Creek, connecting to a 3.5 MGD lift station connected to 3,238 linear feet of 14-inch force main, and then connecting to an 18-inch gravity line connecting to the Riverbend WWTP.

Cutoff valves and air release valves will be constructed in accordance with MSUD and TCEQ regulations. The interceptor lines will be designed to maintain the 3.0 fps minimum velocity. The line will be designed and constructed in accordance with UTRWD standards and specifications and will be owned and operated by the UTRWD. These improvements will benefit the entire project.

A portion of the original contemplated TIRZ Projects have been eliminated from the Development as a result of the above described changes from the original plans for the water distribution system and sanitary sewer improvements.

Road Improvements:

As described above, part of the water distribution and sewer collection system improvements are no longer necessary to serve the Development as a result of MSUD providing retail water and wastewater service to the Development. As a result, the City will finance roadway improvements to be added to the TIRZ Projects.

The roadway portion of the TIRZ Projects consists of approximately 5,545 linear feet of a 3-lane collector road from connecting FM 1385 to Byran Road (referred to as Road A) and approximately 4,610 linear feet of Byran Road (referred to a Road B and C). This will provide access off of FM 1385 into the Development. The revised Road A projects include storm drainage facilities, hardscape and landscape, road right of way excavation and streetlight. Road A includes

approximately 10,200 liner feet of underground reinforced concrete pipe, headwalls, inlets, safety end treatments, manholes and storm sewer energy dissipaters, approximately 58,589 cubic yards of right of way excavation, approximately 2,428 linear feet of brick screen wall, stone columns, trail markers and approximately 391,937 SF of Bermuda sod and irrigation. Byran Road will also be improved for the section adjacent to the Development. These improvements will be constructed to TxDOT, Denton County and City standards. These improvements will benefit the entire project and are referred to as Road B and C projects including approximately 3,460 and 1,150 linear feet respectfully, of road improvements, including drainage facilities, road right of way excavation, hardscape and landscape improvements. In addition, left and right turn lanes will be constructed within FM 1385 to enhance traffic turning movement in and out of the development and will include drainage facilities, road right of way excavation, hardscape and landscape.

5.3. METHOD OF FINANCING

On June 25, 2015, the City of Aubrey City Council passed and approved Resolution No. 709-15 approving and authorizing the creation of the Jackson Ridge Public Improvement District (the "PID") to finance the costs of certain public improvements for the benefit of property in the PID, all of which is within the City. The PID and the TIRZ boundaries are coterminous.

The property in the PID is proposed to be developed in approximately three phases, and the PID will finance improvements for each phase as each phase is developed. Assessments will be imposed on the all property in the PID for the improvements that benefit the entire PID and on the property in each phase for the public improvements to be provided for that phase. As described in the Service and Assessment Plan of the PID (the "SAP"), the City will issue bonds (the "PID Bonds") in order to finance the improvements. The PID Bonds will be issued to finance the project costs shown in Table V-A.

The original TIRZ participation rate was 64.75% of the incremental taxes generated from the development of the Property in the PID, which property is also contained in the TIRZ, for the repayment of a portion of the PID Bonds issued to finance the improvements referenced in this Project and Finance Plan.

In the Amended Plan, the TIRZ participation rate was decreased to 45.20% of the incremental taxes generated from the development of the Property in the PID, which property is also contained in the TIRZ, for the repayment of a portion of the PID Bonds issued to finance the improvements referenced in this Project and Finance Plan.

The City now intends to apply approximately 38.75% of the incremental taxes generated from the development of the Property in the PID, which property is also contained in the TIRZ, for the repayment of a portion of the PID Bonds issued to finance the improvements referenced in this Project and Finance Plan.

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5.4. Estimated Bonded Indebtedness

The project costs are anticipated to be financed with two series of PID Bonds. The first series of PID bonds ("Major Improvement Bonds") are anticipated to be issued in 2015 and will be used to pay or reimburse the Developer for a portion of the costs of improvements that benefit property in all three phases of the development. The second series of PID bonds ("Phase 1 Bonds") are also anticipated to be issued in 2015 and will be used to pay or reimburse the Developer for costs of improvements that primarily benefit just the Phase 1 property including a proportionate share of the costs of improvements that benefit the entire development attributed to the property in Phase 1.

Table V-B-1 below shows the original estimated sources and uses of the Major Improvement Bonds. The detailed estimated annual PID Bond debt service schedule and the prorated debt service schedule related to the Project Costs are shown in Appendix D to this plan.

Table V-B-1
Estimated Sources and Uses – Major Improvement Bonds and Phase 1 Bonds

	Series 2015 Major Improvement Bonds		
Sources of Funds	**City Major Improvements**	**Other Major Improvements**	**Total**
Estimated Bond par amount	$9,090,763	$1,164,237	$10,255,000
Phases #2-3 reimbursement amount	$0	$2,037,269	$2,037,269
Total Sources	**$9,090,763**	**$3,201,506**	**$12,292,269**
Uses of Funds			
Major Improvements			
Road improvements	$0	$1,982,947	$1,982,947
Water distribution system improvements	$2,470,596	$158,806	$2,629,402
Sanitary sewer improvements	$2,713,129	$246,399	$2,959,528
Storm drainage improvements	$0	$0	$0
Other soft and miscellaneous costs	$647,663	$395,933	$1,043,596
Subtotal	**$5,831,388**	**$2,784,084**	**$8,615,472**
Estimated Bond issue costs			
Capitalized interest	$1,297,896	$166,219	$1,464,115
Reserve fund	$830,416	$106,350	$936,766
Administrative expenses fund	$33,604	$4,304	$37,908
Other costs of issuance	$1,097,458	$140,549	$1,238,008
Subtotal	**$3,259,375**	**$417,422**	**$3,676,797**
Total Uses	**$9,090,763**	**$3,201,506**	**$12,292,269**

As described in this report and shown in Table V-A, the original water distribution and sewer collection system improvement part of the TRIZ Projects have been revised to include additional roadway improvements and other TIRZ Projects. As a result, Table V-B-1 is updated to reflect this change as shown in Table V-B-2 below.

Table V-B-2
Estimated Sources and Uses – Major Improvement Bonds and Phase 1 Bonds

Sources of Funds	**Series 2015 Major Improvement Bonds**
Estimated Bond par amount	$10,255,000
Developer Contributions	$2,488,263
Total Sources	**$12,743,263**
Uses of Funds	
Major Improvements	
Road improvements	$3,870,886
Water distribution system improvements	$643,844
Sanitary sewer improvements	$2,846,941
Storm drainage improvements	$0
Other soft and miscellaneous costs	$1,704,796
Subtotal	**$9,066,466**
Estimated Bond issue costs	
Capitalized interest	$1,464,115
Reserve fund	$936,766
Administrative expenses fund	$37,908
Other costs of issuance	$1,238,008
Subtotal	**$3,676,797**
Total Uses	**$12,743,263**

Table V-C-1 on the following page shows the original estimated sources and uses of the Phase 1 Bonds, respectively. The detailed estimated annual PID Bond debt service schedule and the prorated debt service schedule related to the Project Costs are shown in Appendix D to this plan.

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Table V-C-1
Estimated Sources and Uses – Major Improvement Bonds and Phase 1 Bonds

	Series 2015 Phase #1 Bonds			Phase #1 Reimbursement Agreement	
Sources of Funds	**Phase #1 Share of City Major Improvements**	**Phase #1 Share of Other Major Improvements**	**Phase #1 Improvements**	**Phase #1 Improvements**	**Total**
Estimated Bond par amount	$4,092,958	$1,954,104	$7,412,938	$540,000	$14,000,000
Other funding sources	$0	$0	$0	$1,599,875	$1,599,875
Total Sources	**$4,092,958**	**$1,954,104**	**$7,412,938**	**$2,139,875**	**$15,599,875**
Uses of Funds					
Major Improvements					
Road improvements	$0	$980,823	$0	$0	$980,823
Water distribution system improvements	$1,222,029	$78,550	($0)	$0	$1,300,579
Sanitary sewer improvements	$1,341,993	$121,876	$0	$0	$1,463,869
Storm drainage improvements	$0	$0	$0	$0	$0
Other soft and miscellaneous costs	$320,353	$195,840	$0	$0	$516,193
Subtotal	**$2,884,375**	**$1,377,089**	**($0)**		**$4,261,464**
Phase 1 Improvements					
Road improvements	$0	$0	$2,738,041	$1,121,563	$3,859,604
Water distribution system improvements	$0	$0	$695,925	$285,067	$980,992
Sanitary sewer improvements	$0	$0	$672,618	$275,519	$948,137
Storm drainage improvements	$0	$0	$488,429	$200,071	$688,500
Other soft and miscellaneous costs	$0	$0	$629,006	$257,655	$886,662
Subtotal	**$0**	**$0**	**$5,224,018**	**$2,139,875**	**$7,363,894**
Estimated Bond issue costs					
Capitalized interest	$513,524	$245,172	$930,066	$0	$1,688,763
Reserve fund	$310,871	$148,419	$563,031	$0	$1,022,321
Administrative expenses fund	$15,840	$7,563	$28,689	$0	$52,092
Other costs of issuance	$368,349	$175,861	$667,133	**$0**	$1,211,342
Subtotal	**$1,208,584**	**$577,015**	**$2,188,919**	**$0**	**$3,974,518**
Total Uses	**$4,092,958**	**$1,954,104**	**$7,412,938**	**$2,139,875**	**$15,599,875**

As described in this report and shown in Table V-A, the original water distribution and sewer collection system improvement part of the TRIZ Projects have been revised to include additional

roadway improvements and other TIRZ Projects. As a result, Table V-C-1 is updated to reflect this change as shown in Table V-C-2 below.

Table V-C-2
Estimated Sources and Uses – Major Improvement Bonds and Phase 1 Bonds

	Series 2015 Phase #1 Bonds		Phase #1 Reimbursement Agreement	
Sources of Funds	**Phase #1 Share of Other Major Improvements**	**Phase #1 Improvements**	**Phase #1 Improvements**	**Total**
Estimated Bond par amount	$6,337,479	$7,122,521	$540,000	$14,000,000
Other funding sources	$0	$0	$1,804,537	$1,804,537
Total Sources	**$6,337,479**	**$7,122,521**	**$2,344,537**	**$15,804,537**
Uses of Funds				
Major Improvements				
Road improvements	$1,906,791	$0	$0	$1,906,791
Water distribution system improvements	$317,157	$0	$0	$317,157
Sanitary sewer improvements	$1,402,398	$0	$0	$1,402,398
Storm drainage improvements	$0	$0	$0	$0
Other soft and miscellaneous costs	$839,779	$0	$0	$839,779
Subtotal	**$4,466,125**	**$0**		**$4,466,125**
Phase 1 Improvements				
Road improvements	$0	$2,630,772	$1,228,831	$3,859,604
Water distribution system improvements	$0	$668,661	$312,331	$980,992
Sanitary sewer improvements	$0	$646,267	$301,870	$948,137
Storm drainage improvements	$0	$469,293	$219,207	$688,500
Other soft and miscellaneous costs	$0	$604,364	$282,298	$886,662
Subtotal	**$0**	**$5,019,357**	**$2,344,537**	**$7,363,894**
Estimated Bond issue costs				
Capitalized interest	$795,134	$893,629	$0	$1,688,763
Reserve fund	$481,348	$540,974	$0	$1,022,321
Administrative expenses fund	$24,527	$27,565	$0	$52,092
Other costs of issuance	$570,346	$640,996	**$0**	$1,211,342
Subtotal	**$1,871,354**	**$2,103,164**	**$0**	**$3,974,518**
Total Uses	**$6,337,479**	**$7,122,521**	**$2,344,537**	**$15,804,537**

5.5. Estimated Time of Expenditure

Total improvement costs in the estimated amount of $54,780,198 including the total Project Costs, are anticipated to be expended beginning 2015 through 2021.

5.6 Original Total Appraised Values

According to the Developer, there are four current parcels within the TIRZ boundary. According to the Denton CAD records, the 2015 total market value for the four parcels is $8,925,919. The total acreage of the three current parcels is 423.4 acres.

Table V-D
Original (2015) Appraised Values

Parcel ID	Acreage	2015 Assessed Value[1]
Denton County		
38566	171.3	$2,617,250
38571	54.3	$829,265
147923	52.6	$1,021,497
637957	145.1	$4,457,907
Total	**423.4**	**$8,925,919**

[1]The 2015 assessed value represents the 2015 market value shown in the Denton CAD records for the parcels, although the parcels are classified as agricultural use.

5.7 Duration of the TIRZ

The TIRZ will last for a total of 28 years or until the estimated maximum amount of $23,778,147 representing the prorated amount of total bond obligations and estimated administrative expenses related to the TIRZ Project Costs is expended, whichever occurs earlier. See Appendix D for the detailed calculation of the prorated amount of total bond obligations.

5.8 Projected Market and Assessed Value

As described in the discussion on assessment procedures in the appraisal district, assessed values are based on values as appraised by DCAD, which, in turn, are meant to represent fair market value of the properties. Different property types may be appraised using different methods, as described in Section II of this report. This section of the report includes the estimated assessed value and an explanation of the methodology used for each of the proposed development types of the TIRZ.

Assumptions

The properties are first assumed to be on the tax roll as developed property based on estimates of when the property will be substantially completed. No interim construction values are estimated

in this report. For each property type, this study estimates future absorption based on the projected absorption as provided in the Developer's pro forma.

As stated in Section V, the development plan for the District includes approximately 1,395 residential units. Based on the projected absorption from the developer's pro forma provided to the City, this plan assumes that the residential development will be built-out beginning in 2017 and continuing through 2024.

For purposes of this plan, it is assumed that the project is absorbed at the pace contemplated by the Developer. According to the Developer, the sale of residential units is expected to start in 2017 and continue until the units are fully absorbed by 2024. Accordingly, the residential units are assumed to appear in the tax roll starting January 2018. Refer to Appendix E for detailed annual absorption figures.

5.9. Sales Price Comparison

The projected average base homes prices for the residential units in the development as estimated by the developer are shown in Table V-E.

TABLE V-E
Base Asking Price per Unit

Project/Building	Units	Per Unit
70 ft residential units	269	$285,000
50 ft residential units	1,130	$237,500
Total	**1,399**	

Source: the lot type, estimated units and projected asking prices are provided by the Developer.

While it is possible that home buyers might negotiate the asking price, it is also believed that any discount from the base price will be offset by charges for buyer options such as exterior and interior finish upgrades, premium lot locations, and other potential upgrades. Therefore, this study assumes that units at the subject site achieve the average base asking average prices per unit shown in Table V-E.

5.9. Projected Market and Assessed Value

Based on the projected development and estimated home base asking price per unit outlined in Table V-E, the total projected assessed value for the development is shown in Table V-F. The total values shown in these tables assume full build-out and stabilized values using 2024 dollars. Detailed calculations of values are shown in the attached Appendices F at completion in tax year 2024. This study assumes an inflation rate of 1.70 percent that lies within the range of various compounded annual growth rates of average home values calculated and shown in Table III-A in order to account for the effect of market appreciation.

5.10. Incremental Assessed Values

As described in Section II of this Plan, the State of Texas mandates that property must be assessed at its market value. Projected incremental assessed value at full build-out is shown in Table V-F.

TABLE V-F

Projected Incremental Values at Full Build-Out

Year	Projected Value	Base Value	Incremental Value
2026-27	$547,368,779	($198,765)	$547,170,014

Detailed calculations of incremental values are included in Appendices F and G to this plan.

5.10. Calculation of Incremental Tax Revenue

The increase in property value created within the TIRZ will produce additional real property taxes. In accordance with Texas statute, this incremental revenue is calculated by subtracting the base value from the new total assessed value to get the net incremental value, which is then multiplied by the applicable tax rate to determine the incremental tax revenue. Currently, the tax rate for the City is $0.464000 per $100 assessed value, as described in Section II of this report.

The aggregate base value for properties located within the TIRZ is $198,765 based on the 2021 submissions to the comptroller report 50-806. The property in the TIRZ is estimated to have an assessed value of $547,368,779 in 2026-27 using an assumed inflation rate of 1.70 percent per year through 2026-27. Incremental value is, therefore, estimated to be $547,170,014.

Total projected incremental taxes are as shown in the following calculations.

(Incremental Assessed Value) ÷ 101.7 × (Tax Rate) = Incremental Real Property Tax

$547,170,014 ÷ 101.7 × $0.464000 = $2,538,891

Appendices F and G include detailed calculations of projected incremental taxes and the amounts projected to be made available by the City for the TIRZ related bond payments.

Section II of this report describes various exemptions and credits that are available to certain properties within the City. For the purposes of this report, no credits are assumed to pertain to the property within the TIRZ. Therefore, total estimated tax increment revenues at full build-out of Phase 1 are as shown in Table V-G.

TABLE V-G

Projected Incremental Taxes

Year	Annual Incremental Taxes starting 2026-27 [1]	Cumulative Total Through Calendar Year 2045
2026-27	$2,538,891	$69,707,268

[1]Full build-out anticipated to occur in calendar year 2026-27.

Detailed calculations of these figures are included in the attached Appendices F and G.

Pursuant to the TIRZ ordinance, the City had originally committed to use 64.73% of the incremental taxes for the payment of a portion of the debt service on the PID Bonds that have been issued to finance the Project Costs described in this Project and Finance Plan.

Pursuant to the TIRZ ordinance amending the Amended Plan, the City has committed to use 38.75% of the incremental taxes for the payment of a portion of the debt service on the PID Bonds that have been issued to finance the Project Costs described in this Project and Finance Plan. As a result, the total estimated tax increment revenues available for the payment of debt service at full build-out are as shown below in Table V-H.

TABLE V-H

Projected Incremental Taxes available for TIRZ Projects

Year	Full Annual Incremental Taxes available starting 2026-27	Total Annual Incremental Taxes available for payment of PID Bond debt service payment
2026-27	$983,820	$27,400,776

5.11. Plan Feasibility

As explained in the previous sections of this plan, the development is proposed to be developed on a vacant land. As shown in Table V-D, the current aggregate assessed value of the property in the development is $198,765 (shown in submissions to the comptroller report 50-806).

Projected Absorption and Projected Build-out Total Home Values

The development is projected to be fully built-out by 2026-27 based on the preliminary absorption estimated by the Developer. Phase 1 is fully built out. Phase 2 is fully built out. Phase 3 is anticipated to be fully built out in 2026-27.

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Table V-I

Estimated Build-out by Current and Future Phases

Phase	Estimated Build out year	No of Units	Cumulative No. of Units
1	2019-20	459	459
2 and 3	2026-27	940	1,399

Note: Phase 2 and 3 are shown together as Phase 3 is anticipated to commence in 2021 before Phase 2 is fully built out.

The detailed absorption is presented in Appendix E as estimated by the Developer for each Lot Type.

The aggregate home value of the homes planned to be built in Phase 1 of the District is estimated to be $134.7 million based on the estimated absorption and projected home values provided by the Developer by 2026-27. The aggregate home value of the homes planned to be built in Phases 2 and 3 of the District is estimated to be $272.5 million by 2026-27. Such amounts are calculated using the initial estimated home values for each Lot Type with 1.70 percent estimated annual increases in value. Table IV-J below shows the estimated total home values by Phase in 2026-27.

Table V-J

Estimated Build-out by Current and Future Phases

Phase	No of Units	Estimated Build out year	Projected Taxable Values in 2026-27
1	459	2019-20	$134,763,156
2 and 3	940	2024-25	$273,630,048
Total	1,399		$408,393,644

Assuming the development is completed as planned, the proposed development is projected to generate an aggregate of $55,742,765 over 30 years as shown in Table V-G in incremental taxes under a 1.70 estimated annual appreciation scenario. 45.2% of such annual TIRZ incremental revenues generated up to a maximum total amount of $25,216,804 are committed to be used for the payment of debt service on the PID Bonds used to finance the TIRZ Projects while the TIRZ is in existence As a result, the proposed plan of financing the project costs appears feasible.

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6. ASSUMPTION AND LIMITATIONS

The valuation of property for real property tax purposes is determined by the CADs. This plan attempts to estimate how the CAD may estimate the value of the subject properties in the future. The values estimated by the CAD will almost certainly differ from the estimates included in this report. Values can change significantly over time, and these changes can be significantly higher or lower than values in previous years. Determining property values for tax purposes is not as straight forward or as simple as the analysis in this report. Many factors not considered in this report may impact actual future values. Furthermore, property values are not likely to be consistent from year to year.

The DCAD often relies on market data to estimate the value of property. Property values can be appealed, competition can be greater, national or local market conditions can change; in short, there are many factors that can affect the valuation of property. These factors make the projection of future values an imprecise exercise. The successful development of the subject properties is critical to the values estimated in the report.

This report has assumed property taxes are paid as due. This study does not include an analysis to determine if the owners of property within the TIRZ will be able or willing to pay property taxes or if the tax collector will be able to collect unpaid taxes. The actual delinquencies in the payment of real property taxes in the TIRZ will likely be different than assumed in this report and a significant increase in the failure to pay property taxes would materially affect the tax increment revenues available for debt service on the bonds.

This report estimates future tax increment revenues based on current real property tax rates. Scenarios do not assume real property tax rates in the future will be different than tax rates for fiscal year 2023-24. Real property tax rates have varied over the years and have declined over the years. Real property tax rates will likely vary significantly in future years and be different than assumed in this report and a significant decrease in real property tax rates could materially affect the tax increment revenues available for debt on the bonds.

This report includes projections of tax increment revenues based on zero percent annual appreciation for real property. Changes in values will not be consistent from year to year. Future values are estimated based on values in 2024. Values in any future year may be less than values in 2024.

This report assumes that the subject properties will be developed as projected in this report. A delay in the development of properties or changes to the program of development would reduce tax increment revenues during the years of the delay and could result in there being inadequate tax increment revenues to pay debt service on the bonds. No analysis has been conducted to determine if the subject properties are likely to be developed as projected.

Numerous sources of information were relied on in the preparation of this report. These sources are believed to be reliable; however, no effort has been made to verify information obtained from other sources.

In summary, this report necessarily incorporates numerous estimates and assumptions with respect to property performance, general and local business and economic conditions, the absence of material changes in the competitive environment and other matters. Some estimates or assumptions will inevitably not materialize and unanticipated events and circumstance will occur. As a result, actual results will vary from the estimates in this report and the variations may be material.

Other assumptions made in the preparation of this report and limiting conditions to this report are as follows:

1. There are no zoning, building, safety, environmental or other federal, state, or local laws, regulations, or codes that would prohibit or impair the development, marketing or operation of the subject properties in the manner contemplated in this report, and the subject properties will be developed, marketed and operated in compliance with all applicable laws, regulations, and codes.

2. No material changes will occur in (a) any federal, state or local law, regulation or code affecting the subject properties or (b) any federal, state or local grant, financing or other program to be utilized in connection with the subject properties.

3. The local, national and international economies will not deteriorate and there will be no significant changes in interest rates or in rates of inflation or deflation.

4. The subject properties will be served by adequate transportation, utilities and governmental facilities.

5. The subject properties will not be subjected to any war, energy crises, embargo, strike, earthquake, flood, fire or other casualty or act of God.

6. The subject properties will be developed, marketed, and operated in a highly professional manner.

7. There are no existing, impending or threatened litigation that could hinder the development, marketing, or operation of the subject properties.

8. MuniCap, Inc. does not have expertise in and has no responsibility for legal, environmental, architectural, geologic, engineering, and other matters related to the development and operation of the subject properties.

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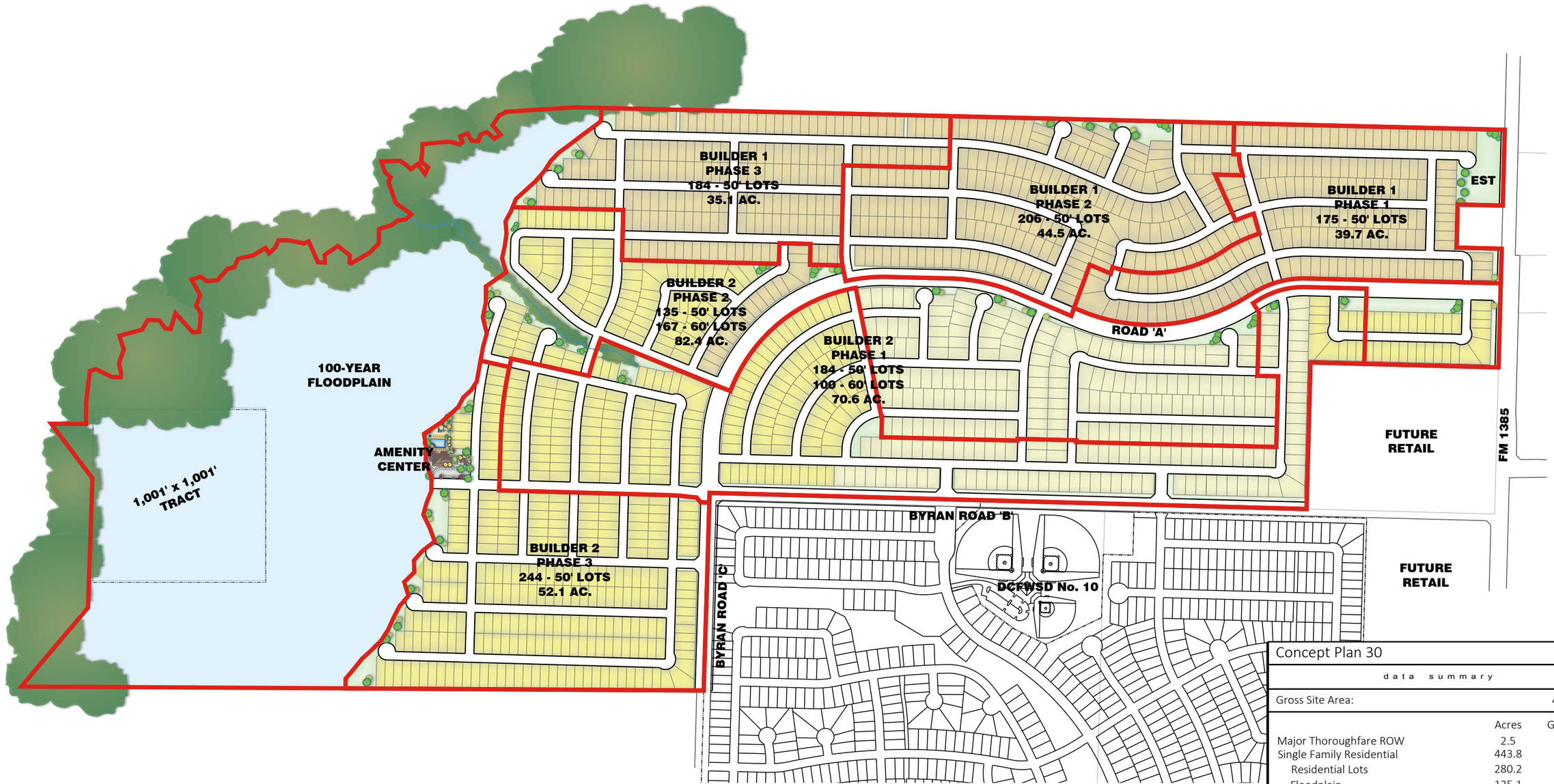
7. LIST OF EXHIBITS

Unless otherwise stated, all references to "Exhibits" contained in this Amended Plan shall mean and refer to the following exhibits, all of which are attached to and made a part of this Amended Plan for all purposes.

Exhibit A	Map of the Property and TIRZ Zone
Exhibit B	Estimated Nonproject Costs
Exhibit C	Estimated Project Costs
Exhibit D	Bond Debt Service Schedule
Exhibit E	Projected Absorption
Exhibit F	Projected Assessed Values
Exhibit G	Projected Incremental Real Estate Taxes
Exhibit H	Development Standards

EXHIBIT A
MAP OF THE PROPERTY AND TIRZ ZONE



Residential Product Type:	Lots
Home Builder 1	
50' x 120' Lots	565
Home Builder 2	
50' x 120' Lots	563
60' x 120' Lots	267
Total Builder 2 Lots	830

Concept Plan 30

data summary

	Acres	Gross %
Gross Site Area:		446.3
Major Thoroughfare ROW	2.5	1%
Single Family Residential	443.8	99%
Residential Lots	280.2	66%
Floodplain	125.1	28%
Open Space	17.8	4%
Elevated Storage Tank Area	1.5	1%
Amenity Center	1.4	1%

Residential Product Type:	Lots	Density
50' x 120' Lots	1128	
60' x 120' Lots	267	
Total Lots	1395	3.1:1

The Jackson Ridge Development does not exceed 4.25 units per gross acre and provides a minimum 10% of open space for the entire development.

CENTURION AMERICAN

MASTER PLAN
JACKSON RIDGE DEVELOPMENT
AUBREY ETJ/ PROSPER ETJ, DENTON COUNTY, TEXAS

N
SCALE: 1"=600'

PETITT BARRAZA LLC
ENGINEERING PLANNING SURVEYING

DATE: JUNE, 2015

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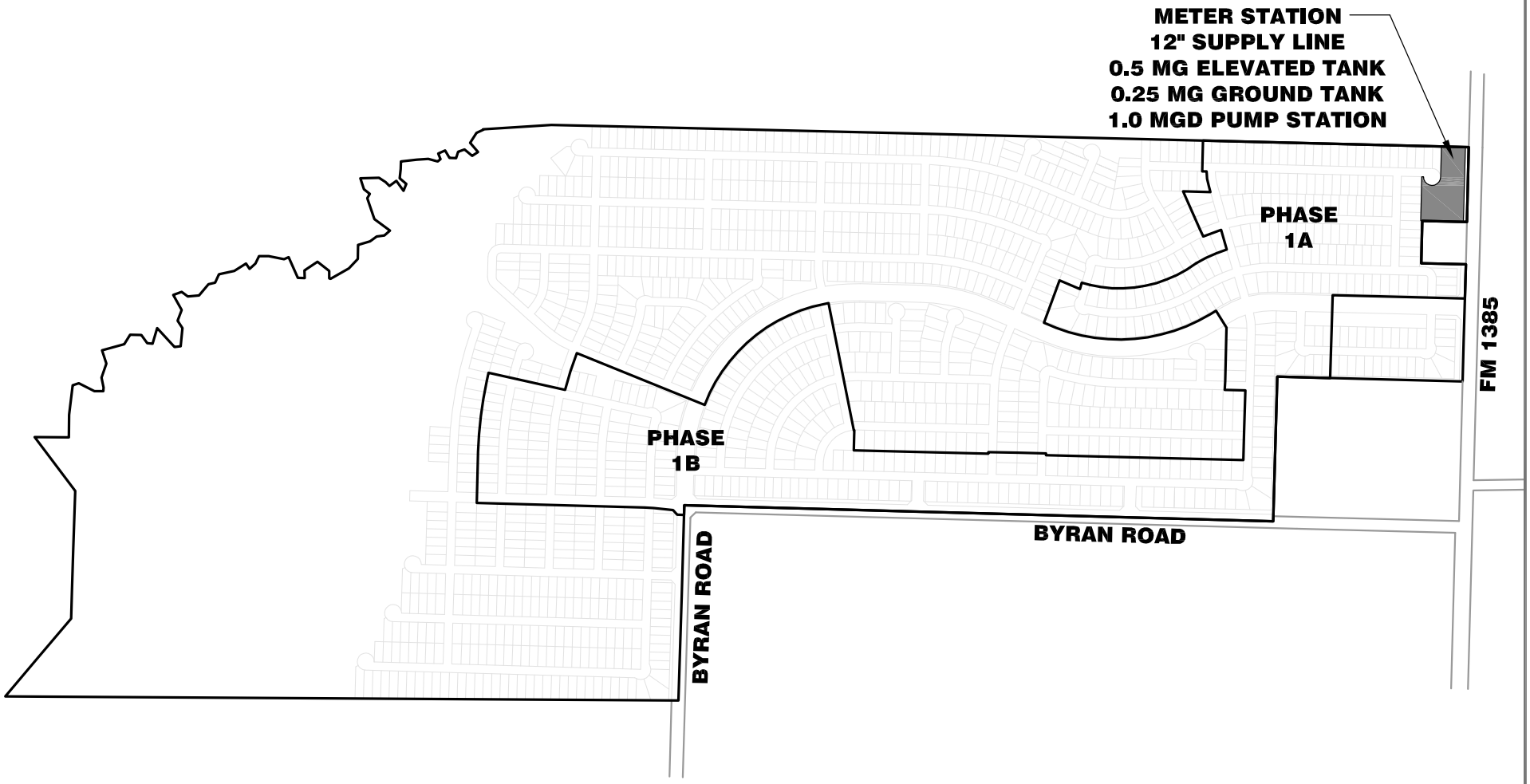

MAJOR CITY WATER IMPROVEMENTS
JACKSON RIDGE DEVELOPMENT
CITY OF AUBREY, DENTON COUNTY, TEXAS

N
SCALE: NTS

PETITT BARRAZA LLC
ENGINEERING PLANNING SURVEYING

DATE: JULY, 2015

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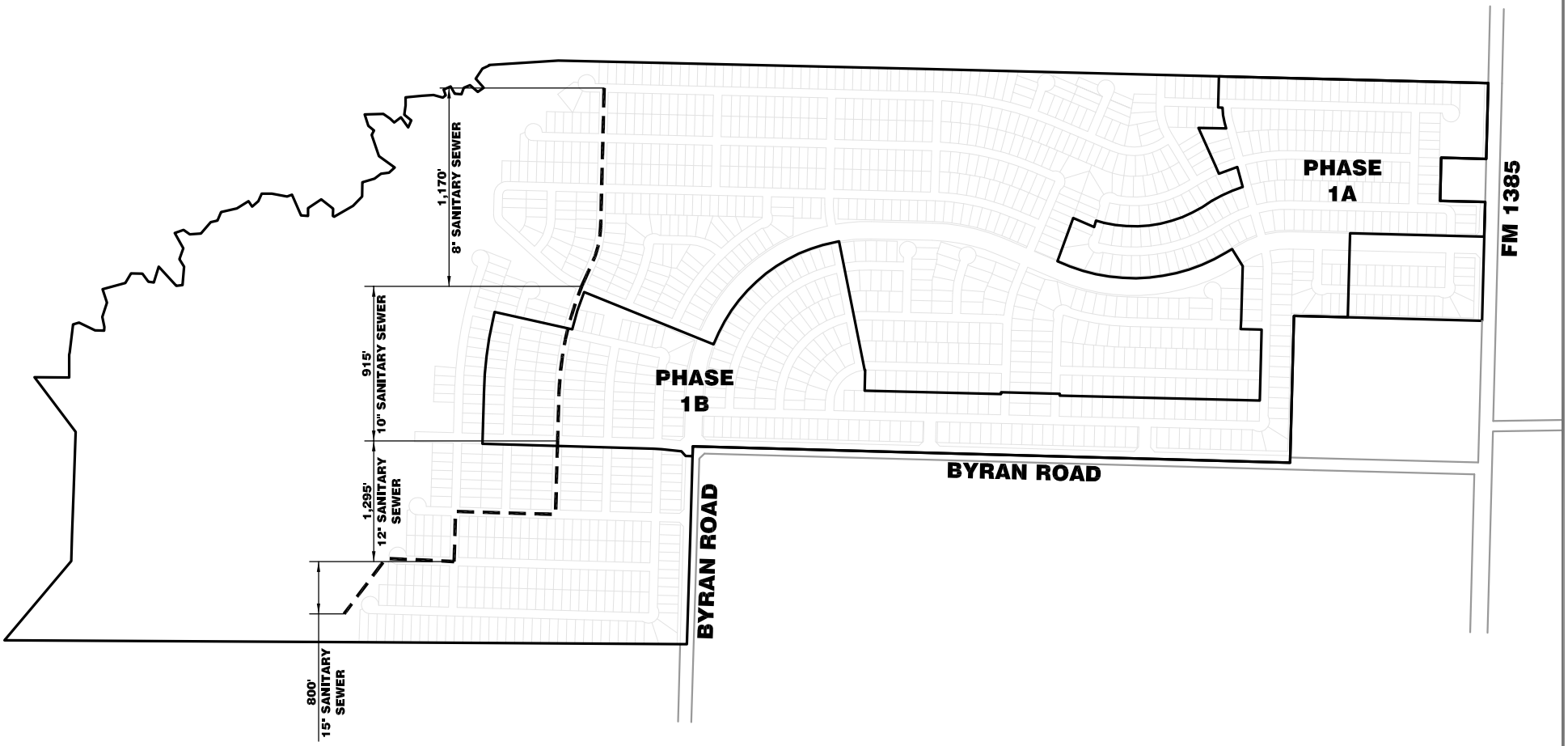

MAJOR SANITARY SEWER IMPROVEMENTS
JACKSON RIDGE DEVELOPMENT
CITY OF AUBREY, DENTON COUNTY, TEXAS

N
SCALE: NTS

PETITT BARRAZA LLC
ENGINEERING PLANNING SURVEYING

DATE: JULY, 2015

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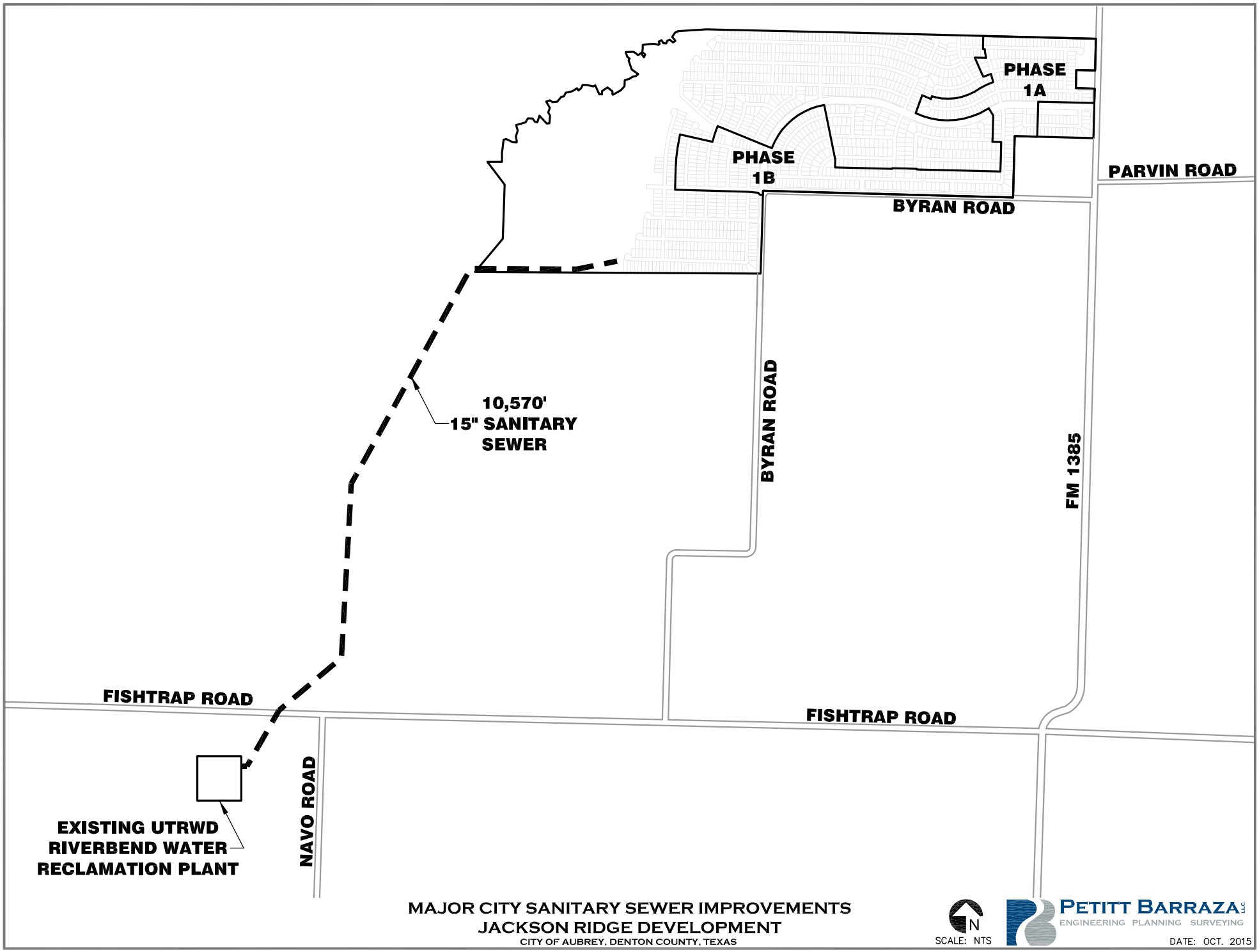

MAJOR CITY SANITARY SEWER IMPROVEMENTS
JACKSON RIDGE DEVELOPMENT
CITY OF AUBREY, DENTON COUNTY, TEXAS

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EXHIBIT B
ESTIMATED NONPROJECT COSTS

Estimated Nonproject Costs

Authorized Improvement	Estimated Costs				
	Total Estimated Authorized Improvement Cost	City Major Improvements to be funded with Series 2015 Major Improvement Improvement Bond	Other Major Improvements to be funded with Series 2015 Major Improvement Improvement Bond	Phase 1 Improvements to be funded with Series 2015 Phase #1 Improvement Bond	Future Phase Improvements to be funded with Future Bonds (For information purposes only)
Road Improvements					
Paving, excavation & erosion control	$ 14,039,410	$0	$2,963,770	$3,859,604	$7,216,037
Water Improvements					
Water distribution system improvements	$ 6,860,088	$3,692,625	$237,356	$980,992	$1,949,116
Sanitary Sewer Improvements					
Sewer collection system improvements	$ 7,245,705	$4,055,122	$368,275	$948,137	$1,874,171
Storm Drainage Improvements					
Storm drainage collection system improvements	$ 2,092,500	$0		$688,500	$1,404,000
Other Improvements					
Screening, trail system & amenity improvements	$ 3,155,030	$0		$0	$3,155,030
Subtotal Construction Cost	**$33,392,734**	**$7,747,747**	**$3,569,401**	**$6,477,232**	**$15,598,353**
Soft Costs					
Engineering, Design & Surveying fees	$2,985,213	$822,492	$422,722	$572,800	$1,167,200
Inspection Fees	$763,446	$94,399	$101,430	$194,317	$373,300
Geotechnical and Materials Testing	$497,156	$51,125	$67,620	$129,545	$248,866
Subtotal Soft Cost	**$4,245,815**	**$968,015**	**$591,772**	**$896,662**	**$1,789,366**
Grand Total Constuction + Soft Costs	**$37,638,549**	**$8,715,762**	**$4,161,173**	**$7,373,894**	**$17,387,720**
Estimated Bond issuance related costs					
Deposits to Debt Service Reserve Fund					
Deposits to Capitalized Interest					
Other costs of issuance					
Total estimated Bond issuance related costs	**$0**	**$0**	**$0**	**$0**	**$0**
TOTAL AUTHORIZED IMPROVEMENT COSTS	**$37,638,549**	**$8,715,762**	**$4,161,173**	**$7,373,894**	**$17,387,720**

Estimated Nonproject Costs

Improvement	Developer Funded Estimated Costs				
	Total Estimated Improvement Cost	City Major Improvements to be funded by Developer	Other Major Improvements to be funded by Developer	Phase 1 Improvements to be funded by Developer	Future Phase Improvements to be funded by Developer (For information purposes only)
Developer Funded Improvements					
Lot preparation, retaining walls & franchise utilities	**$ 8,732,700**	$0	$0	$2,873,340	$5,859,360
Soft Costs					
Engineering, Design & Surveying fees	$460,500	$ -	$ -	$ 151,700	$ 308,800
Inspection Fees (3%)	$178,281	$ -	$ -	$ 58,660	$ 119,621
Geotechnical and Materials Testing (2%)	$118,854	$ -	$ -	$ 39,107	$ 79,747
Subtotal Soft Costs	**$757,635**	**$0**	**$0**	**$249,467**	**$508,168**
TOTAL DEVELOPER FUNDED IMPROVEMENTS	**$ 9,490,335**	**$ -**	**$ -**	**$ 3,122,807**	**$ 6,367,528**
TOTAL ESTIMATED IMPROVEMENT COSTS	**$ 47,128,884**	**$ 8,715,762**	**$ 4,161,173**	**$ 10,496,701**	**$ 23,755,248**

BOND ISSUANCE COSTS	Total	Series 2015 Major Improvement Bonds	Series 2015 Phase #1 Bonds	
Capitalized Interest Fund	$3,152,878	$1,464,115	$1,688,763	
Debt Service Reserve Fund	$1,959,087	$936,766	$1,022,321	
Developer Startup Costs	$711,450	$307,650	$403,800	
Underwriter's discount	$569,300	$245,114	$324,186	
Other costs of issuance	$1,258,600	$723,152	$535,448	
TOTAL BOND ISSUANCE COSTS	**$7,651,314**	**$3,676,797**	**$3,974,518**	
TOTAL ESTIMATED IMPROVEMENT COSTS	**$54,780,198**	**$16,553,732**	**$14,471,219**	**$23,755,248**

THIS ESTIMATE HAS BEEN COMPLETED ON LIMITED INFORMATION AND SHOULD BE USED FOR PROJECT EVALUATION. PRIOR TO MAKING FINANCIAL COMMITMENTS BASED ON THIS ESTIMATE, THESE NUMBERS SHOULD BE VERIFIED BY PETITT BARRAZA LLC.

PROJECT NAME:	**JACKSON RIDGE**	ACREAGE:	320.9	NO. OF LOTS:	1395
MAJOR IMPROVEMENTS:	CITY	CREATED:	6/15/2015	BY	CDH
CITY:	AUBREY	REVISED:	8/18/2015	CHECKED:	AB
JOB NUMBER:	12031-00	REVISED:	9/8/2015	ROADWAY LF:	NA
UTIL. PROVIDER:	AUBREY	REVISED:	10/16/2015	FILE NAME:	Concept 33

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*		*UNIT PRICE*		*TOTAL AMOUNT*
C. PHASE 1 CITY SEWER SYSTEM IMPROVEMENTS						
12INCH OFFSITE SANITARY SEWER	LF	10,570	$	95.83	$	1,012,966
LAND RIGHTS	LS	1	$	182,500.00	$	182,500
15INCH OFFSITE SANITARY SEWER OVERSIZE COST	LS	1	$	489,956.00	$	489,956
UTRWD RIVERBEND EXPANSION COST SHARE	MGD	0.320	$	6,500,000.00	$	2,080,000
CITY SEWER & WATER CCN ACQUISITION	EA	1	$	579,400.00	$	289,700
SUB - TOTAL						**$ 4,055,122**
D. PROFESSIONAL & MISCELLANEOUS FEES						
ENGINEERING, DESIGN & SURVEYING FEES	%	25%	$	1,012,966	$	253,242
GEOTECHNICAL AND MATERIALS TESTING	%	2%	$	1,012,966	$	20,259
INSPECTION FEES	%	3%	$	1,012,966	$	30,389
SUB - TOTAL						**$ 303,890**

THIS ESTIMATE HAS BEEN COMPLETED ON LIMITED INFORMATION AND SHOULD BE USED FOR PROJECT EVALUATION. PRIOR TO MAKING FINANCIAL COMMITMENTS BASED ON THIS ESTIMATE, THESE NUMBERS SHOULD BE VERIFIED BY PETITT BARRAZA LLC.

PROJECT NAME:	**JACKSON RIDGE**	ACREAGE:	324.1	NO. OF LOTS:	1395
MAJOR IMPROVEMENTS:	OTHER	CREATED:	6/15/2015	BY	CDH
CITY:	AUBREY	REVISED:	8/18/2015	CHECKED:	AB
JOB NUMBER:	12031-00	REVISED:	9/8/2015	ROADWAY LF:	9,005
UTIL. PROVIDER:	AUBREY	REVISED:	10/16/2015	FILE NAME:	Concept 33

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*		*UNIT PRICE*		*TOTAL AMOUNT*
A. PAVING - ROAD 'A' - 5,545 LF						
CONNECT TO EX. PAVEMENT	EA	2	$	350.00	$	700
6" LIME STABILIZED SUBGRADE PREPARATION	SY	25,877	$	3.50	$	90,568
LIME FOR SUBGRADE PREPARATION (36LBS/SY)	TON	470	$	150.00	$	70,500
100' ROW, 3 LANE UNDIVIDED (8-INCH, 3,600 PSI)	SY	24,645	$	40.00	$	985,780
BARRIER FREE RAMPS	EA	22	$	2,100.00	$	46,200
5" - 4' REINFORCED CONCRETE SIDEWALK	SY	4,929	$	55.00	$	271,089
4' WIDE CURLEX EROSION CONTROL MATTING	LF	11,090	$	0.75	$	8,318
COMBO STREET NAME & STOP SIGN	EA	2	$	1,300.00	$	2,600
STORM SEWER SYSTEM	LF	5,545	$	50.00	$	277,250
SUB - TOTAL					**$**	**1,753,005**
B. PAVING - 1/2 ROAD 'B' - 3,460 LF						
CONNECT TO EX. PAVEMENT	EA	2	$	350.00	$	700
6" LIME STABILIZED SUBGRADE PREPARATION	SY	10,188	$	3.50	$	35,657
LIME FOR SUBGRADE PREPARATION (36LBS/SY)	TON	190	$	150.00	$	28,500
1/2 OF 80' ROW, 4 LANE UNDIVIDED (8-INCH, 3,600 PSI)	SY	9,611	$	40.00	$	384,448
BARRIER FREE RAMPS	EA	5	$	2,100.00	$	10,500
5" - 4' REINFORCED CONCRETE SIDEWALK	SY	1,538	$	55.00	$	84,578
4' WIDE CURLEX EROSION CONTROL MATTING	LF	3,460	$	0.75	$	2,595
COMBO STREET NAME & STOP SIGN	EA	3	$	1,300.00	$	3,900
STORM SEWER SYSTEM	LF	3,460	$	25.00	$	86,500
SUB - TOTAL					**$**	**637,378**
C .PAVING - 1/2 ROAD 'C' - 1,150 LF						
CONNECT TO EX. PAVEMENT	EA	2	$	350.00	$	700
6" LIME STABILIZED SUBGRADE PREPARATION	SY	2,811	$	3.50	$	9,839
LIME FOR SUBGRADE PREPARATION (36LBS/SY)	TON	60	$	150.00	$	9,000
1/2 OF 100' ROW, 3 LANE UNDIVIDED (8-INCH, 3,600 PSI)	SY	2,556	$	40.00	$	102,224
BARRIER FREE RAMPS	EA	3	$	2,100.00	$	6,300
5" - 4' REINFORCED CONCRETE SIDEWALK	SY	511	$	55.00	$	28,111
4' WIDE CURLEX EROSION CONTROL MATTING	LF	1,150	$	0.75	$	863
COMBO STREET NAME & STOP SIGN	EA	2	$	1,300.00	$	2,600
STORM SEWER SYSTEM	LF	1,150	$	25.00	$	28,750
SUB - TOTAL					**$**	**188,387**

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PROJECT NAME:	**JACKSON RIDGE**	ACREAGE:	324.1	NO. OF LOTS:	1395
MAJOR IMPROVEMENTS:	OTHER	CREATED:	6/15/2015	BY	CDH
CITY:	AUBREY	REVISED:	8/18/2015	CHECKED:	AB
JOB NUMBER:	12031-00	REVISED:	9/8/2015	ROADWAY LF:	9,005
UTIL. PROVIDER:	AUBREY	REVISED:	10/16/2015	FILE NAME:	Concept 33

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*		*UNIT PRICE*		*TOTAL AMOUNT*
D. PAVING - FM 1385 TURN LANES						
FM 1385 LEFT TURN LANES	EA	1	$	385,000.00	$	385,000
SUB - TOTAL					**$**	**385,000**
E. WATER SYSTEM						
CONNECT TO EXIST. WATER LINE (Remove Plug & Connect)	EA	1	$	900.00	$	900
12" P.V.C. WATERLINE	LF	4,920	$	40.00	$	196,800
12" GATE VALVE & BOX	EA	14	$	2,200.00	$	30,800
TRENCH SAFETY	LF	4,920	$	0.80	$	3,936
TESTING (EXCLUDING GEOTECH)	LF	4,920	$	1.00	$	4,920
SUB - TOTAL					**$**	**237,356**
F. SANITARY SEWER SYSTEM						
CONNECT TO EXIST. SEWER LINE	EA	1	$	500.00	$	500
12" P.V.C. PIPE (SDR 35: 0' to 11.5' Depth)	EA	6,250	$	40.00	$	250,000
5' DIAMETER DROP MANHOLE W/RAIN PANS	EA	22	$	4,700.00	$	103,400
TESTING (EXCLUDING GEOTECH)	LF	6,250	$	1.50	$	9,375
TRENCH SAFETY	LF	6,250	$	0.80	$	5,000
SUB - TOTAL					**$**	**368,275**
G. PROFESSIONAL & MISCELLANEOUS FEES						
ENGINEERING, SURVEYING & TESTING	%	12%	$	3,381,014	$	405,722
BIDDING and LETTING	EA	1	$	10,000	$	10,000
SWPPP ADMINISTRATION	LS	1	$	7,000	$	7,000
CONSTRUCTION INSPECTION	%	3%	$	3,381,014	$	101,430
MATERIAL TESTING	%	2%	$	3,381,014	$	67,620
SUB - TOTAL					**$**	**591,772**

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PROJECT NAME:	**JACKSON RIDGE**	ACREAGE:	110.3	NO. OF LOTS:	459
ON-SITE FACILITIES:	PHASE 1	CREATED:	6/15/2015	BY:	CDH
CITY:	AUBREY	REVISED:	8/18/2015	CHECKED:	AB
JOB NUMBER:	12031-00	REVISED:	9/8/2015	ROADWAY LF:	19,777
UTIL. PROVIDER:	AUBREY	REVISED:	10/16/2015	FILE NAME:	Concept 33

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*		*UNIT PRICE*		*TOTAL AMOUNT*
A. ROADWAY IMPROVEMENTS						
R.O.W. CLEARING & GRUBBING (1/4 Area Heavily Treed)	ACRE	110	$	2,000.00	$	220,600
CONSTRUCTION ENTRANCE	EA	1	$	2,000.00	$	2,000
SILT FENCE	LF	22,316	$	1.50	$	33,474
UNCLASSIFIED EXCAVATION OF STREET R.O.W.	CY	204,255	$	2.20	$	449,361
OVER SEEDING DISTURBED AREAS	ACRE	66	$	500.00	$	33,000
STREET PREPARATION (3' MOISTURE CONDITIONING)	CY	92,120	$	2.75	$	253,330
6" LIME STABILIZED SUBGRADE PREPARATION	SY	74,304	$	3.50	$	260,064
LIME FOR SUBGRADE PREPARATION (36LBS/SY)	TON	1,350	$	150.00	$	202,500
31' B-B CONC. PAVEMENT (6-INCH, 3,600 PSI)	SY	64,835	$	30.00	$	1,945,050
37' B-B CONC. PAVEMENT (6-INCH, 3,600 PSI)	SY	5,016	$	40.00	$	200,640
BARRIER FREE RAMPS	EA	53	$	1,200.00	$	63,600
4' REINFORCED CONCRETE SIDEWALK (5-INCH)	SY	444	$	55.00	$	24,420
4' WIDE CURLEX EROSION CONTROL MATTING	LF	40,086	$	0.75	$	30,065
COMBO STREET NAME & STOP SIGN	EA	30	$	1,300.00	$	39,000
STREET LIGHTS (Standard Lights)	EA	41	$	2,500.00	$	102,500
SUB - TOTAL					**$**	**3,859,604**
B. WATER SYSTEM						
CONNECT TO EXIST. WATER LINE (Remove Plug & Connect)	EA	1	$	900.00	$	900
8" P.V.C. WATERLINE	LF	17,882	$	22.00	$	393,404
8" GATE VALVE & BOX	EA	53	$	1,400.00	$	74,200
FIRE HYDRANT ASSEMBLY (INCLUDING 6" GATE VALVE)	EA	60	$	4,000.00	$	240,000
1" SINGLE WATER SERVICE	EA	459	$	500.00	$	229,500
TRENCH SAFETY	LF	17,882	$	0.80	$	14,306
TESTING (EXCLUDING GEOTECH)	LF	17,882	$	1.00	$	17,882
1" IRRIGATION WATER SERVICE (To Green Space)	EA	12	$	900.00	$	10,800
SUB - TOTAL					**$**	**980,992**

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PROJECT NAME:	**JACKSON RIDGE**	ACREAGE:	110.3	NO. OF LOTS:	459
ON-SITE FACILITIES:	PHASE 1	CREATED:	6/15/2015	BY:	CDH
CITY:	AUBREY	REVISED:	8/18/2015	CHECKED:	AB
JOB NUMBER:	12031-00	REVISED:	9/8/2015	ROADWAY LF:	19,777
UTIL. PROVIDER:	AUBREY	REVISED:	10/16/2015	FILE NAME:	Concept 33

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*		*UNIT PRICE*		*TOTAL AMOUNT*
C. SANITARY SEWER SYSTEM						
CONNECT TO EXIST. SEWER LINE	EA	1	$	500.00	$	500
8" P.V.C. PIPE (SDR 35: 0' to 11.5' Depth)	LF	17,140	$	25.00	$	428,500
4' DIAMETER MANHOLE W/RAIN PANS	EA	48	$	2,700.00	$	129,600
5' DIAMETER MANHOLE W/RAIN PANS	EA	9	$	3,800.00	$	34,200
STANDARD CLEANOUTS	EA	1	$	875.00	$	875
4" SINGLE SEWER SERVICE	EA	459	$	600.00	$	275,400
WATER CROSSING PER TCEQ REQUIREMENTS	EA	30	$	750.00	$	22,500
TESTING (EXCLUDING GEOTECH)	LF	17,140	$	1.50	$	25,710
ADDITIONAL TESTING AFTER DRY UTIL INSTALL	LF	17,140	$	1.00	$	17,140
TRENCH SAFETY	LF	17,140	$	0.80	$	13,712
SUB - TOTAL					**$**	**948,137**
D. STORM DRAINAGE SYSTEM						
BASED ON AVERAGE COST PER LOT	EA	459	$	1,500.00	$	688,500
SUB - TOTAL					**$**	**688,500**

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PROJECT NAME:	**JACKSON RIDGE**	ACREAGE:	110.3	NO. OF LOTS:	459
ON-SITE FACILITIES:	PHASE 1	CREATED:	6/15/2015	BY:	CDH
CITY:	AUBREY	REVISED:	8/18/2015	CHECKED:	AB
JOB NUMBER:	12031-00	REVISED:	9/8/2015	ROADWAY LF:	19,777
UTIL. PROVIDER:	AUBREY	REVISED:	10/16/2015	FILE NAME:	Concept 33

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*	*UNIT PRICE*	*TOTAL AMOUNT*
E. LOT PREPARATION				
LOT GRADING (ROUGH)	LOT	459	$ 200.00	$ 91,800
LOT GRADING (FINAL)	LOT	459	$ 100.00	$ 45,900
MOISTURE CONDITIONING LOTS 8' BELOW FINAL GRADE	LOT	459	$ 2,500.00	$ 1,147,500
WRAP LOTS w/ 6 MIL PLASTIC SHEETING	LOT	459	$ 460.00	$ 211,140
SUB - TOTAL, DEVELOPER COST				**$ 1,496,340**
F. RETAINING WALLS				
RETAINING WALL (4' Top of Wall to Bottom of Wall)	LOT	459	$ 1,000.00	$ 459,000
SUB - TOTAL, DEVELOPER COST				**$ 459,000**
G. FRANCHISE UTILITIES				
ELECTRIC SERVICE	LOT	459	$ 1,000.00	$ 459,000
GAS SERVICE	LOT	459	$ 1,000.00	$ 459,000
SUB - TOTAL, DEVELOPER COST				**$ 918,000**

NOTES FUNDED DEVELOPER ITEMS

H. PROFESSIONAL & MISCELLANEOUS FEES				
ENGINEERING & SURVEYING	LOT	459	$ 1,500	$ 688,500
BIDDING and LETTING	EA	3	$ 10,000	$ 30,000
SWPPP ADMINISTRATION	LS	1	$ 6,000	$ 6,000
CONSTRUCTION INSPECTION	%	3%	$ 8,432,572	$ 252,977
MATERIAL TESTING	%	2%	$ 8,432,572	$ 168,651
SUB - TOTAL				**$ 1,146,129**
I. PID DIRECT PROFESSIONAL & MISC. FEES				
ENGINEERING & SURVEYING	LOT	459	$ 1,200	$ 550,800
BIDDING and LETTING	EA	2	$ 10,000	$ 20,000
SWPPP ADMINISTRATION	LS	1	$ 2,000	$ 2,000
CONSTRUCTION INSPECTION	%	3%	$ 6,477,232	$ 194,317
MATERIAL TESTING	%	2%	$ 6,477,232	$ 129,545
SUB - TOTAL				**$ 896,662**

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PROJECT NAME:	**JACKSON RIDGE**	ACREAGE:	324.1	NO. OF LOTS:	1395
ON-SITE FACILITIES:	FUTURE PHASES	CREATED:	6/15/2015	BY:	CDH
CITY:	AUBREY	REVISED:	8/18/2015	CHECKED:	AB
JOB NUMBER:	12031-00	REVISED:	8/26/2015	ROADWAY LF:	57,133
UTIL. PROVIDER:	AUBREY	REVISED:	10/16/2015	FILE NAME:	Concept 33

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*		*UNIT PRICE*		*TOTAL AMOUNT*
A. ROADWAY IMPROVEMENTS						
R.O.W. CLEARING & GRUBBING (1/4 Area Heavily Treed)	ACRE	213.8	$	2,000.00	$	427,600
CONSTRUCTION ENTRANCE	EA	2	$	2,000.00	$	4,000
SILT FENCE	LF	41,209	$	1.50	$	61,814
UNCLASSIFIED EXCAVATION OF STREET R.O.W.	CY	416,520	$	2.20	$	916,344
OVER SEEDING DISTURBED AREAS	ACRE	134	$	500.00	$	67,000
STREET PREPARATION (3' MOISTURE CONDITIONING)	CY	169,229	$	2.75	$	465,380
6" LIME STABILIZED SUBGRADE PREPARATION	SY	136,260	$	3.50	$	476,910
LIME FOR SUBGRADE PREPARATION (36LBS/SY)	TON	2,470	$	150.00	$	370,500
31' B-B CONC. PAVEMENT (6-INCH, 3,600 PSI)	SY	126,394	$	30.00	$	3,791,820
37' B-B CONC. PAVEMENT (6-INCH, 3,600 PSI)	SY	1,624	$	40.00	$	64,960
BARRIER FREE RAMPS	EA	121	$	1,200.00	$	145,200
4' REINFORCED CONCRETE SIDEWALK (5-INCH)	SY	1,785	$	55.00	$	98,175
4' WIDE CURLEX EROSION CONTROL MATTING	LF	74,180	$	0.75	$	55,635
COMBO STREET NAME & STOP SIGN	EA	64	$	1,300.00	$	83,200
STREET LIGHTS (Standard Lights)	EA	75	$	2,500.00	$	187,500
SUB - TOTAL					**$**	**7,216,037**
B. WATER SYSTEM						
CONNECT TO EXIST. WATER LINE (Remove Plug & Connect)	EA	2	$	900.00	$	1,800
8" P.V.C. WATERLINE	LF	34,862	$	22.00	$	766,964
8" GATE VALVE & BOX	EA	121	$	1,400.00	$	169,400
FIRE HYDRANT ASSEMBLY (INCLUDING 6" GATE VALVE)	EA	116	$	4,000.00	$	464,000
1" SINGLE WATER SERVICE	EA	936	$	500.00	$	468,000
TRENCH SAFETY	LF	34,862	$	0.80	$	27,890
TESTING (EXCLUDING GEOTECH)	LF	34,862	$	1.00	$	34,862
1" IRRIGATION WATER SERVICE (To Green Space)	EA	18	$	900.00	$	16,200
SUB - TOTAL					**$**	**1,949,116**

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PROJECT NAME:	**JACKSON RIDGE**	ACREAGE:	324.1	NO. OF LOTS:	1395
ON-SITE FACILITIES:	FUTURE PHASES	CREATED:	6/15/2015	BY:	CDH
CITY:	AUBREY	REVISED:	8/18/2015	CHECKED:	AB
JOB NUMBER:	12031-00	REVISED:	8/26/2015	ROADWAY LF:	57,133
UTIL. PROVIDER:	AUBREY	REVISED:	10/16/2015	FILE NAME:	Concept 33

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*		*UNIT PRICE*		*TOTAL AMOUNT*
C. SANITARY SEWER SYSTEM						
CONNECT TO EXIST. SEWER LINE	EA	2	$	500.00	$	1,000
8" P.V.C. PIPE (SDR 35: 0' to 11.5' Depth)	LF	33,135	$	25.00	$	828,375
4' DIAMETER MANHOLE W/RAIN PANS	EA	77	$	2,700.00	$	207,900
5' DIAMETER MANHOLE W/RAIN PANS	EA	34	$	3,800.00	$	129,200
STANDARD CLEANOUTS	EA	12	$	875.00	$	10,500
4" SINGLE SEWER SERVICE	EA	936	$	600.00	$	561,600
WATER CROSSING PER TCEQ REQUIREMENTS	EA	35	$	750.00	$	26,250
TESTING (EXCLUDING GEOTECH)	LF	33,135	$	1.50	$	49,703
ADDITIONAL TESTING AFTER DRY UTIL INSTALL	LF	33,135	$	1.00	$	33,135
TRENCH SAFETY	LF	33,135	$	0.80	$	26,508
SUB - TOTAL					**$**	**1,874,171**
D. STORM DRAINAGE SYSTEM						
BASED ON AVERAGE COST PER LOT	EA	936	$	1,500.00	$	1,404,000
SUB - TOTAL					**$**	**1,404,000**

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PROJECT NAME:	**JACKSON RIDGE**	ACREAGE:	324.1	NO. OF LOTS:	1395
ON-SITE FACILITIES:	FUTURE PHASES	CREATED:	6/15/2015	BY:	CDH
CITY:	AUBREY	REVISED:	8/18/2015	CHECKED:	AB
JOB NUMBER:	12031-00	REVISED:	8/26/2015	ROADWAY LF:	57,133
UTIL. PROVIDER:	AUBREY	REVISED:	10/16/2015	FILE NAME:	Concept 33

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*	*UNIT PRICE*	*TOTAL AMOUNT*
E. LOT PREPARATION				
LOT GRADING (ROUGH)	LOT	936	$ 200.00	$ 187,200
LOT GRADING (FINAL)	LOT	936	$ 100.00	$ 93,600
MOISTURE CONDITIONING LOTS 8' BELOW FINAL GRADE	LOT	936	$ 2,500.00	$ 2,340,000
WRAP LOTS w/ 6 MIL PLASTIC SHEETING	LOT	936	$ 460.00	$ 430,560
SUB - TOTAL, DEVELOPER COST				**$ 3,051,360**
F. RETAINING WALLS				
RETAINING WALL (4' Top of Wall to Bottom of Wall)	LOT	936	$ 1,000.00	$ 936,000
SUB - TOTAL, DEVELOPER COST				**$ 936,000**
G. FRANCHISE UTILITIES				
ELECTRIC SERVICE	LOT	936	$ 1,000.00	$ 936,000
GAS SERVICE	LOT	936	$ 1,000.00	$ 936,000
SUB - TOTAL, DEVELOPER COST				**$ 1,872,000**

NOTES FUNDED DEVELOPER ITEMS

H. PROFESSIONAL & MISCELLANEOUS FEES				
ENGINEERING & SURVEYING	LOT	936	$ 1,500	$ 1,404,000
BIDDING and LETTING	EA	6	$ 10,000	$ 60,000
SWPPP ADMINISTRATION	LS	2	$ 6,000	$ 12,000
CONSTRUCTION INSPECTION	%	3%	$ 16,430,683	$ 492,921
MATERIAL TESTING	%	2%	$ 16,430,683	$ 328,614
SUB - TOTAL				**$ 2,297,534**
I. PID DIRECT PROFESSIONAL & MISC. FEES				
ENGINEERING & SURVEYING	LOT	936	$ 1,200	$ 1,123,200
BIDDING and LETTING	EA	4	$ 10,000	$ 40,000
SWPPP ADMINISTRATION	LS	2	$ 2,000	$ 4,000
CONSTRUCTION INSPECTION	%	3%	$ 12,443,323	$ 373,300
MATERIAL TESTING	%	2%	$ 12,443,323	$ 248,866
SUB - TOTAL				**$ 1,789,366**

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PROJECT NAME:	**JACKSON RIDGE**	ACREAGE:	324.1	NO. OF LOTS:	1395
IMPROVEMENTS:	COMMON AREA AMENITIES	CREATED:	6/15/2015	BY	CDH
CITY:	AUBREY	REVISED:	8/18/2015	CHECKED:	AB
JOB NUMBER:	12031-00	REVISED:	8/26/2015		
UTIL. PROVIDER:	AUBREY	REVISED:	10/16/2015	FILE NAME:	Concept 33

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*		*UNIT PRICE*		*TOTAL AMOUNT*
A. COMMON AREA AMENITIES						
AMENITY CENTER	EA	1	$	850,000.00	$	850,000
SOCCER FIELDS	EA	4	$	35,000.00	$	140,000
ENTRY	EA	1	$	150,000.00	$	150,000
TRAIL SYSTEM	LF	8,520	$	39.00	$	332,280
PERIMETER SCREENING WALL	LF	7,090	$	100.00	$	709,000
BOULEVARD ORNAMENTAL FENCE	LF	8,280	$	100.00	$	828,000
TUBULAR STEEL FENCE	LF	2,915	$	50.00	$	145,750
SUB - TOTAL					**$**	**3,155,030**

EXHIBIT C
ESTIMATED PROJECT COSTS

EXHIBIT "D"

THIS ESTIMATE HAS BEEN COMPLETED ON LIMITED INFORMATION AND SHOULD BE USED FOR PROJECT EVALUATION. PRIOR TO MAKING FINANCIAL COMMITMENTS BASED ON THIS ESTIMATE, THESE NUMBERS SHOULD BE VERIFIED BY PETITT BARRAZA LLC.

PROJECT NAME:	**JACKSON RIDGE**	ACREAGE:	307.6	NO. OF LOTS:	1400
SUMMARY:	TOTAL DEVELOPMENT				
LOCATION:	AUBREY EJT/PROSPER ETJ				
JOB NUMBER:	12031-00				
UTIL. PROVIDER:	MSUD			FILE NAME:	LAND PLAN 16

ON-SITE IMPROVEMENTS SUMMARY		**BY CATEGORY**		**BY LOT**
A. LOT GRADING	$	7,784,822	$	5,561
B. RETAINING WALLS	$	1,950,000	$	1,393
C. WATER DISTRIBUTION SYSTEM	$	3,063,691	$	2,188
D. SANITARY SEWER SYSTEM	$	3,020,717	$	2,158
E. STORM SEWER SYSTEM	$	2,100,000	$	1,500
F. PAVING	$	8,255,745	$	5,897
G. DRY UTILITIES & STREET LIGHTING	$	3,057,960	$	2,184
H. PROFESSIONAL & MISCELLANEOUS FEES	$	3,630,749	$	2,593
SUB-TOTAL ON-SITE CONSTRUCTION COSTS	$	32,863,683	$	23,474
CONTINGENCIES 20%	$	6,572,737	$	4,695
SUB-TOTAL ON SITE CONSTRUCTION COSTS W/CONTINGENCIES	*$*	*39,436,420*	*$*	*28,169*

MAJOR IMPROVEMENTS SUMMARY		**BY CATEGORY**		**BY LOT**
A. WATER DISTRIBUTION SYSTEM	$	1,540,401	$	1,100
B. SANITARY SEWER SYSTEM	$	677,199	$	484
C. OFF-SITE SEWER	$	3,572,139		
D. PAVING - ROAD 'A'	$	3,762,273	$	2,687
E. PAVING - ROAD 'B' - 5,585 LF	$	1,248,998	$	892
F. PAVING - 1/2 ROAD 'C' - 3,460 LF	$	202,897	$	145
G. PAVING - FM 1385 TURN LANES	$	563,509	$	403
H. PROFESSIONAL & MISCELLANEOUS FEES	$	1,965,176	$	1,404
SUB-TOTAL MAJOR IMPROVEMENTS CONSTRUCTION COSTS	$	13,532,592	$	7,115
CONTINGENCIES 20%			$	-
SUB-TOTAL OFF SITE CONSTRUCTION COSTS W/CONTINGENCIES	*$*	*13,532,592*	*$*	*7,115*
TOTAL CONSTRUCTION COSTS	**$**	**46,396,275**	**$**	**30,589**
CONTINGENCIES	**$**	**6,572,737**	**$**	**4,695**
TOTAL CONSTRUCTION COSTS W/CONTINGENCIES	***$***	***52,969,012***	***$***	***35,283***

THIS ESTIMATE HAS BEEN COMPLETED ON LIMITED INFORMATION AND SHOULD BE USED FOR PROJECT EVALUATION. PRIOR TO MAKING FINANCIAL COMMITMENTS BASED ON THIS ESTIMATE, THESE NUMBERS SHOULD BE VERIFIED BY PETITT BARRAZA LLC.

PROJECT NAME:	**JACKSON RIDGE**	ACREAGE:	307.6	NO. OF LOTS:	1400
ON-SITE FACILITIES	TOTAL DEVELOPMENT	CREATED:	1/1/1904	BY:	1/1/1904
DISTRICT:	AUBREY EJT/PROSPER ETJ	REVISED:	5/7/2015	CHECKED:	1/1/1904
JOB NUMBER:	12031-00		5/15/2015	ROADWAY LF:	51,592
UTIL. PROVIDER:	MSUD			FILE NAME:	LAND PLAN 16

SUMMARY		**BY CATEGORY**	**BY LOT**	**BY ACRE**
A. LOT GRADING		$ 7,784,822	$ 5,561	$ 25,308
B. RETAINING WALLS		$ 1,950,000	$ 1,393	$ 6,339
C. WATER DISTRIBUTION SYSTEM		$ 3,063,691	$ 2,188	$ 9,960
D. SANITARY SEWER SYSTEM		$ 3,020,717	$ 2,158	$ 9,820
E. STORM SEWER SYSTEM		$ 2,100,000	$ 1,500	$ 6,827
F. PAVING		$ 8,255,745	$ 5,897	$ 26,839
G. DRY UTILITIES & STREET LIGHTING		$ 3,057,960	$ 2,184	$ 9,941
H. PROFESSIONAL & MISCELLANEOUS FEES		$ 3,630,749	$ 2,593	$ 11,803
TOTAL CONSTRUCTION COSTS		**$ 32,863,683**	**$ 23,474**	**$ 106,839**
CONTINGENCIES	20%	$ 6,572,737	$ 4,695	$ 21,368
TOTAL CONSTRUCTION COSTS WITH CONTINGENCIES		*$ 39,436,420*	*$ 28,169*	*$ 128,207*

NOTES:

1. COSTS DO NOT INCLUDE THE FOLLOWING:
   A. TRAIL SYSTEMS
   B. ROCK EXCAVATION
   C. DISTRICT & COUNTY FEES (I.E. PLATTING, PLAN REVIEW, APPLICATION, ETC.)
   D. LANDSCAPING, IRRIGATION, SCREENING WALLS & MONUMENTS
   E. COMMON AREA AMENITIES

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*	*UNIT PRICE*	*TOTAL AMOUNT*
A. LOT GRADING				
CLEARING & GRUBBING (1/4 Area Heavily Treed)	ACRE	308	$ 1,900.00	$ 584,440
CONSTRUCTION ENTRANCE	EA	1	$ 4,175.00	$ 4,175
SILT FENCE	LF	10,846	$ 1.55	$ 16,811
UNCLASSIFIED EXCAVATION OF STREET R.O.W. & LOTS	CY	624,000	$ 3.01	$ 1,878,240
LOT GRADING (ROUGH)	LOT	1,400	$ 200.00	$ 280,000
MOISTURE CONDITIONING LOTS 6' BELOW FINAL GRADE	LOT	1,700	$ 2,300.00	$ 3,910,000
WRAP LOTS w/ 6 MIL PLASTIC SHEETING	LOT	700	$ 475.00	$ 332,500
LOT GRADING (FINAL)	LOT	1,400	$ 100.00	$ 140,000
OVER SEEDING LOTS	ACRE	187	$ 900.00	$ 168,595
STREET PREPARATION (3' MOISTURE CONDITIONING)	CY	235,030	$ 2.00	$ 470,060
SUB - TOTAL				**$ 7,784,822**

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PROJECT NAME:	**JACKSON RIDGE**	ACREAGE:	307.6	NO. OF LOTS:	1400
ON-SITE FACILITIES	TOTAL DEVELOPMENT	CREATED:	1/1/1904	BY:	1/1/1904
DISTRICT:	AUBREY EJT/PROSPER ETJ	REVISED:	5/7/2015	CHECKED:	1/1/1904
JOB NUMBER:	12031-00		5/15/2015	ROADWAY LF:	51,592
UTIL. PROVIDER:	MSUD			FILE NAME:	LAND PLAN 16

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*		*UNIT PRICE*		*TOTAL AMOUNT*
B. RETAINING WALLS						
RETAINING WALL (4' Top of Wall to Bottom of Wall)	LOT	1,300	$	1,500.00	$	1,950,000
SUB - TOTAL					**$**	**1,950,000**
C. WATER DISTRIBUTION SYSTEM						
8" P.V.C. WATERLINE	LF	49,012	$	25.00	$	1,225,310
8" GATE VALVE & BOX	EA	211	$	1,200.00	$	253,200
FIRE HYDRANT ASSEMBLY (INCLUDING 6" GATE VALVE)	EA	163	$	3,750.00	$	612,750
1" SINGLE WATER SERVICE	EA	1,400	$	600.00	$	840,000
TRENCH SAFETY	LF	49,012	$	1.00	$	49,012
TESTING (EXCLUDING GEOTECH)	LF	49,012	$	1.50	$	73,519
1" IRRIGATION WATER SERVICE (To Green Space)	EA	9	$	1,100.00	$	9,900
SUB - TOTAL					**$**	**3,063,691**
D. SANITARY SEWER SYSTEM						
8" P.V.C. PIPE (SDR 35: 0' to 11.5' Depth)	LF	50,960	$	25.00	$	1,274,004
4' DIAMETER MANHOLE	EA	170	$	2,700.00	$	458,730
5' DIAMETER MANHOLE	EA	34	$	5,125.00	$	174,148
STANDARD CLEANOUTS	EA	13	$	575.00	$	7,475
4" SINGLE SEWER SERVICE	EA	1,400	$	600.00	$	840,000
WATER CROSSING PER TCEQ REQUIREMENTS	EA	88	$	1,000.00	$	88,000
TESTING (EXCLUDING GEOTECH)	LF	50,960	$	1.50	$	76,440
ADDITIONAL TESTING AFTER DRY UTIL INSTALL	LF	50,960	$	1.00	$	50,960
TRENCH SAFETY	LF	50,960	$	1.00	$	50,960
SUB - TOTAL					**$**	**3,020,717**
E. STORM SEWER SYSTEM						
BASED ON AVERAGE COST PER LOT	EA	1,400	$	1,500.00	$	2,100,000
SUB - TOTAL					**$**	**2,100,000**

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PROJECT NAME:	**JACKSON RIDGE**	ACREAGE:	307.6	NO. OF LOTS:	1400
ON-SITE FACILITIES	TOTAL DEVELOPMENT	CREATED:	1/1/1904	BY:	1/1/1904
DISTRICT:	AUBREY EJT/PROSPER ETJ	REVISED:	5/7/2015	CHECKED:	1/1/1904
JOB NUMBER:	12031-00		5/15/2015	ROADWAY LF:	51,592
UTIL. PROVIDER:	MSUD			FILE NAME:	LAND PLAN 16

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*		*UNIT PRICE*		*TOTAL AMOUNT*
F. PAVING						
CONNECT TO EX. PAVEMENT	EA	3	$	540.00	$	1,620
6" LIME STABILIZED SUBGRADE PREPARATION	SY	189,171	$	3.00	$	567,512
LIME FOR SUBGRADE PREPARATION (36LBS/SY)	TON	3,410	$	25.00	$	85,250
31' B-B CONC. PAVEMENT (6-INCH, 3,600 PSI)	SY	177,706	$	40.00	$	7,108,232
BARRIER FREE RAMPS	EA	211	$	1,100.00	$	232,100
4' REINFORCED CONCRETE SIDEWALK (5-INCH)	SY	2,228	$	40.00	$	89,120
4' WIDE CURLEX EROSION CONTROL MATTING	LF	103,184	$	0.60	$	61,910
COMBO STREET NAME & STOP SIGN	EA	88	$	1,250.00	$	110,000
SUB - TOTAL					**$**	**8,255,745**
G. DRY UTILITIES & STREET LIGHTING						
ELECTRIC and GAS SERVICES	LOT	1,400	$	2,000.00	$	2,800,000
STREET LIGHTS (Standard Lights)	EA	103	$	2,500.00	$	257,960
SUB - TOTAL					**$**	**3,057,960**
H. PROFESSIONAL & MISCELLANEOUS FEES						
ENGINEERING & SURVEYING	LOT	1,500	$	1,500	$	2,250,000
BIDDING and LETTING	EA	6	$	10,000	$	60,000
CONSTRUCTION INSPECTION	%	3%	$	26,174,974	$	785,249
MATERIAL TESTING	%	2%	$	26,174,974	$	523,499
SWPPP ADMINISTRATION	LS	1	$	12,000	$	12,000
SUB - TOTAL					**$**	**3,630,749**

Winn Ridge
MI Water

Phase	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	MI Blvd.
Water					
	12" P.V.C. Waterline	LF	1,467	$ 33.86	$ 49,672.62
	12" Gate Valve & Box	EA	8	$ 2,253.08	$ 18,024.64
	8" P.V.C. Waterline	LF	4,426	$ 20.78	$ 91,972.28
	8" Gate Valve & Box	EA	21	$ 1,183.07	$ 24,844.47
	Fire Hydrant Assembly with Gate Valves	EA	14	$ 3,672.20	$ 51,410.80
	Combination Air Release Valve	EA	1	$ 2,563.10	$ 2,563.10
	12" Plug	EA	3	$ 254.96	$ 764.88
	8" Plug w/ 2" Tap & 2" Galvanized Riser	EA	7	$ 579.00	$ 4,053.00
	1" Single Water Service (All Lengths)	EA	36	$ 723.40	$ 26,042.40
	4" Conduit (Schedule 40) at Intersections	LF	446	$ 7.04	$ 3,139.84
	Fittings Not Incl. in Factored 12" PVC Price	LS	1	$ 19,190.00	$ 19,190.00
	16" P.V.C. Waterline	LF	134	$ 115.52	$ 15,479.68
	16" Gate Valve & Box	EA	1	$ 10,132.43	$ 10,132.43
	36" x 16" Tapping Sleeve & Valve	EA	1	$ 19,599.85	$ 19,599.85
	Testing (Excluding Geotech)	LF	6,027	$ 0.56	$ 3,375.12
	Trench Safety	LF	6,027	$ 0.06	$ 361.62
					$ 340,626.73
	8" P.V.C. Waterline	LF	1,160	$ 20.95	$ 24,302.00
	8" Gate Valve & Box	EA	8	$ 1,183.07	$ 9,464.56
	12" P.V.C. Waterline	LF	4,318	$ 34.88	$ 150,611.84
	12" Gate Valve & Box	EA	23	$ 2,280.12	$ 52,442.76
	Fire Hydrant Assembly with Gate Valves	EA	17	$ 3,672.20	$ 62,427.40
	1.5" Irrigation Service	EA	1	$ 1,246.57	$ 1,246.57
	2" Irrigation Service	EA	1	$ 1,538.67	$ 1,538.67
	Combination Air Release Valve	EA	1	$ 2,563.10	$ 2,563.10
					$ 304,596.90
	Bonds/Grading Misc work				$ 119,514.00
	CCN				$ 579,400.00
	Mustang Connection water lines				$ 75,000.00
	Water line changes to modify system				$ 121,263.00
					$ 895,177.00
	Total				$ 1,540,400.63

Winn Ridge
MI Sewer

Phase	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	MI Winn Ridge Blvd.
SANITARY SEWER					
	8" PVC Pipe (ALL DEPTHS) (SDR 26)	LF	4,564	$ 38.29	$ 174,755.56
	8" PVC Pipe (ALL DEPTHS) (SDR 35)	LF	880	$ 20.08	$ 17,670.40
	12" PVC Pipe (ALL DEPTHS) (SDR 26)	LF	1,371	$ 40.87	$ 56,032.77
	15" PVC Pipe (ALL DEPTHS) (SDR 26)	LF	175	$ 41.74	$ 7,304.50
	15" PVC Pipe (ALL DEPTHS) (SDR 35)	LF	1,415	$ 41.74	$ 59,062.10
	4" Service Lines	EA	25	$ 477.92	$ 11,948.00
	4' Diameter Manhole (ALL DEPTHS)	EA	11	$ 2,910.08	$ 32,010.88
	5' Diameter Manhole (ALL DEPTHS)	EA	19	$ 6,637.33	$ 126,109.27
	5' Diameter Manhole INSIDE DROP (ALL DEPTHS)	EA	8	$ 6,879.63	$ 55,037.04
	Water Crossing per TCEQ requirements	EA	11	$ 942.83	$ 10,371.13
	Testing (Excluding Geotech)	LF	8,405	$ 0.91	$ 7,648.55
	Trench Safety	LF	8,405	$ 0.43	$ 3,614.15
					$ 561,564.35
	8" PVC Pipe (ALL DEPTHS) (SDR 35)	LF	561	$ 20.75	$ 11,640.75
	8" PVC Pipe (ALL DEPTHS) (SDR 26)	LF	814	$ 28.20	$ 22,954.80
	5' Diameter Manhole INSIDE DROP (ALL DEPTHS)	EA	3	$ 6,212.24	$ 18,636.72
					$ 53,232.27
	8" PVC Pipe (ALL DEPTHS) (SDR 35)	LF	1,369	$ 21.08	$ 28,858.52
	8" PVC Pipe (ALL DEPTHS) (SDR 26)	LF	222	$ 23.41	$ 5,197.02
	10" PVC Pipe (ALL DEPTHS) (SDR 35)	LF	240	$ 24.49	$ 5,877.60
	15" PVC Pipe (ALL DEPTHS) (SDR 26)	LF	270	$ 51.47	$ 13,896.90
	4' Diameter Manhole (ALL DEPTHS)	EA	3	$ 2,857.57	$ 8,572.71
					$ 62,402.75
					$ 677,199.37

Winn Ridge
Offsite Sewer Analysis

FM/GM Contract	1,743,334.06
Lift Station	1,426,337.00
Total Costs	3,169,671.06
Hillwood Participation	(780,032.00)
Sewer WWTP Capacity	1,182,500.00
Total Winn Ridge Cost	3,572,139.06

Winn Ridge
Paving Road A

DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	BID AMOUNT
				$ 1,791,454.61
Winn Ridge Blvd.				
Paving				
8" 3,600 psi Reinforced Concrete Street Pavement	SY	23,427	$ 34.12	$ 799,329.24
8" Lime Subgrade Preparation	SY	24,765	$ 2.03	$ 50,272.95
Lime for Subgrade Preparation (36LB/SY)	TONS	446	$ 135.35	$ 60,366.10
Asphalt Pavement	SY	703	$ 36.25	$ 25,483.75
Pavement Header	LF	427	$ 8.81	$ 3,761.87
Pavement Barricade	EA	5	$ 1,719.73	$ 8,598.65
Rock Rip-Rap at End of Streets	SY	55	$ 50.06	$ 2,753.30
Barrier Free Ramps	EA	13	$ 1,237.66	$ 16,089.58
8' Curlex	LF	10,990	$ 1.05	$ 11,539.50
Stop Sign with Street Name Sign	EA	5	$ 406.88	$ 2,034.40
8' Reinforced Concrete Sidewalk	SF	43,807	$ 6.09	$ 266,784.63
6' Reinforced Concrete Sidewalk	SF	16,051	$ 5.44	$ 87,317.44
8" Yellow Strip	LF	8,802	$ 2.50	$ 22,005.00
8" Yellow 10' Dashed Strip	LF	2,100	$ 2.50	$ 5,250.00
8" White Strip	LF	482	$ 2.50	$ 1,205.00
Turn Arrows	EA	43	$ 233.28	$ 10,031.04
Yield Triangle	EA	39	$ 37.98	$ 1,481.22
8" White 1' Dash Strip	LF	61	$ 2.50	$ 152.50
"ONLY" White	EA	4	$ 271.25	$ 1,085.00
Traffic Control	LS	1	$ 3,797.50	$ 3,797.50
Maintenance Bond	LS	1	$ -	$ -
Payment & Performance Bonds	LS	1	$ 16,500.00	$ 16,500.00
ADD ALTERNATE - Additional Move-in (Only if needed)	EA	1	*$ 16,500.00*	$ 16,500.00
				$ 1,412,338.67

DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	BID AMOUNT
WINN RIDGE BLVD.				
CLEARING & GRUBBING	ACRE	12.6	$ 933.00	$ 11,755.80
CONSTRUCTION ENTRANCE	EA	1	$ 1,540.15	$ 1,540.15
SILT FENCE	LF	1,000	$ 1.33	$ 1,331.00
UNCLASSIFIED EXCAVATION OF ROW'S & LOTS	CY	58,589	$ 1.73	$ 101,358.97
				$ 115,985.92

Hardscape/Landscape

6'-0" Ht. Brick Thinwall Panels on top of or adjacent to retaining walls w/ 6'-6" Ht. Brick Thinwall Columns every 12'-0" as shown on plans and details 1,2&3/S4 and 2&3/S5, and all related appurtances complete and in place for the sum of	**LF**	**2428.00**	**$ 100.00**	**$ 242,800.00**
7'-0" Ht. Stone columns on grade as shown on plans and details 1&6/S3, and all related appurtances complete and in place for the sum of	**EA**	**26.00**	**$ 2,500.00**	**$ 65,000.00**
Steel and Stone Trail Markers as shown on plans and detail 5/S2, and all related appurtances complete and in place for the sum of	**EA**	**12.00**	**$ 7,000.00**	**$ 84,000.00**
7'-6" Ht. Enhanced Stone Columns with recessed metal accent as shown on plans and details 4&6/S2 and all related appurtances complete and in place for the sum of	**EA**	**18.00**	**$ 3,000.00**	**$ 54,000.00**
Provide and plant Common Bermuda Solid Sod, complete in place for the sum of	**SF**	**391937.00**	**$ 0.41**	**$ 160,694.17**
Irrigation	**LS**	**1.00**	**$ 198,000.00**	**$ 198,000.00**
				$ 804,494.17

has	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	BID AMOUNT	MI Winn Ridge Blvd.
STORM SEWER						
	18" R.C.P. (ALL DEPTHS)	LF	685	$ 43.71		$ 29,941.35
	18" R.C.P.Class lV (ALL DEPTHS)	LF	274	$ 46.48		$ 12,735.52
	21" R.C.P. (ALL DEPTHS)	LF	297	$ 62.85		$ 18,666.45
	24" R.C.P. (ALL DEPTHS)	LF	121	$ 64.38		$ 7,789.98
	27" R.C.P. (ALL DEPTHS)	LF	167	$ 65.96		$ 11,015.32
	30" R.C.P. (ALL DEPTHS)	LF	300	$ 86.76		$ 26,028.00
	36" R.C.P. (ALL DEPTHS)	LF	231	$ 101.17		$ 23,370.27
	39" R.C.P. (ALL DEPTHS)	LF	-	$ 131.63		$ -
	42" R.C.P. (ALL DEPTHS)	LF	154	$ 135.93		$ 20,933.22
	48" R.C.P. (ALL DEPTHS)	LF	267	$ 162.82		$ 43,472.94
	60" R.C.P. (ALL DEPTHS)	LF	-	$ 244.60		$ -
	66" R.C.P. (ALL DEPTHS)	LF	-	$ 303.66		$ -
	18" Sloped Headwall	EA	4	$ 1,394.90		$ 5,579.60
	21" Sloped Headwall	EA	1	$ 1,448.55		$ 1,448.55
	42" Sloped Headwall	EA	1	$ 2,575.20		$ 2,575.20
	60" Sloped Headwall	EA	-	$ 3,487.25		$ -
	66" Sloped Headwall	EA	-	$ 3,755.50		$ -
	10' Inlet	EA	5	$ 3,621.38		$ 18,106.90
	15' Inlet	EA	3	$ 4,774.85		$ 14,324.55
	20' Inlet	EA	1	$ 6,008.80		$ 6,008.80
	8' Square Storm Manhole	EA	-	$ 8,852.25		$ -
	7' Square Storm Manhole	EA	-	$ 7,403.70		$ -
	4' Square Storm Manhole	EA	3	$ 3,755.50		$ 11,266.50
	Grade to Drain	LF	893	$ -		$ -
	Inlet Protection	EA	9	$ 74.90		$ 674.10
	Rock Rip Rap at Headwall	SY	20	$ 80.25		$ 1,605.00
	Trench Safety	LF	2,496	$ 0.28		$ 698.88
						$ 256,241.13

48" R.C.P. (ALL DEPTHS)	LF	531	$ 160.86	$ 85,416.66
54" R.C.P. (ALL DEPTHS)`	LF	560	$ 234.04	$ 131,062.40
60" R.C.P. (ALL DEPTHS)	LF	64	$ 244.60	$ 15,654.40
66" R.C.P. (ALL DEPTHS)	LF	73	$ 303.66	$ 22,167.18
72" R.C.P. (ALL DEPTHS)	LF	57	$ 385.02	$ 21,946.14
48" Sloped Headwall	EA	1	$ 2,682.50	$ 2,682.50
5' Square Storm Manhole	EA	1	$ 4,748.03	$ 4,748.03
6' Square Storm Manhole	EA	1	$ 5,955.15	$ 5,955.15
7' Square Storm Manhole	EA	1	$ 9,120.50	$ 9,120.50
Rock Rip Rap at Headwall	SY	13	$ 80.25	$ 1,043.25
				$ 299,796.21

18" R.C.P. (ALL DEPTHS)	LF	771	$ 42.75	$ 32,960.25
24" R.C.P. (ALL DEPTHS)	LF	944	$ 57.03	$ 53,831.60
27" R.C.P. (ALL DEPTHS)	LF	302	$ 64.21	$ 19,391.42
30" R.C.P. (ALL DEPTHS)	LF	1,713	$ 73.89	$ 126,573.57
33" R.C.P. (ALL DEPTHS)	LF	558	$ 87.65	$ 48,908.70
36" R.C.P. (ALL DEPTHS)	LF	1,140	$ 102.32	$ 116,644.80
39" R.C.P. (ALL DEPTHS)	LF	179	$ 121.85	$ 21,811.15
42" R.C.P. (ALL DEPTHS)	LF	73	$ 135.03	$ 9,857.19
48" R.C.P. (ALL DEPTHS)	LF	515	$ 162.79	$ 83,836.85
39" Sloped Headwall	EA	1	$ 2,146.00	$ 2,146.00
10' Inlet	EA	9	$ 3,514.08	$ 31,626.72
15' Inlet	EA	8	$ 4,667.55	$ 37,340.40
20' Inlet	EA	4	$ 5,847.85	$ 23,391.40
6' Square Storm Manhole	EA	1	$ 5,955.15	$ 5,955.15
5' Square Storm Manhole	EA	3	$ 4,506.60	$ 13,519.80
4' Square Storm Manhole	EA	6	$ 3,755.50	$ 22,533.00
3' Square Storm Manhole	EA	1	$ 3,219.00	$ 3,219.00
4'x4' "Y" Inlet	EA	1	$ 4,292.00	$ 4,292.00
48" Plug	EA	1	$ 577.96	$ 577.96
				$ 658,416.96

	MI
Storm Sewer	$ 256,241.13
Storm Sewer	$ 299,796.21
Storm Sewer	$ 658,416.96
	$ 1,214,454.30

DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	BID AMOUNT
;hts (150 LF Spacing), including budget for post, trenching,	EA	36	$5,000.00	$ 180,000.00
Subtotal				**$ 180,000.00**
Contingency	%	10%	$ -	$ 18,000.00
Engineering Design	LS			$ 17,000.00
				$ 215,000.00

TOTAL

Lacy Contrct	
Paving	$ 1,412,338.67
Storm	$ 1,214,454.30
RPMx	$ 115,985.92
Hardscape/Landscape	$ 804,494.17
Street Lights	$ 215,000.00
Total Paving Road A	$ 3,762,273.06

Winn Ridge
Paving Road B

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*	*UNIT PRICE*	*TOTAL AMOUNT*
B. PAVING - 1/2 ROAD 'B' - 3,460 LF				
CONNECT TO EX. PAVEMENT	EA	2	$ 350.00	$ 700
6" LIME STABILIZED SUBGRADE PREPARA	SY	10,188	$ 3.50	$ 35,657
LIME FOR SUBGRADE PREPARATION (36l	TON	190	$ 150.00	$ 28,500
1/2 OF 80' ROW, 4 LANE UNDIVIDED (8-I	SY	9,611	$ 40.00	$ 384,448
BARRIER FREE RAMPS	EA	4	$ 2,100.00	$ 8,400
5" - 4' REINFORCED CONCRETE SIDEWAL	SY	1,538	$ 55.00	$ 84,578
4' WIDE CURLEX EROSION CONTROL MA	LF	3,460	$ 0.75	$ 2,595
COMBO STREET NAME & STOP SIGN	EA	3	$ 1,300.00	$ 3,900
18" R.C.P.	LF	57	$ 40.00	$ 2,280
21" R.C.P.	LF	55	$ 50.00	$ 2,750
27" R.C.P.	LF	33	$ 70.00	$ 2,310
15' INLET	EA	2	$ 4,200.00	$ 8,400
INLET AND HEADWALL PROTECTION	EA	3	$ 125.00	$ 375
TRENCH SAFETY	LF	145	$ 1.00	$ 145
21" Type "B" HDWL	EA	1	1,900	1,900
SCREENWALL/TURF/IRRIGATION	EA	1	682,060	682,060

SUB - TOTAL **$ 1,248,998**

Winn Ridge
Paving Road C

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*		*UNIT PRICE*		*TOTAL AMOUNT*
C .PAVING - 1/2 ROAD 'C' - 1,150 LF						
CONNECT TO EX. PAVEMENT	EA	2	$	350.00	$	700
6" LIME STABILIZED SUBGRADE PREPARATION	SY	2,811	$	3.50	$	9,839
LIME FOR SUBGRADE PREPARATION (36LBS/SY)	TON	60	$	150.00	$	9,000
1/2 OF 100' ROW, 4 LANE DIVIDED (8-INCH, 3,600 PSI)	SY	2,556	$	40.00	$	102,224
BARRIER FREE RAMPS	EA	2	$	2,100.00	$	4,200
5" - 4' REINFORCED CONCRETE SIDEWALK	SY	511	$	55.00	$	28,111
4' WIDE CURLEX EROSION CONTROL MATTING	LF	1,150	$	0.75	$	863
COMBO STREET NAME & STOP SIGN	EA	2	$	1,300.00	$	2,600
18" R.C.P.	LF	192	$	40.00	$	7,680
27" R.C.P.	LF	33	$	70.00	$	2,310
48" R.C.P.	LF	145	$	150.00	$	21,750
10' INLET	EA	3	$	3,250.00	$	9,750
INLET AND HEADWALL PROTECTION	EA	4	$	125.00	$	500
TRENCH SAFETY	LF	370	$	1.00	$	370
48" Type "B" HDWL	EA	1	$	3,000.00	$	3,000
SUB - TOTAL					**$**	**202,897**

Winn Ridge
Left Turn Lane

D. PAVING - FM 1385 TURN LANES				
FM 1385 LEFT TURN LANES	EA	1	385,000	385,000
Screening/Erosion Control	EA	1	178,509	178,509
SUB - TOTAL				**563,509**

Winn Ridge
Professional Fees

		Eng/Surv/Testing 9.50%	Inspection 2.50%	Mat. Testing 1.35%	Total
Paving - Road "A" 5,5	3,762,273	357,416	94,057	50,784	502,257
Paving - 1/2 Road "B"	1,248,998	118,655	31,225	16,859	166,739
Paving - 1/2 Road "C"	202,897	19,275	5,072	2,739	27,086
Paving - FM 1385 Tur	563,509	53,533	14,088	7,606	75,227
Water System	1,540,401	146,338	38,510	20,793	205,641
Sanitary Sewer Syste	677,199	64,334	16,930	9,141	90,405
Total	7,995,277	759,551	199,882	107,922	1,067,355
Offsite Engineering/Testing/Inspecton					897,820.00
Total					1,965,175.08

EXHIBIT D
BOND DEBT SERVICE

Estimated Project Costs

Authorized Improvement	Estimated Costs City Major Improvements to be funded with Series 2015 Major Improvement Improvement Bond
Road Improvements	
Paving, excavation & erosion control	$0
Water Improvements	
Water distribution system improvements	$3,692,625
Sanitary Sewer Improvements	
Sewer collection system improvements	$4,055,122
Storm Drainage Improvements	
Storm drainage collection system improvements	$0
Other Improvements	
Screening, trail system & amenity improvements	$0
Subtotal Construction Cost	**$7,747,747**
Soft Costs	
Engineering, Design & Surveying fees	$822,492
Inspection Fees	$94,399
Geotechnical and Materials Testing	$51,125
Subtotal Soft Cost	**$968,015**
Grand Total Constuction + Soft Costs	**$8,715,762**
Estimated Bond issuance related costs	
Deposits to Debt Service Reserve Fund	
Deposits to Capitalized Interest	
Other costs of issuance	
Total estimated Bond issuance related costs	**$0**
TOTAL AUTHORIZED IMPROVEMENT COSTS	**$8,715,762**
BOND ISSUANCE COSTS	**Series 2015 Major Imp and Phase #1 Bonds**
Capitalized Interest Fund	$1,811,420
Debt Service Reserve Fund	$1,141,286
Developer Startup Costs	$395,512
Underwriter's discount	$315,866
Other costs of issuance	$803,874
TOTAL BOND ISSUANCE COSTS	**$4,467,958**
TOTAL ESTIMATED IMPROVEMENT COSTS	**$13,183,720**

Water distribution system improvements	$3,692,625
Sewer collection system improvements	$4,055,122
Estimated soft costs including engineering	$968,015
Subtotal:	$8,715,762
Other bond issuance related costs (details in Appendix C)	$4,467,958
Total Estimated Project Costs	**$13,183,721**
Add: Roadway improvements	$2,747,598
Water distribution system improvements	$604,131
Sewer collection system improvements	$308,924
Less: Water improvements systems eliminated	($3,283,411)
Net sewer collection system improvements eliminated (including capacity fees)	($193,283)
Net professional fees related to eliminated projects	($70,194)
Developer funded excess improvements	($113,765)
MSUD Contract Payment offsets par amount	($2,794,820)
MSUD Lump sum payment offsets	($1,182,500)
Total Revised Estimated Project Costs	**$9,206,401**

THIS ESTIMATE HAS BEEN COMPLETED ON LIMITED INFORMATION AND SHOULD BE USED FOR PROJECT EVALUATION. PRIOR TO MAKING FINANCIAL COMMITMENTS BASED ON THIS ESTIMATE, THESE NUMBERS SHOULD BE VERIFIED BY PETITT BARRAZA LLC.

PROJECT NAME:	**JACKSON RIDGE**	ACREAGE:	320.9	NO. OF LOTS:	1395
MAJOR IMPROVEMENTS:	CITY	CREATED:	6/15/2015	BY	CDH
CITY:	AUBREY	REVISED:	8/18/2015	CHECKED:	AB
JOB NUMBER:	12031-00	REVISED:	9/8/2015	ROADWAY LF:	NA
UTIL. PROVIDER:	AUBREY	REVISED:	10/16/2015	FILE NAME:	Concept 33

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*		*UNIT PRICE*		*TOTAL AMOUNT*
A. PHASE 1 CITY WATER SYSTEM IMPROVEMENTS						
UTRWD DELIVER POINT (12-INCH WATER & METER	LS	1	$	431,525.00	$	431,525
0.25 MG GROUND STORAGE RESIVOR	LS	1	$	402,500.00	$	402,500
1.0 MGD PUMP STATION	LS	1	$	765,000.00	$	765,000
0.50 MG ELEVATED STORAGE TANK	LS	1	$	1,487,500.00	$	1,487,500
EQUITY FEE	MGD	1	$	200,000.00	$	200,000
DEMAND CHARGE ($388K/1MGD FOR 5 YEARS)	MGD	0.30	$	388,000.00	$	116,400
CITY SEWER & WATER CCN ACQUISITION	EA	1	$	579,400.00	$	289,700
SUB - TOTAL					**$**	**3,692,625**
B. PROFESSIONAL & MISCELLANEOUS FEES						
ENGINEERING, DESIGN & SURVEYING FEES	%	18%	$	3,086,525	$	569,250
GEOTECHNICAL AND MATERIALS TESTING	%	1%	$	3,086,525	$	30,865
INSPECTION FEES	%	2%	$	3,086,525	$	64,010
SUB - TOTAL					**$**	**664,125**

THIS ESTIMATE HAS BEEN COMPLETED ON LIMITED INFORMATION AND SHOULD BE USED FOR PROJECT EVALUATION. PRIOR TO MAKING FINANCIAL COMMITMENTS BASED ON THIS ESTIMATE, THESE NUMBERS SHOULD BE VERIFIED BY PETITT BARRAZA LLC.

PROJECT NAME:	**JACKSON RIDGE**	ACREAGE:	320.9	NO. OF LOTS:	1395
MAJOR IMPROVEMENTS:	CITY	CREATED:	6/15/2015	BY	CDH
CITY:	AUBREY	REVISED:	8/18/2015	CHECKED:	AB
JOB NUMBER:	12031-00	REVISED:	9/8/2015	ROADWAY LF:	NA
UTIL. PROVIDER:	AUBREY	REVISED:	10/16/2015	FILE NAME:	Concept 33

DESCRIPTION	*UNIT*	*APPROXIMATE QUANTITY*		*UNIT PRICE*		*TOTAL AMOUNT*
C. PHASE 1 CITY SEWER SYSTEM IMPROVEMENTS						
12INCH OFFSITE SANITARY SEWER	LF	10,570	$	95.83	$	1,012,966
LAND RIGHTS	LS	1	$	182,500.00	$	182,500
15INCH OFFSITE SANITARY SEWER OVERSIZE COST	LS	1	$	489,956.00	$	489,956
UTRWD RIVERBEND EXPANSION COST SHARE	MGD	0.320	$	6,500,000.00	$	2,080,000
CITY SEWER & WATER CCN ACQUISITION	EA	1	$	579,400.00	$	289,700
SUB - TOTAL						**$ 4,055,122**
D. PROFESSIONAL & MISCELLANEOUS FEES						
ENGINEERING, DESIGN & SURVEYING FEES	%	25%	$	1,012,966	$	253,242
GEOTECHNICAL AND MATERIALS TESTING	%	2%	$	1,012,966	$	20,259
INSPECTION FEES	%	3%	$	1,012,966	$	30,389
SUB - TOTAL						**$ 303,890**

EXHIBIT E
PROJECTED ABSORBTION

Breakdown of Estimated Bond Debt Service Payments
City Major Improvements Portion

	Sereis 2015 MI Bonds		Sereis 2015 Phase 1 Bonds			
	City Major Improvements		City Major Improvements		Estimated TIRZ Admin Expenses	Total Combined Obligations
Year	Principal[1]	Interest[1]	Principal[2]	Interest[2]		
1	$0	$581,114	$0	$231,735	$0	$812,850
2	$0	$795,442	$0	$317,204	$15,000	$1,127,646
3	$0	$795,442	$48,653	$317,204	$15,000	$1,176,299
4	$159,565	$795,442	$51,694	$313,434	$15,000	$1,335,134
5	$172,862	$781,480	$56,255	$309,427	$15,000	$1,335,024
6	$186,159	$766,354	$60,817	$305,068	$15,000	$1,333,398
7	$203,888	$750,066	$63,857	$300,354	$15,000	$1,333,166
8	$217,185	$732,225	$69,939	$295,405	$15,000	$1,329,755
9	$234,915	$713,222	$74,500	$289,985	$15,000	$1,327,622
10	$257,077	$692,666	$79,062	$284,211	$15,000	$1,328,016
11	$274,806	$670,172	$85,143	$278,084	$15,000	$1,323,206
12	$301,400	$646,127	$91,225	$271,485	$15,000	$1,325,237
13	$323,562	$619,754	$98,827	$264,415	$15,000	$1,321,559
14	$350,156	$591,443	$104,909	$256,756	$15,000	$1,318,264
15	$381,183	$560,804	$112,511	$248,626	$15,000	$1,318,123
16	$412,209	$527,450	$121,633	$239,906	$15,000	$1,316,199
17	$443,236	$491,382	$129,235	$230,480	$15,000	$1,309,333
18	$483,127	$452,599	$138,358	$220,464	$15,000	$1,309,548
19	$523,018	$410,325	$149,001	$209,741	$15,000	$1,307,085
20	$562,909	$364,561	$159,644	$198,194	$15,000	$1,300,308
21	$611,665	$315,307	$171,807	$185,821	$15,000	$1,299,600
22	$660,421	$261,786	$183,970	$172,506	$15,000	$1,293,684
23	$718,042	$203,999	$197,654	$158,249	$15,000	$1,292,944
24	$775,662	$141,171	$211,338	$142,930	$15,000	$1,286,101
25	$837,715	$73,300	$226,542	$126,552	$15,000	$1,279,109
26	$0	$0	$243,266	$108,995	$15,000	$367,261
27	$0	$0	$261,511	$90,142	$15,000	$366,653
28	$0	$0	$279,756	$69,874	$15,000	$364,631
29	$0	$0	$299,522	$48,193	$15,000	$362,715
30	$0	$0	$322,328	$24,980	$15,000	$362,308
31	$0	$0	$0	$0	$0	$0
Total	**$9,090,763**	**$13,733,633**	**$4,092,958**	**$6,510,424**	**$435,000**	**$33,862,778**

1 - The principal and interest shares of the City Major Improvements are calculated as 88.59%
based on the prorated estimated costs and Par amounts shown in Section IV, Table IV-A.
The principal and interest amounts are based on the underwriter's final cashflows dated as of 11-16-15.
The interest amounts include the 0.5% additional interest amount for prepayment and delinquency reserves.

1 - The principal and interest shares of the City Major Improvements are calculated as 30.41% based on the prorated estimated costs and Par amounts shown in Section IV, Table IV-C. The principal and interest amounts are based on the underwriter's final bond cashflows dated as of 11-16-15.
The interest amounts include 0.5% for prepayment and delinquency reserves.

Original Breakdown of Bond Debt Service Payments
City Major Improvements Portion

Year	Sereis 2015 MI Bonds: City Major Improvements Principal[1]	Sereis 2015 MI Bonds: City Major Improvements Interest[1]	Sereis 2015 Phase 1 Bonds: City Major Improvements Principal[2]	Sereis 2015 Phase 1 Bonds: City Major Improvements Interest[2]	Estimated TIRZ Admin Expenses	Total Combined Obligations
1	$0	$581,114	$0	$231,735	$0	$812,850
2	$0	$795,442	$0	$317,204	$15,000	$1,127,646
3	$0	$795,442	$48,653	$317,204	$15,000	$1,176,299
4	$159,565	$795,442	$51,694	$313,434	$15,000	$1,335,134
5	$172,862	$781,480	$56,255	$309,427	$15,000	$1,335,024
6	$186,159	$766,354	$60,817	$305,068	$15,000	$1,333,398
7	$203,888	$750,066	$63,857	$300,354	$15,000	$1,333,166
8	$217,185	$732,225	$69,939	$295,405	$15,000	$1,329,755
9	$234,915	$713,222	$74,500	$289,985	$15,000	$1,327,622
10	$257,077	$692,666	$79,062	$284,211	$15,000	$1,328,016
11	$274,806	$670,172	$85,143	$278,084	$15,000	$1,323,206
12	$301,400	$646,127	$91,225	$271,485	$15,000	$1,325,237
13	$323,562	$619,754	$98,827	$264,415	$15,000	$1,321,559
14	$350,156	$591,443	$104,909	$256,756	$15,000	$1,318,264
15	$381,183	$560,804	$112,511	$248,626	$15,000	$1,318,123
16	$412,209	$527,450	$121,633	$239,906	$15,000	$1,316,199
17	$443,236	$491,382	$129,235	$230,480	$15,000	$1,309,333
18	$483,127	$452,599	$138,358	$220,464	$15,000	$1,309,548
19	$523,018	$410,325	$149,001	$209,741	$15,000	$1,307,085
20	$562,909	$364,561	$159,644	$198,194	$15,000	$1,300,308
21	$611,665	$315,307	$171,807	$185,821	$15,000	$1,299,600
22	$660,421	$261,786	$183,970	$172,506	$15,000	$1,293,684
23	$718,042	$203,999	$197,654	$158,249	$15,000	$1,292,944
24	$775,662	$141,171	$211,338	$142,930	$15,000	$1,286,101
25	$837,715	$73,300	$226,542	$126,552	$15,000	$1,279,109
26	$0	$0	$243,266	$108,995	$15,000	$367,261
27	$0	$0	$261,511	$90,142	$15,000	$366,653
28	$0	$0	$279,756	$69,874	$15,000	$364,631
29	$0	$0	$299,522	$48,193	$15,000	$362,715
30	$0	$0	$322,328	$24,980	$15,000	$362,308
31	$0	$0	$0	$0	$0	$0
Total	**$9,090,763**	**$13,733,633**	**$4,092,958**	**$6,510,424**	**$435,000**	**$33,862,778**

Prorated Reductions in Debt Service Payments

MSUD Contract Payment Offsets	$2,794,820
MSUD Lump sum payment Offsets	$1,182,500
Total Prorated Reduction (PAR)	**$3,977,320**

Year	Prorated Debt Service Amounts for $3,977,320: Prorated Principal (1&2)	Prorated Interest (1&2)	Total
1	$0	$245,224	$245,224
2	$0	$335,668	$335,668
3	$14,678	$335,668	$350,346
4	$63,733	$334,530	$398,264
5	$69,121	$329,109	$398,230
6	$74,509	$323,231	$397,740
7	$80,775	$316,895	$397,670
8	$86,621	$310,020	$396,641
9	$93,346	$302,652	$395,997
10	$101,408	$294,709	$396,116
11	$108,591	$286,074	$394,665
12	$118,449	$276,829	$395,278
13	$127,428	$266,740	$394,168
14	$137,286	$255,888	$393,174
15	$148,939	$244,192	$393,132
16	$161,052	$231,499	$392,551
17	$172,705	$217,774	$390,480
18	$187,492	$203,052	$390,545
19	$202,737	$187,064	$389,802
20	$217,983	$169,774	$387,757
21	$236,361	$151,182	$387,544
22	$254,740	$131,019	$385,759
23	$276,251	$109,284	$385,535
24	$297,762	$85,709	$383,471
25	$321,070	$60,292	$381,362
26	$73,390	$32,882	$106,272
27	$78,894	$27,194	$106,088
28	$84,398	$21,080	$105,478
29	$90,361	$14,539	$104,900
30	$97,241	$7,536	$104,777
31	$0	$0	$0
Total	**$3,977,320**	**$6,107,312**	**$10,084,632**

Revised Breakdown of Bond Debt Service Payments
Major Improvements

Year	Series 2015 MI Bonds Principal[1]	Series 2015 MI Bonds Interest[1]	Series 2015 MI Bonds Principal[2]	Series 2015 MI Bonds Interest[2]	Estimated TIRZ Admin Expenses	Total Combined Obligations
1	$0	$405,801	$0	$161,824	$0	$567,626
2	$0	$555,470	$0	$221,509	$15,000	$791,978
3	$0	$555,470	$33,975	$221,509	$15,000	$825,954
4	$111,427	$555,470	$36,099	$218,876	$15,000	$936,871
5	$120,712	$545,720	$39,284	$216,078	$15,000	$936,794
6	$129,998	$535,157	$42,469	$213,033	$15,000	$935,658
7	$142,378	$523,783	$44,593	$209,742	$15,000	$935,496
8	$151,664	$511,324	$48,840	$206,286	$15,000	$933,114
9	$164,045	$498,054	$52,025	$202,501	$15,000	$931,625
10	$179,521	$483,700	$55,210	$198,469	$15,000	$931,900
11	$191,901	$467,992	$59,457	$194,190	$15,000	$928,541
12	$210,473	$451,201	$63,704	$189,583	$15,000	$929,959
13	$225,948	$432,784	$69,012	$184,645	$15,000	$927,391
14	$244,520	$413,014	$73,259	$179,297	$15,000	$925,090
15	$266,186	$391,618	$78,568	$173,619	$15,000	$924,992
16	$287,852	$368,327	$84,938	$167,530	$15,000	$923,648
17	$309,518	$343,140	$90,247	$160,948	$15,000	$918,853
18	$337,375	$316,057	$96,617	$153,954	$15,000	$919,003
19	$365,232	$286,537	$104,050	$146,466	$15,000	$917,284
20	$393,088	$254,579	$111,482	$138,402	$15,000	$912,551
21	$427,135	$220,184	$119,976	$129,762	$15,000	$912,057
22	$461,183	$182,809	$128,469	$120,464	$15,000	$907,925
23	$501,420	$142,456	$138,025	$110,508	$15,000	$907,408
24	$541,657	$98,582	$147,580	$99,811	$15,000	$902,630
25	$584,990	$51,187	$158,198	$88,373	$15,000	$897,747
26	$0	$0	$169,877	$76,113	$15,000	$260,990
27	$0	$0	$182,618	$62,947	$15,000	$260,565
28	$0	$0	$195,358	$48,794	$15,000	$259,153
29	$0	$0	$209,161	$33,654	$15,000	$257,815
30	$0	$0	$225,087	$17,444	$15,000	$257,531
31	$0	$0	$0	$0	$0	$0
Total	**$6,348,224**	**$9,590,414**	**$2,858,178**	**$4,546,332**	**$435,000**	**$23,778,147**

1 - The principal and interest shares of the original City Major Improvements are calculated as 88.59% based on the prorated estimated costs and Par amounts shown in Section IV, Table IV-A.
The principal and interest amounts are based on the underwriter's final cashflows dated as of 11-16-15. The interest amounts include the 0.5% additional interest amount for prepayment and delinquency reserves.
2 - The principal and interest shares of the original City Major Improvements are calculated as 30.41% based on the prorated estimated costs and Par amounts shown in Section IV, Table IV-C.
The principal and interest amounts are based on the underwriter's final bond cashflows dated as of 11-16-15. The interest amounts include 0.5% for prepayment and delinquency reserves.

EXHIBIT F
PROJECTED ASSESSED VALUES

CITY OF AUBREY TAX INCREMENT REINVESTMENT ZONE No.__
CITY OF AUBREY, TX

Schedule III: Projected Absorption - All Phases

Assessment Year	Debt Service Year	Bond Year Ending	Lot Type 1 (60' Lot)		Lot Type 2 (50' Lot)		Total	
			Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
1-Jan-16	1	1-Sep-16	0	0	0	0	0	0
1-Jan-17	2	1-Sep-17	0	0	0	0	0	0
1-Jan-18	3	1-Sep-18	25	25	145	145	170	170
1-Jan-19	4	1-Sep-19	40	65	160	305	200	370
1-Jan-20	5	1-Sep-20	64	129	160	465	224	594
1-Jan-21	6	1-Sep-21	48	177	175	640	223	817
1-Jan-22	7	1-Sep-22	48	225	180	820	228	1,045
1-Jan-23	8	1-Sep-23	44	269	180	1,000	224	1,269
1-Jan-24	9	1-Sep-24		269	126	1,126	126	1,395
1-Jan-25	10	1-Sep-25		269		1,126		1,395
1-Jan-26	11	1-Sep-26		269		1,126		1,395
1-Jan-27	12	1-Sep-27		269		1,126		1,395
1-Jan-28	13	1-Sep-28		269		1,126		1,395
1-Jan-29	14	1-Sep-29		269		1,126		1,395
1-Jan-30	15	1-Sep-30		269		1,126		1,395
1-Jan-31	16	1-Sep-31		269		1,126		1,395
1-Jan-32	17	1-Sep-32		269		1,126		1,395
1-Jan-33	18	1-Sep-33		269		1,126		1,395
1-Jan-34	19	1-Sep-34		269		1,126		1,395
1-Jan-35	20	1-Sep-35		269		1,126		1,395
1-Jan-36	21	1-Sep-36		269		1,126		1,395
1-Jan-37	22	1-Sep-37		269		1,126		1,395
1-Jan-38	23	1-Sep-38		269		1,126		1,395
1-Jan-39	24	1-Sep-39		269		1,126		1,395
1-Jan-40	25	1-Sep-40		269		1,126		1,395
1-Jan-41	26	1-Sep-41		269		1,126		1,395
1-Jan-42	27	1-Sep-42		269		1,126		1,395
1-Jan-43	28	1-Sep-43		269		1,126		1,395
1-Jan-44	29	1-Sep-44		269		1,126		1,395
1-Jan-45	30	1-Sep-45		269		1,126		1,395
1-Jan-46	31	1-Sep-46		269		1,126		1,395
1-Jan-47	32	1-Sep-47		269		1,126		1,395
1-Jan-48	33	1-Sep-48		269		1,126		1,395
1-Jan-49	34	1-Sep-49		269		1,126		1,395
1-Jan-50	35	1-Sep-50		269		1,126		1,395
Total			269		1,126		1,395	

Note: The projected absorption schedule is provided by the developer.

CITY OF AUBREY TAX INCREMENT REINVESTMENT ZONE No.__
CITY OF AUBREY, TX

Schedule III: Projected Absorption - All Phases - Updated

Assessment Year	Debt Service Year	Bond Year Ending	Lot Type 1 (60' Lot)		Lot Type 2 (50' Lot)		Total	
			Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
1-Jan-16	1	1-Sep-16	0	0	0	0	0	0
1-Jan-17	2	1-Sep-17	0	0	0	0	0	0
1-Jan-18	3	1-Sep-18	25	25	145	145	170	170
1-Jan-19	4	1-Sep-19	40	65	160	305	200	370
1-Jan-20	5	1-Sep-20	64	129	160	465	224	594
1-Jan-21	6	1-Sep-21	48	177	175	640	223	817
1-Jan-22	7	1-Sep-22	48	225	180	820	228	1,045
1-Jan-23	8	1-Sep-23	44	269	180	1,000	224	1,269
1-Jan-24	9	1-Sep-24		269	130	1,130	130	1,399
1-Jan-25	10	1-Sep-25		269		1,130		1,399
1-Jan-26	11	1-Sep-26		269		1,130		1,399
1-Jan-27	12	1-Sep-27		269		1,130		1,399
1-Jan-28	13	1-Sep-28		269		1,130		1,399
1-Jan-29	14	1-Sep-29		269		1,130		1,399
1-Jan-30	15	1-Sep-30		269		1,130		1,399
1-Jan-31	16	1-Sep-31		269		1,130		1,399
1-Jan-32	17	1-Sep-32		269		1,130		1,399
1-Jan-33	18	1-Sep-33		269		1,130		1,399
1-Jan-34	19	1-Sep-34		269		1,130		1,399
1-Jan-35	20	1-Sep-35		269		1,130		1,399
1-Jan-36	21	1-Sep-36		269		1,130		1,399
1-Jan-37	22	1-Sep-37		269		1,130		1,399
1-Jan-38	23	1-Sep-38		269		1,130		1,399
1-Jan-39	24	1-Sep-39		269		1,130		1,399
1-Jan-40	25	1-Sep-40		269		1,130		1,399
1-Jan-41	26	1-Sep-41		269		1,130		1,399
1-Jan-42	27	1-Sep-42		269		1,130		1,399
1-Jan-43	28	1-Sep-43		269		1,130		1,399
1-Jan-44	29	1-Sep-44		269		1,130		1,399
1-Jan-45	30	1-Sep-45		269		1,130		1,399
1-Jan-46	31	1-Sep-46		269		1,130		1,399
1-Jan-47	32	1-Sep-47		269		1,130		1,399
1-Jan-48	33	1-Sep-48		269		1,130		1,399
1-Jan-49	34	1-Sep-49		269		1,130		1,399
1-Jan-50	35	1-Sep-50		269		1,130		1,399
Total			269		1,130		1,399	

Note: The projected absorption schedule is provided by the developer.

EXHIBIT G
PROJECTED INCREMENTAL REAL ESTATE TAXES

CITY OF AUBREY TAX INCREMENT REINVESTMENT ZONE No. 1
CITY OF AUBREY, TX

Schedule IV: Projected Assessed Value - All Phases - Updated

CAGR 8-yr 1.70%

Assessment Year	Debt Service Year	Bond Year Ending	Inflation Factor[1]	Projected Additional Homes Completed: Units[2]	Value Per Unit[3]	Market Value	Total Estimated Market Value[4]	Estimated Assessment Rate[2]	Estimated Assessed Value
1-Jan-16	1	1-Sep-16	100.0%	0	$0	$0	$11,936,903	100%	$11,936,903
1-Jan-17	2	1-Sep-17	100.0%	0	$0	$0	$14,707,195	100%	$14,707,195
1-Jan-18	3	1-Sep-18	100.0%	0	$0	$0	$45,114,833	100%	$45,114,833
1-Jan-19	4	1-Sep-19	100.0%	0	$0	$0	$91,498,694	100%	$91,498,694
1-Jan-20	5	1-Sep-20	100.0%	0	$0	$0	$144,432,343	100%	$144,432,343
1-Jan-21	6	1-Sep-21	100.0%	0	$0	$0	$206,992,147	100%	$206,992,147
1-Jan-22	7	1-Sep-22	100.0%	0	$0	$0	$332,658,227	100%	$332,658,227
1-Jan-23	8	1-Sep-23	100.0%	0	$0	$0	$463,738,737	100%	$463,738,737
1-Jan-24	9	1-Sep-24	100.0%	0	$0	$0	$512,273,627	100%	$512,273,627
1-Jan-25	10	1-Sep-25	101.7%	9	$305,185	$2,746,666	$523,728,945	100%	$523,728,945
1-Jan-26	11	1-Sep-26	101.7%	9	$310,373	$2,793,359	$535,425,696	100%	$535,425,696
1-Jan-27	12	1-Sep-27	101.7%	9	$315,650	$2,840,846	$547,368,779	100%	$547,368,779
1-Jan-28	13	1-Sep-28	101.7%	0	$0	$0	$556,674,048	100%	$556,674,048
1-Jan-29	14	1-Sep-29	101.7%	0	$0	$0	$566,137,507	100%	$566,137,507
1-Jan-30	15	1-Sep-30	101.7%	0	$0	$0	$575,761,845	100%	$575,761,845
1-Jan-31	16	1-Sep-31	101.7%	0	$0	$0	$585,549,796	100%	$585,549,796
1-Jan-32	17	1-Sep-32	101.7%	0	$0	$0	$595,504,142	100%	$595,504,142
1-Jan-33	18	1-Sep-33	101.7%	0	$0	$0	$605,627,713	100%	$605,627,713
1-Jan-34	19	1-Sep-34	101.7%	0	$0	$0	$615,923,384	100%	$615,923,384
1-Jan-35	20	1-Sep-35	101.7%	0	$0	$0	$626,394,082	100%	$626,394,082
1-Jan-36	21	1-Sep-36	101.7%	0	$0	$0	$637,042,781	100%	$637,042,781
1-Jan-37	22	1-Sep-37	101.7%	0	$0	$0	$647,872,508	100%	$647,872,508
1-Jan-38	23	1-Sep-38	101.7%	0	$0	$0	$658,886,341	100%	$658,886,341
1-Jan-39	24	1-Sep-39	101.7%	0	$0	$0	$670,087,409	100%	$670,087,409
1-Jan-40	25	1-Sep-40	101.7%	0	$0	$0	$681,478,895	100%	$681,478,895
1-Jan-41	26	1-Sep-41	101.7%	0	$0	$0	$693,064,036	100%	$693,064,036
1-Jan-42	27	1-Sep-42	101.7%	0	$0	$0	$704,846,124	100%	$704,846,124
1-Jan-43	28	1-Sep-43	101.7%	0	$0	$0	$716,828,508	100%	$716,828,508
1-Jan-44	29	1-Sep-44	101.7%	0	$0	$0	$729,014,593	100%	$729,014,593
1-Jan-45	30	1-Sep-45	101.7%	0	$0	$0	$741,407,841	100%	$741,407,841
1-Jan-46	31	1-Sep-46	101.7%	0	$0	$0	$754,011,775	100%	$754,011,775
1-Jan-47	32	1-Sep-47	101.7%	0	$0	$0	$766,829,975	100%	$766,829,975
1-Jan-48	33	1-Sep-48	101.7%	0	$0	$0	$779,866,084	100%	$779,866,084

[1] The inflation factor is the CAGR pf 1.7% at the time of TIRZ creation.

[2] The additional number of homes to be built are based on 2024 parcels reflecting lot values for 27 lots, which are assumed to be built in three years.

[3] Projected home values for additional homes are based on average 2024 home values in Phase #3B, excluding lot values.

[4] The values shown for 2016 through 2023 are actual values as reported to the Comptroller. 2024 values are based on Denton County Appraisail District online records as of August 8, 2024.
Future aggregate home values are based on 2024 home values with a CAGR of 1.7%.

EXHIBIT F
PROJECTED ASSESSED VALUES

CITY OF AUBREY TAX INCREMENT REINVESTMENT ZONE No. 1
CITY OF AUBREY, TX

Schedule V: Projected Incremental Real Property Tax - All Phases - Updated

Assessment Year	Bond Year Ending	Inflation Factor	Estimated Assessed Value[1]	Base Year Value	City of Aubrey Tax Rate[2]	Estimated Real Propert Tax	Base Year Tax	Estimated Incremental Real Property Tax	Estimated TIRZ Participation Percentage[3]	Projected TIRZ Increments Available	Total Estimated Incremental Real Property Tax Committed[4]	Percentage of Incremental Real Property Tax Committed
1-Jan-16	1-Sep-16	100.0%	$11,936,903	($8,925,919)	$0.561956	$67,080	($50,160)	$0	64.73%	$0	$0	
1-Jan-17	1-Sep-17	100.0%	$14,707,195	($8,925,919)	$0.542049	$79,720	($50,160)	$29,560	45.20%	$13,361	$7,648	45.20%
1-Jan-18	1-Sep-18	101.7%	$45,114,833	($8,925,919)	$0.542000	$244,522	($50,160)	$194,363	45.20%	$87,852	$14,156	45.20%
1-Jan-19	1-Sep-19	103.4%	$91,498,694	($8,925,919)	$0.541600	$495,557	($50,160)	$445,397	45.20%	$201,320	$85,749	45.20%
1-Jan-20	1-Sep-20	105.2%	$144,432,343	($8,925,919)	$0.541400	$781,957	($50,160)	$731,797	45.20%	$330,772	$220,267	45.20%
1-Jan-21	1-Sep-21	107.0%	$206,992,147	($198,765)	$0.452905	$937,478	($900)	$936,578	45.20%	$423,333	$342,699	45.20%
1-Jan-22	1-Sep-22	108.8%	$332,658,227	($198,765)	$0.464928	$1,546,621	($900)	$1,545,721	45.20%	$698,666	$474,905	45.20%
1-Jan-23	1-Sep-23	110.6%	$463,738,737	($198,765)	$0.464000	$2,151,748	($900)	$2,150,848	45.20%	$972,183	$626,293	45.20%
1-Jan-24	1-Sep-24	112.5%	$512,273,627	($198,765)	$0.464000	$2,376,950	($900)	$2,376,049	38.75%	$920,719	$972,183	45.20%
1-Jan-25	1-Sep-25	114.4%	$523,728,945	($198,765)	$0.464000	$2,430,102	($900)	$2,429,202	38.75%	$941,316	$920,719	38.75%
1-Jan-26	1-Sep-26	116.4%	$535,425,696	($198,765)	$0.464000	$2,484,375	($900)	$2,483,475	38.75%	$962,347	$941,316	38.75%
1-Jan-27	1-Sep-27	118.4%	$547,368,779	($198,765)	$0.464000	$2,539,791	($900)	$2,538,891	38.75%	$983,820	$962,347	38.75%
1-Jan-28	1-Sep-28	118.4%	$556,674,048	($198,765)	$0.464000	$2,582,968	($900)	$2,582,067	38.75%	$1,000,551	$983,820	38.75%
1-Jan-29	1-Sep-29	118.4%	$566,137,507	($198,765)	$0.464000	$2,626,878	($900)	$2,625,978	38.75%	$1,017,566	$1,000,551	38.75%
1-Jan-30	1-Sep-30	118.4%	$575,761,845	($198,765)	$0.464000	$2,671,535	($900)	$2,670,635	38.75%	$1,034,871	$1,017,566	38.75%
1-Jan-31	1-Sep-31	118.4%	$585,549,796	($198,765)	$0.464000	$2,716,951	($900)	$2,716,051	38.75%	$1,052,470	$1,034,871	38.75%
1-Jan-32	1-Sep-32	118.4%	$595,504,142	($198,765)	$0.464000	$2,763,139	($900)	$2,762,239	38.75%	$1,070,368	$1,052,470	38.75%
1-Jan-33	1-Sep-33	118.4%	$605,627,713	($198,765)	$0.464000	$2,810,113	($900)	$2,809,212	38.75%	$1,088,570	$1,070,368	38.75%
1-Jan-34	1-Sep-34	118.4%	$615,923,384	($198,765)	$0.464000	$2,857,885	($900)	$2,856,984	38.75%	$1,107,081	$1,088,570	38.75%
1-Jan-35	1-Sep-35	118.4%	$626,394,082	($198,765)	$0.464000	$2,906,469	($900)	$2,905,568	38.75%	$1,125,908	$1,107,081	38.75%
1-Jan-36	1-Sep-36	118.4%	$637,042,781	($198,765)	$0.464000	$2,955,879	($900)	$2,954,978	38.75%	$1,145,054	$1,125,908	38.75%
1-Jan-37	1-Sep-37	118.4%	$647,872,508	($198,765)	$0.464000	$3,006,128	($900)	$3,005,228	38.75%	$1,164,526	$1,145,054	38.75%
1-Jan-38	1-Sep-38	118.4%	$658,886,341	($198,765)	$0.464000	$3,057,233	($900)	$3,056,332	38.75%	$1,184,329	$1,164,526	38.75%
1-Jan-39	1-Sep-39	118.4%	$670,087,409	($198,765)	$0.464000	$3,109,206	($900)	$3,108,305	38.75%	$1,204,468	$1,184,329	38.75%
1-Jan-40	1-Sep-40	118.4%	$681,478,895	($198,765)	$0.464000	$3,162,062	($900)	$3,161,162	38.75%	$1,224,950	$1,204,468	38.75%
1-Jan-41	1-Sep-41	118.4%	$693,064,036	($198,765)	$0.464000	$3,215,817	($900)	$3,214,917	38.75%	$1,245,780	$1,224,950	38.75%
1-Jan-42	1-Sep-42	118.4%	$704,846,124	($198,765)	$0.464000	$3,270,486	($900)	$3,269,586	38.75%	$1,266,964	$1,245,780	38.75%
1-Jan-43	1-Sep-43	118.4%	$716,828,508	($198,765)	$0.464000	$3,326,084	($900)	$3,325,184	38.75%	$1,288,509	$1,266,964	38.75%
1-Jan-44	1-Sep-44	118.4%	$729,014,593	($198,765)	$0.464000	$3,382,628	($900)	$3,381,727	38.75%	$1,310,419	$1,288,509	38.75%
1-Jan-45	1-Sep-45	118.4%	$741,407,841	($198,765)	$0.464000	$3,440,132	($900)	$3,439,232	38.75%	$1,332,702	$1,310,419	38.75%
						$69,997,493	**($273,304)**	**$69,707,268**		**$27,400,776**	**$26,084,487**	**40.2%**

[1] See Appendix F for more details.

[2] Years 2016-2023 are based on actual taxes. 2024 and on is estimated based on the 2023 tax rate.

[3] The original participation rate of 64.73% was reduced to 45.20% in 2016 and is further being reduced to 38.75% for 2024 and forward.

[4] Ammounts shown for years 2016 through 2023 are actual incremental tax revenues applied towards the TIRZ obligations. Amounts shown for 2024 are based on the incremental tax projections.

EXHIBIT H
DEVLOPMENT STANDARDS

Exhibit "F"

Development Standards

I. PLANNING STANDARDS

1.1 Purpose: The purpose of these Development Standards ("Standards") is to establish enforceable minimum requirements for the development and use of a 467.6 tract of land known as Jackson Ridge (the "Property"), which is the subject of the Jackson Ridge Development Agreement between the City of Aubrey, Texas and CADG Comanche 248, LLC, and Comanche Ridge 52 Partners, Ltd (the "Development Agreement"). The intent is for these requirements to result in a quality subdivision and thoroughfare development with residential uses in an orderly fashion.

1.2 Establishment of Use Districts: For the purpose of regulating land use, the Property shall be developed and used in accordance with the standards set forth in the following use districts to apply to the Property in the corresponding areas of lots designated by size in the Concept Plan with a maximum 4.25 units per acre:

SF-6	-	Single Family Residential, 6,000 sf minimum lot;
SF-72	-	Single Family Residential, 7,200 sf minimum lot;
AC	-	Amenity Center

Upon application by Developer demonstrating with respect to one or more lots that the minimum lot area established for SF-6 does not allow for construction of a single family residence on such a lot that is otherwise in compliance with these Development Standards, the City shall administratively through its city engineer grant a variance to allow for a reduced minimum lot area that is no less than 5,700 sf.

Use Regulations:

a) <u>SF-6</u>

Permitted Uses: Single-family detached dwellings in accordance with the limits of SF-6 zoning or the following limits:

Development Minimums:

Lot Area:	6,000 square feet
Lot Width:	50 feet, 45 feet for lots fronting cul-de-sac
Lot Depth:	120 feet
Front Yard:	20 feet
Side Yard:	5 feet; 10 feet on corner lots adjacent to street, except for corner lots adjacent to streets where 15' side yards are required as shown in Master Plan on page 6 of these Standards.
Rear Yard	20 feet, 10' for lots adjacent to park or trail with tubular steel, wrought iron, masonry or similar material fencing (No Wood).
Dwelling Unit Size:	1,200 square feet
Parking spaces:	2 per dwelling unit in an enclosed garage

Development Maximums:

Height	35 feet
Lot Coverage	55%

b) SF-72

Permitted Uses: Single-family detached dwellings in accordance with the following limits:

Development Minimums:

Lot Area:	7,200 square feet
Lot Width:	60 feet, 55 feet for lots fronting cul-de-sac
Lot Depth:	120 feet
Front Yard:	20 feet
Side Yard:	5 feet; 10 feet on corner lots adjacent to street, except for corner lots adjacent to streets where 15' side yards are required as shown in Master Plan on page 6 of these Standards.
Rear Yard	20 feet, 10' for lots adjacent to park or trail with tubular steel, wrought iron, or similar material fencing (No Wood).
Dwelling Unit Size:	1,200 square feet
Parking spaces:	2 per dwelling unit in an enclosed garage

Development Maximums:

Height	35 feet
Lot Coverage	55%

c) AC – Amenity Center

The purpose of the Amenity Center District is to allow for a unified development under a common architectural theme for neighborhood amenities such as pool, sports fields, playground, restrooms, pavilion, and public/civic uses, as submitted by the Developer of property in the Amenity Center District.

Permitted Uses: Amenities, in accordance with the following limits:

Development Minimums:

Lot Area:	5,000 square feet
Lot Width:	50 feet
Lot Depth:	100 feet
Front Yard:	30 feet
Side Yard:	15 feet
Rear Yard	20 feet
Floor Area Ratio:	0.6: 1

Development Maximums:

Height	35 feet
Lot Coverage	70%

Special Regulations: Development in the Amenity Center Districts shall be subject to prior Site Plan submittal and approval by the City Council. The Site Plan shall be approved if the proposed development is in conformity these Development Standards, applicable City Regulations, and the Developer's architectural guidelines. Further, the Planning and Zoning Commission and City Council have the express authority to authorize development in a manner that is contrary to the minimums stated herein, only to the extent necessary to allow development to conform to the architectural and stylistic theme proposed by the Developer.

1.3 Regulations Applicable: When not in conflict with these Development Standards, the development of the Property shall be subject to all applicable City Regulations, as that term is defined in the Development Agreement, including but not limited to the City's subdivision regulations, engineering design standards, property maintenance codes, building codes and other applicable uniform codes.

1.4 Signage: Signage shall be allowed in the Amenity Center District only, and shall be limited to one sign per lot, advertising the location of a facility on that lot. Lots with two or more sides of public street frontage shall be allowed one sign per side with street frontage. Signage shall be of a monument type with a maximum height of 6 feet. The location and elevation of proposed signage shall be depicted on the Site Plan, and shall be approved if in accordance with these regulations.

1.5 Hike and Bike Trail System: The Property shall be developed in a manner consistent with the hike and bike trail system as required under the Development Agreement. Developers shall provide interconnectivity of the system between phases and areas of the development and the amenity center by way of a sidewalk, stairs and/or ramps. The system shall provide access to abutting retail development and shall be designed such that all residential units are within three thousand (3,000) feet of the system. The minimum trail width shall be 6 feet.

1.6 Homeowner's Association (HOA):

a) An HOA shall be established to maintain open space, landscaping and screening, recreational and amenity areas, and other commonly owned facilities.

b) The Developer is responsible for drafting the HOA documents pertaining to the HOA's responsibilities to maintain these areas and include notification to homeowners within the Property.

c) Certain parks within the Property shall be dedicated to the City of Aubrey, locations to be determined by City and Developer and the HOA shall be responsible for the maintenance of these parks, as documented in a separate agreement.

d) Prior to approval of a Final Plat, a document establishing the HOA shall be submitted to the City for review and approved by the City for conformance with all requirements and other applicable ordinances.

1.7 Exterior Wall Masonry: All exterior walls, excluding doors, windows and window units, shall be comprised of at least ninety (90%) percent masonry product. Masonry product shall include stone, brick, cultured stone and stucco, or equivalent, permanent, architecturally finished material, such as cementitious fiberboard or "hardiboard-type" material. Any cementitious fiberboard product shall be limited to no more than forty (40%) percent of any exterior. Prohibited exterior finish materials include vinyl and wood siding, exterior insulation finishing system (EIFS), and manufactured wood products

1.8 Roofing: All roofs shall have a minimum roof pitch of 6:12 with roofing materials consisting of asphalt and composite shingles, clay and concrete tile, slate and slate-type shingles, or an equivalent or better product, and accompanied with a 25 year warranty.

1.9 Garages: Garages shall be situated so that they are not the predominant design feature of the dwelling. Any front loading or front facing garage shall include at least one architectural elements, such as decorative overhangs above doors, banding or moldings, detailed door designs, windows/openings on garage doors, decorative vent covers, raised panel garage door, decorative hardware, or similar elements.

1.10 **Parking:** In Amenity Center Districts, at least one off-street parking space shall be provided per three hundred (300) square feet of gross structure area.

1.11 **Floodplain Dedication:** All floodplain areas shall be dedicated to the HOA or City, and shall be considered Common Open Space.

1.12 **Screening and Outside Storage:** Amenity Center Districts, all ground–mounted antennas, satellite dishes, mechanical equipment, HVAC units, trash receptacles and auxiliary power units shall be screened from view by the street by means of a masonry wall or tubular steel with a living screen. Outside storage of materials shall only be allowed in the back yard area, unless properly screened. Roof mounted equipment shall be adequately screened by a parapet wall.

1.13 **Landscaping** per lot – minimum 2 trees per lot - 2' caliper inch; minimum 8 shrubs for mid-level planting - must be 24" x 24" at planting; minimum 4 plants used for upper-level landscape should be 30" tall at the time of planting.

1.14 **City Service Fees:** The City of Aubrey shall assess a library service fee of $5.00 per lot per year in accordance to the City's current Ordinances.

1.15 **Open Space Requirements:** The project will include a minimum of 10% open space including parks, flood plain, amenity centers, trails and landscape areas.

1.16 **Screening Walls:** The purpose of providing screening walls is to improve the appearance of subdivisions abutting public rights-of-way; preserve and promote the aesthetic appeal of surrounding neighborhoods; and provide a cohesive identity for each subdivision. Screening along the thoroughfares shall consist of several methods, including berms, trees, shrubs, and walls/fences as designated on an approved screening plan. Solid wood fences abutting the thoroughfares are prohibited.

1. Lots Backing Upon a Freeway Frontage Road, Arterial Thoroughfare, or a Major or Residential Collector Street:

   A screening wall shall be provided and maintained along the property line of any subdivision of single-family or multifamily lots where the rear of such lots abuts any freeway frontage road, or arterial thoroughfare, as such thoroughfare is identified on the Concept Plan, or a major or residential collector street. This requirement shall also apply where such lots are separated from the freeway frontage road, arterial thoroughfare, or major or residential collector street by an alley. In such instance the screening wall shall be placed in a five-foot wide easement within the Property along the right-of-way line separating the alley, and freeway frontage road, arterial thoroughfare, or major or residential collector street. The HOA shall be responsible for maintenance of the screening wall.

   The construction of such screening wall shall be the responsibility of the developer of the subdivision. Construction of the required screening wall shall occur subsequent to the final grading of the subdivision, but prior to formal acceptance of the subdivision by the City of Aubrey. In such instance the screening wall shall be placed in a five-foot wide easement within the Property along the right-of-way line separating the alley, and freeway frontage road, arterial thoroughfare, or major or residential collector street. The HOA shall be responsible for maintenance of the screening wall.

2. Lots Siding Upon a Freeway Frontage Road or Arterial Thoroughfare:

   Where a street within a single-family or multifamily subdivision must intersect a freeway frontage road or arterial thoroughfare, as identified on the Development Site Plan, in order to provide access into the subdivision, and where a single-family, lot sides to a freeway frontage road or arterial thoroughfare, a screening wall shall be provided along the side of the lot adjacent to such freeway frontage road or arterial

thoroughfare where the screening wall would constitute a continuation of any existing or proposed screening wall. In such instance the screening wall shall be placed in a five-foot wide easement within the Property along the right-of-way line separating the alley, and freeway frontage road, arterial thoroughfare, or major or residential collector street. The HOA shall be responsible for maintenance of the screening wall.

Where two residential streets intersect with a freeway frontage road or arterial thoroughfare identified on the Concept Plan, the City Council shall determine whether adequate distance exists between the residential streets such that the provision of a masonry screening wall would be reasonable and appropriate.

The provisions of this subsection shall apply where the sides of such lots are separated from the freeway frontage road or arterial thoroughfare by an alley. In such instance the screening wall shall be placed on the right-of-way line separating the alley and freeway frontage road or arterial thoroughfare.

3. Building Materials:

   Screening walls may be constructed of masonry, decorative metals, wood, or a combination of these materials as designated on the approved screening plan

4. Maintenance:

   All areas adjacent to any screening wall or fence, or areas adjacent to a public street or right-of-way, shall be maintained in a clean and orderly condition by the property owner, free of debris and trash, in accordance with the applicable codes of the City of Aubrey.

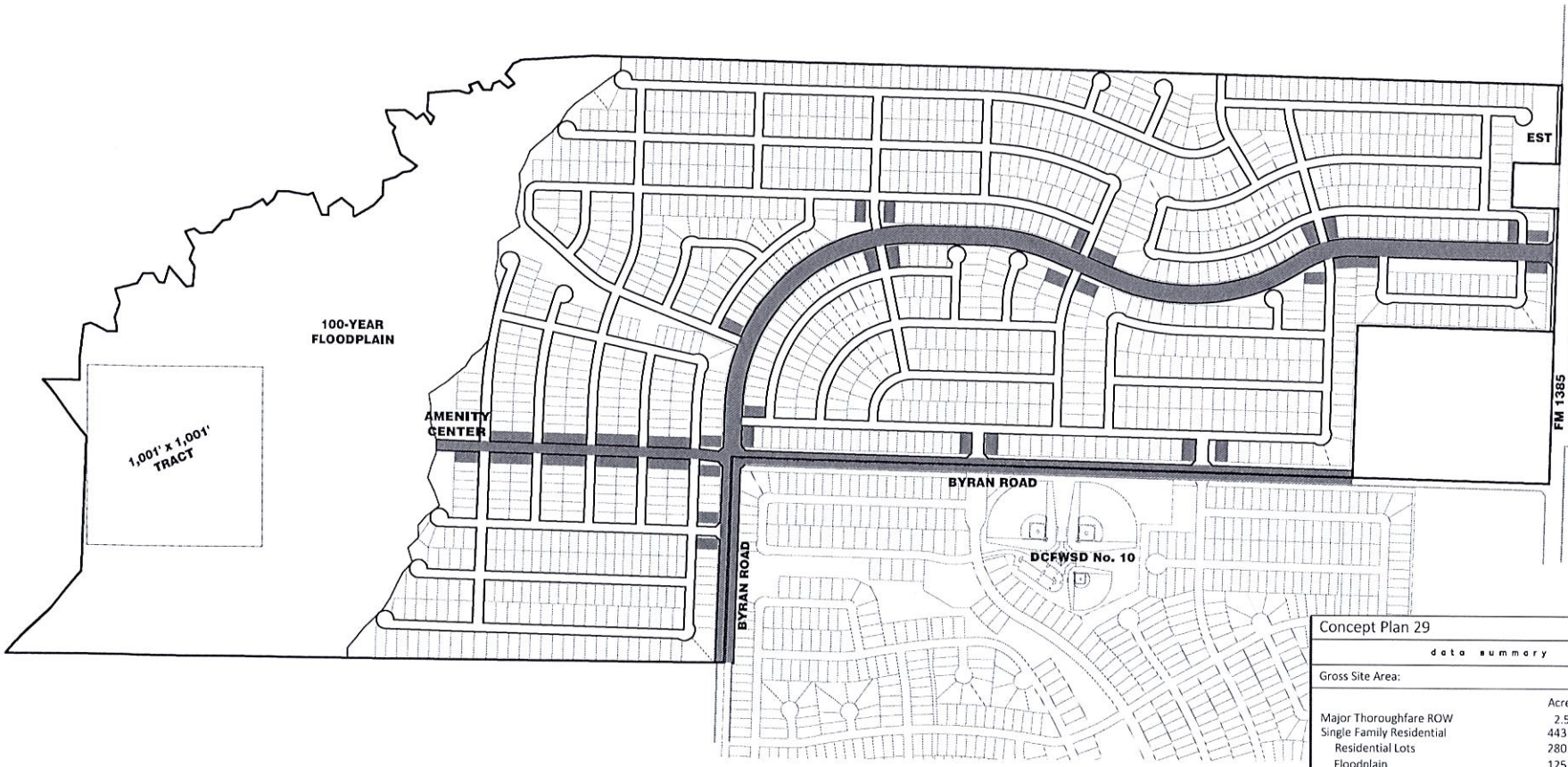
5. Alternative Screening Material:

   Other material or screening devices which meet the intent of these Standards, may be utilized to satisfy the requirements of this Section only upon approval of the City Council.

6. Conflicts:

   Where the screening or buffering standards prescribed by this section are in conflict with special screening or buffering requirements which have been established within zoning districts on the Property, then the more restrictive requirements shall apply.

   In instances where placement of a screening wall conflicts with the Visibility Obstructions Ordinance or other applicable ordinances, the screening wall shall be placed on private property within a screening wall maintenance easement which shall be provided on the subdivision plat of the property.



LOT WITH MINIMUM 15' SIDE YARD

Concept Plan 29

data summary

Gross Site Area:		446.3
	Acres	Gross %
Major Thoroughfare ROW	2.5	1%
Single Family Residential	443.8	99%
Residential Lots	280.7	66%
Floodplain	125.1	28%
Open Space	17.8	4%
Elevated Storage Tank Area	1.5	1%
Amenity Center	1.4	1%
Residential Product Type:	Lots	Density
50' x 120' Lots	1126	
60' x 120' Lots	269	
Total Lots	1395	3.1:1

The Jackson Ridge Development does not exceed 4.25 units per gross acre and provides a minimum 10% of open space for the entire development.

MASTER PLAN
JACKSON RIDGE DEVELOPMENT
AUBREY ETJ / PROSPER ETJ, DENTON COUNTY, TEXAS

SCALE: 1"=500'

PETITT BARRAZA
ENGINEERING PLANNING SURVEYING

DATE: MAY, 2015

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Hold a Public Hearing, Consider and take appropriate action regarding an Ordinance of the City Council of Aubrey, Texas, approving the proposed amendment to the approved Amended Project Plan and Financing Plan for Tax Increment Reinvestment Zone No. 1, City of Aubrey, Texas (the "zone") resulting in the decrease of the participation rate pursuant to Chapter 311, Texas Tax Code.

Staff Contact
Mike English, Finance Director
menglish@aubreytx.gov
940-440-9343

Summary
Municap, the City's PID and TIRZ administrator, has prepared the amendment to the approved Amended Project Plan and Financing Plan for the Tax Increment Reinvestment Zone No. 1, City of Aubrey, Texas. Chapter 311 or the Texas Tax Code requires the amendment be approved by Council by City ordinance. The amendment provides for a decrease in the participation rate by the City of Aubrey (45.2% to 38.75%).

Financial Summary
The refunding of the Jackson Ridge PID bonds resulted in lower debt service costs for the City. Staff recommended and Council approved a 50/50 split of the savings between the assessments to the residents of the District and the City. The savings to the City resulted in a reduction of the TIRZ #1 participation rate from 45.2% to 38.75%.

Staff Recommended Motion
Approve

Conditions
N/A

ORDINANCE NO. 866-24

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF AUBREY, TEXAS, CHANGING THE PARTICIPATION RATE OF THE TAX INCREMENT TAX INCREMENT REINVESTMENT ZONE NUMBER ONE, CITY OF AUBREY, TEXAS; APPROVING THE AMENDMENT TO THE APPROVED SECOND AMENDED PROJECT PLAN AND FINANCING PLAN FOR TAX INCREMENT TAX INCREMENT REINVESTMENT ZONE NUMBER ONE, CITY OF AUBREY, TEXAS; AUTHORIZING THE CITY CLERK TO DISTRIBUTE SUCH PLANS; CONTAINING FINDINGS AND PROVISIONS RELATED TO THE FOREGOING SUBJECTS; PROVIDING FOR SEVERABILITY; AND PROVIDING FOR THE EFFECTIVE DATE THEREOF.

WHEREAS, the City Council of the City of Aubrey ("City") pursuant to the provisions of Chapter 311, Texas Tax Code, created Tax Increment Reinvestment Zone Number One, City of Aubrey, Texas, (the "Zone"), by Ordinance 580-16, adopted November 17, 2015; and

WHEREAS, by Ordinance 628-17 adopted March 21, 2017, the City approved the Amended Project Plan and Financing Plan for the Tax Increment Reinvestment Zone Number One, City of Aubrey, Texas, for the purpose of updating the project costs and reducing the participation rate; and

WHEREAS, the Board of Directors of the Zone considered and adopted the Second Amended Project Plan and Financing Plan, which reduces the participation rate, and recommended the Amendment for approval by City Council; NOW THEREFORE,

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF AUBREY, TEXAS:

Section 1: The findings and recitals contained in the preamble of this ordinance are hereby found and declared to be true and correct and are adopted as part of this ordinance for all purposes.

Section 2: The City, acting under and in accordance with the provisions of Chapter 311, Texas Tax Code, including does hereby change the participation rate of the Tax Increment Reinvestment Zone Number One, City of Aubrey, Texas, as follows:

Participation rate for the City of Aubrey, Texas was decreased from 45.2% to 38.75%.

Section 3: The tax increment base for the enlarged Zone shall include the tax increment base established by the Ordinance creating the Zone.

Section 4: The Plan is hereby amended to reflect the new participation rate and is attached hereto as Exhibit “A” and incorporated herein for all intents and purposes. The Amendment is

determined to be feasible and is approved. The appropriate officials of the City are authorized to take all steps reasonably necessary to implement the Amendment.

Section 5: The City Clerk is directed to provide copies of the Amendment to each taxing unit levying ad valorem taxes in the Zone.

Section 6: If any provision, section, subsection, sentence, clause, or phrase of this ordinance, or the application of same to any person or set of circumstances is for any reason held to be unconstitutional, void, or invalid, the validity of the remaining portions of this ordinance or their application to other persons or sets of circumstances shall not be affected thereby, it being the intent of the City Council in adopting this ordinance that no portion hereof or provision or regulation contained herein shall become inoperative or fail by reason of any unconstitutionality, voidness, or invalidity of any other portion hereof, and all provisions of this ordinance are declared to be severable for that purpose.

Section 7: This ordinance shall take effect immediately from and after its passage by the City Council of the City of Aubrey.

INTRODUCED, READ AND PASSED by the affirmative vote of the City Council of the City of Aubrey this the 22nd day of August 2024.

_____
CHIS RICH, Mayor

_____
JENNY HICKS, City Secretary

_____
PATRICIA ADAMS, City Attorney

EXHIBIT A
AMENDED PROJECT PLAN AND FINANCING PLAN

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Presentation from Rodney Dryden, from Hub International, regarding the city's health insurance plans, and consideration and action for making plan changes.

Staff Contact
Shaena Williams, Human Resources
swilliams@aubreytx.gov
940-440-9343

Summary
The City of Aubrey continues to strive to offer competitive benefits. Keeping in line with that goal, we recommend the following with regard to our health insurance plans. We would stay with our current provider, Blue Cross Blue Shield, for medical and dental, and switch the vision, life, short-term disability, and long-term disability insurance to Blue Cross Blue Shield. For medical insurance, we would keep our three most utilized plans. The City would absorb the 2.9% rate increase for the High Deductible Health Plan and Basic PPO and the rate increase for the High PPO plan will be passed on to the employee. We would also increase the City contribution to the health savings account (HSA), for employees enrolled in the Family High Deductible Health Plan from $3,000 to $3,600 annually. There will be no rate increase for dental and vision. Currently, the City offers First Stop Health for telemedicine and virtual mental health visits. The City would like to enhance this benefit, to also include virtual primary care providers. In addition, staff is recommending an increase to the City's employee paid life insurance from a $50,000 limit to one times the employee's salary.

Financial Summary
The health benefits with the proposed changes would cost the City $1,193,728.80, which is an increase of $4,527.60 from FY 2024's cost of $1,189,201.20.

Staff Recommended Motion
Approve

Conditions
N/A

CITY OF AUBREY RECOMMENDATIONS 2024

The following summarizes the results or our marketing effort and focuses on the recommended providers for the City.

Medical Plan - TML, EMI Health, Scott & White declined to quote. Aetna quoted but uncompetitive.

GENERAL INFORMATION

* **No adjustments were made to current employee selections**
* Current employee count is 110 with 104 enrolled in medical - 74 EO and 30 with Fam/Dep coverage
* **At the current HSA Contribution levels ($1500 individuals/$3000 family), the City's additional cost for the HSA plan is $139,500**
* **By moving to a 3-tiered HSA Contribution arrangement ($1500 individuals/$3000 for Emp+Spouse/$3600 for Emp & Family), the City's cost for the HSA increases to $154,500 (with current enrollment numbers - $176,100 with 110 EE projection).**

Blue Cross Blue Shield

* All BCBS Plans are PPO - In-Network and Out-of-Network benefits
* Initial Renewal Offer - 16.9% increase, BAFO - 5% with a bundled discount (Dental, Vision, Life & Disability)
* BCBS agreed to a FINAL 2.9% increase in medical premiums with the bundle discount, and a 0% increase in dental premiums.
* With the current enrollment, the City's cost would increase 5% for medical premiums (including increased HSA contributions)
* City wants to drop the HMO plan option due to a lack of interest / low enrollment.
* Wellness Benefits included with BCBS: Catapult At-Home Biometrics Screenings, Wondr weight loss program, Omada hypertension / diabetes prevention program, TeleHealth (Livongo) Pre-Diabetes prevention, Blue Rewards

Cigna Level Funding

* Cigna presented a competitive offer that is 5.3% below Current Rates
* Level Funding Option that provides an opportunity to recoup 2/3 share of any Claims Surplus (Cigna keeps the other 1/3)
* Cigna offered a $20,000 upfront credit if Dental is sold with medical (Dental rates are below current with a 24 month rate guarantee)
* Offer includes a $5500 Wellness Fund to complement their integrated incentive platform (OR funds can be used for a Health Fair)
* Cigna Enhanced Features include: Expanded Preventive Drug List applicable to ALL medical plans, Pre-Enrollment Line & Virtual Benefit Eduction site, Cigna OneGuide concierge service model, Virgin Pulse (wellness engagement platform), Three EAP visits at no cost, Omada Diabetes Prevention program, MD Live telehealth with $0 copay
* A 2nd Year Rate Cap can likely be negotiated if interested in moving to Cigna - Estimating rate cap between 10-12%.
* Cigna network costs tend to run 2-3% higher for the same service compared to BCBS network.
* New carrier 1st year renewals tend to be higher to offset the lower initial plan costs associated with "new business."

United Healthcare

* Comparable plans to current BCBS with a 4.7% increase over Current rates
* UHC offered a $10,000 Implementation Credit

Dental, Vision and Other Ancillary Products

* BCBS Best and Final Offer includes a bundle discount with Dental, Vision, Basic Life, Voluntary Life, Short-Term and Long-Term Disability
* The Standard renewal offered a rate pass (no increase) for Life and Disability products
* Consider an increase in Basic Life/AD&D benefit to 1 x Annual Salary with a $50,000 minimum
* Add First Stop Health Virtual PCP service for an additional $7.70 PEPM ($15.90 PEPM for Virtual Urgent Care, Mental Health Counseling, and a dedicated Virtual Primary Care Physician at no cost to the member or the BCBS medical plan. Also, provides the ability to host an Onsite Biometric Screening event to encourage preventive care and improve overall health & wellness.

BENEFIT RECOMMENDATIONS

* **Average PEPY Budget increases from $10,810.92 to $10,852.08 (inc ALL benefits) with enhanced benefits.**
* Renew with Blue Cross for consistency and avoidance of the disruption factor that comes with a carrier change.
* Blue Cross has been fair with their renewals and shown a level of commitment to the partnership with the City.
* Blue Cross network costs are slightly lower than the Cigna network - Better value for employees.
* **Keep Employee Payroll Deductions the same as current EXCEPT for the "Buy Up" Copay plan.**
* **Adjust the "Buy Up" plan to match the HSA "Base" plan EO contribution.**
* $164,700 HSA cost to City if 3-tiered HSA Contribution schedule is adopted ($1500 Individual/$3000 ES or EC/$3600 Emp&Family)
* Current Enrollment - HSA Contribution is $139,500
* City pays 100% of the EO cost and a portion of Dependent Cost for the HSA "Base" plan - other plans are "buy-up" or "buy down" options.
* Increase Basic Life/AD&D to a 1 x Annual Salary benefit ($50,000 minimum).
* Add First Stop Health Virtual PCP service

City Cost Scenario Recommendations:	Current Cost PEPM	New Cost PEPM	Static Cost PEPM	Net Change in Cost
> Renew current BCBS plans with the HSA medical as "Base Plan"	$695.99	$678.76	$696.24	($17.23)
> $1500/$3000/$3600 HSA contribution based upon projected enrollment of 110 - Average	$110.23	$124.77	$119.32	$14.54

>	Dental - Bundle discount equal to 1% of medical premiums applied to Final rates	$29.96	$29.96	$29.96	$0.00
>	Vision - BCBS Vision fpr 0.5% medical discount (applied to medical rates)	$5.73	$5.73	$5.73	$0.00
>	Life, STD, LTD - Bundle discount applied to medical rates to move to BCBS Ancillary*	$50.80	$49.22	$44.81	($1.58)
>	First Stop Health - Add Virtual PCP Service*	$8.20	$15.90	$8.20	$7.70
	Net Cost Change to the City	$900.91	$904.34	$904.26	$3.43
			100.4%	100.0%	

**Cost change due in part to "Buy Up" plan contribution change.*
**Medical Cost & HSA contributions based upon 110 employees to match up with last year's projections.*
**Life and First Stop Health numbers are based upon current enrollment of 104 employees.*
**Life and Disability are based upon salaries - Last year's projection was $32 PEPM. As the City adds more employees, this number increases.*

CITY OF AUBREY - 2024-2025 PLAN YEAR

HUB

Medical Plan Analysis - Blue Cross Blue Shield HSA 100% EO BASE PLAN

	CURRENT PLANS				BCBS FINAL OFFER WITH DISCOUNTS		
	BCBS MTBCP023 PPO	BCBSMTBCP014H PPO HSA	BCBSMTBCB042 BASIC PPO	BCBS MTBEE040 HMO PCP & Ref Req.	BCBS MTBCP023 PPO	BCBSMTBCP014H PPO HSA	BCBSMTBCB042 BASIC PPO
Annual Deductible (single/family)	$2500 / $7500	$5000 / $10000	$5000 / $14700	$5000 / $15000	$2500 / $7500	$5000 / $10000	$5000 / $14700
Out-of-pocket Maximum	$5500 / $14700	$5000 / $10,000	$7,350 / $14700	$7900/$15800	$5500 / $14700	$5000 / $10,000	$7,350 / $14700
Coinsurance In-Network / Out of Network	80% / 50%	100% / 70%	80% / 50%	80%	80% / 50%	100% / 70%	80% / 50%
Primary Care Copay	$30	N/A	$45	$40	$30	N/A	$45
Specialist Copay	$60	N/A	$90	$80	$60	N/A	$90
Preventive Care	No Charge in Network	No Charge In-Network	No Charge In-Network	No Charge in Network	No Charge in Network	No Charge In-Network	No Charge In-Network
In-Patient Hospital	20% After Deductible	0% After Deductible	20% After Deductible	20% After Deductible	20% After Deductible	0% After Deductible	20% After Deductible
Out-Patient Hospital	20% After Deductible	0% After Deductible	20% After Deductible	20% After Deductible	20% After Deductible	0% After Deductible	20% After Deductible
Emergency Room Copay	$500+20% After Deductible	0% After Deductible	$500 Copay + Deductible + 20%	$500 Copay + Deductible + 20%	$500+20% After Deductible	0% After Deductible	$500 Copay + Deductible + 20%
Urgent Care Copay	$75 copay	0% After Deductible	$75 Copay	$75 Copay	$75 copay	0% After Deductible	$75 Copay
Labs / X Rays	20% After Deductible	0% After Deductible	20% After Deductible	20% After Deductible	20% After Deductible	0% After Deductible	20% After Deductible
High-Tech Imaging	20% After Deductible	0% After Deductible	20% After Deductible	20% After Deductible	20% After Deductible	0% After Deductible	20% After Deductible
Pharmacy Services	Preferred RX	*Preventive RX No Deductible	Preferred RX	Preferred RX	Preferred RX	*Preventive RX No Deductible	Preferred RX
Preferred Generic	$0	0% After Deductible	$0	$0	$0	0% After Deductible	$0
Non-Preferred Generic	$10	0% After Deductible	$10	$10	$10	0% After Deductible	$10
Preferred / Non-Preferred Brand	$50	0% After Deductible	$50	$50	$50	0% After Deductible	$50
Preferred / Non-Preferred Specialty	$100/$150/$250	0% After Deductible	$100/$150/$250	$100/$150/$250	$100/$150/$250	0% After Deductible	$100/$150/$250
EMPLOYEE COUNTS:							
Employee Only	19	47	8	0	19	47	8
Employee & Spouse	0	4	2	0	0	4	2
Employee & Child(ren)	0	13	2	1	0	13	3

Employee & Family	0	6	2	0	0	12	2
TOTAL EMPLOYEE COUNT	19	70	14	1	19	76	15
BILLED PREMIUM:						City Cost Basis	
Employee Only	$670.13	$482.58	$538.69	$477.43	$681.47	$498.77	$553.59
Employee & Spouse	$1,627.20	$1,171.81	$1,308.05	$1,159.28	$1,654.67	$1,211.06	$1,344.17
Employee & Child(ren)	$1,617.41	$1,164.76	$1,300.20	$1,152.30	$1,644.73	$1,203.77	$1,336.09
Employee & Family	$2,574.62	$1,854.08	$2,069.65	$1,834.27	$2,618.15	$1,916.22	$2,126.84
Total Monthly Premium	$12,732.47	$53,634.86	$13,665.32	$1,152.30	$12,947.93	$66,930.08	$15,379.01
Total Annual Premium	$152,789.64	$643,618.32	$163,983.84	$13,827.60	$155,375.16	$803,160.96	$184,548.12
$ Change by Plan					$2,585.52	$159,542.64	$20,564.28
COMBINED ANN PREMIUM		$974,219.40				$1,143,084.24	
TOTAL $ Change from Current						$182,692.44	
% Change by Plan					1.7%	24.8%	12.5%
TOTAL % Change in Premium						18.8%	
Employer Monthly Cost Per Employee based upon current contribution *							
Employee Only	$600.00	$482.58	$538.69	$477.43	$498.77	$498.77	$553.59
Employee Spouse	$600.00	$846.81	$850.00	$850.00	$498.77	$886.06	$886.12
Employee Child(ren)	$600.00	$948.09	$950.00	$950.00	$498.77	$987.10	$985.89
Employee Family	$600.00	$1,095.75	$1,100.00	$1,100.00	$498.77	$1,157.89	$1,157.19
Employer Annual Premium	$136,800.00	$539,618.32	$121,314.24	$11,400.00	$113,719.56	$644,560.96	$137,676.12
Total City Premium Cost/Change		$797,732.56				$895,956.64	$98,224.08
City HSA Contribution		$1500 PEPY Emp Only / $3000 PEPY Emp/Dep				$164,700 HSA Cost Based upon Projected Enrollment (110)*	
City Cost w/ $1500/$3000 HSA		$937,232.56				$1,060,656.64	13%
Employee Cost Per Month							
Employee Only	$70.13	$0.00	$0.00	$0.00	$182.70	$0.00	$0.00
Employee Spouse	$1,027.20	$325.00	$458.05	$309.28	$1,155.90	$325.00	$458.05
Employee Child(ren)	$1,017.41	$216.67	$350.20	$202.30	$1,145.96	$216.67	$350.20
Employee Family	$1,974.62	$758.33	$969.65	$734.27	$2,119.38	$758.33	$969.65
Employee Cost Per 26pp							
Employee Only	$32.37	$0.00	$0.00	$0.00	$84.32	$0.00	$0.00
Employee Spouse	$474.09	$150.00	$211.41	$142.74	$533.49	$150.00	$211.41
Employee Child(ren)	$469.57	$100.00	$161.63	$93.37	$528.90	$100.00	$161.63
Employee Family	$911.36	$350.00	$447.53	$338.89	$978.18	$350.00	$447.53

** Select Preventive RX*
at no cost-share

** Select Preventive RX*
at no cost-share

*3-Tiered HSA Contributions - $1500 Emp Only / $3000 ES or EC / $3600 Emp+Family

*Increased Family enrollment by 6 to match up with last year's projections of 110 employees.

CITY OF AUBREY - 2024-2025 PLAN YEAR

DENTAL FINAL PLAN

HUB	Blue Cross Blue Shield - Current	
Benefits	Low Plan - DTNLR36	High Plan - DTNHR32
Annual Deductible (single/family)	$50 / $150	$50 / $150
Preventive Care	100%	100%
Basic Services	80%	80%
Major Services	50%	50%
Endodontics / Periodontics	50%	80%
Orthodontics	N/A	50%
Annual Max Per Member	$1,000	$2,000
Child Orthodontics	N/A	Adult & Child Ortho
Orthodontics Lifetime Max	N/A	$2,000
Out of Network Benefits	90th %	90th %
Waiting Period	None	None
CarryOver Benefits	N/A	N/A
Rate Guarantee	12 Months	12 Months
EMPLOYEE COUNTS:		
Employee Only	32	31
Employee & Spouse	3	7
Employee & Child(ren)	6	9
Employee & Family	7	10
TOTAL EMPLOYEE COUNT	48	57
BILLED PREMIUM:		
Employee Only	$29.96	$39.46
Employee & Spouse	$59.90	$78.91
Employee & Child(ren)	$70.34	$95.93
Employee & Family	$109.57	$148.34
Total Monthly Premium	$2,327.45	$4,122.40
Total Annual Premium	$27,929.40	$49,468.80

COMBINED ANNUAL PREMIUM	$77,398.20	
TOTAL $ Change in Premium		
TOTAL % Change in Premium		
EMPLOYER COST	**$1,438.08**	**$2,249.22**
COMBINED EMPLOYER COST/MO.	**$3,687.30**	
Employee Cost Per Pay Period (26pp)		
Employee Only	$0.00	$4.38
Employee Spouse	$13.82	$22.59
Employee Child(ren)	$18.64	$30.45
Employee Family	$36.74	$54.64

BCBS agreed to a rate pass. 8/14/2024

Declined to quote: Ameritas, SunLife, Unum, Mutual of Omaha, United Concordia, Lincoln Financial, Delta Dental

CITY OF AUBREY - 2024-2025 PLAN YEAR

VISION FINAL PLAN

HUB	Current Plan Renewal	
Benefits	BCBS VISION	BCBS VISION Renewal
Network	EyeMed	EyeMed
Benefit Frequency	12 / 12 / 24	12 / 12 / 24
Exam Copay	$10	$10
Materials Copay	$25	$25
Frame Allowance	$150, 20% off balance	$150, 20% off balance
Contacts Allowance	$150, 15% off balance	$150, 15% off balance
Contact Fitting Fee Allowance	Up to $40	Up to $55
Progressive Lenses - Standard	$90 Copay	$90 Copay
Progressive Lenses - Tier 1	$110 Copay	$110 Copay
Progressive Lenses - Tier 2	$120 Copay	$120 Copay
Progressive Lenses- Tier 3	$135 Copay	$135 Copay
Progressive Lenses - Tier 4	$90 Copay, then 80% of charge less $120 allowance	$90 Copay, then 80% of charge less $120 allowance
Rate Guarantee	4 year	Until 9/30/2026
EMPLOYEE COUNTS:		
Employee Only	51	51
Employee & Spouse	7	7
Employee & Child(ren)	4	4
Employee & Family	16	16
BILLED PREMIUM:		
Employee Only	$5.73	$5.73
Employee & Spouse	$10.89	$10.89
Employee & Child(ren)	$11.47	$11.47
Employee & Family	$16.85	$16.85

Total Monthly Premium	$683.94	$683.94
Total Annual Premium	$8,207.28	$8,207.28
TOTAL $ Change in Premium		$0.00
TOTAL % Change in Premium		0.0%
Employee Cost Per Pay Period (26 pp)		
Employee Only	$2.64	$2.64
Employee Spouse	$5.03	$5.03
Employee Child(ren)	$5.29	$5.29
Employee Family	$7.78	$7.78

Declined to Quote - Uncompetitive: SunLife, Mutual of Omaha, Unum, Lincoln Financial

CITY OF AUBREY - 2024-2025 PLAN YEAR

LONG-TERM DISABILITY FINAL PLANS

HUB	Current / Renewal	FINAL PLAN
Rates	**The Standard**	**BCBS (Dearborn)**
Rate per $100	$0.260	$0.180
Volume of Covered Payroll	$641,463	$641,463
Total Monthly Premium	**$1,667.80**	**$1,154.63**
Total Annual Premium	**$20,013.65**	**$13,855.60**
$ Change from Current		-$6,158.04
% Change from Current		-31%
Benefits		
Class 1 Description:	All Eligible Employees	All Eligible Employees
Benefit Percentage	60% of monthly earnings	60% of monthly earnings
Maximum Monthly Amount	$5,000	$5,000
Elimination Period	180 Days	180 Days
Maximum Benefit Duration	SSNRA	SSNRA
Own Occupation	24 Months	24 Months
Partial Disability Earnings Test:	Included	Included
During Own Occ. Period	80%	80%
During Any Occ. Period	60%	60%
Limitations:		
Mental/Nervous (M/N)	24 Months	24 Months
Substance Abuse (SA)	24 Months	24 Months
Are limitations per occurrence or lifetime?	Lifetime	Lifetime
Pre-existing condition exclusion	3 / 12	3 / 12
Rates Guaranteed Through	9/30/2026	9/30/2026

SHORT-TERM DISABILITY FINAL PLANS

HUB	Current / Renewal	Plan Option 1
Rates	**The Standard**	**BCBS (Dearborn)**
Rate per $10	$0.323	$0.323
Volume of Weekly Benefit	$86,097	$86,097
Total Monthly Premium	**$2,780.93**	**$2,780.93**
Total Annual Premium	**$33,371.20**	**$33,371.20**
$ Change from Current		$0.00
% Change from Current		0%
Benefits		
Class 1 Description:	All Eligible Employees	All Eligible Employees
Benefit Percentage	60%	60%
Maximum Weekly Amount	$1,000	$1,000
Elimination Period - Accident	0 Days	0 Days
Elimination Period - Sickness	7 Days	7 Days
Maximum Benefit Duration	26 weeks	26 weeks
Rates Guaranteed Through	9/30/2026	9/30/2026

Declined to Quote due to Industry: Principal, Guardian
Equitable, The Hartford, Lincoln Financial Group, OneAmerica, Mutual of Omaha, SunLife, Unum (Uncompetitive)

CITY OF AUBREY - 2024-2025 PLAN YEAR

LIFT DISABILITY FINAL PLANS

HUB	Current / Renewal	Plan Option 1	Plan Option 2
Rates	The Standard	Dearborn	Dearborn
Life Rate per $1,000	$0.130	$0.113	$0.106
AD&D Rate per $1,000	$0.030	$0.033	$0.033
Combined Life/AD&D Rate per $1,000	$0.160	$0.146	$0.139
Total Monthly Volume	$5,212,500	$8,106,412	$5,212,500
Total Monthly Premium	$834.00	$1,183.54	$724.54
Total Annual Premium	$10,008.00	$14,202.43	$8,694.45
$ Change from Current		$4,194.43	-$5,507.98
% Change from Current		42%	-39%
Benefits			
Class 1 Description:	All Eligible Employees	All Eligible Employees	All Eligible Employees
Life Amount	$50,000	1 x Annual Salary	$50,000
AD&D Amount	$50,000	1 x Annual Salary	$50,000
Age Reduction Schedule			
First Reduction	35% at age 70	35% at age 70	35% at age 70
Second Reduction	50% at age 75	50% at age 75	50% at age 75
Conversion / Portability	Included	Included	Included
Waiver of Premium	Included	Included	Included
Elimination Period	9 months	9 months	9 months
Maximum Age Duration	To Age 65	To Age 65	To Age 65
Accelerated Benefit	100% of Benefit	75% of Benefit	75% of Benefit
Maximum Benefit	$250,000	$250,000	$250,000
Enhanced Product Services		Line of Duty Benefit	Line of Duty Benefit
Travel Assistance Services	Included	Included	Included
Employee Assistance Program			
Beneficiary Resources Services	Included	Included	Included
Temporary Layoff / Leave	12 month Rehire		

RATE GUARANTEE	2 years - 10/1/2026	2 years - 10/1/2026	2 years - 10/1/2026

Declined to Quote:

Principal (Declined to Quote Disability), Guardian (Industry)

Equitable, The Hartford, Lincoln Financial Group, OneAmerica, Mutual of Omaha, SunLife, Unum (Uncompetitive)

CITY OF AUBREY - 2024-2025 PLAN YEAR

VOLUNTARY LIFE / AD&D

HUB	Current / Renewal	Plan Option 1
Rates	The Standard	BCBS (Dearborn)
Employee:	$10,000 Increments	$10,000 Increments
Maximum Amount	$300,000	$300,000
Guaranteed Issue (GI)	$100,000	$100,000
Portability	With EOI	With EOI
Conversion	Included	Included
Waiver of Premium	To age 65 if disabled prior to 60	To age 65 if disabled prior to 60
Accelerated Life Benefit	75% of benefit to $250,000	75% of benefit to $250,000
Spouse:	$5,000 increments	$5,000 Increments
Maximum	$150,000	$150,000
Not to Exceed	100% of Employee Benefit	50% of Employee Benefit
Guaranteed Issue (GI)	$25,000	$25,000
Dependent Children:	$5,000 increments	$5,000 Increments
Maximum	$10,000	$10,000
Guaranteed Issue (GI)	$10,000	$10,000
	One Family Rate	One Family Rate
Age Brackets	Rate per $1,000	Rate per $1,000
< 25	$0.070	$0.070
25 - 29	$0.080	$0.080
30 - 34	$0.110	$0.110
35 - 39	$0.130	$0.130
40 - 44	$0.140	$0.140
45 - 49	$0.210	$0.210
50 - 54	$0.320	$0.320
55 - 59	$0.610	$0.610

60 - 64	$0.930	$0.930
65 - 69	$1.790	$1.790
70 - 74	$2.900	$2.900
75 +	$2.900	$2.900
AD&D Benefit Amount	Same as Life Amount	Same as Life Amount
AD&D Rate	$0.030 per $1,000	$0.020 per $1,000
Spouse Rate	Rate Based on Employees Age	Rate Based on Employees Age
Dependent Life/AD&D Rate	$2.58 for $10,000	$2.58 per $10,000

True Open Enrollment

Annual Increase Option Included

Declined to Quote: Guardian (Industry), The Hartford, Lincoln Financial Group, OneAmerica, Mutual of Omaha, SunLife, Unum (Uncompetitive)

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item

Hold a Public Hearing, Consider and take appropriate action regarding an Ordinance of the City Council of Aubrey, Texas, making appropriations for the support of the City, appropriating money to a sinking fund to pay interest and principal of the City's indebtedness; approving and adopting the annual Budget of the City of Aubrey, Texas for the 2024-2025 Fiscal Year; providing for the filing of the budget in the Office of the City Secretary; and providing an effective date.

Staff Contact

Mike English, Finance Director
menglish@aubreytx.gov
940-440-9343

Summary

Roll-call vote required on this item.

This item is an ordinance approving the annual budget for fiscal year 2025. The funds included in the budget are the General Fund, Enterprise Fund, Debt Service Fund, and the Capital Improvement Project ("CIP") Fund and Minor Funds. The minor funds include the Special Revenue Fund, TIF Fund, Development Fees Fund, Grant Fund, Developer Holding Fund (i.e., professional services agreement reimbursement transaction activity), and the Employee Benefits Trust Fund. MDD is not included in the table below. The following table summarizes the budgets for these funds.

	Fiscal Year 2025 Budget			Fiscal Year 2024 Budget			YOY Change		
Fund	**Revenue**	**Expense**	**Surplus**	**Revenue**	**Expense**	**Surplus**	**Revenue**	**Expense**	**Surplus**
General Fund	19,069,076	18,310,203	758,873	18,758,154	16,270,793	2,487,361	310,922	2,039,410	(1,728,488)
Enterprise Fund	9,356,811	8,014,227	1,342,584	6,170,654	5,736,436	434,218	3,186,157	2,277,791	908,366
Debt Service Fund	1,927,419	1,927,419	-	1,336,000	1,376,229	(40,229)	591,419	551,190	40,229
CIP Fund	80,214,371	80,214,371	-	25,108,373	25,108,373	-	55,105,998	55,105,998	-
Minor Funds	6,382,228	5,131,000	1,251,228	4,465,846	3,926,006	539,840	1,916,382	1,204,994	711,388
	116,949,905	113,597,220	3,352,685	55,839,027	52,417,837	3,421,190	61,110,878	61,179,383	(68,505)

For Fiscal Year 2025, both the General Fund and the Enterprise Fund expect to generate budget surpluses with both revenue and expense increasing compared to the current year budget. The fire department is adding 15 new personnel to staff the new fire station (station #3) – this is the most significant increase in expense. The remaining General Fund departments are budgeted to hire 12 additional staff.

Enterprise revenue and expense is increasing primarily due to the impact of expected borrowing for the Waste Water Treatment Plant – the Enterprise budget reflecting both the revenue from interest income on the bond proceeds and the debt service expense. Additionally, charges for services (water and sewer) and Impact fees are both increasing – these are the major contributors to Enterprise Fund surplus.

The surplus in the Minor Funds results from fees paid by developers and builders in the Keeneland and Highpointe projects. The City will use these fees to fund future projects.

Note regarding the "Budget Cover Page" immediately following the Ordinance: the budget cover page says,

"This budget will raise more total property taxes than last year's budget by $1,219,498 for approximately a 43.06 percent tax levy increase." The amount listed on the Budget Cover Page is taken from the Truth in Taxation ("TNT") worksheet and is required by state law. The amount calculated on the TNT worksheet is skewed due to an error in the reporting of the TIRZ value in prior years. The prior year we reported 100% of the Jackson Ridge TIRZ tax valuation and this year we corrected to reflect the participation percent of 38.75% (down from 45.2% due to the Jackson Ridge PID refunding). The actual increase in the total tax levy is expected to be between 10% and 12%.

Financial Summary
See financial table and summary above.

Staff Recommended Motion
Approve

Conditions
N/A

ADOPTED BUDGET

AS OF: JUNE 30TH, 2024

101-General Fund

REVENUES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
GENERAL REVENUE								
Fines and Fees								
101-4000-01-4363 Code Enforcement Citations	0	0	0	0	0	300	300	300
101-4000-01-4400 Fines and fees	40,051	93,237	118,974	80,000	126,956	130,000	130,000	130,000
101-4000-01-4410 Warrant Income	4,751	4,132	2,742	2,000	3,272	4,000	4,000	4,000
TOTAL Fines and Fees	44,802	97,369	121,716	82,000	130,228	134,300	134,300	134,300
Taxes								
101-4000-02-4100 Property Taxes	1,140,619	1,726,007	1,904,893	2,380,000	2,484,102	2,750,000	2,750,000	2,750,000
101-4000-02-4101 Penalties and Interest	11,012	0	0	0	0	0	0	0
101-4000-02-4130 Sales Taxes	1,348,662	1,715,692	1,989,698	2,300,000	1,829,351	2,500,000	2,500,000	2,500,000
101-4000-02-4140 Franchise Tax-Electric	171,678	159,022	286,227	300,000	236,652	317,000	317,000	317,000
101-4000-02-4141 Franchise Tax-Gas	18,694	26,224	33,243	12,000	14,595	45,000	45,000	45,000
101-4000-02-4142 Franchise Tax-Telephone	3,319	8,164	4,660	4,000	2,498	4,000	4,000	4,000
101-4000-02-4143 Franchise Tax-Cable TV	10,959	5,570	11,587	12,000	8,392	12,000	12,000	12,000
101-4000-02-4144 Franchise Tax-Water	126,119	200,273	368,368	700,000	614,879	840,000	840,000	840,000
101-4000-02-4145 Franchise Tax-Sewer	53,818	60,947	3,000	0	0	0	0	0
101-4000-02-4146 Franchise Tax-Garbage	128,294	173,581	246,200	280,000	216,499	315,000	315,000	315,000
TOTAL Taxes	3,013,173	4,075,480	4,847,876	5,988,000	5,406,969	6,783,000	6,783,000	6,783,000
Grants								
101-4000-03-4391 Grants - Police	0	0	0	131,686	65,843	74,979	74,979	74,979
101-4000-03-4393 Grants - Fire	4,350	2,830	4,753	0	0	0	0	0
101-4000-03-4495 Grants - Library	1,048	0	0	0	0	0	0	0
TOTAL Grants	5,398	2,830	4,753	131,686	65,843	74,979	74,979	74,979
Donations								
101-4000-04-4390 Donations-Police	100	0	0	0	1,261	0	0	0
101-4000-04-4392 Donations-Fire	0	0	65,517	250,357	252,307	0	0	0
101-4000-04-4393 Donations-Library	10,331	4,891	7,360	6,000	26,006	4,200	4,200	4,200
101-4000-04-4510 Contributions from Government	0	0	16,159	0	0	0	0	0
TOTAL Donations	10,431	4,891	89,036	256,357	279,574	4,200	4,200	4,200
Charges for Services								
101-4000-06-4104 Aspen Meadow Police	7,956	21,084	71,141	97,000	68,930	100,000	100,000	100,000
101-4000-06-4312 DC FWSD # 8A	0	0	0	0	111,119	0	0	0
101-4000-06-4314 DC FWSD # 8B	0	0	0	0	99,373	0	0	0
101-4000-06-4316 Providence Village WCID	0	0	0	0	411,164	615,000	615,000	615,000
101-4000-06-4318 DC FWSD # 10 Elm Ridge	0	0	0	0	372,670	0	0	0
101-4000-06-4319 Arrow Brook	0	0	0	0	141,727	0	0	0
101-4000-06-4320 DC FWSD # 11A	0	0	0	0	198,162	0	0	0
101-4000-06-4321 DC FWSD # 11B	0	0	0	0	187,699	0	0	0
101-4000-06-4323 DC FWSD #11C	0	0	0	0	72,810	0	0	0
101-4000-06-4370 DC FWSD Total Revenue	0	0	0	2,180,000	0	777,000	777,000	777,000
101-4000-06-4401 Providence Village Police	789,156	938,283	912,676	1,274,388	949,291	1,275,156	1,275,156	1,275,156

101-General Fund

REVENUES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
101-4000-06-4402 Silverado Police	101,112	167,745	598,293	825,000	591,861	1,000,800	1,000,800	1,000,800
101-4000-06-4403 Sandbrock Police	81,780	116,784	333,737	350,000	282,047	477,000	477,000	477,000
101-4000-06-4404 DISD SRO	0	0	0	108,000	54,396	242,488	242,488	242,488
101-4000-06-4420 Accident Reports	654	798	696	500	450	500	500	500
101-4000-06-4425 Park Rental Fee	3,150	0	0	0	0	0	0	0
101-4000-06-4480 Library fines & fees	334	512	595	500	373	500	500	500
101-4000-06-4481 Public Services - copies, fax	1,466	1,534	1,439	1,500	1,462	1,500	1,500	1,500
101-4000-06-4482 Denton Co Library Pledge	22,500	23,500	20,400	22,500	2,500	22,500	22,500	22,500
101-4000-06-4483 Krugerville Library ILA	5,000	20,000	5,000	5,000	5,000	5,000	5,000	5,000
101-4000-06-4484 Cross Roads Library ILA	14,448	0	10,000	5,000	0	5,000	5,000	5,000
101-4000-06-4485 Providence Village Library IL	23,600	26,250	28,000	32,500	32,543	32,500	32,500	32,500
101-4000-06-4486 Silverado Library Fee	4,725	7,485	0	11,240	11,240	15,000	15,000	15,000
101-4000-06-4498 Donations - Yoga	360	0	0	0	0	0	0	0
101-4000-06-4501 Community Building rental	3,810	10,225	12,055	2,000	1,790	2,000	2,000	2,000
101-4000-06-4730 Denton County Pledge Fire	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
101-4000-06-4732 Denton Co Medic	0	0	364,585	385,882	385,882	385,000	385,000	385,000
101-4000-06-4735 Denton Co Fire Runs	494,200	615,500	975,650	800,000	746,400	500,000	500,000	500,000
101-4000-06-4741 Krugerville ILA Fire	136,000	114,375	198,232	165,000	83,818	165,000	165,000	165,000
101-4000-06-4742 Silverado Fire	84,260	129,740	233,800	900,000	638,288	1,250,000	1,250,000	1,250,000
101-4000-06-4743 Crossroads ILA Fire	425,000	0	0	0	0	0	0	0
101-4000-06-4744 Sandbrock Fire	102,225	134,535	203,882	250,000	192,156	306,000	306,000	306,000
101-4000-06-4745 Aspen Meadow Fire	5,440	17,570	32,840	110,000	74,119	110,000	110,000	110,000
101-4000-06-4746 Oak Point ILA EMS	0	24,619	24,619	50,469	50,469	27,143	27,143	27,143
101-4000-06-4748 Krugerville ILA EMS	0	0	0	17,850	0	17,850	17,850	17,850
101-4000-06-4749 Insurance Billing EMS	0	0	173,752	1,200,000	962,848	1,377,000	1,377,000	1,377,000
101-4000-06-4770 EMS Cost Reimbursement	314,191	266,939	562,902	0	0	0	0	0
TOTAL Charges for Services	2,631,368	2,647,478	4,774,293	8,804,329	6,740,587	8,719,937	8,719,937	8,719,937
Permits								
101-4000-07-4190 Certificate of Occupancy	300	0	0	0	0	0	0	0
101-4000-07-4200 Building Permits	1,466,641	1,394,216	1,175,334	1,100,000	529,351	1,100,000	1,100,000	1,100,000
101-4000-07-4210 Plan Review fees	1,840,992	1,590,994	1,351,742	1,300,000	845,008	1,300,000	1,300,000	1,300,000
101-4000-07-4220 Inspection fees	101,258	165,705	222,881	225,000	123,319	200,000	200,000	200,000
101-4000-07-4250 Contractor registration	7,590	6,215	6,123	4,000	4,510	4,000	4,000	4,000
101-4000-07-4260 Other Permit fee	1,470	2,280	1,280	3,000	3,800	14,000	14,000	14,000
101-4000-07-4290 Health Permits	9,850	11,650	12,500	15,000	11,950	15,000	15,000	15,000
101-4000-07-4310 Demolition Permits	0	300	300	0	1,050	0	0	0
101-4000-07-4320 Sign Permit	500	1,800	700	1,200	2,542	1,300	1,300	1,300
101-4000-07-4330 Solicitation permit	0	240	120	360	360	360	360	360
101-4000-07-4350 Alcohol Permit	1,490	0	695	120	620	120	120	120
101-4000-07-4360 Plat Fees	0	0	544	0	0	0	0	0
101-4000-07-4362 Lein Reimbursements	223	0	1,037	0	0	0	0	0
TOTAL Permits	3,430,313	3,173,400	2,773,255	2,648,680	1,522,510	2,634,780	2,634,780	2,634,780

101-General Fund

REVENUES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Miscellaneous								
101-4000-09-4430 All Admin Fees	223,905	190,720	173,220	185,000	123,745	172,380	172,380	172,380
101-4000-09-4435 City Event Fees	0	80,810	38,387	80,000	35,730	80,000	80,000	80,000
101-4000-09-4500 Interest Income	6,091	56,361	370,626	400,000	333,891	400,000	400,000	400,000
101-4000-09-4540 Other Income	148,395	9,270	3,467	426	786	500	500	500
101-4000-09-4550 Gain on sale of assets	8,233	8,880	15,534	18,605	18,605	15,000	15,000	15,000
101-4000-09-4600 Operating Transfers In	(1,318,129)	30,748	23,396	0	0	0	0	0
101-4000-09-4800 Insurance Proceeds	38,628	34,145	48,202	63,071	68,523	50,000	50,000	50,000
101-4000-09-5616 Reimbursement - Electricity	1,720	0	0	0	0	0	0	0
101-4000-09-5620 TIFMAS/TDEM Reimbursement	0	71,387	0	0	0	0	0	0
101-4000-09-5630 DC SRO Reimbursement	0	0	0	100,000	0	0	0	0
TOTAL Miscellaneous	(891,157)	482,322	672,831	847,102	581,280	717,880	717,880	717,880
Contingency/FB								
TOTAL GENERAL REVENUE	8,244,327	10,483,769	13,283,759	18,758,154	14,726,991	19,069,076	19,069,076	19,069,076
TOTAL REVENUES	8,244,327	10,483,769	13,283,759	18,758,154	14,726,991	19,069,076	19,069,076	19,069,076

101-General Fund
Administration

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Personnel								
101-5101-01-5101 Salaries	276,094	519,859	571,349	675,000	501,419	640,500	640,500	640,500
101-5101-01-5105 Overtime	9,398	7,782	6,078	2,500	2,094	2,000	2,000	2,000
101-5101-01-5106 Longevity	800	900	800	1,950	1,950	1,300	1,300	1,300
101-5101-01-5107 Retirement - TMRS	17,186	34,653	36,097	42,500	32,156	68,565	68,565	68,565
101-5101-01-5108 Payroll Tax Expense (medicare	3,927	7,597	7,409	9,600	7,411	9,335	9,335	9,335
101-5101-01-5109 Group Health Insurance	15,405	46,174	56,596	65,000	53,491	59,388	59,388	59,388
101-5101-01-5110 Workers Comp TML	692	995	1,457	1,500	973	1,000	1,000	1,000
101-5101-01-5621 Travel & Training	1,463	9,010	13,884	15,000	7,712	13,000	13,000	13,000
TOTAL Personnel	324,966	626,971	693,670	813,050	607,206	795,088	795,088	795,088
Materials & Supplies								
101-5101-03-5050 Office Supplies	4,141	9,291	21,001	12,000	9,233	12,000	12,000	12,000
101-5101-03-5081 Uniforms	0	0	0	0	0	3,000	3,000	3,000
101-5101-03-5090 Postage	1,171	1,912	1,784	2,000	1,663	2,000	2,000	2,000
TOTAL Materials & Supplies	5,312	11,203	22,784	14,000	10,896	17,000	17,000	17,000
Repairs & Maintenance								
101-5101-04-5120 Building Maintenance	7,257	149,006	69,243	41,544	15,576	40,000	40,000	40,000
101-5101-04-5121 Equipment Maintenance	0	200	528	1,500	567	2,000	2,000	2,000
101-5101-04-5122 Vehicle Maintenance	0	0	392	2,000	229	1,000	1,000	1,000
TOTAL Repairs & Maintenance	7,257	149,206	70,162	45,044	16,373	43,000	43,000	43,000
Utilities								
101-5101-05-5616 Utilities -Electricity	3,641	4,108	7,680	8,000	6,791	8,000	8,000	8,000
101-5101-05-5617 Utilities -Gas	1,464	1,511	1,799	2,500	1,383	2,500	2,500	2,500
101-5101-05-5618 Utilities -Telephone	1,781	6,878	7,732	8,500	6,453	8,500	8,500	8,500
101-5101-05-5619 Utilities -Water/Sewer	3,243	3,222	3,678	4,000	3,097	4,000	4,000	4,000
TOTAL Utilities	10,129	15,719	20,890	23,000	17,724	23,000	23,000	23,000
Contract Services								
101-5101-06-5060 Election Services	13,602	0	9,665	132	132	11,000	11,000	11,000
101-5101-06-5230 Contract Labor	59,933	2,144	2,043	3,000	647	2,000	2,000	2,000
101-5101-06-5240 Drug testing/background check	154	301	2,292	1,500	1,283	0	0	0
101-5101-06-5300 Benefits Administration	37,690	25,626	20,029	20,000	15,543	26,400	26,400	26,400
101-5101-06-5620 Legal & Professional	133,143	267,694	304,387	400,000	161,490	325,000	325,000	325,000
101-5101-06-5685 Storage Building	320	1,083	3,844	4,000	2,590	4,000	4,000	4,000
TOTAL Contract Services	244,842	296,848	342,260	428,632	181,685	368,400	368,400	368,400
Fees & Other Services								
101-5101-07-5150 Printing	991	3,103	11,855	12,200	20,634	15,000	15,000	15,000
101-5101-07-5190 Insurance - TML	3,089	3,167	4,300	6,000	4,323	7,000	7,000	7,000
101-5101-07-5220 Advertising & Notices	3,484	14,212	3,704	5,300	3,865	4,800	4,800	4,800
101-5101-07-5260 Dues and Membership	2,680	3,115	7,870	8,000	9,017	9,000	9,000	9,000
101-5101-07-5280 Copier Maintenance contract	8,044	7,807	8,974	9,000	5,792	10,000	10,000	10,000
101-5101-07-5310 Tax Assessor/Collector	2,829	172	0	3,000	10	0	0	0

ADOPTED BUDGET
AS OF: JUNE 30TH, 2024

101-General Fund
Administration

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
101-5101-07-5320 Appraisal District Fees	13,474	17,298	21,216	31,165	23,374	36,804	36,804	36,804
101-5101-07-5540 Bond Insurance	938	938	1,407	1,407	1,407	1,407	1,407	1,407
101-5101-07-5665 Technology	56,702	55,136	77,037	115,000	122,916	117,640	117,640	117,640
101-5101-07-5666 Bank Fees	371	0	0	5,565	8,342	5,000	5,000	5,000
TOTAL Fees & Other Services	92,603	104,948	136,363	196,637	199,679	206,651	206,651	206,651
Miscellaneous								
101-5101-09-5130 Community Development	0	7,094	12,041	25,000	7,005	20,000	20,000	20,000
101-5101-09-5131 Meetings	0	0	73	5,000	612	5,000	5,000	5,000
101-5101-09-5132 Employee Appreciation	0	0	0	15,000	13,032	0	0	0
101-5101-09-5133 Marketing & Promotions	0	0	0	0	0	5,000	5,000	5,000
101-5101-09-5685 Capital Expenditures	22,416	(58,586)	192,228	0	0	0	0	0
TOTAL Miscellaneous	22,416	(51,492)	204,343	45,000	20,649	30,000	30,000	30,000
Debt Service								
101-5101-98-5899 Bond issue costs	0	0	9,500	0	0	0	0	0
TOTAL Debt Service	0	0	9,500	0	0	0	0	0
TOTAL Administration	707,524	1,153,402	1,499,972	1,565,363	1,054,213	1,483,139	1,483,139	1,483,139

101-General Fund
Police Department

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Personnel								
101-5102-01-5101 Salaries	809,475	1,087,332	1,357,973	1,792,391	1,207,557	3,088,499	3,088,499	3,088,499
101-5102-01-5105 Overtime	30,224	25,765	37,715	50,127	34,009	94,883	94,883	94,883
101-5102-01-5106 Longevity	1,300	1,750	1,750	1,375	1,375	4,950	4,950	4,950
101-5102-01-5107 Retirement - TMRS	51,636	73,709	98,200	119,839	80,678	339,557	339,557	339,557
101-5102-01-5108 Payroll Tax Expense (medicare	11,319	15,665	21,366	28,597	18,130	46,231	46,231	46,231
101-5102-01-5109 Group Health Insurance	73,372	116,271	154,582	219,492	152,634	427,594	427,594	427,594
101-5102-01-5110 Workers Comp TML	15,303	17,010	27,545	60,045	60,044	87,700	87,700	87,700
101-5102-01-5621 Travel & Training	7,514	9,696	15,476	26,605	19,790	54,889	54,889	54,889
TOTAL Personnel	1,000,142	1,347,198	1,714,606	2,298,471	1,574,217	4,144,303	4,144,303	4,144,303
Materials & Supplies								
101-5102-03-5050 Office Supplies	6,882	7,650	6,266	9,212	8,100	16,968	16,968	16,968
101-5102-03-5051 Printing	3,349	2,752	1,470	2,500	0	5,000	5,000	5,000
101-5102-03-5080 Gas & Oil	35,243	81,573	93,135	129,000	77,418	175,000	175,000	175,000
101-5102-03-5081 Uniforms	9,513	9,804	16,602	25,804	21,857	27,376	27,376	27,376
101-5102-03-5082 Ballistic Vests	0	0	0	14,124	6,545	9,299	9,299	9,299
101-5102-03-5090 Postage	131	283	156	500	408	500	500	500
TOTAL Materials & Supplies	55,118	102,062	117,629	181,140	114,328	234,143	234,143	234,143
Repairs & Maintenance								
101-5102-04-5120 Building Maintenance	12,342	6,251	7,130	8,000	3,070	8,000	8,000	8,000
101-5102-04-5121 Equipment Maintenance	4,294	473	48	2,000	455	5,000	5,000	5,000
101-5102-04-5122 Vehicle Maintenance	13,920	29,678	70,347	55,186	44,061	60,000	60,000	60,000
TOTAL Repairs & Maintenance	30,555	36,402	77,525	65,186	47,586	73,000	73,000	73,000
Utilities								
101-5102-05-5616 Utilities -Electricity	2,817	3,514	4,380	3,500	2,947	3,500	3,500	3,500
101-5102-05-5618 Utilities -Telephone	8,600	11,183	16,699	18,883	16,239	30,010	30,010	30,010
101-5102-05-5619 Utilities -Water/Sewer	1,306	1,360	1,536	2,200	898	2,200	2,200	2,200
TOTAL Utilities	12,723	16,057	22,615	24,583	20,083	35,710	35,710	35,710
Contract Services								
101-5102-06-5240 Drug testing/background check	630	883	1,990	2,700	5,841	2,300	2,300	2,300
101-5102-06-5610 Power DMS	0	0	0	25,371	25,371	29,259	29,259	29,259
101-5102-06-5620 Legal and Professional	2,500	2,775	107	3,000	2,500	3,000	3,000	3,000
101-5102-06-5621 Childerns' Advocacy Center	0	0	0	3,500	0	7,000	7,000	7,000
101-5102-06-5685 Storage Building - Wilson	188	0	960	540	480	540	540	540
101-5102-06-5690 Forensic Testing	0	260	4,005	24,010	465	26,510	26,510	26,510
TOTAL Contract Services	3,318	3,918	7,061	59,121	34,657	68,609	68,609	68,609

101-General Fund
Police Department

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Fees & Other Services								
101-5102-07-5190 Insurance - TML	17,510	20,256	24,695	28,500	20,532	45,710	45,710	45,710
101-5102-07-5220 Advertising & Notices	0	0	184	300	265	300	300	300
101-5102-07-5260 Dues and Memberships	1,137	1,205	1,305	2,000	1,234	2,855	2,855	2,855
101-5102-07-5280 Maintenance contracts	17,311	25,340	33,350	50,000	1,553	116,307	116,307	116,307
101-5102-07-5660 Administration Fee	0	0	0	0	0	43,000	43,000	43,000
101-5102-07-5665 Technology	25,591	27,207	33,000	16,547	34,375	30,418	30,418	30,418
TOTAL Fees & Other Services	61,549	74,007	92,535	97,347	57,959	238,590	238,590	238,590
Public Safety								
101-5102-08-5070 Police Supplies	2,259	0	4,965	13,810	5,751	14,196	14,196	14,196
101-5102-08-5071 Communications Supplies	0	0	0	24,683	8,330	11,229	11,229	11,229
101-5102-08-5072 Promotional Supplies	0	0	0	5,840	4,280	15,440	15,440	15,440
101-5102-08-5625 Ammo/Firearms/Safety Equipmen	15,216	13,338	77,839	62,149	18,146	30,000	30,000	30,000
101-5102-08-5626 Taser 7 Lease	0	0	0	5,731	3,890	7,496	7,496	7,496
101-5102-08-5686 Flock Cameras	0	0	0	43,700	43,700	21,500	21,500	21,500
101-5102-08-5687 Denton Cty Communications	17,113	20,524	22,245	49,286	36,966	83,169	83,169	83,169
TOTAL Public Safety	34,587	33,862	105,049	205,199	121,064	183,030	183,030	183,030
Miscellaneous								
101-5102-09-5633 Capital - vehicles	27,931	468,979	228,517	0	(1)	0	0	0
101-5102-09-5685 Capital - equipment	128,780	51,212	21,222	65,843	65,848	0	0	0
TOTAL Miscellaneous	156,712	520,192	249,739	65,843	65,847	0	0	0
Debt Service								
TOTAL Police Department	1,354,705	2,133,699	2,386,759	2,996,890	2,035,741	4,977,385	4,977,385	4,977,385

101-General Fund
Fire Department

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Personnel								
101-5103-01-5101 Salaries	906,141	971,237	1,864,854	3,831,375	2,657,677	4,617,400	4,617,400	4,617,400
101-5103-01-5105 Overtime	194,853	226,307	271,375	490,375	281,282	450,000	450,000	450,000
101-5103-01-5106 Longevity	2,950	3,275	4,150	7,850	7,850	10,900	10,900	10,900
101-5103-01-5107 Retirement - TMRS	67,404	79,979	139,987	282,724	190,600	553,619	553,619	553,619
101-5103-01-5108 Payroll Tax Expense (medicare	15,352	17,140	29,219	63,069	43,277	75,375	75,375	75,375
101-5103-01-5109 Group Health Insurance	93,964	113,895	214,277	459,888	311,437	712,656	712,656	712,656
101-5103-01-5110 Workers Comp TML	23,850	27,509	54,321	118,800	118,244	162,000	162,000	162,000
101-5103-01-5621 Travel/Training	10,685	7,786	28,275	64,100	42,242	33,100	33,100	33,100
101-5103-01-5622 TIFMAS	0	3,617	9	0	0	0	0	0
TOTAL Personnel	1,315,199	1,450,745	2,606,466	5,318,181	3,652,607	6,615,050	6,615,050	6,615,050
Materials & Supplies								
101-5103-03-5080 Gas & Oil	9,927	17,481	43,305	109,800	68,507	102,250	102,250	102,250
101-5103-03-5081 Uniforms	23,793	52,437	149,224	114,091	98,605	80,000	80,000	80,000
101-5103-03-5090 Postage	0	0	45	300	219	200	200	200
101-5103-03-5150 Office Supplies	548	389	15,033	14,700	13,743	10,800	10,800	10,800
101-5103-03-5155 Supplies - Medic	0	0	148,160	160,000	103,421	120,000	120,000	120,000
TOTAL Materials & Supplies	34,267	70,306	355,767	398,891	284,495	313,250	313,250	313,250
Repairs & Maintenance								
101-5103-04-5120 Building Maintenance	4,304	13,627	58,103	71,000	92,397	65,000	65,000	65,000
101-5103-04-5121 Equipment Maintenace	8,784	8,479	31,310	302,592	272,969	201,728	201,728	201,728
101-5103-04-5122 Vehicle Maintenance	22,048	50,333	92,270	134,000	133,659	120,000	120,000	120,000
TOTAL Repairs & Maintenance	35,136	72,439	181,683	507,592	499,025	386,728	386,728	386,728
Utilities								
101-5103-05-5616 Utilities -Electricity	8,841	8,963	11,503	16,000	17,470	16,000	16,000	16,000
101-5103-05-5617 Utilities -Gas	2,310	2,259	2,148	6,900	3,780	6,900	6,900	6,900
101-5103-05-5618 Utilities -Telephone	6,312	5,892	9,650	25,980	12,109	25,980	25,980	25,980
101-5103-05-5619 Utilities -Water/Sewer	3,495	3,732	4,704	7,600	5,097	7,600	7,600	7,600
101-5103-05-5620 Direct TV Navo	0	0	0	2,100	1,325	1,500	1,500	1,500
101-5103-05-5621 Garbage Navo	0	0	39	0	0	0	0	0
TOTAL Utilities	20,958	20,845	28,045	58,580	39,781	57,980	57,980	57,980
Contract Services								
101-5103-06-5240 Drug testing/background check	1,818	1,721	3,396	2,100	2,019	0	0	0
101-5103-06-5620 Legal and Professional	0	0	26,100	53,000	18,913	50,000	50,000	50,000
101-5103-06-5658 Fire Extinguishers	79	56	510	600	563	450	450	450
TOTAL Contract Services	1,897	1,777	30,006	55,700	21,495	50,450	50,450	50,450

101-General Fund
Fire Department

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Fees & Other Services								
101-5103-07-5190 Insurance - TML	9,396	9,989	39,897	77,751	56,014	86,250	86,250	86,250
101-5103-07-5220 Advertising & Notices	0	0	49	0	0	0	0	0
101-5103-07-5260 Dues and Memberships	1,444	1,647	4,248	12,400	8,796	10,000	10,000	10,000
101-5103-07-5280 Copier Maintenance Contract	0	420	2,383	2,000	2,012	2,000	2,000	2,000
101-5103-07-5660 Admin Fee Navo	0	0	0	30,000	2,465	0	0	0
101-5103-07-5665 Technology	3,646	4,514	19,008	40,000	28,269	27,000	27,000	27,000
TOTAL Fees & Other Services	14,485	16,571	65,585	162,151	97,556	125,250	125,250	125,250
Public Safety								
101-5103-08-5070 Firefighting Supplies	431	10,532	14,165	35,000	19,675	30,000	30,000	30,000
101-5103-08-5687 Denton Cty Communications	11,007	16,552	30,019	55,893	41,922	37,262	37,262	37,262
TOTAL Public Safety	11,438	27,084	44,184	90,893	61,597	67,262	67,262	67,262
Miscellaneous								
101-5103-09-5132 Employee Appreciation	0	0	0	0	0	5,000	5,000	5,000
101-5103-09-5633 Capital - vehicles	34,253	8,465	151,316	0	0	0	0	0
101-5103-09-5685 Capital Expenditures	62,363	24,950	124,716	0	0	0	0	0
TOTAL Miscellaneous	96,616	33,415	276,032	0	0	5,000	5,000	5,000
Debt Service								
101-5103-98-5691 Note Principal - 11 Pierce	23,672	23,673	0	0	0	0	0	0
101-5103-98-5693 Capital Lease - '18 Pirece PN	0	0	0	95,436	71,577	0	0	0
TOTAL Debt Service	23,672	23,673	0	95,436	71,577	0	0	0
TOTAL Fire Department	1,553,669	1,716,854	3,587,767	6,687,424	4,728,133	7,620,970	7,620,970	7,620,970

101-General Fund
Streets Department

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Personnel								
101-5105-01-5101 Salaries	0	0	204,988	235,796	152,224	250,592	250,592	250,592
101-5105-01-5105 Overtime	0	0	8,993	6,000	6,270	6,000	6,000	6,000
101-5105-01-5106 Longevity	0	0	1,450	1,050	1,050	1,000	1,000	1,000
101-5105-01-5107 Retirement - TMRS	0	0	14,097	15,785	10,264	27,434	27,434	27,434
101-5105-01-5108 Payroll Tax Expense (medicare	0	0	3,001	3,521	2,605	3,735	3,735	3,735
101-5105-01-5109 Group Health Insurance	0	0	32,588	41,808	26,218	47,510	47,510	47,510
101-5105-01-5110 Workers Comp TML	0	0	1,159	3,000	2,086	3,000	3,000	3,000
101-5105-01-5121 Travel & Training	0	0	800	5,000	3,598	5,000	5,000	5,000
TOTAL Personnel	0	0	267,078	311,960	204,315	344,271	344,271	344,271
Materials & Supplies								
101-5105-03-5050 Office Supplies	0	0	1,421	2,000	1,377	2,000	2,000	2,000
101-5105-03-5080 Gas & Oil	5,169	8,130	7,408	8,251	7,072	8,251	8,251	8,251
101-5105-03-5081 Uniforms	0	0	464	2,000	1,871	1,500	1,500	1,500
101-5105-03-5607 Rock, Sand and Gravel	308	3,744	1,082	8,800	12,127	8,800	8,800	8,800
101-5105-03-5608 Chemicals Purchased	4,017	3,368	22	4,000	1,312	4,000	4,000	4,000
101-5105-03-5630 Tools	231	0	2,726	4,000	4,906	4,000	4,000	4,000
TOTAL Materials & Supplies	9,724	15,242	13,124	29,051	28,664	28,551	28,551	28,551
Repairs & Maintenance								
101-5105-04-5121 Equipment Maintenance	4,606	2,282	8,457	10,000	14,184	10,000	10,000	10,000
101-5105-04-5122 Vehicle Maintenance	0	0	0	0	1,692	0	0	0
101-5105-04-5609 Street Signs	5,212	9,526	2,598	45,000	42,195	30,000	30,000	30,000
101-5105-04-5629 Street maintenance	9,165	64,189	15,411	8,000	5,856	20,000	20,000	20,000
TOTAL Repairs & Maintenance	18,982	75,997	26,466	63,000	63,928	60,000	60,000	60,000
Utilities								
101-5105-05-5616 Utilities - Electricity	28,322	42,218	44,735	38,270	40,396	38,270	38,270	38,270
TOTAL Utilities	28,322	42,218	44,735	38,270	40,396	38,270	38,270	38,270
Contract Services								
101-5105-06-5230 Outside Services	0	500	110	0	0	0	0	0
101-5105-06-5240 Drug testing/background check	0	0	259	350	178	0	0	0
101-5105-06-5620 Legal and Professional	52,354	36,536	21,959	20,000	9,723	30,000	30,000	30,000
TOTAL Contract Services	52,354	37,036	22,327	20,350	9,900	30,000	30,000	30,000
Fees & Other Services								
101-5105-07-5190 Insurance - TML	1,208	1,232	1,709	1,563	1,126	1,563	1,563	1,563
101-5105-07-5220 Advertising & Public Notices	144	563	114	250	0	250	250	250
101-5105-07-5260 Dues and Memberships	0	0	0	650	0	650	650	650
101-5105-07-5665 Technology	0	0	0	2,000	612	2,000	2,000	2,000
TOTAL Fees & Other Services	1,352	1,794	1,822	4,463	1,738	4,463	4,463	4,463

101-General Fund
Streets Department

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Miscellaneous								
101-5105-09-5633 Capital - vehicles	0	0	40,532	0	0	0	0	0
101-5105-09-5685 Capital - equipment	0	542,177	0	26,588	26,588	0	0	0
101-5105-09-5689 Capital - streets	76,322	0	82,403	15,000	0	0	0	0
TOTAL Miscellaneous	76,322	542,177	122,935	41,588	26,588	0	0	0
TOTAL Streets Department	187,056	714,465	498,487	508,682	375,530	505,555	505,555	505,555

101-General Fund
Development Services

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Personnel								
101-5107-01-5101 Salaries	24,458	58,540	212,437	481,829	241,710	550,413	550,413	550,413
101-5107-01-5105 Overtime	0	2,447	4,381	4,000	6,163	4,000	4,000	4,000
101-5107-01-5106 Longevity	0	50	100	250	250	750	750	750
101-5107-01-5107 Retirement - TMRS	1,701	3,903	14,416	25,000	16,235	59,125	59,125	59,125
101-5107-01-5108 Payroll Tax Expense (medicare	380	763	3,090	6,000	3,434	8,050	8,050	8,050
101-5107-01-5109 Group Health Insurance	5,193	10,411	24,880	60,000	36,021	83,143	83,143	83,143
101-5107-01-5110 Workers Comp TML	111	132	245	16,000	13,572	2,700	2,700	2,700
101-5107-01-5621 Travel/Training	0	2,100	8,174	5,175	883	5,175	5,175	5,175
TOTAL Personnel	31,843	78,346	267,722	598,254	318,269	713,356	713,356	713,356
Materials & Supplies								
101-5107-03-5050 Office Supplies	591	2,773	3,067	7,000	6,461	7,000	7,000	7,000
101-5107-03-5080 Gas & Oil	0	0	353	3,000	371	3,000	3,000	3,000
101-5107-03-5081 Uniforms	0	0	145	600	429	600	600	600
101-5107-03-5090 Postage	88	264	661	1,500	383	1,500	1,500	1,500
101-5107-03-5150 Printing	20	65	1,271	1,500	470	1,500	1,500	1,500
TOTAL Materials & Supplies	699	3,101	5,497	13,600	8,115	13,600	13,600	13,600
Repairs & Maintenance								
101-5107-04-5122 Vehicle Maintenance	0	0	480	1,000	460	1,000	1,000	1,000
TOTAL Repairs & Maintenance	0	0	480	1,000	460	1,000	1,000	1,000
Contract Services								
101-5107-06-5240 Drug testing/background check	135	146	479	400	401	0	0	0
101-5107-06-5620 Legal and Professional	59,570	127,065	142,192	75,000	89,308	125,000	125,000	125,000
101-5107-06-5723 Animal Control	24,022	35,190	36,138	56,130	35,936	0	0	0
101-5107-06-5724 Code Enforcement	15,600	15,600	15,600	0	4,186	0	0	0
101-5107-06-5725 Mowing and clean-up	0	32,575	10,199	35,000	43,298	35,000	35,000	35,000
101-5107-06-5763 Inspectors - Bureau Veritas	1,815,285	1,648,394	1,469,525	1,450,000	874,485	1,300,000	1,300,000	1,300,000
101-5107-06-5764 Planners	61,590	200,696	69,008	60,000	80,088	80,000	80,000	80,000
TOTAL Contract Services	1,976,201	2,059,665	1,743,141	1,676,530	1,127,702	1,540,000	1,540,000	1,540,000
Fees & Other Services								
101-5107-07-5190 Insurance - TML	1,880	936	1,292	1,300	937	0	0	0
101-5107-07-5220 Advertising & Notices	290	2,323	1,658	2,000	964	2,000	2,000	2,000
101-5107-07-5260 Dues and Memberships	500	857	711	2,160	864	2,160	2,160	2,160
101-5107-07-5665 Technology	9,481	9,065	31,417	35,000	27,196	35,000	35,000	35,000
101-5107-07-5762 Filing Fees	956	4,294	3,757	3,000	3,198	13,000	13,000	13,000
101-5107-07-5765 Property Liens	0	0	0	500	0	0	0	0
TOTAL Fees & Other Services	13,107	17,476	38,834	43,960	33,160	52,160	52,160	52,160

101-General Fund
Development Services

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Miscellaneous								
101-5107-09-5633 Capital - vehicles	0	0	67,355	0	0	0	0	0
101-5107-09-5685 Capital Equipment	0	50,037	0	50,000	27,539	0	0	0
TOTAL Miscellaneous	0	50,037	67,355	50,000	27,539	0	0	0
Debt Service								
TOTAL Development Services	2,021,850	2,208,625	2,123,028	2,383,344	1,515,245	2,320,116	2,320,116	2,320,116

101-General Fund
Court

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Personnel								
101-5108-01-5101 Salaries	55,061	54,045	58,528	59,100	44,182	64,100	64,100	64,100
101-5108-01-5105 Overtime	19	97	534	1,000	640	1,000	1,000	1,000
101-5108-01-5106 Longevity	200	250	300	350	350	400	400	400
101-5108-01-5107 Retirement - TMRS	3,442	3,603	3,946	3,929	2,936	6,976	6,976	6,976
101-5108-01-5108 Payroll Tax Expense (medicare	776	791	900	877	662	950	950	950
101-5108-01-5109 Group Health Insurance	6,714	7,908	8,630	10,452	6,668	11,878	11,878	11,878
101-5108-01-5110 Workers Comp TML	147	173	243	120	83	120	120	120
101-5108-01-5621 Travel/Training	150	100	300	300	500	300	300	300
TOTAL Personnel	66,508	66,968	73,381	76,128	56,021	85,724	85,724	85,724
Materials & Supplies								
101-5108-03-5050 Office Supplies	12	647	484	200	501	400	400	400
101-5108-03-5090 Postage	228	391	582	500	373	500	500	500
101-5108-03-5150 Printing	239	57	0	100	0	100	100	100
TOTAL Materials & Supplies	479	1,096	1,066	800	873	1,000	1,000	1,000
Repairs & Maintenance								
101-5108-04-5121 Equipment Maintenace	1,280	0	0	0	0	0	0	0
TOTAL Repairs & Maintenance	1,280	0	0	0	0	0	0	0
Contract Services								
101-5108-06-5235 Contract Jail Services	0	0	0	2,900	0	2,900	2,900	2,900
101-5108-06-5620 Legal & Professional	9,924	12,208	13,853	10,000	7,157	14,000	14,000	14,000
101-5108-06-5765 Contract Svcs - Judge	6,000	5,700	9,300	15,000	12,600	15,000	15,000	15,000
TOTAL Contract Services	15,924	17,908	23,153	27,900	19,757	31,900	31,900	31,900
Fees & Other Services								
101-5108-07-5190 Insurance - TML	880	936	1,292	1,300	937	1,300	1,300	1,300
101-5108-07-5260 Dues and Memberships	0	81	0	150	303	150	150	150
101-5108-07-5540 Bond Insurance	235	235	0	235	0	235	235	235
101-5108-07-5665 Technology	5,391	1,245	1,399	4,000	1,271	4,000	4,000	4,000
TOTAL Fees & Other Services	6,506	2,496	2,691	5,685	2,510	5,685	5,685	5,685
Debt Service								
TOTAL Court	90,697	88,468	100,291	110,513	79,161	124,309	124,309	124,309

101-General Fund
Parks & Recreation

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Personnel								
101-5110-01-5101 Salaries	0	0	80,585	160,000	95,798	201,990	201,990	201,990
101-5110-01-5105 Overtime	0	0	3,245	6,000	7,104	4,000	4,000	4,000
101-5110-01-5106 Longevity	0	0	450	50	0	250	250	250
101-5110-01-5107 Retirement - TMRS	0	0	4,969	8,968	6,689	21,965	21,965	21,965
101-5110-01-5108 Payroll Tax Expense (medicare	0	0	1,117	2,000	1,541	2,990	2,990	2,990
101-5110-01-5109 Group Health Insurance	0	0	14,413	30,000	21,155	47,510	47,510	47,510
101-5110-01-5110 Workers Comp TML	0	0	505	2,048	1,536	2,000	2,000	2,000
101-5110-01-5121 Travel & Training	0	0	1,436	4,000	3,617	3,000	3,000	3,000
TOTAL Personnel	0	0	106,721	213,066	137,439	283,705	283,705	283,705
Materials & Supplies								
101-5110-03-5050 Office Supplies	0	0	452	6,000	968	4,000	4,000	4,000
101-5110-03-5080 Gas & Oil	0	0	409	1,200	569	1,200	1,200	1,200
101-5110-03-5081 Uniforms	0	0	162	600	480	600	600	600
101-5110-03-5150 Printing	0	0	0	400	0	400	400	400
101-5110-03-5608 Chemicals	0	0	0	600	950	600	600	600
101-5110-03-5630 Small Tools	121	1,122	702	2,000	1,619	2,000	2,000	2,000
101-5110-03-5903 Parts and Fittings	0	0	0	500	0	500	500	500
TOTAL Materials & Supplies	121	1,122	1,724	11,300	4,586	9,300	9,300	9,300
Repairs & Maintenance								
101-5110-04-5121 Equipment Maintenance	4,889	3,692	8,160	6,000	5,703	6,000	6,000	6,000
101-5110-04-5122 Vehicle Maintenance	0	0	166	4,000	3,870	4,000	4,000	4,000
101-5110-04-5630 Park Maintenance	8,743	19,288	25,904	20,000	8,784	50,000	50,000	50,000
TOTAL Repairs & Maintenance	13,632	22,980	34,230	30,000	18,357	60,000	60,000	60,000
Utilities								
101-5110-05-5616 Utilities - Electricity	3,867	1,079	1,592	2,500	3,686	2,500	2,500	2,500
101-5110-05-5619 Utilities - Water/Sewer	906	861	1,926	1,000	1,502	2,000	2,000	2,000
TOTAL Utilities	4,772	1,941	3,518	3,500	5,187	4,500	4,500	4,500
Contract Services								
101-5110-06-5240 Drug testing/background check	0	0	100	0	0	0	0	0
TOTAL Contract Services	0	0	100	0	0	0	0	0
Fees & Other Services								
101-5110-07-5190 Insurance - TML	1,697	1,804	2,409	1,600	1,081	1,600	1,600	1,600
101-5110-07-5260 Memberships and Dues	0	0	0	770	550	1,520	1,520	1,520
101-5110-07-5280 Maintenance Contract	0	0	0	0	293	0	0	0
101-5110-07-5624 Equipment Rental	0	0	0	2,000	0	2,000	2,000	2,000
101-5110-07-5665 Technology	0	0	0	4,000	1,000	4,000	4,000	4,000
TOTAL Fees & Other Services	1,697	1,804	2,409	8,370	2,924	9,120	9,120	9,120

101-General Fund
Parks & Recreation

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Miscellaneous								
101-5110-09-5131 City Events	0	55,638	121,114	160,000	89,351	160,000	160,000	160,000
101-5110-09-5631 Capital - equipment	0	14,127	18,200	0	0	13,000	13,000	13,000
101-5110-09-5633 Capital - vehicles	0	0	40,219	0	0	0	0	0
101-5110-09-5635 Capital Outlay 305 S Main	0	10,000	484,093	0	0	0	0	0
TOTAL Miscellaneous	0	79,765	663,626	160,000	89,351	173,000	173,000	173,000
TOTAL Parks & Recreation	20,222	107,612	812,327	426,236	257,844	539,625	539,625	539,625

CURRENT YEAR NOTES:
Mowing trailer

101-General Fund
Library

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Personnel								
101-5111-01-5101 Salaries	174,312	150,621	176,248	201,890	148,397	274,000	274,000	274,000
101-5111-01-5105 Overtime	0	462	1,616	3,000	3,461	3,000	3,000	3,000
101-5111-01-5106 Longevity	1,400	1,225	0	150	150	400	400	400
101-5111-01-5107 Retirement - TMRS	9,302	7,049	8,782	9,545	8,822	20,911	20,911	20,911
101-5111-01-5108 Payroll Tax Expense (medicare	2,476	1,908	2,211	2,973	2,217	3,152	3,152	3,152
101-5111-01-5109 Group Health Insurance	19,567	17,549	29,515	41,808	29,995	47,510	47,510	47,510
101-5111-01-5110 Workers Comp TML	514	596	848	600	417	600	600	600
101-5111-01-5621 Travel/Training	459	1,072	2,987	3,500	2,459	3,500	3,500	3,500
TOTAL Personnel	208,029	180,481	222,207	263,466	195,917	353,073	353,073	353,073
Materials & Supplies								
101-5111-03-5050 Office Supplies	5,069	3,951	7,240	5,460	5,364	5,460	5,460	5,460
101-5111-03-5052 Library Supplies	2,926	2,813	4,391	4,000	2,382	4,000	4,000	4,000
101-5111-03-5090 Postage	293	2,350	415	1,600	1,017	1,600	1,600	1,600
101-5111-03-5661 Collection Development	26,534	29,659	28,959	44,000	29,196	44,000	44,000	44,000
TOTAL Materials & Supplies	34,823	38,772	41,005	55,060	37,959	55,060	55,060	55,060
Repairs & Maintenance								
101-5111-04-5120 Building Maintenance	6,112	26,484	34,423	68,000	67,208	9,000	9,000	9,000
101-5111-04-5121 Equipment Maintenance	260	5,498	1,723	0	0	3,280	3,280	3,280
TOTAL Repairs & Maintenance	6,372	31,982	36,146	68,000	67,208	12,280	12,280	12,280
Utilities								
101-5111-05-5616 Utilities - Electricity	10,411	12,990	11,835	13,000	8,537	13,000	13,000	13,000
101-5111-05-5618 Utilities - Telephone	2,855	2,858	4,197	4,248	2,907	4,248	4,248	4,248
101-5111-05-5619 Utilities - Water/Sewer	1,872	2,070	1,821	3,726	2,135	2,300	2,300	2,300
TOTAL Utilities	15,138	17,918	17,853	20,974	13,579	19,548	19,548	19,548
Contract Services								
101-5111-06-5240 Drug testing/background check	121	823	48	0	0	0	0	0
101-5111-06-5620 Legal & Professional	97	185	0	300	0	300	300	300
101-5111-06-5658 Fire Extinguishers	2,560	460	845	1,500	450	1,500	1,500	1,500
TOTAL Contract Services	2,777	1,468	893	1,800	450	1,800	1,800	1,800
Fees & Other Services								
101-5111-07-5150 Printing	0	0	75	500	420	500	500	500
101-5111-07-5190 Insurance - TML	8,409	8,631	11,673	11,000	7,925	12,650	12,650	12,650
101-5111-07-5260 Dues and Memberships	1,134	621	6,302	4,352	3,537	4,352	4,352	4,352
101-5111-07-5280 Copier Maintenance Contract	0	0	252	500	849	1,164	1,164	1,164
101-5111-07-5665 Technology	14,741	16,172	13,700	17,000	12,122	17,000	17,000	17,000
TOTAL Fees & Other Services	24,283	25,424	32,002	33,352	24,853	35,666	35,666	35,666

101-General Fund
Library

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Miscellaneous								
101-5111-09-5130 Community Development	512	2,162	12,499	13,400	6,746	13,400	13,400	13,400
101-5111-09-5666 Donation Expenditures	5,029	1,860	0	0	0	0	0	0
101-5111-09-5667 Senior Programs	0	0	1,296	3,000	995	3,000	3,000	3,000
101-5111-09-5685 Capital Equipment	0	4,339	23,833	9,262	9,262	0	0	0
TOTAL Miscellaneous	5,541	8,360	37,628	25,662	17,003	16,400	16,400	16,400
TOTAL Library	296,963	304,405	387,733	468,314	356,969	493,827	493,827	493,827

101-General Fund
Providence Village PD

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Miscellaneous								
101-5114-09-5633 Capital - Vehicles	0	185,731	16,155	0	20,798	0	0	0
101-5114-09-5685 Capital - police equipment	46,358	1,563	4,980	0	0	0	0	0
TOTAL Miscellaneous	46,358	187,294	21,135	0	20,798	0	0	0
Debt Service								
101-5114-98-5657 City Financed Vehicles	23,396	23,396	23,396	0	0	0	0	0
101-5114-98-5660 Capital Lease - Patrol Cars	23,396	23,396	1,947	0	0	0	0	0
TOTAL Debt Service	46,792	46,792	25,343	0	0	0	0	0
TOTAL Providence Village PD	749,275	1,023,419	1,034,459	1,124,027	882,566	0	0	0

101-General Fund
Fleet

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Personnel								
Materials & Supplies								
Repairs & Maintenance								
101-5115-04-5120 Building Maintenance	11,536	6,197	0	0	0	0	0	0
TOTAL Repairs & Maintenance	11,536	6,197	0	0	0	0	0	0
Contract Services								
Fees & Other Services								
Miscellaneous								
101-5115-09-5667 Senior Programs	1,373	1,001	0	0	0	0	0	0
101-5115-09-5668 Community Center Programs	721	831	0	0	0	0	0	0
101-5115-09-5685 Capital Expenditures	16,673	0	0	0	0	0	0	0
TOTAL Miscellaneous	18,766	1,832	0	0	0	0	0	0
TOTAL Fleet	30,302	8,029	0	0	0	0	0	0

101-General Fund
HR

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Personnel								
101-5117-01-5101 Salaries	0	0	0	0	0	131,000	131,000	131,000
101-5117-01-5106 Longevity	0	0	0	0	0	50	50	50
101-5117-01-5107 Retirement - TMRS	0	0	0	0	0	13,957	13,957	13,957
101-5117-01-5108 Payroll Tax Expense (medicare	0	0	0	0	0	1,900	1,900	1,900
101-5117-01-5109 Group Health Insurance	0	0	0	0	0	18,290	18,290	18,290
101-5117-01-5110 Workers Comp TML	0	0	0	0	0	320	320	320
101-5117-01-5621 Travel & Training	0	0	0	0	0	3,050	3,050	3,050
TOTAL Personnel	0	0	0	0	0	168,567	168,567	168,567
Materials & Supplies								
101-5117-03-5050 Office Supplies	0	0	0	0	0	300	300	300
TOTAL Materials & Supplies	0	0	0	0	0	300	300	300
Repairs & Maintenance								
Utilities								
Contract Services								
101-5117-06-5240 Drug Testing/background	0	0	0	0	0	12,500	12,500	12,500
101-5117-06-5300 Benefits Admininstration	0	0	0	0	0	2,400	2,400	2,400
TOTAL Contract Services	0	0	0	0	0	14,900	14,900	14,900
Fees & Other Services								
101-5117-07-5220 Advertising & Notices	0	0	0	0	0	500	500	500
101-5117-07-5260 Dues and Memberships	0	0	0	0	0	650	650	650
101-5117-07-5665 Technology	0	0	0	0	0	12,360	12,360	12,360
TOTAL Fees & Other Services	0	0	0	0	0	13,510	13,510	13,510
Miscellaneous								
101-5117-09-5131 Meetings	0	0	0	0	0	1,000	1,000	1,000
101-5117-09-5132 Employee Appreciation	0	0	0	0	0	20,000	20,000	20,000
101-5117-09-5133 Marketing & Promotions	0	0	0	0	0	2,000	2,000	2,000
101-5117-09-5134 Tuition Reimbursement	0	0	0	0	0	25,000	25,000	25,000
TOTAL Miscellaneous	0	0	0	0	0	48,000	48,000	48,000
Contingency/FB								
TOTAL HR	0	0	0	0	0	245,277	245,277	245,277
TOTAL EXPENDITURES	0	9,812,651	12,430,825	16,270,793	11,285,402	18,310,203	18,310,203	18,310,203
REVENUE OVER/(UNDER) EXPENDITURES	8,244,327	671,118	852,935	2,487,361	3,441,589	758,873	758,873	758,873

ADOPTED BUDGET
AS OF: JUNE 30TH, 2024

201-Water Fund

REVENUES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
GENERAL REVENUE								
Fines and Fees								
201-4000-01-4012 Late Penalties-Water	17,849	22,151	25,593	26,000	23,826	30,000	30,000	30,000
201-4000-01-4013 Application fee	9,100	6,780	7,680	5,000	5,480	7,500	7,500	7,500
201-4000-01-4014 Reconnects	8,151	9,140	8,720	6,500	5,015	6,000	6,000	6,000
201-4000-01-4630 Bank Fees collected	690	720	1,050	500	420	0	0	0
201-4000-01-4710 Water Impact Fees	289,841	100,320	0	300,000	265,392	736,812	736,812	736,812
TOTAL Fines and Fees	325,632	139,111	43,043	338,000	300,133	780,312	780,312	780,312
Charges for Services								
201-4000-06-4010 Water Billings	1,028,908	1,216,473	1,503,767	1,734,386	1,206,600	2,000,000	2,000,000	2,000,000
201-4000-06-4011 Water Conection/Tap Fees	310,452	39,222	53,833	80,000	157,801	100,000	100,000	100,000
201-4000-06-4015 Bulk Water	81	0	48	1,500	0	0	0	0
201-4000-06-4019 Billing Adjustments	47,055	92,464	74,998	0	47,166	0	0	0
201-4000-06-4020 Infrastructure Inspection Fee	0	0	461,236	250,000	154,760	250,000	250,000	250,000
TOTAL Charges for Services	1,386,496	1,348,160	2,093,883	2,065,886	1,566,327	2,350,000	2,350,000	2,350,000
Miscellaneous								
201-4000-09-4500 Interest Income	4,023	12,622	70,718	65,000	41,542	60,000	60,000	60,000
201-4000-09-4505 Interest Inc Ph2 Offsites CO	0	0	0	0	0	1,994,072	1,994,072	1,563,884
201-4000-09-4540 Other Income	5,008	750	3,567	2,000	3,925	0	0	0
201-4000-09-4800 Insurance Proceeds	34,782	0	0	0	0	0	0	0
201-4000-09-5616 Reimbursement - Electricity	(542)	0	0	0	0	0	0	0
TOTAL Miscellaneous	43,271	13,372	74,285	67,000	45,468	2,054,072	2,054,072	1,623,884
Contingency/FB								
201-4000-99-4091 Transfers In	125,000	0	0	0	0	0	0	0
TOTAL Contingency/FB	125,000	0	0	0	0	0	0	0
TOTAL GENERAL REVENUE	1,880,398	1,500,643	2,211,211	2,470,886	1,911,927	5,184,384	5,184,384	4,754,196
TOTAL REVENUES	1,880,398	1,500,643	2,211,211	2,470,886	1,911,927	5,184,384	5,184,384	4,754,196

201-Water Fund
Water

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Personnel								
201-5201-01-5101 Salaries	260,911	313,583	268,184	324,008	205,813	346,333	346,333	346,333
201-5201-01-5105 Overtime	2,698	10,606	15,935	12,000	9,525	12,000	12,000	12,000
201-5201-01-5106 Longevity	1,750	1,900	1,200	450	450	450	450	450
201-5201-01-5107 TMRS Contribution	16,754	20,974	20,020	20,675	14,026	38,409	38,409	38,409
201-5201-01-5108 Payroll Tax Expense (medicare	3,733	4,452	4,049	4,835	3,112	5,202	5,202	5,202
201-5201-01-5109 Group Health Insurance	37,489	52,619	47,768	52,712	34,353	71,266	71,266	71,266
201-5201-01-5110 Workmens Comp TML	10,574	8,264	11,102	9,000	6,257	9,013	9,013	9,013
201-5201-01-5621 Travel/Training	653	3,201	5,348	5,500	3,894	5,700	5,700	5,700
TOTAL Personnel	334,562	415,600	373,606	429,180	277,430	488,373	488,373	488,373
Materials & Supplies								
201-5201-03-5050 Office Supplies	746	1,842	3,711	6,000	4,852	6,000	6,000	6,000
201-5201-03-5080 Gas & Oil	9,585	15,739	20,111	20,000	18,258	20,000	20,000	20,000
201-5201-03-5081 Uniforms	2,171	4,049	4,748	5,000	5,747	5,000	5,000	5,000
201-5201-03-5090 Postage	8,830	9,735	12,315	11,500	8,378	11,500	11,500	11,500
201-5201-03-5150 Printing	3,625	4,517	4,247	4,500	4,124	4,500	4,500	4,500
201-5201-03-5608 Rock, Sand & Gravel	0	338	540	1,000	5,200	1,500	1,500	1,500
201-5201-03-5630 Tools	385	1,175	4,164	6,000	5,089	6,000	6,000	6,000
201-5201-03-5903 Parts and Fittings	3,668	5,901	5,166	30,000	39,040	30,000	30,000	30,000
201-5201-03-5904 Chlorine	5,426	8,276	11,382	10,000	8,697	12,000	12,000	12,000
201-5201-03-5905 Meters	128,615	65,214	103,338	140,000	148,980	140,000	140,000	140,000
TOTAL Materials & Supplies	163,050	116,786	169,721	234,000	248,366	236,500	236,500	236,500
Repairs & Maintenance								
201-5201-04-5120 Building Maintenance	1,602	4,410	5,396	6,500	11,714	6,500	6,500	6,500
201-5201-04-5121 Equipment Maintenance	51,102	49,532	30,861	40,000	20,332	40,000	40,000	40,000
201-5201-04-5122 Vehicle Maintenance	4,912	6,773	10,249	8,000	9,936	8,000	8,000	8,000
201-5201-04-5902 Water System Maintenance	110,474	96,195	177,660	300,000	91,748	300,000	300,000	300,000
TOTAL Repairs & Maintenance	168,090	156,911	224,166	354,500	133,730	354,500	354,500	354,500
Utilities								
201-5201-05-5616 Utilities - Electricity	58,732	80,084	114,167	90,000	95,411	90,000	90,000	90,000
201-5201-05-5617 Utilities - Gas	1,788	2,226	2,230	4,000	2,615	4,000	4,000	4,000
201-5201-05-5618 Utilities - Telephone	2,962	4,443	6,159	7,000	4,689	7,000	7,000	7,000
201-5201-05-5619 Utilities - Water/Sewer	2,869	974	1,117	1,200	761	1,200	1,200	1,200
TOTAL Utilities	66,350	87,727	123,674	102,200	103,476	102,200	102,200	102,200
Contract Services								
201-5201-06-5240 Drug testing/background check	638	652	137	200	201	0	0	0
201-5201-06-5620 Legal & Professional	4,185	(16,381)	23,649	38,650	7,195	38,650	38,650	38,650
201-5201-06-5766 Consultant - engineering	38,644	43,337	27,126	60,000	7,721	60,000	60,000	60,000
201-5201-06-5911 Water Master Plan	15,661	6,301	0	0	0	0	0	0
TOTAL Contract Services	59,128	33,908	50,911	98,850	15,116	98,650	98,650	98,650

ADOPTED BUDGET
AS OF: JUNE 30TH, 2024

201-Water Fund
Water

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Fees & Other Services								
201-5201-07-5190 Insurance - TML	6,797	8,262	9,520	9,000	6,484	9,000	9,000	9,000
201-5201-07-5220 Advertising & Notices	1,930	2,136	1,301	750	0	750	750	750
201-5201-07-5260 Dues & Memberships	744	111	1,820	1,500	1,101	1,000	1,000	1,000
201-5201-07-5261 Permits-TCEQ	5,785	3,469	3,729	6,087	6,087	6,087	6,087	6,087
201-5201-07-5262 UTRW membership	2,268	2,470	2,805	2,800	3,041	3,041	3,041	3,041
201-5201-07-5624 Equipment Rental	625	1,705	11,027	6,000	3,897	6,000	6,000	6,000
201-5201-07-5665 Technology	4,765	12,574	5,164	8,250	4,115	8,250	8,250	8,250
201-5201-07-5666 Bank fees	350	175	350	366	366	366	366	366
201-5201-07-5901 Lab Fees	6,011	2,699	17,645	20,000	19,407	20,000	20,000	20,000
201-5201-07-5906 Groundwater Pumpage Fee	11,669	16,764	15,149	15,000	7,084	15,000	15,000	15,000
201-5201-07-5909 AMR Annual Fees	3,867	5,076	2,963	6,000	1,893	6,000	6,000	6,000
201-5201-07-5931 Franchise Fees 8%	79,800	96,200	0	0	0	0	0	0
TOTAL Fees & Other Services	124,611	151,641	71,473	75,753	53,475	75,494	75,494	75,494
Debt Service								
201-5201-98-5791 Transfer out	97,801	84,588	0	0	0	0	0	0
201-5201-98-5801 2016 Bond Principal	0	0	0	215,000	215,000	230,000	230,000	230,000
201-5201-98-5841 2012 CO Bond Interest	901	0	0	0	0	0	0	0
201-5201-98-5866 2016 Bond Interest	130,003	132,476	125,900	122,300	62,225	116,700	116,700	116,700
201-5201-98-5867 2023 CO Bond Principal	0	0	0	60,000	60,000	60,000	60,000	60,000
201-5201-98-5868 2023 CO Bond Interest	0	0	152,223	317,706	159,303	315,906	315,906	315,906
201-5201-98-5870 Ph 2 Offsites CO Interest	0	0	0	0	0	2,229,122	2,229,122	1,798,934
201-5201-98-5899 Bond Issue Costs	0	0	(2,007)	0	0	0	0	0
201-5201-98-9900 Amortization	(12,054)	(14,502)	0	0	0	0	0	0
TOTAL Debt Service	216,651	202,562	276,116	715,006	496,528	2,951,728	2,951,728	2,521,540
Contingency/FB								
201-5201-99-4090 Administrative fee	106,860	98,640	98,640	98,640	73,980	98,640	98,640	98,640
201-5201-99-5902 Capital - equipment	0	0	0	10,000	0	0	0	0
201-5201-99-9900 Depreciation expense	379,174	423,427	468,030	450,000	0	600,000	600,000	600,000
TOTAL Contingency/FB	486,034	522,067	566,670	558,640	73,980	698,640	698,640	698,640
TOTAL Water	1,618,476	1,687,202	1,856,337	2,568,129	1,402,101	5,006,085	5,006,085	4,575,897
TOTAL EXPENDITURES	0	1,687,202	1,856,337	2,568,129	1,402,101	5,006,085	5,006,085	4,575,897
REVENUE OVER/(UNDER) EXPENDITURES	1,880,398	(186,560)	354,874	(97,243)	509,827	178,299	178,299	178,299

ADOPTED BUDGET
AS OF: JUNE 30TH, 2024

202-Sewer Fund

REVENUES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
GENERAL REVENUE								
Fines and Fees								
202-4000-01-4021 Late Penalties - Sewer	8,787	10,632	12,048	8,000	9,201	10,000	10,000	10,000
202-4000-01-4710 Sewer Impact Fees	380,789	13,878	0	300,000	301,340	836,615	836,615	836,615
TOTAL Fines and Fees	389,577	24,510	12,048	308,000	310,541	846,615	846,615	846,615
Charges for Services								
202-4000-06-4011 Sewer Connection/Tap Fees	3,400	3,400	8,828	10,000	1,700	0	0	0
202-4000-06-4019 Billing Adjustments	3,271	42,759	(1,769)	0	0	0	0	0
202-4000-06-4020 Sewer Billings	693,633	771,320	916,351	1,078,560	714,321	1,150,000	1,150,000	1,150,000
202-4000-06-4022 Lift Station	400	2,900	9,500	0	1,750	0	0	0
TOTAL Charges for Services	700,703	820,379	932,910	1,088,560	717,771	1,150,000	1,150,000	1,150,000
Miscellaneous								
202-4000-09-4500 Interest Income	0	5,600	36,278	40,000	32,771	60,000	60,000	60,000
202-4000-09-4540 Other Income	0	(440)	0	0	0	0	0	0
TOTAL Miscellaneous	0	5,160	36,278	40,000	32,771	60,000	60,000	60,000
Contingency/FB								
202-4000-99-4091 Transfer In	115,004	0	104,779	0	0	0	0	0
TOTAL Contingency/FB	115,004	0	104,779	0	0	0	0	0
TOTAL GENERAL REVENUE	1,205,284	850,049	1,086,015	1,436,560	1,061,082	2,056,615	2,056,615	2,056,615
TOTAL REVENUES	1,205,284	850,049	1,086,015	1,436,560	1,061,082	2,056,615	2,056,615	2,056,615

202-Sewer Fund
Sewer

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Personnel								
202-5202-01-5101 Salaries	181,439	263,183	180,556	230,000	165,419	280,933	280,933	280,933
202-5202-01-5105 Overtime	16,176	20,427	13,848	12,000	18,185	15,000	15,000	15,000
202-5202-01-5106 Longevity	900	1,100	200	1,050	1,100	1,350	1,350	1,350
202-5202-01-5107 Retirement - TMRS	13,088	17,738	13,286	17,176	12,006	31,860	31,860	31,860
202-5202-01-5108 Payroll Tax Expense (medicare	3,006	4,001	2,600	4,055	2,787	4,311	4,311	4,311
202-5202-01-5109 Group Health Insurance	27,030	38,952	40,861	42,260	28,119	47,510	47,510	47,510
202-5202-01-5110 Workers Comp TML	7,071	8,703	11,134	6,751	4,693	6,026	6,026	6,026
202-5202-01-5621 Travel/training	961	3,885	3,613	5,000	5,548	5,000	5,000	5,000
TOTAL Personnel	249,671	357,989	266,097	318,292	237,856	391,990	391,990	391,990
Materials & Supplies								
202-5202-03-5050 Office Supplies	721	1,839	5,529	6,000	2,405	5,000	5,000	5,000
202-5202-03-5080 Gas & Oil	5,962	11,162	11,153	14,000	11,261	14,000	14,000	14,000
202-5202-03-5081 Uniforms	1,897	2,560	2,725	3,500	2,602	3,500	3,500	3,500
202-5202-03-5090 Postage	21	15	145	300	295	300	300	300
202-5202-03-5150 Printing	0	0	336	600	0	600	600	600
202-5202-03-5607 Rock, Sand & Gravel	0	0	0	4,000	7,384	4,000	4,000	4,000
202-5202-03-5608 Chemicals Purchased	6,643	13,852	12,024	10,000	8,685	10,000	10,000	10,000
202-5202-03-5630 Tools	232	2,228	3,824	1,500	5,553	5,000	5,000	5,000
202-5202-03-5903 Parts and Fittings	7,104	2,151	2,216	3,000	2,549	3,000	3,000	3,000
202-5202-03-5904 Chlorine	4,868	7,712	10,626	11,000	10,678	11,000	11,000	11,000
TOTAL Materials & Supplies	27,448	41,518	48,577	53,900	51,412	56,400	56,400	56,400
Repairs & Maintenance								
202-5202-04-5120 Building Maintenance	1,874	210	9,938	5,000	8,154	5,000	5,000	5,000
202-5202-04-5121 Equipment Maintenance	9,302	48,903	21,910	30,000	30,041	35,000	35,000	35,000
202-5202-04-5122 Vehicle Maintenance	2,926	3,168	8,920	5,000	6,272	7,000	7,000	7,000
202-5202-04-5902 Sewer System Maintenance	35,282	61,442	75,954	55,000	38,698	60,000	60,000	60,000
202-5202-04-5903 WWTP Maintenance	36,037	103,867	62,837	85,000	107,049	85,000	85,000	85,000
TOTAL Repairs & Maintenance	85,421	217,590	179,559	180,000	190,213	192,000	192,000	192,000
Utilities								
202-5202-05-5616 Utilities - Electricity	34,840	47,709	40,046	42,500	41,355	42,500	42,500	42,500
202-5202-05-5618 Utilities - Telephone	3,043	4,090	7,017	7,000	6,451	7,000	7,000	7,000
202-5202-05-5619 Utilities - Water/Sewer	51,230	56,113	106,027	100,000	115,665	100,000	100,000	100,000
202-5202-05-5621 Utilities - Sludge Disposal	11,296	7,131	0	10,000	3,304	10,000	10,000	10,000
TOTAL Utilities	100,408	115,043	153,089	159,500	166,776	159,500	159,500	159,500
Contract Services								
202-5202-06-5240 Drug testing/background check	0	2,232	0	200	200	0	0	0
202-5202-06-5620 Legal & Professional	0	14,770	3,743	6,000	1,871	6,000	6,000	6,000
202-5202-06-5766 Consultant - engineering	121,092	29,665	45,707	30,000	16,414	30,000	30,000	30,000
202-5202-06-5912 Sewer Master Plan	17,700	3,564	0	0	0	0	0	0
TOTAL Contract Services	138,793	50,231	49,449	36,200	18,485	36,000	36,000	36,000

202-Sewer Fund
Sewer

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Fees & Other Services								
202-5202-07-5190 Insurance - TML	10,333	10,583	14,400	15,000	10,806	15,000	15,000	15,000
202-5202-07-5260 Dues & Memberships	200	550	320	2,601	2,601	740	740	740
202-5202-07-5261 Permits-TCEQ	1,666	2,316	4,697	4,700	0	4,700	4,700	4,700
202-5202-07-5624 Equipment Rental	0	0	15,392	15,000	3,516	15,000	15,000	15,000
202-5202-07-5665 Technology	2,278	6,144	2,597	6,000	3,750	6,000	6,000	6,000
202-5202-07-5901 Lab Fees	6,362	10,539	14,393	15,000	7,075	15,000	15,000	15,000
202-5202-07-5931 Franchise Fees 8%	53,818	60,947	0	0	0	0	0	0
TOTAL Fees & Other Services	74,657	91,079	51,800	58,301	27,748	56,440	56,440	56,440
Debt Service								
202-5202-98-5841 2012 CO Bond Interest	10,220	5,504	0	0	0	0	0	0
TOTAL Debt Service	10,220	5,504	0	0	0	0	0	0
Contingency/FB								
202-5202-99-5902 Capital - equipment	0	0	0	98,906	98,905	0	0	0
TOTAL Contingency/FB	0	0	0	98,906	98,905	0	0	0
TOTAL Sewer	686,619	878,955	748,570	905,099	791,396	892,330	892,330	892,330
TOTAL EXPENDITURES	0	878,955	748,570	905,099	791,396	892,330	892,330	892,330
REVENUE OVER/(UNDER) EXPENDITURES	1,205,284	(28,906)	337,444	531,461	269,687	1,164,285	1,164,285	1,164,285

CITY OF AUBREY
ADOPTED BUDGET
AS OF: JUNE 30TH, 2024

205-Solid Waste Fund

REVENUES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
GENERAL REVENUE								
Charges for Services								
205-4000-06-4019 Billing Adjustments	815	1,537	28,196	0	0	0	0	0
205-4000-06-4025 Garbage Billings	833,395	1,160,527	1,497,156	2,263,208	1,467,101	2,546,000	2,546,000	2,546,000
TOTAL Charges for Services	834,210	1,162,065	1,525,352	2,263,208	1,467,101	2,546,000	2,546,000	2,546,000
Miscellaneous								
205-4000-09-4540 Other income	0	0	537	0	0	0	0	0
TOTAL Miscellaneous	0	0	537	0	0	0	0	0
Contingency/FB								
205-4000-99-4091 Transfer from W/S	97,801	84,588	0	0	0	0	0	0
TOTAL Contingency/FB	97,801	84,588	0	0	0	0	0	0
TOTAL GENERAL REVENUE	932,011	1,246,652	1,525,889	2,263,208	1,467,101	2,546,000	2,546,000	2,546,000
TOTAL REVENUES	932,011	1,246,652	1,525,889	2,263,208	1,467,101	2,546,000	2,546,000	2,546,000

205-Solid Waste Fund
Solid Waste

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Materials & Supplies								
205-5205-03-5150 Printing	0	0	68	0	0	0	0	0
TOTAL Materials & Supplies	0	0	68	0	0	0	0	0
Fees & Other Services								
205-5205-07-5666 Mustang Collection Fees	25,843	40,610	61,830	95,000	61,171	116,000	116,000	116,000
205-5205-07-5931 Franchise Fees 15%	123,992	169,091	219,077	280,000	216,499	315,000	315,000	315,000
205-5205-07-5935 Waste Connections	782,177	860,704	0	0	0	0	0	0
205-5205-07-5940 Rhino Removal	0	176,247	668,084	0	0	0	0	0
205-5205-07-5941 Republic Waste	0	0	849,754	1,888,208	1,319,022	2,115,000	2,115,000	2,115,000
TOTAL Fees & Other Services	932,011	1,246,652	1,798,745	2,263,208	1,596,692	2,546,000	2,546,000	2,546,000
Contingency/FB								
TOTAL Solid Waste	932,011	1,246,652	1,798,813	2,263,208	1,596,692	2,546,000	2,546,000	2,546,000
TOTAL EXPENDITURES	0	1,246,652	1,798,813	2,263,208	1,596,692	2,546,000	2,546,000	2,546,000
REVENUE OVER/(UNDER) EXPENDITURES	932,011	0	(272,924)	0	(129,591)	0	0	0

CITY OF AUBREY
ADOPTED BUDGET
AS OF: JUNE 30TH, 2024

301-Debt Service Fund

REVENUES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
GENERAL REVENUE								
Taxes								
301-4000-02-4100 Property Taxes	840,025	774,743	1,328,281	1,321,000	1,336,664	1,465,000	1,465,000	1,465,000
301-4000-02-4101 Penalties & Interest	3,501	0	0	0	0	0	0	0
TOTAL Taxes	843,526	774,743	1,328,281	1,321,000	1,336,664	1,465,000	1,465,000	1,465,000
Miscellaneous								
301-4000-09-4500 Interest Income	549	1,562	24,648	15,000	24,958	28,500	28,500	28,500
TOTAL Miscellaneous	549	1,562	24,648	15,000	24,958	28,500	28,500	28,500
Contingency/FB								
301-4000-99-4091 Transfers in	2,773,000	0	0	0	0	433,919	433,919	433,919
TOTAL Contingency/FB	2,773,000	0	0	0	0	433,919	433,919	433,919
TOTAL GENERAL REVENUE	3,617,075	776,305	1,352,929	1,336,000	1,361,622	1,927,419	1,927,419	1,927,419
TOTAL REVENUES	3,617,075	776,305	1,352,929	1,336,000	1,361,622	1,927,419	1,927,419	1,927,419

ADOPTED BUDGET
AS OF: JUNE 30TH, 2024

301-Debt Service Fund
Debt Service

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Fees & Other Services								
301-5301-07-5870 Agent Fees	48,137	3,500	1,580	4,000	3,500	3,500	3,500	3,500
TOTAL Fees & Other Services	48,137	3,500	1,580	4,000	3,500	3,500	3,500	3,500
Debt Service								
301-5301-98-5850 2020 Time Warrant Principal	146,000	36,000	36,000	36,000	36,000	38,000	38,000	38,000
301-5301-98-5851 2020 Time Warrant Interest	9,609	10,572	10,140	9,708	4,962	9,264	9,264	9,264
301-5301-98-5852 2006 CO Principal	0	30,000	75,000	40,000	0	45,000	45,000	45,000
301-5301-98-5853 2006 CO Interest	42,915	11,685	7,385	7,380	3,690	5,740	5,740	5,740
301-5301-98-5854 2017 CO Principal	1,325,000	0	0	0	0	0	0	0
301-5301-98-5855 2017 CO Interest	8,117	0	0	0	0	0	0	0
301-5301-98-5857 2010 GO Refunding Interest	0	10,251	0	0	0	0	0	0
301-5301-98-5860 2013 GO Refunding Principal	64,216	65,360	170,000	57,000	57,000	56,000	56,000	56,000
301-5301-98-5861 2013 GO Refunding Interest	6,264	10,382	8,116	4,169	4,019	2,796	2,796	2,796
301-5301-98-5862 2018 Time Warrant Principal	1,261,000	0	0	0	0	0	0	0
301-5301-98-5863 2018 Time Warrant Interest	9,463	0	0	0	0	0	0	0
301-5301-98-5864 2019 Time Warrant Principal	92,000	94,000	96,000	98,000	98,000	101,000	101,000	101,000
301-5301-98-5865 2019 Time Warrant Interest	19,584	17,840	16,063	14,250	7,583	12,389	12,389	12,389
301-5301-98-5866 2020 GO Refunding Prinicipal	435,000	422,000	434,000	558,000	558,000	562,000	562,000	562,000
301-5301-98-5867 2020 GO Refunding Interest	20,091	12,508	18,179	12,872	7,929	6,880	6,880	6,880
301-5301-98-5868 2022 CO Public Safety Prin	0	0	0	70,000	70,000	290,000	290,000	290,000
301-5301-98-5869 2022 CO Public Safety Int	0	0	418,644	464,850	233,300	455,850	455,850	455,850
301-5301-98-5871 Interest - CO 2024 FS#2	0	0	0	0	0	339,000	339,000	339,000
301-5301-98-5899 Bond Issue Costs	0	0	0	0	200	0	0	0
TOTAL Debt Service	3,439,259	720,597	1,289,528	1,372,229	1,080,683	1,923,919	1,923,919	1,923,919
Contingency/FB								
301-5301-99-5791 Transfers out	240,004	0	0	0	0	0	0	0
TOTAL Contingency/FB	240,004	0	0	0	0	0	0	0
TOTAL Debt Service	3,727,399	724,097	1,291,108	1,376,229	1,084,183	1,927,419	1,927,419	1,927,419
TOTAL EXPENDITURES	0	724,097	1,291,108	1,376,229	1,084,183	1,927,419	1,927,419	1,927,419
REVENUE OVER/(UNDER) EXPENDITURES	3,617,075	52,208	61,822	(40,229)	277,439	0	0	0

ADOPTED BUDGET
AS OF: JUNE 30TH, 2024

401-Special Revenue Fund

REVENUES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
GENERAL REVENUE								
Fines and Fees								
401-4000-01-4310 Court Security Fee	1,920	3,232	4,018	3,000	4,073	4,600	4,600	4,600
401-4000-01-4421 Child Safety Fees	3,594	7,381	7,075	8,000	7,147	8,000	8,000	8,000
401-4000-01-4710 Court Technology Fee	1,693	2,724	3,303	2,000	3,355	4,000	4,000	4,000
TOTAL Fines and Fees	7,207	13,338	14,395	13,000	14,575	16,600	16,600	16,600
Taxes								
401-4000-02-4170 Hotel/Motel Tax	541	3,358	9,463	2,000	6,802	10,000	10,000	10,000
TOTAL Taxes	541	3,358	9,463	2,000	6,802	10,000	10,000	10,000
Grants								
401-4000-03-4701 NCTCOG/State Comp/LEOSE	1,434	1,326	1,452	1,250	4,128	4,128	4,128	4,128
TOTAL Grants	1,434	1,326	1,452	1,250	4,128	4,128	4,128	4,128
Miscellaneous								
401-4000-09-4500 Interest Income	13	146	1,332	500	1,729	3,000	3,000	3,000
TOTAL Miscellaneous	13	146	1,332	500	1,729	3,000	3,000	3,000
Contingency/FB								
TOTAL GENERAL REVENUE	9,194	18,168	26,642	16,750	27,235	33,728	33,728	33,728
TOTAL REVENUES	9,194	18,168	26,642	16,750	27,235	33,728	33,728	33,728

401-Special Revenue Fund
Officers Training Fund

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Personnel								
401-5401-01-5621 Travel/training	0	0	1,360	3,000	2,380	3,000	3,000	3,000
TOTAL Personnel	0	0	1,360	3,000	2,380	3,000	3,000	3,000
Materials & Supplies								
Contract Services								
401-5401-06-5677 Child Safety - Child Advoc Ct	3,500	3,500	3,500	3,500	0	3,500	3,500	3,500
TOTAL Contract Services	3,500	3,500	3,500	3,500	0	3,500	3,500	3,500
Fees & Other Services								
401-5401-07-5665 Court Technology	1,859	4,033	2,278	4,000	3,525	4,000	4,000	4,000
TOTAL Fees & Other Services	1,859	4,033	2,278	4,000	3,525	4,000	4,000	4,000
Public Safety								
Contingency/FB								
TOTAL Officers Training Fund	5,359	7,533	7,138	10,500	5,905	10,500	10,500	10,500

401-Special Revenue Fund
Seizure

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	(-------- 2023-2024 --------) CURRENT BUDGET	Y-T-D ACTUAL	(---------- 2024-2025 ----------) DEPARTMENT REQUESTED DR	PROPOSED BUDGET PB	ADOPTED BUDGET AB
Materials & Supplies								
Contract Services								
401-5402-06-5620 Seizure - Legal & Professiona	0	0	0	0	375	0	0	0
TOTAL Contract Services	0	0	0	0	375	0	0	0
Fees & Other Services								
TOTAL Seizure	0	0	0	0	375	0	0	0

401-Special Revenue Fund
Court Technology

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	(-------- 2023-2024 --------) CURRENT BUDGET	Y-T-D ACTUAL	(---------- 2024-2025 ----------) DEPARTMENT REQUESTED DR	PROPOSED BUDGET PB	ADOPTED BUDGET AB
Debt Service								
Contingency/FB								

401-Special Revenue Fund
Court Security

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Personnel								
401-5404-01-5101 Salaries	2,449	2,400	560	2,000	0	0	0	0
401-5404-01-5108 Payroll Tax Expense (medicare	38	35	8	50	0	0	0	0
TOTAL Personnel	2,488	2,435	568	2,050	0	0	0	0
Contingency/FB								
TOTAL Court Security	2,488	2,435	568	2,050	0	0	0	0
TOTAL EXPENDITURES	0	9,968	7,706	12,550	6,280	10,500	10,500	10,500
REVENUE OVER/(UNDER) EXPENDITURES	9,194	8,200	18,936	4,200	20,955	23,228	23,228	23,228

402-TIRZ Jackson Ridge

REVENUES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
GENERAL REVENUE								
Taxes								
402-4000-02-4100 Property Taxes	335,679	474,905	475,000	900,000	881,485	900,000	900,000	900,000
TOTAL Taxes	335,679	474,905	475,000	900,000	881,485	900,000	900,000	900,000
Grants								
Donations								
Miscellaneous								
402-4000-09-4500 Interest Income	166	1,920	5,689	6,000	14,684	10,000	10,000	10,000
TOTAL Miscellaneous	166	1,920	5,689	6,000	14,684	10,000	10,000	10,000
Contingency/FB								
TOTAL GENERAL REVENUE	335,845	476,825	480,689	906,000	896,169	910,000	910,000	910,000
TOTAL REVENUES	335,845	476,825	480,689	906,000	896,169	910,000	910,000	910,000

402-TIRZ Jackson Ridge
Seizure Fund

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	(-------- 2023-2024 --------) CURRENT BUDGET	Y-T-D ACTUAL	(---------- 2024-2025 ----------) DEPARTMENT REQUESTED DR	PROPOSED BUDGET PB	ADOPTED BUDGET AB
Materials & Supplies								
Fees & Other Services								
402-5402-07-5665 Jackson Ridge PID TIRZ Credit	220,266	342,699	474,905	900,000	0	900,000	900,000	900,000
402-5402-07-5870 Bank Charges	0	6,310	(49,960)	0	0	0	0	0
TOTAL Fees & Other Services	220,266	349,009	424,945	900,000	0	900,000	900,000	900,000
TOTAL Seizure Fund	220,266	349,009	424,945	900,000	0	900,000	900,000	900,000
TOTAL EXPENDITURES	0	349,009	424,945	900,000	0	900,000	900,000	900,000
REVENUE OVER/(UNDER) EXPENDITURES	335,845	127,816	55,743	6,000	896,169	10,000	10,000	10,000

403-Impact Fees

REVENUES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
GENERAL REVENUE								
Fines and Fees								
403-4000-01-4710 Street Impact Fees	226,598	0	0	0	0	0	0	0
TOTAL Fines and Fees	226,598	0	0	0	0	0	0	0
Miscellaneous								
403-4000-09-4500 Interest Income	169	1,888	16,535	10,000	16,074	14,000	14,000	14,000
TOTAL Miscellaneous	169	1,888	16,535	10,000	16,074	14,000	14,000	14,000
Contingency/FB								
TOTAL GENERAL REVENUE	226,767	1,888	16,535	10,000	16,074	14,000	14,000	14,000
TOTAL REVENUES	226,767	1,888	16,535	10,000	16,074	14,000	14,000	14,000

403-Impact Fees
MCTF

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	(-------- 2023-2024 --------) CURRENT BUDGET	Y-T-D ACTUAL	(---------- 2024-2025 ----------) DEPARTMENT REQUESTED DR	PROPOSED BUDGET PB	ADOPTED BUDGET AB
Contract Services								
403-5403-06-5766 CONSULTING ENGINEERING	0	17,059	5,111	0	1,630	0	0	0
TOTAL Contract Services	0	17,059	5,111	0	1,630	0	0	0
Fees & Other Services								
Contingency/FB								
403-5403-99-5762 Fee Credit to Developer	68,933	0	0	0	0	0	0	0
TOTAL Contingency/FB	68,933	0	0	0	0	0	0	0
TOTAL MCTF	68,933	17,059	5,111	0	1,630	0	0	0
TOTAL EXPENDITURES	0	17,059	5,111	0	1,630	0	0	0
REVENUE OVER/(UNDER) EXPENDITURES	226,767	(15,171)	11,424	10,000	14,444	14,000	14,000	14,000

404-Development Fees

REVENUES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
GENERAL REVENUE								
Fines and Fees								
404-4000-01-4310 Street Impact Fees	0	0	0	0	186,276	464,200	464,200	464,200
TOTAL Fines and Fees	0	0	0	0	186,276	464,200	464,200	464,200
Charges for Services								
Permits								
404-4000-07-4200 Development Fees	298,376	97,352	153,972	100,000	11,727	10,000	10,000	10,000
404-4000-07-4210 Street Fee	1,471,446	197,775	569,592	200,000	63,288	75,000	75,000	75,000
404-4000-07-4700 Fire Services Fund	951,987	770,500	666,488	600,000	251,779	400,000	400,000	400,000
404-4000-07-4710 Park Development Fees	316,794	772,450	219,100	200,000	482,950	691,800	691,800	691,800
TOTAL Permits	3,038,603	1,838,077	1,609,152	1,100,000	809,744	1,176,800	1,176,800	1,176,800
Miscellaneous								
404-4000-09-4500 Interest Income	5,481	67,772	431,187	260,000	394,709	100,000	100,000	100,000
TOTAL Miscellaneous	5,481	67,772	431,187	260,000	394,709	100,000	100,000	100,000
Contingency/FB								
404-4000-99-4091 Transfers In	0	0	0	0	0	1,000,000	1,000,000	1,000,000
TOTAL Contingency/FB	0	0	0	0	0	1,000,000	1,000,000	1,000,000
TOTAL GENERAL REVENUE	3,044,084	1,905,849	2,040,339	1,360,000	1,390,729	2,741,000	2,741,000	2,741,000
TOTAL REVENUES	3,044,084	1,905,849	2,040,339	1,360,000	1,390,729	2,741,000	2,741,000	2,741,000

ADOPTED BUDGET
AS OF: JUNE 30TH, 2024

404-Development Fees
MCSF

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Personnel								
Contract Services								
404-5404-06-5911 ParkMaster Plan	0	142,304	0	0	0	0	0	0
404-5404-06-5912 Capital Expenditure - Parks	0	0	0	840,000	267,285	328,000	328,000	328,000
404-5404-06-5913 Capital Expenditure - Fire	0	0	0	0	45,386	1,000,000	1,000,000	1,000,000
404-5404-06-5914 Capital Expenditure - Streets	0	0	0	0	0	410,000	410,000	410,000
404-5404-06-5915 Capital Outlay Land Purchase	0	1,647,595	(6,313)	0	0	0	0	0
TOTAL Contract Services	0	1,789,899	(6,313)	840,000	312,671	1,738,000	1,738,000	1,738,000
Public Safety								
Contingency/FB								
TOTAL MCSF	0	1,789,899	(6,313)	840,000	312,671	1,738,000	1,738,000	1,738,000
TOTAL EXPENDITURES	0	1,789,899	(6,313)	840,000	312,671	1,738,000	1,738,000	1,738,000
REVENUE OVER/(UNDER) EXPENDITURES	3,044,084	115,951	2,046,652	520,000	1,078,059	1,003,000	1,003,000	1,003,000

405-Grant Fund

REVENUES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
GENERAL REVENUE								
Charges for Services								
Miscellaneous								
405-4000-09-4500 Interest Income	1	3,225	54,354	50,000	48,008	20,000	20,000	20,000
TOTAL Miscellaneous	1	3,225	54,354	50,000	48,008	20,000	20,000	20,000
Tocker Foundation-Libry								
USDOJ PD Vests								
405-4000-82-4125 TxDOT Main St Improvement	0	0	0	0	0	104,000	104,000	104,000
405-4000-82-4126 Opioid Grant Proceeds	0	0	0	0	925	0	0	0
TOTAL USDOJ PD Vests	0	0	0	0	925	104,000	104,000	104,000
CJD Video,Computers								
CDBG Water Lines								
405-4000-84-4126 SECO LED Grant Proceeds	0	0	24,441	0	0	0	0	0
TOTAL CDBG Water Lines	0	0	24,441	0	0	0	0	0
Grant Revenue								
405-4000-85-4123 CLFRF Proceeds	606,456	(0)	0	700,000	190,897	102,000	102,000	102,000
405-4000-85-4125 TDA Water/Sewer Grant	0	24,476	30,802	256,956	256,956	0	0	0
TOTAL Grant Revenue	606,456	24,476	30,802	956,956	447,853	102,000	102,000	102,000
Contingency/FB								
405-4000-99-4091 Transfers In CDBG match W/S	76,322	0	0	0	0	0	0	0
TOTAL Contingency/FB	76,322	0	0	0	0	0	0	0
TOTAL GENERAL REVENUE	682,779	27,701	109,597	1,006,956	496,785	226,000	226,000	226,000
TOTAL REVENUES	682,779	27,701	109,597	1,006,956	496,785	226,000	226,000	226,000

405-Grant Fund
Grants

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Contract Services								
405-5405-06-5620 ENGINEERING	0	28,739	140,838	100,000	0	0	0	0
TOTAL Contract Services	0	28,739	140,838	100,000	0	0	0	0
Miscellaneous								
Tocker Foundation Libry								
USDOJ PD Vests								
CJD Video,Computers								
CDBG Water lines								
405-5405-84-5121 TxDot Grant	0	0	0	0	88,147	104,000	104,000	104,000
405-5405-84-5122 CDBG water lines	0	31,500	220,133	306,956	133,083	0	0	0
405-5405-84-5123 ARPA Pump Station Generators	0	0	70,961	600,000	357,586	102,000	102,000	102,000
TOTAL CDBG Water lines	0	31,500	291,095	906,956	578,816	206,000	206,000	206,000
Contingency/FB								
TOTAL Grants	0	60,239	431,932	1,006,956	578,816	206,000	206,000	206,000
TOTAL EXPENDITURES	0	60,239	431,932	1,006,956	578,816	206,000	206,000	206,000
REVENUE OVER/(UNDER) EXPENDITURES	682,779	(32,538)	(322,336)	0	(82,031)	20,000	20,000	20,000

ADOPTED BUDGET
AS OF: JUNE 30TH, 2024

406-Holding Acct Dev Agreemts

REVENUES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
GENERAL REVENUE								
Charges for Services								
406-4000-06-4501 Regatta (Silverado) DA	0	(1,057)	0	0	0	20,000	20,000	20,000
406-4000-06-4502 Venable Development Agreement	0	(72)	0	0	0	0	0	0
406-4000-06-4505 Horizon Deer Creek Dev Agrmt	0	(539)	0	0	0	0	0	0
406-4000-06-4509 Keeneland Developmenet Agree	25,000	200,000	58,971	0	0	10,000	10,000	10,000
406-4000-06-5407 DA - Aubrey Plant/N/S	0	25,000	0	0	0	100,000	100,000	100,000
406-4000-06-5408 PSA - High Point Ranch	50,000	350,008	248,752	0	100,000	50,000	50,000	50,000
406-4000-06-5409 Sweet Cow Holdings, LLC PSA	0	10,784	0	0	0	0	0	0
406-4000-06-5410 Deccan Ranch & Aubrey Farms	0	29,266	50,552	0	0	0	0	0
406-4000-06-5411 DA Pecan Creek	0	0	5,000	0	0	50,000	50,000	50,000
406-4000-06-5412 DA Running Branch	0	0	5,000	0	0	0	0	0
406-4000-06-5413 High Point Ranch Commercial D	0	0	0	0	0	50,000	50,000	50,000
406-4000-06-5414 HPR - Lennar	0	0	0	0	50,000	200,000	200,000	200,000
406-4000-06-5415 Duck Point MM Aubrey	0	0	0	0	50,000	100,000	100,000	100,000
406-4000-06-5416 ARCK Development (Knuckles Rd	0	0	0	0	10,000	50,000	50,000	50,000
406-4000-06-5417 Aubrey Hts PSA	0	0	0	0	10,000	50,000	50,000	50,000
406-4000-06-5418 Ribbonwood	0	0	0	0	0	50,000	50,000	50,000
406-4000-06-5419 Lennar Loyd Ranch	0	0	0	0	0	50,000	50,000	50,000
406-4000-06-5420 Project Alpha US 377	0	0	0	0	0	50,000	50,000	50,000
406-4000-06-5421 Blackjack 4Star	0	0	0	0	0	50,000	50,000	50,000
TOTAL Charges for Services	75,000	613,391	368,276	0	220,000	880,000	880,000	880,000
Miscellaneous								
406-4000-09-4500 Interest Income	0	252	1,104	0	60	0	0	0
TOTAL Miscellaneous	0	252	1,104	0	60	0	0	0
TOTAL GENERAL REVENUE	75,000	613,642	369,379	0	220,060	880,000	880,000	880,000
TOTAL REVENUES	75,000	613,642	369,379	0	220,060	880,000	880,000	880,000

406-Holding Acct Dev Agreemts
Development Agreements

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Contract Services								
406-5406-06-5620 Arrow Brooke Dev Agreement	0	0	0	0	3,019	0	0	0
406-5406-06-5720 Silverado (Regatta) Dev Agrmt	0	1,057	0	0	27,818	20,000	20,000	20,000
406-5406-06-5722 DA - EMLI Pecan Creek	0	0	134	0	0	0	0	0
406-5406-06-5723 DA - Aubrey Plant/N/S	0	25,000	31,997	0	32,585	100,000	100,000	100,000
406-5406-06-5724 DA - High Pointe Ranch	50,000	205,234	0	0	187,119	50,000	50,000	50,000
406-5406-06-5725 Keenland Addition	25,000	376,746	0	0	8,148	10,000	10,000	10,000
406-5406-06-5728 DA - RIBBONWOOD	0	0	0	0	15,173	50,000	50,000	50,000
406-5406-06-5729 Sweet Cow Holdings LLC PSA	0	5,605	2,377	0	988	0	0	0
406-5406-06-5730 Deccan Ranch & Aubrey Farms	0	0	105,593	0	0	0	0	0
406-5406-06-5731 Running Branch	0	0	17	0	0	0	0	0
406-5406-06-6450 Sandbrock Dev Agreement	0	0	0	0	6,058	0	0	0
406-5406-06-6460 Duck Point MM Aubrey	0	0	0	0	26,517	100,000	100,000	100,000
406-5406-06-6461 High Point Ranch Commercial D	0	0	0	0	0	50,000	50,000	50,000
406-5406-06-6462 Pecan Creek Residential	0	0	2,104	0	1,718	50,000	50,000	50,000
406-5406-06-6463 HPR - Lennar	0	0	0	0	11,623	200,000	200,000	200,000
406-5406-06-6465 DA Lennar Loyd Ranch	0	0	0	0	5,652	50,000	50,000	50,000
406-5406-06-6470 DA US 377 Project Alpha	0	0	0	0	2,306	50,000	50,000	50,000
406-5406-06-6471 Blackjack 4Star PSA	0	0	0	0	958	50,000	50,000	50,000
406-5406-06-6472 ARCK Development (Knuckles Rd	0	0	0	0	163	50,000	50,000	50,000
406-5406-06-6473 Aubrey Hts PSA Expense	0	0	0	0	0	50,000	50,000	50,000
TOTAL Contract Services	75,000	613,642	142,221	0	329,844	880,000	880,000	880,000
TOTAL Development Agreements	75,000	613,642	142,221	0	329,844	880,000	880,000	880,000
TOTAL EXPENDITURES	0	613,642	142,221	0	329,844	880,000	880,000	880,000
REVENUE OVER/(UNDER) EXPENDITURES	75,000	0	227,158	0	(109,785)	0	0	0

501-Capital Projects Fund

REVENUES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
GENERAL REVENUE								
Penalties & Interest								
501-4000-05-4500 Interest Income	783	25,528	791,977	726,414	712,570	227,255	227,255	227,255
TOTAL Penalties & Interest	783	25,528	791,977	726,414	712,570	227,255	227,255	227,255
Charges for Services								
Miscellaneous								
501-4000-09-4900 Bond proceeds	1,045,000	11,167,193	8,170,000	8,925,000	5,525,000	57,350,000	57,350,000	57,350,000
501-4000-09-4901 Premium on Sale of Bonds	0	0	0	183,336	183,336	0	0	0
TOTAL Miscellaneous	1,045,000	11,167,193	8,170,000	9,108,336	5,708,336	57,350,000	57,350,000	57,350,000
Contingency/FB								
501-4000-99-4091 Transfers In	1,348,879	0	4,655,049	14,271,544	0	22,637,116	22,637,116	22,637,116
501-4000-99-4092 Capital Carryforward	0	0	0	1,002,079	0	0	0	0
TOTAL Contingency/FB	1,348,879	0	4,655,049	15,273,623	0	22,637,116	22,637,116	22,637,116
TOTAL GENERAL REVENUE	2,394,662	11,192,721	13,617,025	25,108,373	6,420,906	80,214,371	80,214,371	80,214,371
TOTAL REVENUES	2,394,662	11,192,721	13,617,025	25,108,373	6,420,906	80,214,371	80,214,371	80,214,371

ADOPTED BUDGET
AS OF: JUNE 30TH, 2024

501-Capital Projects Fund
Capital Projects

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Capital								
501-5501-02-5641 Park Development	0	0	0	13,000	0	0	0	0
TOTAL Capital	0	0	0	13,000	0	0	0	0
Contract Services								
501-5501-06-5765 IT Projects	0	0	0	92,415	42,368	50,000	50,000	50,000
501-5501-06-5766 Engineering	84,641	19,602	0	500,000	0	150,000	150,000	150,000
TOTAL Contract Services	84,641	19,602	0	592,415	42,368	200,000	200,000	200,000
Miscellaneous								
501-5501-09-5633 Capital Public Safety Equip	0	0	0	631,257	100,000	0	0	0
501-5501-09-5650 Capital Public Safety 2022 CO	0	19,515	1,014,655	6,044,149	3,085,513	3,000,000	3,000,000	3,000,000
501-5501-09-5651 Capital Vehicle Replacement	0	0	0	1,606,516	1,855,092	1,800,000	1,800,000	1,800,000
501-5501-09-5652 Capital Project 38	0	0	0	3,400,000	0	3,500,000	3,500,000	3,500,000
501-5501-09-5655 Capital 305 S Main	0	10,000	0	0	0	0	0	0
501-5501-09-5656 2023 PH 1 Offsights	0	0	0	3,134,698	1,112,238	0	0	0
501-5501-09-5657 Capital Modular Building	0	0	0	291,582	291,582	0	0	0
501-5501-09-5658 CO 2024 FS#2	0	0	0	5,708,336	638,207	5,708,336	5,708,336	5,708,336
501-5501-09-5659 Council Chambers 2023	0	0	0	932,025	675,448	0	0	0
501-5501-09-5660 HW 377 Utility Relocates	0	0	0	0	50,659	6,000,000	6,000,000	6,000,000
501-5501-09-5689 Street Projects	1,545,476	(18,231)	1,101,719	1,065,902	1,052,698	0	0	0
501-5501-09-5690 Admin Projects	0	0	0	436,349	8,824	0	0	0
501-5501-09-5901 Water System Expansion	0	0	0	733,086	364,699	1,816,707	1,816,707	1,816,707
501-5501-09-5902 Capex Water	0	0	0	0	0	43,000	43,000	43,000
501-5501-09-5950 Sewer System Expansion	0	0	0	998,721	527,253	56,929,548	56,929,548	56,929,548
501-5501-09-5951 Capex Sewer	0	0	0	0	0	210,000	210,000	210,000
TOTAL Miscellaneous	1,545,476	11,284	2,116,373	24,982,621	9,762,213	79,007,591	79,007,591	79,007,591
Debt Service								
501-5501-98-5899 Bond Issue Costs	42,729	270,018	320,793	203,337	203,337	1,006,780	1,006,780	1,006,780
TOTAL Debt Service	42,729	270,018	320,793	203,337	203,337	1,006,780	1,006,780	1,006,780
Contingency/FB								
TOTAL Capital Projects	1,672,846	300,905	2,437,167	25,791,373	10,007,918	80,214,371	80,214,371	80,214,371
TOTAL EXPENDITURES	0	300,905	2,437,167	25,791,373	10,007,918	80,214,371	80,214,371	80,214,371
REVENUE OVER/(UNDER) EXPENDITURES	2,394,662	10,891,816	11,179,858	(683,000)	(3,587,012)	0	0	0

ADOPTED BUDGET

AS OF: JUNE 30TH, 2024

801-Employee Benefit Trust

REVENUES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	(-------- 2023-2024 --------) CURRENT BUDGET	Y-T-D ACTUAL	(---------- 2024-2025 ----------) DEPARTMENT REQUESTED DR	PROPOSED BUDGET PB	ADOPTED BUDGET AB
GENERAL REVENUE								
Miscellaneous								
801-4000-09-4430 Employer Insurance Premiums	435,682	586,801	750,389	904,000	665,962	1,260,000	1,260,000	1,260,000
801-4000-09-4440 Employee Insurance Premiums	151,482	251,159	257,945	250,000	184,398	302,500	302,500	302,500
801-4000-09-4480 Flex Spending Account	6,213	16,297	6,714	8,000	8,441	10,000	10,000	10,000
801-4000-09-4490 Employee benefits	6,583	7,802	7,724	0	0	0	0	0
801-4000-09-4500 Interest Income	26	408	2,647	4,500	3,048	5,000	5,000	5,000
801-4000-09-4540 COBRA Premiums	0	0	966	0	0	0	0	0
TOTAL Miscellaneous	599,986	862,468	1,026,386	1,166,500	861,849	1,577,500	1,577,500	1,577,500
TOTAL GENERAL REVENUE	599,986	862,468	1,026,386	1,166,500	861,849	1,577,500	1,577,500	1,577,500
TOTAL REVENUES	599,986	862,468	1,026,386	1,166,500	861,849	1,577,500	1,577,500	1,577,500

801-Employee Benefit Trust
Insurance Premiums

DEPARTMENTAL EXPENDITURES	2020-2021 ACTUAL	2021-2022 ACTUAL	2022-2023 ACTUAL	2023-2024 CURRENT BUDGET	2023-2024 Y-T-D ACTUAL	2024-2025 DEPARTMENT REQUESTED DR	2024-2025 PROPOSED BUDGET PB	2024-2025 ADOPTED BUDGET AB
Personnel								
801-5000-01-4090 Administrative Fee	0	53	1,307	1,500	1,194	1,500	1,500	1,500
801-5000-01-5111 Health Insurance	496,848	734,774	880,240	997,000	740,088	1,160,000	1,160,000	1,160,000
801-5000-01-5112 Dental Insurance	33,098	56,415	68,501	70,000	55,843	90,000	90,000	90,000
801-5000-01-5113 Vision Insurance	6,741	10,090	9,868	10,000	8,538	15,000	15,000	15,000
801-5000-01-5115 Life Insurance	33,281	40,715	55,906	50,000	61,769	75,000	75,000	75,000
801-5000-01-5117 Voluntary Policies	13,047	16,963	13,481	15,000	11,086	20,000	20,000	20,000
801-5000-01-5118 Flex Spending	8,279	3,629	5,977	8,000	8,995	15,000	15,000	15,000
801-5000-01-5119 New Benefits	7,417	5,726	9,848	8,000	6,781	12,000	12,000	12,000
801-5000-01-5120 Careflight/PHI	1,275	1,200	1,895	7,000	3,608	8,000	8,000	8,000
TOTAL Personnel	599,986	869,565	1,047,023	1,166,500	897,901	1,396,500	1,396,500	1,396,500
TOTAL Insurance Premiums	599,986	869,565	1,047,023	1,166,500	897,901	1,396,500	1,396,500	1,396,500
TOTAL EXPENDITURES	0	869,565	1,047,023	1,166,500	897,901	1,396,500	1,396,500	1,396,500
REVENUE OVER/(UNDER) EXPENDITURES	599,986	(7,097)	(20,638)	0	(36,052)	181,000	181,000	181,000

ORDINANCE NO. 867-24

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF AUBREY, TEXAS ADOPTING THE ANNUAL BUDGET OF THE CITY OF AUBREY FOR THE 2024-2025 FISCAL YEAR IN ACCORDANCE WITH STATE LAW; PROVIDING FOR THE INCORPORATION OF PREMISES; PROVIDING FOR REPEALING, SAVINGS AND SEVERABILITY CLAUSES; PROVIDING FOR THE FILING OF THE BUDGET; AND PROVIDING FOR AN EFFECTIVE DATE.

WHEREAS, an annual budget for the fiscal year beginning October 1, 2024 and ending September 30, 2025 (FY 24-25 Budget) has been duly created by the City Manager of the City of Aubrey, Texas, in accordance with sections 102.002 and 102.003 of the Texas Local Government Code; and

WHEREAS, the proposed budget was made available for public inspection by the taxpayers in accordance with section 102.005(b) of the Texas Local Government Code; and

WHEREAS, pursuant to section 102.006 of the Texas Local Government Code, a public hearing on the proposed budget was properly noticed and a public hearing was held on August 22, 2024, providing an opportunity for all interested citizens and parties of interest to express opinions on the proposed FY 24-25 Budget; and

WHEREAS, the City Council, upon full consideration of the matter, is of the opinion that the budget hereinafter set forth is proper and should be approved and adopted; and

WHEREAS, the adoption of the budget will require raising more revenue from property taxes than in the previous year, and the City Council has ratified (or will ratify), by separate vote, the property tax increase reflected in the adopted budget; and

WHEREAS, the City Council finds that all legal notices, hearings, procedures and publishing requirements for the adoption of the budget have been performed or completed in the manner and form set forth by law.

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF AUBREY, TEXAS:

Section 1: All of the above premises are found to be true and correct and are incorporated into the body of this Ordinance as if copied in their entirety.

Section 2: The appropriations for the fiscal year beginning October 1, 2024 and ending September 30, 2025, for the support of the General Debt Services of the City of Aubrey, Texas, as expenditures shown in the City's FY 24-25 Budget, a copy of which is attached hereto and incorporated herein as ***Exhibit A,*** are hereby adopted.

Section 3: The FY 24-25 Budget, as shown in words and figures in ***Exhibit A***, is hereby approved in all respects and the budget is adopted at the departmental level as the City's budget for the fiscal year beginning October 1, 2024 and ending September 30, 2025.

Section 4: There is appropriated the amount shown in such budget necessary to provide for a sinking fund for the payment of the principal and interest and the retirement of the bonded debt.

Section 5: Expenditures during the 2024-2025 fiscal year shall be made in accordance with this budget and this Ordinance, unless otherwise authorized by an ordinance duly enacted in accordance with law. Pursuant to state law, no expenditure of the funds of the City shall hereafter be made except in compliance with the budget and applicable state law; provided, however, that in case of grave public necessity emergency expenditures to meet unusual and unforeseen conditions, which could not by reasonable, diligent thought and attention have been included in the original budget, may from time to time be authorized by the City Council as amendments to the original budget. Pursuant to state law, the Council may make emergency appropriations to address a public emergency affecting life, health, property or the public peace and other appropriations as authorized thereby.

Section 6: All provisions of any ordinance in conflict with this Ordinance are hereby repealed; but such repeal shall not abate any pending prosecution for violation of the repealed Ordinance, nor shall the repeal prevent prosecution from being commenced for any violation if occurring prior to the repeal of the Ordinance. Any remaining portions of conflicting ordinances shall remain in full force and effect.

Section 7: Should any section, subsection, sentence, clause or phrase of this Ordinance be declared unconstitutional or invalid by a court of competent jurisdiction, it is expressly provided that any and all remaining portions of this Ordinance shall remain in full force and effect. Aubrey hereby declares that it would have passed this Ordinance, and each section, subsection, sentence, clause, or phrase thereof irrespective of the fact that any one or more sections, subsections, sentences, clauses, or phrases be declared unconstitutional or invalid.

Section 8: A true and correct copy of the approved budget shall be filed in the office of the City Secretary. In addition, the City Manager is hereby directed to file or cause to be filed a true and correct copy of this Ordinance along with the approved budget as represented in Exhibit A attached hereto, and any amendments thereto, in the office of the County Clerk of Denton County, Texas, as required by law.

Section 9: That this Ordinance shall take effect and be enforced from and after its passage by a record vote.

PASSED, APPROVED AND ADOPTED on this 22nd day of August, 2024.

Council Member:	For:	Against:
Jeff Perry	_____	_____
Matt Jones	_____	_____
Erin Allen	_____	_____
Randy Jones	_____	_____
Chuck Fikes	_____	_____

_____
CHRIS RICH, MAYOR

ATTEST:

_____
JENNY HICKS
CITY SECRETARY

APPROVED AS TO FORM:

_____
PATRICIA ADAMS
CITY ATTORNEY

EXHIBIT A
2024-2025 Budget

CITY OF AUBREY
FISCAL YEAR 2024-2025
BUDGET COVER PAGE

This budget will raise more total property taxes than last year's budget by $1,219,498 for approximately a 43.06 percent tax levy increase and of that amount $378,453 is tax revenue to be raised from new property added to the tax roll this year.

The above statement is required by Section 102.005(b) of the Texas Local Government Code, as amended by HB 3195 of the 80th Texas Legislature.

Record Vote to adopt the Fiscal Year 2024-2025 Budget on August 22, 2024

Council Member Perry:	_____ FOR	____ AGAINST
Council Member M. Jones:	_____ FOR	____ AGAINST
Council Member Allen:	_____ FOR	____ AGAINST
Council Member R. Jones:	_____ FOR	____ AGAINST
Council Member Fikes:	_____ FOR	____ AGAINST

Texas Local Government Code Section 102.007(d)(2).

Property Tax Rate Comparison

	FY 2024-2025	FY 2023-2024
Property Tax Rate:	$0.464000/$100	$0.464000/$100
No-New-Revenue Tax Rate:	$0.355081/$100	$0.547078/$100
No-New-Revenue Maintenance & Operations Tax Rate:	$0.308496/$100	$0.382972/$100
Voter-Approval Tax Rate:	$0.582733/$100	$0.622542/$100
Debt Rate:	$0.146893/$100	$0.161734/$100

Total debt obligation for City of Aubrey secured by property taxes: $26,919,910.

Texas Local Government Code Section 102.007(d)(3) and 102.007(d)(4).

Capital Improvement Plan Budgeting
FY 2024 - FY 2028

Project Description	2024-2025	2025-2026	2026-2027	2027-2028	2028-2029
Glenview Area					
Meadow, Cottonwood, Willow					
Project S1 - Pecan Creek LS, Phase I					
Project S4 - 24" Trunk Sewer					
Project W1 - 16" Waterline & S2 Sewer					
2024 Street Reha (Trace, Michelle, etc.)					
Project W2.2 - 8" Waterline					
Veterians Park Memorial Improvements					
Project W2.1 - 16" Waterline					
Project S6.1 & S6.3 - 18" & 10" Trunk Sewer					
Mathews Park Improvements					
Project S6.2 - 18" Trunk Sewer					
Project W3.1 - 12" Waterline					
Project W5 - 12" Waterline					
Leslie Park Improvements					
Main Street Project, Phase I	$ 300,000				
Dane Street (left from 2019)	$ 1,100,000				
Hwy 377 Utility Relocates	$ 6,000,000				
Highmeadow Park	$ 378,000				
Drainage Study and Rate Development	$ 150,000				
Project 38 - Land Purchase UTRWD Delivery	$ 3,500,000				
Street Lighting (WR & ACE)	$ 30,000				
Blackjack Improvements	$ 80,000				
Project S5 - Pecan Creek LS, Phase II Expansion	$ 379,548				
Project W4.3 - Rockhill GS (.50 MG)	$ 475,880				
Project W4.2 - Rockhill HS Pumps (1 MGD)	$ 627,007				
Project W4.1 - Rockhill Well (.75 MGD)	$ 713,820				
Project S7 - WWTP Expansion, Phase I (2.25 MGD)	$ 37,000,000				
I&I Sewer Line Improvements	$ 300,000	$ 300,000			
Veterians Park Improvements	$ 75,000	$ 800,000			
Trivedi Park	$ 100,000	$ 350,000	$ 1,500,000		
Winn Ridge Park Development	$ 35,000	$ 350,000			
North Street Drainage -2 Phases	$ 75,000	$ 500,000			
Farmers Market	$ 48,000	$ 50,000			
Splash Park		$ 500,000			
Main Street Phase II		$ 300,000	$ 2,000,000		
Sports Complex - Ball Fields		$ 1,000,000	$ 12,000,000		
Garland Wilson Addition Drainage		$ 1,000,000			
Drainage between Maple & Caddell			$ 650,000		
Dog Park			$ 100,000		
North Amyjo Drainage			$ 650,000		
Upper Trinity GS & HS Pump Station			$ 3,500,000		
Magnolia ISD to Blackjack - Bond Priority 4			$ 2,000,000		
Circle Y Park Development				$ 30,000	
Blackjack (377 to east city limits) - Bond Priority 11				$ 2,500,000	
Hwy 377 N Water and Sewer Extension				$ 3,000,000	
Hwy 428 W Water and Sewer Extension				$ 4,000,000	
Magnolia Tisdell to Springhill - Bond Priority 7				$ 650,000	
McNatt Construction - Bond Priority 1				$ 1,000,000	
Plum Widening - Bond Priority 2					$ 1,000,000
Rockhill Construction - Bond Priority 6					$ 2,000,000
Senior Center					
Recreations Center					
Project S7 - WWTP Expansion, Phase II (2.25 MGD)					
Totals	**$ 51,367,255**	**$ 5,150,000**	**$ 22,400,000**	**$ 11,180,000**	**$ 3,000,000**

Project pushed forward for funding
Current Yr Funding

City of Aubrey
Vehicle and Equipment Replacement Schedule
Fiscal Year 2025 Budget

4% Fixed Annual Growth

Unit Number	*Year*	*Lic Plate*	*VIN*	*Vehicle Description*	*Life*	*Creation Cost*	*22-23*	1.04 *23-24*	1.08 *24-25*
			Fire Department						
E521	2019	137-1596	4P1BAAGF9KA020532	Pumper/Engine	120	$750,000			
E522	2019	137-1597	1P1BAAGF9KA020533	Pumper/Engine	120	$750,000			
Q523	2024		Purchased	Ladder Truck	180	$1,500,000			
B521	2017	133-4560	1FDUF5HT5HEE06149	Brush Truck	96	$125,000			
B522	2003	129-0373	1FDXF47P73ED01021	Brush Truck	96	$125,000			*135,000*
S523	2023	TEMP	1FD0W5HT2PEC51394	Attack/Squad	84	$250,000	250,000		
M521	2022	146-6551	1FDUF5GT3HEE65735	Ambulance	60	$250,000	250,000		
M522	2023		Ordered	Ambulance	60	$343,000	343,000		
M523	2023		Ordered	Ambulance	60	$343,000	343,000		
B521	2020	145-1434	1GNSKBED5MR467935	Suburban (Battalion Chief)	60	$75,000			*81,000*
INV 521	2024		To Be Ordered	Tahoe (Fire Marshal)	84	$65,000		*67,600*	
EMS 521	2024		To Be Ordered	Tahoe (EMS Captain)	84	$65,000		*67,600*	
C522	2023	146-6588	1GNSKLED3PR302797	Tahoe (Assistant Chief)	84	$65,000	65,000		
C521	2023	146-6587	1GNSKLED6PR030340	Tahoe (Fire Chief)	84	$65,000	65,000		
			Sub-Total Fire				$1,316,000	*$135,200*	*$216,000*
							-$1,316,000	***-$1,451,200***	***-$1,667,200***
			Police Department						
TBO1	2024	Pending	To Be Ordered	SSV (Admin) 4x4	84	$59,924		*62,321*	
TBO2	2024	Pending	To Be Ordered	SSV (Admin) 4x4	84	$59,924		*62,321*	
TBO4	2024	Pending	To Be Ordered	PPV (Patrol) 4x4	60	$77,016		*80,097*	
TBO5	2024	Pending	To Be Ordered	Truck (CID) 4x4	84	$48,930		*50,887*	
TBO6	2024	Pending	To Be Ordered	Truck (CID) 4x4	84	$48,930		*50,887*	
TBO7	2024	Pending	To Be Ordered	Truck (CID) 4x4	84	$48,930		*50,887*	
4523	2023	Pending	Ordered	PPV (Patrol) 4x4	60	$86,458	86,458		
4423	2023	Pending	Ordered	PPV (Patrol) 4x4	60	$86,458	86,458		
4323	2023	Pending	Ordered	PPV (Patrol) 4x4	60	$86,458	86,458		
4223	2023	Pending	Ordered	PPV (Patrol) 4x4	60	$86,458	86,458		
4023	2023	None	BW2303-366994	Golf Cart (Winn Ridge)	120	$14,000	14,000		
3822	2022	None	N/A	Radar Trailer (Aubrey)	120	$8,500	8,500		
3722	2022	1466514	1GNSCLED5NR233251	PPV (Patrol)	60	$77,016			
3622	2022	1466500	1GNSCLED4NR226887	SSV (Patrol LT)	84	$59,924			
371	2014	1154153	1GNLC2E02ER134060	PPV (Patrol)	60	$77,016			

City of Aubrey
Vehicle and Equipment Replacement Schedule
Fiscal Year 2025 Budget

4% Fixed Annual Growth

								1.04	1.08
Unit Number	***Year***	***Lic Plate***	***VIN***	***Vehicle Description***	***Life***	***Creation Cost***	***22-23***	***23-24***	***24-25***
1919	2019	1371559	1GNLCDECXKR148189	SSV (CID LT)	84	$49,950			
1819	2019	1371585	1G1ZC5ST3KF183356	SSV (CID)	84	$49,950			
2120	2020	MYL7678	1GNLDCDKC1LR245478	SSV (Admin Chief)	84	$49,950			
2621	2021	1451443	1GNSCLEDXMR480182	PPV (Patrol Supervisor)	60	$77,016			
2520	2020	1418991	1GNLCDEC5LR237590	PPV (Patrol)	60	$77,016			*83,177*
2420	2020	1418990	1GNLCDEC6LR238862	PPV (Patrol)	60	$77,016			*83,177*
2320	2020	1418989	1GNLCDEC8LR239060	PPV Patrol	60	$77,016			*83,177*
3522	2022	1451417	1GNSCLED3NR226511	PPV (Patrol)	60	$77,016			
3122	2022	1451421	1GNSCLED6NR226498	PPV (Patrol)	60	$77,016			
3022	2022	RNP1129	1GNSCLED6NR243738	PPV (City Admin)	84	$49,950			
2921	2021	1141446	1GNSCLED1MR479650	PPV (Patrol Supervisor)	60	$77,016			
2821	2021	1451444	1GNSCLED0MR479963	PPV (Patrol Supervisor)	60	$77,016			
2721	2021	1451445	1GNSCLEDXMR479937	PPV (Patrol Supervisor)	60	$77,016			
3422	2022	1451419	1GNSCLED6NR226522	PPV (Patrol)	60	$77,016			
3322	2022	1451420	1GNSCLED0NR226577	PPV (Patrol)	60	$77,016			
3222	2022	1451418	1GNSCLED9NR226528	PPV (Patrol)	60	$77,016			
2220	2020	1418988	1GNLCDEC8LR238877	PPV (SRO)	84	$77,016			
2119	2019	1371558	1GTNLCDEC1KR148419	PPV (Patrol)	60	$77,016			
4123	2023	Pending	Ordered	PPV (Patrol) 4x4	60	$77,016	77,016		
3922	2022	Pending	Ordered	SSV - (Admin) LT	84	$49,950	49,950		
1719	2019	None	N/A	Golf Cart (PV)	120	$14,000			
TBO3	2024	Pending	To Be Ordered	PPV (Patrol) 4x4	60	$86,458		*89,916*	
			Sub-Total Police				*$495,298*	*$447,316*	*$249,532*
							-$495,298	***-$942,614***	***-$1,192,146***
			Public Works						
	2022	1466523	1FMSK7KH1NGB70070	Ford Explorer (DPW)	60	$53,000			
T715	2007	1284963	1FTRF12W07K016073	Ford F150 1/2T	60	$54,000		*56,160*	
T935	2009	1044655	1FDWF36559EA26103	Ford F350 1T	84	$120,000	120,000		
FE2019	2019	1371555	1FM5K7B88KGA16982	Ford Explorer	60	$53,000			*57,240*
T2025	2020	1431604	1FT7W2A67LED09967	Ford F250 Super Duty	72	$65,000			
5107-1	2022	1569290	1FTER4EHXNLD53112	Ford Ranger	72	$32,000			
				Ford Ranger	84	$32,000		*33,280*	
5107-2	2022	1569291	1FTER4EH6NLD53494	Ford Ranger	72	$32,000			

City of Aubrey
Vehicle and Equipment Replacement Schedule
Fiscal Year 2025 Budget

4% Fixed Annual Growth

								1.04	1.08
Unit Number	***Year***	***Lic Plate***	***VIN***	***Vehicle Description***	***Life***	***Creation Cost***	***22-23***	***23-24***	***24-25***
5110-2	2022	1569292	1FTER4EH2NLD53668	Ford Ranger	72	$32,000			
5110-3	2022	1564780	1FTFW1E54NKE91641	Ford F150 4x4	60	$54,000			
	1997		T0310EX849059	John Deere Backhoe	120	$200,000			*216,000*
				Skid Steer	120	$165,000		*171,600*	
				Polaris SxS	84	$25,000		*25,000*	
				Mini X	120	$95,000		*95,000*	
				Dump Truck	84	$150,000		*156,000*	
	2005		TXS1030007821	John Deere 5103	84	$25,000			
Sub-Total Public Works							$120,000	*$537,040*	*$273,240*
							-$120,000	***-$657,040***	***-$930,280***
Water & Sewer									
				Flush Truck		$400,000		*72,000*	*72,000*
T1125	2011	1044672	1FT7X2A66BEB76422	Ford 250 3/4T	84	$65,000		*67,600*	
T1225	2012	1044688	1FT7X2A65CEB00952	Ford F250 3/4T	84	$65,000		*67,600*	
T1425	2014	1154157	1FT7X2B61EEB27521	Ford 250 3/4T	84	$65,000		*67,600*	
				Ford F150	84	$54,000		*56,160*	
T735	2007	1284964	1FDWF36517EB12408	Ford F350 1T	84	$200,000			*216,000*
T2225	2022	1451442	1FT7X2A68NEC16729	Ford F250 Super Duty	72	$65,000			
5201-23	2022	1550824	1FTFW1E50NKE91488	Ford F150 4x4	60	$54,000			
5202-2	2022	1466549	1GC5YLE77PF155478	Chevy	60	$57,000			
	2021		1T03105LJNF419276	John Deere Backhoe	120	$200,000			
5202-3	2022	1L0936		Polaris SxS	60	$20,000			
		1334496		Ford Explorer	72	$45,000			
	2000	1184386	1FDW37F7YEE52204	Ford F350 1T - Crew Truck	84	$150,000		*156,000*	
Sub-Total Water & Sewer							$0	*$486,960*	*$288,000*
Amortized Balance								***-$486,960***	***-$774,960***
Grand Totals						$9,829,390	$1,931,298	$1,606,516	$1,026,772
Annual Contribution (Even Distribution)						$1,700,000		$93,484	$766,712
Annual Contribution (First Year Inflated)						$1,800,000		$193,484	$666,712
						$1,500,000			

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Hold a Public Hearing, Consider and take appropriate action regarding an Ordinance of the City Council of the City of Aubrey, levying taxes and fixing and adopting the tax rate on all taxable property for the year 2024 at the rate of $0.464000 per one hundred dollars ($100.00) assessed value on all taxable property within the corporate limits of the City of Aubrey, Texas; the said tax rate having a maintenance and operations component and a debt service component; providing when taxes shall become due and when same shall become delinquent if not paid together with penalties and interest thereon; and providing an effective date.

Staff Contact
Mike English, Finance Director
menglish@aubreytx.gov
940-440-9343

Summary
Roll-call vote required on this item.

This item is to approve the property tax rate for the upcoming fiscal year. The Council has elected to not increase the tax rate which will remain at $0.464000 per $100 of tax value. Although we are not raising the tax rate compared to this year, the rate exceeds the Truth in Taxation ("TNT") calculation of the No New Revenue Rate ("NNR"). In cases where the rate being adopted exceeds the NNR, the motion to adopt the new rate must be read as follows per state law: **"I move that the property tax rate be increased by the adoption of a tax rate of $0.464 per $100 of taxable value, which is effectively a 30.7% increase in the tax rate."** The increase percentage is the difference between the adopted rate and the NNR, so in this case the NNR is $0.355081 compared to the adopted rate of $0.464 (.464 - .355081) / .355081 = 30.7%.

For the past several years, the adopted tax rate has been less than the NNR, although we have seen constant downward pressure on the NNR due to new housing added to the tax rolls (i.e., the first year you are in a new home, the tax is based on the unimproved value and then you get hit in the second year with the improved value and your taxes go up). Also, "normal" market value increases contribute to the downward lean on the NNR. This is caused by the way the TNT calculation determines the NNR, comparing the tax on a higher value (due to new home improved values in the second year) in the current year to the lower value in the prior year (prior to improved value). Our growth has consistently caused downward pressure on the NNR due to this "glitch" in the calculation.

Compounding the downward impact, this year we made a correction in the reporting of our TIRZ value, which had the effect of increasing the downward pressure in the TNT calculation resulting in an unnaturally low NNR. We had been applying the entire TIRZ value to the TNT calculation when we should have applied only the participation value. We also reduced the participation percentage this year from 45.2% to 38.75% resulting from the financially favorable refunding of the Jackson Ridge PID bonds. This further increased the downward pressure on the NNR. Without the negative impact of the TIRZ participation error and the one-time change to the participation rate, the NNR would have exceeded the adopted rate. We expect the negative impacts to the NNR from these changes in the participation rate to be a one-time occurrence, but we will continue to experience the downward pressure from new homes added to the tax rolls.

Financial Summary
Financial impact described above.

Staff Recommended Motion
Approve

Conditions
N/A

ORDINANCE NO. 868-24

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF AUBREY, TEXAS LEVYING AND ADOPTING AN AD VALOREM PROPERTY TAX RATE FOR TAX YEAR 2024 AT THE RATE OF $0.464000 PER ONE HUNDRED DOLLARS ASSESSED VALUATION OF ALL TAXABLE PROPERTY WITHIN THE CORPORATE LIMITS OF THE CITY TO PROVIDE REVENUES FOR CURRENT EXPENSES, INTEREST AND SINKING FUND REQUIREMENTS, AND MAINTENANCE AND OPERATIONS, IN ACCORDANCE WITH STATE LAW; PROVIDING FOR THE INCORPORATION OF PREMISES; PROVIDING DUE AND DELINQUENT DATES, PENALTIES AND INTEREST; PROVIDING A SEVERABILITY CLAUSE; PROVIDING A CUMULATIVE REPEALER CLAUSE; AND PROVIDING AN EFFECTIVE DATE.

WHEREAS, the City of Aubrey, Texas is a Home Rule municipality acting pursuant to the authority provided to it under state law and the Texas Constitution;

WHEREAS, Section 302.001 of the Texas Tax Code permits a Type-A General Law municipality to levy, assess, and collect taxes within the jurisdiction of the City for current expenses;

WHEREAS, the City Council of the City of Aubrey wishes, via a record vote, to adopt the proposed tax rate of $0.464000 for 2024, which is more than the City's 2024 no-new-revenue rate of $0.355081, and less than the voter-approval rate of $0.582733. No election is required but the City is required to hold a public hearing on the proposed tax rate pursuant to Section 26.05 of the Texas Tax Code; and

WHEREAS, the City Council held a public hearing on the proposed 2024 tax rate on August 22, 2024, and gave all interested persons the opportunity to provide input on the proposed tax rate.

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF AUBREY, TEXAS:

SECTION 1. INCORPORATION OF PREMISES.

All of the above premises are found to be true and correct and are incorporated into the body of this Ordinance as if copied in their entirety.

SECTION 2. ADOPTION OF TAX RATE.

That there be and is hereby levied for the year 2024 on all taxable property, real, personal and mixed, situated within the corporate limits of the City of Aubrey, Texas and not exempt by the Constitution of the State and valid State laws, a tax

of $0.464000 on each one hundred dollars ($100.00) assessed value of taxable property, which shall be apportioned and distributed as follows:

(a) For the purpose of defraying the current expenses of the municipal government of the City, and for maintenance and operations of the municipal government of the City, a tax of $0.317107 on each One Hundred Dollars ($100.00) assessed value of all taxable property.

(b) For the purpose of creating a sinking fund to pay the interest and principal on all outstanding bonds or indebtedness of the City, not otherwise provided for, a tax of $0.146893 on each One Hundred Dollars ($100.00) assessed value of all taxable property within the City which shall be applied to the payment of such interest and maturates of all outstanding bonds and indebtedness.

(c) **THIS TAX RATE WILL RAISE MORE TAXES FOR MAINTENANCE AND OPERATIONS THAN LAST YEAR'S TAX RATE.**

(d) **THE TAX RATE WILL EFFECTIVELY BE RAISED BY 2.79 PERCENT AND WILL RAISE TAXES FOR MAINTENANCE AND OPERATIONS ON A $100,000 HOME BY APPROXIMATELY $27.90.**

SECTION 3. DUE AND DELINQUENT DATES/INTEREST/PENALTIES.

That all ad valorem taxes for the year 2024 shall become due and payable on October 1, 2024 and all ad valorem taxes for said year shall become delinquent if not paid before January 31, 2025. There shall be no discount for payment of taxes prior to January 31, 2025. A delinquent tax shall incur a penalty of six percent (6%) of the amount of the tax for the first calendar month it is delinquent plus one percent (1%) for each additional month or portion of a month the tax remains unpaid prior to July 1, 2025. Provided, however, a tax delinquent on July 1, 2025, shall incur a total penalty of twelve percent (12%) of the amount of the delinquent tax without regard to the number of months the tax has been delinquent. A delinquent tax shall also accrue interest at a rate of one percent (1%) for each month or portion of a month the tax remains unpaid. Taxes that remain delinquent on July 1, 2025, shall incur an additional penalty of twenty percent (20%) or the maximum rate allowed by law, whichever is higher, of the amount of taxes, penalty, and interest due in order to defray costs of collection pursuant to the Texas Property Tax Code.

SECTION 4. ENFORCEMENT.

Taxes are payable to the Denton County Tax Assessor-Collector. The City shall have available all rights and remedies provided by law for the enforcement of the collection of taxes levied under this Ordinance.

All taxes shall become a lien upon the property against which assessed, and the city assessor and collector of the City of Aubrey is hereby authorized and empowered to enforce the collections of such taxes according to the Constitution and laws of the State of Texas and ordinances of the City of Aubrey shall, by virtue of the tax rolls, fix and establish a lien by levying upon such property, whether real or personal, for the payment of said taxes, penalty and interest; and, the interest and penalty collected from such delinquent taxes shall be apportioned to the general funds of the City of Aubrey. All delinquent taxes shall bear interest from date of delinquency at the rate as prescribed by state law.

SECTION 5. CUMULATIVE REPEALER.

That all provisions of the ordinances of the City of Aubrey, Texas in conflict with the provisions of this Ordinance be and the same are hereby repealed, and all other provisions of the ordinances of the City of Aubrey, Texas not in conflict with the provisions of this Ordinance shall remain in full force and effect.

SECTION 6. SEVERABILITY.

That should any word, sentence, paragraph, subdivision, clause, phrase or section of this Ordinance be adjudged or held to be unconstitutional, illegal, or invalid, the same shall not affect the validity of this Ordinance as a whole, or any part or provision hereof other than the part so decided to be invalid, illegal or unconstitutional.

SECTION 7. EFFECTIVE DATE.

That this Ordinance shall take effect immediately from and after its passage.

PASSED AND APPROVED this, the 22nd day of August, 2024.

AYES ____ NAYS ____ ABSTAINED ___

Council Member:	For:	Against:
Jeff Perry	_____	_____
Matt Jones	_____	_____
Erin Allen	_____	_____
Randy Jones	_____	_____
Chuck Fikes	_____	_____

_____
CHRIS RICH, MAYOR

ATTEST:

_____
JENNY HICKS
CITY SECRETARY

APPROVED AS TO FORM:

_____
PATRICIA ADAMS
CITY ATTORNEY

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Consideration and action on a Resolution ratifying the property tax revenue increase reflected in the Budget for Fiscal Year 2024-2025.

Staff Contact
Mike English, Finance Director
menglish@aubreytx.gov
940-440-9343

Summary
Roll-call vote required on this item.

State law requires a separate vote of the Council if the budget requires raising more revenue from property taxes. The Fiscal Year 2025 budget reflects higher property tax revenue and higher overall revenue than the previous year budget. As noted a previous item (budget ordinance), the increase in revenue from property taxes of $1,219,498 (43.06%) is taken from the Truth in Taxation (TNT) worksheet. The calculation was skewed by the change made this year in reporting of the TIRZ value. In prior years we reported 100% of the Jackson Ridge TIRZ tax valuation and this year we corrected to reflect the participation percent of 38.75% (down from 45.2% resulting from the Jackson Ridge PID refunding completed earlier this year). The actual increase in the total tax levy is expected to be between 10% and 12%.

Financial Summary
Property tax revenue in the budget expected to be 10% to 12% higher than the previous year.

Staff Recommended Motion
Approve

Conditions
N/A

CITY OF AUBREY, TEXAS
RESOLUTION NO. 978-24

A RESOLUTION OF THE CITY OF AUBREY, TEXAS ACKNOWLEDGING AND RATIFYING THAT THE ADOPTION OF THE FISCAL YEAR 2024-2025 ANNUAL BUDGET WILL REQUIRE RAISING MORE REVENUE FROM PROPERTY TAXES THAN IN THE PREVIOUS FISCAL YEAR; AND PROVIDING AN EFFECTIVE DATE.

WHEREAS, The City Council (the "Council") of the City of Aubrey wishes to comply with Section 102.007 of the Local Government Code; and

WHEREAS, Section 102.007 of the Local Government Code requires a separate vote of the Council if the budget will require raising more revenue from property taxes than the previous fiscal year; and

WHEREAS, this Resolution satisfies the aforementioned requirement.

NOW THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF AUBREY, TEXAS THAT:

Section 1. Recitals Incorporated.

The facts and recitals above are incorporated herein as if set forth in full for all purposes.

Section 2. **Acknowledgement and Ratification**

The Fiscal Year 2024-2025 annual budget will raise more revenue from property taxes than the previous fiscal year's budget by $1,219,498 or 43.06%, and of that amount $378,453 is tax revenue to be raised from new property added to the tax roll this year.

Section 3. Effective Date.

This Resolution shall take effect upon its passage as required by law.

PASSED AND APPROVED by the City Council of the City of Aubrey, Texas on this 22nd day of August, 2024.

Therefore, Council Member _____ motioned to ratify the property tax increase reflected in the FY 2024-2025 Budget. Council Member _____ seconded the motion. The motion to ratify the property tax increase passed by a vote of ____ to ____, with ____ abstaining.

Council Member:	For:	Against:
Jeff Perry	_____	_____
Matt Jones	_____	_____
Erin Allen	_____	_____
Randy Jones	_____	_____
Chuck Fikes	_____	_____

_____
CHRIS RICH, MAYOR

ATTEST:

_____
JENNY HICKS
CITY SECRETARY

APPROVED AS TO FORM:

_____
PATRICIA ADAMS
CITY ATTORNEY

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item

Consider and take appropriate action regarding Ordnance No. 869-24 amending Ordinance No. 781-24 approving an Exclusive Agreement for Solid Waste and Recycling Services between the City and Republic Services of Lewisville (the "Franchise Agreement") to increase various Residential solid waste collection and recycling rates, including rates for containers, to increase various Commercial solid waste collection rates, including rates for containers; providing for a change in bulk waste pickup frequency; approving the amendment of the Franchise Agreement; providing an effective date of October 1, 2024 for the implementation of amendments; and authorizing the Mayor to execute necessary documents.

Staff Contact

Leanne Wilson, Director of Public Works and Development Services
lwilson@aubreytx.gov

Summary

The City of Aubrey entered into an Exclusive Franchise Agreement for the Collection, Hauling and Disposal of Municipal Solid Waste and Recycling, effective August 1, 2022, with Rhino Removal. On March 25, 2023, an Assignment and Assumption Agreement and Consent with Republic Service was executed. In this agreement, Section 9, Rate Adjustment, no base rate adjustments were allowed before August 1, 2024. After August 1, 2024, service rates will be increased by the Dallas, Fort Worth, Arlington Consumer Price Index - Water, Sewer, Trash.

Effective October 1, 2024, Republic is requesting the rolling average CPI of 5.30% increase. The impact on our citizens is summarized below:

	Current Rate	Proposed Rate
Monthly Residential Trash Curbside:	$10.95	$11.53
Monthly Residential Recycle Curbside:	$3.99	$4.20
Bulk	$0.35	$0.37
Household Hazardous Waste	$0.65	$0.68
Franchise Fee	$2.39	$2.52
Residential Total:	$18.33	$19.30

	Current Rate	Proposed Rate
Senior Citizen Monthly Trash Curbside:	$10.00	$10.53
Senior Citizen Monthly Recycle Curbside:	$3.50	$3.69
Bulk	$0.35	$0.37
Household Hazardous Waste	$0.65	$0.68
Franchise Fee	$2.18	$2.29
Senior Residential Total:	$16.68	$17.56

Extra Cart - Trash	$6.90	$7.27
Extra Cart - Recycle	$5.00	$5.27

Financial Summary
None

Staff Recommended Motion

Conditions
N/A

ORDINANCE NO. 869-24

AN ORDINANCE OF THE CITY OF AUBREY, TEXAS AMENDING ORDINANCE NO. 781-24 APPROVING THE AMENDMENT OF THE FRANCHISE AGREEMENT BETWEEN THE CITY AND REPUBLIC SERVICES OF LEWISVILLE TO INCREASE VARIOUS RESIDENTIAL SOLID WASTE COLLECTION AND RECYCLING RATES, INCLUDING RATES FOR CONTAINERS, TO INCREASE VARIOUS COMMERCIAL SOLID WASTE COLLECTION RATES, INCLUDING RATES FOR CONTAINERS AND PROVIDING FOR A CHANGE IN BULK WASTE PICKUP FREQUENCY; PROVIDING FOR THE INCORPORATION OF PREMISES; APPROVING THE TERMS OF THE FIRST AMENDMENT; PROVIDING FOR THE AMENDMENT OF COLLECTION RATES AND FREQUENCY OF BULK WASTE PICKUPS; PROVIDING FOR THE INCORPORATION OF PREMISES; AUTHORIZING THE MAYOR TO EXECUTE THE AGREEMENT; PROVIDING A CUMULATIVE REPEALER CLAUSE; PROVIDING A SEVERABILITY CLAUSE; AND PROVIDING AN EFFECTIVE DATE

WHEREAS, the City of Aubrey, Texas (the "City"), is a Home Rule municipality located in Denton County, created in accordance with provision of the Texas Local Government Code and operating pursuant to the enabling legislation of the State of Texas; and

WHEREAS, the collection of municipal solid waste and recyclable materials is a governmental function performed for the protection of the public health, safety, and general welfare; and

WHEREAS, the City, through the City Council and pursuant state law, is authorized to enter into a contract with an independent contractor to provide exclusive solid waste and recyclable material collection services to the residents of the City of Aubrey; and

WHEREAS, in 2023 City of Aubrey and Republic Services of Lewisville ("Republic") entered into an Exclusive Franchise Agreement for the Collection, Hauling and Disposal of Municipal Solid Waste Recycling in the City of Aubrey, Texas, Denton County, State of Texas (the "Franchise Agreement") ; and

WHEREAS, on or about July, 2024, the City received a request from Republic for a Consumer Price Index (CPI) rate increase for Residential Solid Waste and Recycling Collection Services and Containers and for Commercial Solid Waste Collection Services and Containers;

WHEREAS, the City and Contractor desire to amend the Franchise Agreement by entering into a First Amendment to the Exclusive Franchise Agreement for the Collection, Hauling and Disposal of Municipal Solid Waste Recycling in the City of Aubrey, Texas, Denton County, State of Texas ("First Amendment") to amend the Franchise Agreement to provide for an increase in fees based upon CPI for the collection of solid waste and to change the frequency for bulk waste pickup by Republic; and

WHEREAS, after Council presented the request and heard public comments, reviewed costs, determined the fees proposed herein are not excessive; rather, the fees are determined to be reasonable and necessary to due to the rate of change in inflation over time as is reasonable to increase the frequency of bulk waste pickup; and

WHEREAS, the City Council has determined that the best interests of the City are served by entering into this First Amendment for the collection of solid waste and recycling services for the City of Aubrey Texas by and between the City of Aubrey and Republic pursuant to the terms of the First Amendment attached hereto and approved by this Ordinance.

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF AUBREY, TEXAS:

Section 1. **Incorporation of Premises/Ordinance Repealed.** The above and foregoing recitals are true and correct and are incorporated herein as findings of fact and made a part of this Ordinance.

Section 2. **Amendment**. This Ordinance amends Ordinance No. __ approving the Franchise Agreement and the Franchise Agreement is hereby amended as set forth in the First Amendment, a copy of which is attached hereto as **Exhibit "A"** and incorporated herein for all purposes, is hereby approved in form and substance for an increase in fees for the collection of solid waste and for the change to the frequency in bulk waste pickup for City Customers. All terms of Ordinance No 781-24.and the Franchise Agreement not expressly amended hereby shall remain in full force and effect. The First Amendment for public services granted hereby shall be exercised in accordance with the terms of the Franchise Agreement and all ordinances of the City.

Section 3. **Execution of Agreement**. The Mayor or his designee is authorized to execute the Agreement on behalf of the City.

Section 4. **Cumulative Repealer**. This ordinance shall be and is hereby declared to be cumulative of all other ordinances of the City and shall not operate to repeal or affect any such other ordinances, except insofar as the provisions thereof are inconsistent or in conflict with the provisions hereof, and to the extent of such conflict, if any, such other ordinances are hereby repealed.

Section 5. **Severability Clause**. It is hereby declared by the City Council that if any of the sections, paragraphs, sentences, clauses, phrases, words, or provisions of this Ordinance should be declared unconstitutional or otherwise invalid for any reason, such event shall not affect any remaining sections, paragraphs, sentences, clauses, phrases, words, or provisions of this Ordinance.

Section 6. **Effective Date.** This Ordinance shall take effect upon its passage and approval in accordance with the law; provided however, the First Amendment shall become effective on October 1, 2024.

PASSED AND APPROVED by the City Council of the City of Aubrey, Texas this the 22nd day of August 2024.

_____
Chris Rich, Mayor

ATTEST:

_____
Jenny Hicks, Secretary

APPROVED AS TO FORM:

_____
Patricia A. Adams, City Attorney

EXHIBIT "A"

FIRST AMENDMENT TO EXCLUSIVE FRANCHISE AGREEMENT FOR THE COLLECTION, HAULING AND DISPOSAL OF MUNICIPAL SOLID WASTE AND RECYCLING IN THE CITY OF AUBREY, TEXAS, DENTON COUNTY, STATE OF TEXAS
(REPUBLIC SERVICES OF LEWISVILLE)
(First Amendment Effective October 1, 2024)

Case Report –Site Plan Application – Aubrey High School
Planning and Zoning Commission – August 8, 2024
City Council – August 22, 2024

To: Mayor, City Council, Planning and Zoning Commission

From: Helen-Eve Beadle, AICP, HE Planning+Design, LLC

Request: Consideration and action on a Site Plan application for proposed Lot 1, Block A, Aubrey High School Addition, being approximately 63.613 acres out of the Francisco Trevino Survey, Abstract 1243 generally located south of FM 428 (Spring Hill Road) and east of U.S. Highway 377, City of Aubrey, Denton County, Texas.

Owner:	Aubrey Independent School District
Engineer:	Teague Nall & Perkins, Inc. (Amanda Mullen, PE)
Application Date:	July 10, 2024
Location:	The property is generally located south of FM 428 (Spring Hill Road) and east of U.S. Highway 377
Zoning:	SF-75 Single Family Residential
Future Land Use Plan:	School & Civic
Current Use:	Aubrey High School

Analysis:

In December of 202 and January 2024 Aubrey Independent School District submitted and received approval for Site Plan applications to provide for the expansion of the existing site.

Since those approvals the school district has submitted a Site Plan application to provide for an addition to the existing field house for an indoor practice facility (±106,817 SF). An existing parking area will be removed to provide for the structure and parking has been provided on-site to satisfy parking requirements. Additionally, a portion of land has been acquired by the school district at the southeast corner of the property to accommodate a practice field.

The Site Plan application includes a variance request regarding the screening of mechanical equipment. Section 14A-23 Supplementary District Regulations require mechanical equipment to be screened as outlined below.
https://ecode360.com/40432943

> "Mechanical and heating and air conditioning equipment in nonresidential and multifamily uses shall be screened from view from the public right-of-way and from adjacent residential property with a solid masonry wall of the same material and color as the main

exterior facade of the main structure. For such equipment located on the roof of a nonresidential or multifamily structure, the screening of the equipment shall be a minimum of one foot higher than the height of the equipment."

The same Section, 14A-23 F. (4). Nonresidential Design Standards provides for a variance to be considered by the P&Z Commission and approved by City Council if the following findings are satisfied. https://ecode360.com/40432816

"Unique circumstances exist on the property that make application of specific items in this section unduly burdensome on the applicant;

(b) The variance will have no adverse impact on current or future development;

(c) The variance is in keeping with the spirit of the zoning regulations, and will have a minimal impact, if any, on the surrounding land uses;

(d) The variance will have no adverse impact on the public health, safety and general welfare.

A financial hardship shall not be considered a basis for the granting of a variance."

There are two instances where the screening cannot be accommodated on the High School site:

1. Roof Top Mechanical Units: The existing walls on the field house structure's south elevation are not tall enough to fully screen the equipment. Adding wall height or screening panels onto the roof would be costly and compromise the roof and structure integrity. The new addition meets the requirements of the Code; and

2. Air Rotation Units: The proposed air rotation units for circulating conditioned air are ground units and screening them prohibits the flow of air which is needed for the units to work properly.

The applicant's consultant has provided site line studies and a summary of the hardships. *See attachments to this report.*

The rooftop mechanical on the existing field house is over 700 feet from the southern property boundary.

The ground units on the north side of the new field house addition are over 900 feet from the property ling/FM 428 (Spring Hill Road).

Staff reviewed the variance request and supports the hardship findings.

Recommendation:

The Site Plan for Aubrey High School is recommended for approval subject to the following conditions:

1. Approval of the mechanical screening equipment variances and revision of NOTE #2 to reflect P&Z and Council consideration/approval (if approved);
2. An updated lighting and photometric plan has been submitted and is in review. The Photometric Report shall provide levels at the

eastern property boundary; and

3. The Site Plan is in review and approval is subject to subsequent review comments by the City Planner and City Engineer.

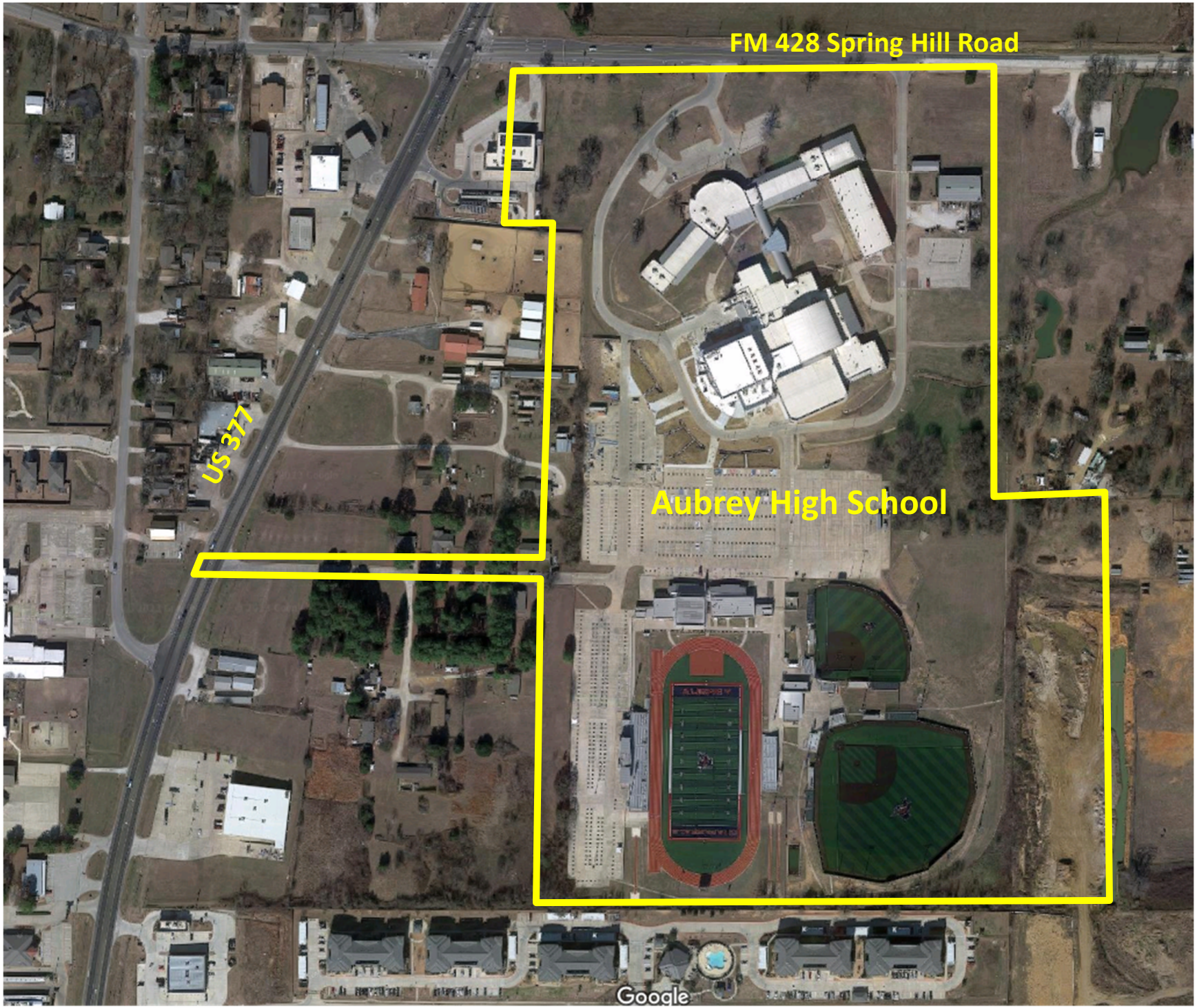
The Planning & Zoning Commission unanimously recommended approval of the Aubrey High School Site Plan at their August 8, 2024 meeting with the conditions outlined above.

The City Council may:

4. Approve the Site Plan;
5. Approve the Site Plan with conditions; or
6. Deny the Site Plan.

Attachments:

Location Map
Site Plan for Aubrey High School
Site Line Exhibits and Hardship Statement for Variance Request


FM 428 Spring Hill Road
US 377
Aubrey High School
Google

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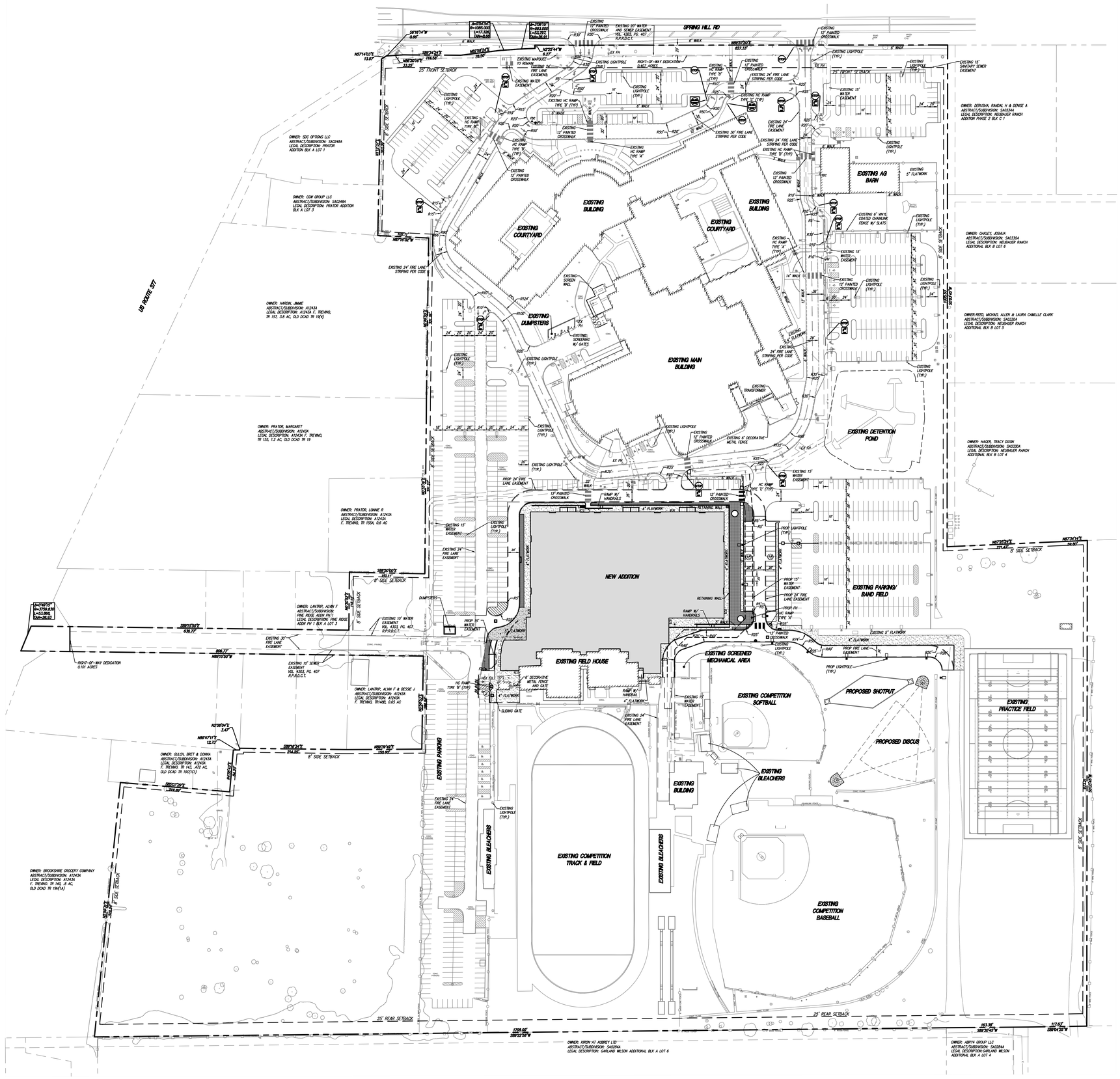

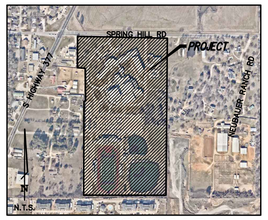

LOCATION MAP
NOT TO SCALE

tnp

GRAPHIC SCALE

80 0 40 80 160

GRAPHIC SCALE: 1" = 80'

LEGEND

- PROPOSED FLATWORK
- PROPOSED FIRE HYDRANT
- (12) PARKING COUNT

SITE INFORMATION

LAND USE: PUBLIC SCHOOL

LOT SIZE: 63.613 AC (2,770,991.8 SF)

SITE ADDRESS: 510 FM 428, AUBREY, TX 76227

EXISTING FIELD HOUSE HEIGHT: 32'-0"

MAX HEIGHT OF NEW ADDITION
AT FIELD HOUSE: 57'-10"

EXISTING FIELD HOUSE FLOOR AREA: 17,931 SF

PROPOSED FIELD HOUSE ADDITION
FLOOR AREA:106,817 SF

LOT COVERAGE: 71.48%
FLOOR AREA RATIO: 20.57%

ZONING DISTRICT SF75 – SINGLE-FAMILY RESIDENTIAL
7,500 SQUARE FEET

PARKING DATA

PARKING SPACES: 1 SPACES PER CLASSROOM
PLUS 1 PER 3 STUDENTS
PLUS 1 PER 4 SEATS

CLASSROOMS	=	106 CLASSROOMS
STUDENTS	=	2,000 STUDENTS
SEATS	=	705 SEATS (AUDITORIUM)
REQUIRED PARKING		
106 CLASSROOMS X 1	=	106 SPACES
2,000 STUDENTS ÷ 3	=	667 SPACES
705 SEATS ÷ 4	=	177 SPACES
TOTAL PARKING REQUIRED	=	950 SPACES
PROVIDED PARKING		
PROPOSED PARKING	=	39 SPACES
EXISTING PARKING	=	953 SPACES
TOTAL PARKING	=	992 SPACES

NOTES

1. THE SANITATION CONTAINER SCREENING WALLS SHALL BE BRICK MASONRY STONE MASONRY, OR OTHER AGRICULTURAL MASONRY FINISH, INCLUDING A METAL GATE, PRIMED AND PAINTED, AND THE SANITATION CONTAINER SCREENING WALLS, GATE, AND PAD SITE SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE CITY DESIGN SPECIFICATIONS.
2. MECHANICAL AND HEATING AND AIR-CONDITIONING EQUIPMENT IN NON RESIDENTIAL USES SHALL BE SCREENED FROM VIEW FROM THE PUBLIC RIGHT-OF-WAY AND FROM ADJACENT RESIDENTIAL PROPERTIES. REFERENCE BOA ACTION FOR SCREENING.
3. THE LIGHTING FOR THE SUBJECT PROPERTY WILL BE CONSTRUCTED AND OPERATED IN CONFORMANCE WITH THE CITY OF AUBREY ZONING ORDINANCE.
4. THE REQUIRED UTILITY PLANS, DRAINAGE PLANS, AND LANDSCAPE PLAN FOR A SITE PLAN ARE INCLUDED IN THE CIVIL CONSTRUCTION PLAN SET.

SITE PLAN
FOR
AUBREY HIGH SCHOOL
INDOOR PRACTICE FIELD
ADDITIONS/RENOVATIONS
AUBREY INDEPENDENT
SCHOOL DISTRICT

DATE PREPARED: AUGUST 2024

OWNER/APPLICANT:
AUBREY I.S.D
415 TISDELL LANE
AUBREY, TEXAS 76227
CONTACT: TERRIE MCNABB
PHONE: 940.668.0060
FAX: 940.385.2627

ENGINEER:
tnp
teague nall & perkins
5237 N Riverside Drive, Suite 100
Fort Worth, Texas 76137
817.336.5773 ph 817.336.2813 fx
TBPE Registration No. F-230
www.tnpinc.com

TNP PROJECT NO. HUC24091
TNP TBPELS REGISTRATION NO. F-230

Revision / Date

Project: AUBREY HIGH SCHOOL INDOOR PRACTICE FACILITY AND FIELD HOUSE ADDITION/RENOVATION FOR AUBREY I.S.D. AUBREY, TEXAS

tnp
teague nall & perkins
5237 N Riverside Drive, Suite 100
Fort Worth, Texas 76137
817.336.5773 ph 817.336.2813 fx
TBPELS: ENGR F-230;
SURV 10011600, 10011601, 10194381
GBPE: PEF007431; TBAE: BR 2673
www.tnpinc.com

STATE OF TEXAS
AMANDA M. MULLER
123232
LICENSED
08/08/2024

Huckabee
AUSTIN • DALLAS • FORT WORTH
HOUSTON • SAN ANTONIO • WACO
www.huckabee-inc.com
800.687.1229

SITE PLAN

VOLUME 1

Job No. 1916-05-01	Sheet No. 01
Drawn By: TNP	
Date: 08.06.2024	

VARIANCE APPLICATION

I/WE, the undersigned owner(s) (Print) Aubrey Independent School District of all property within described do hereby file this, my/our Application for a Variance under the provisions of the Zoning Ordinance of the City of Aubrey, Texas on said property, so there may be permitted on said property the following Variance:

A variance on mechanical equipment screening requirements (RTUs and Air Rotation Units) put forth by the ordinance.

Said property is currently zoned: SF-75

Proposed development plans are/are not submitted herewith, explanation if any.

A grading plan is included showing grade elevations for lines of sight taken from the property lines. Additionally, 3D views and sections are attached showing the intent of the ordinance is upheld to the extends possible due to existing conditions.

Explanation of hardship:

See attached page.

I/We REPRESENT AND CERTIFY that I/We own said property and have full authority to make and file this application. I/We acknowledge that the variance application fee is non-refundable.

SIGNATURE(S) — DATE: 7/9/2024

E-MAIL ADDRESS: ssaylor@aubreyisd.net — PHONE NUMBER: 940-668-0060

OFFICE USE ONLY BELOW

- ☐ Letters sent to property owners within 200-foot of subject property 10-days prior to meeting
- ☐ Legal notice published in official newspaper 15-days prior to meeting

Date Received: _____

Receipt #: _____

Check #: _____

Received by: _____

Roof Top Units
Proposed construction is an addition on the north side of the existing Field House, the south portion of the building will remain intact. While all new construction includes parapet walls that sufficiently hide the roof top units/ductwork and upholds the intend of the ordinance, existing walls on the south side are shorter and do not hide the units/ductwork when sightlines are taken from the southern portions of the property line.

Air Rotation Units
Due to the function and open floor plan of the Indoor Practice facility, air rotation units are the recommended mechanical solution to property condition and ventilate the space. These units work by circulating conditioned air. They pull the return air at floor level and provide supply air at a higher level. They are custom units that are designed to meet the HVAC demands of the space and in our case they are approximately 17'-4" high x 6'-8" wide x 6'-8" deep. These units are typically not screened in order to function at best performance. Furthermore, the manufacturer does not recommend screening above the height of their adjacent condensing unit (approximately 6'-1" in our specific case). Below is a reference photo that will be similar to our condition.

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CAUTION!!! GEOTHERMAL WELLS, VALVES AND WATERLINES TO BE PRESERVED AND PROTECTED CONTRACTOR TO RAISE EXISTING VALVES TO GRADE.

NOTE:
CONTRACTOR SHALL VERIFY EXACT LOCATION AND SIZE OF ALL UTILITIES AND USE EXTREME CAUTION DURING CONSTRUCTION.

NOTE:
REFER TO LANDSCAPE ARCHITECT'S PLANS FOR ADDITIONAL TREE REMOVAL.

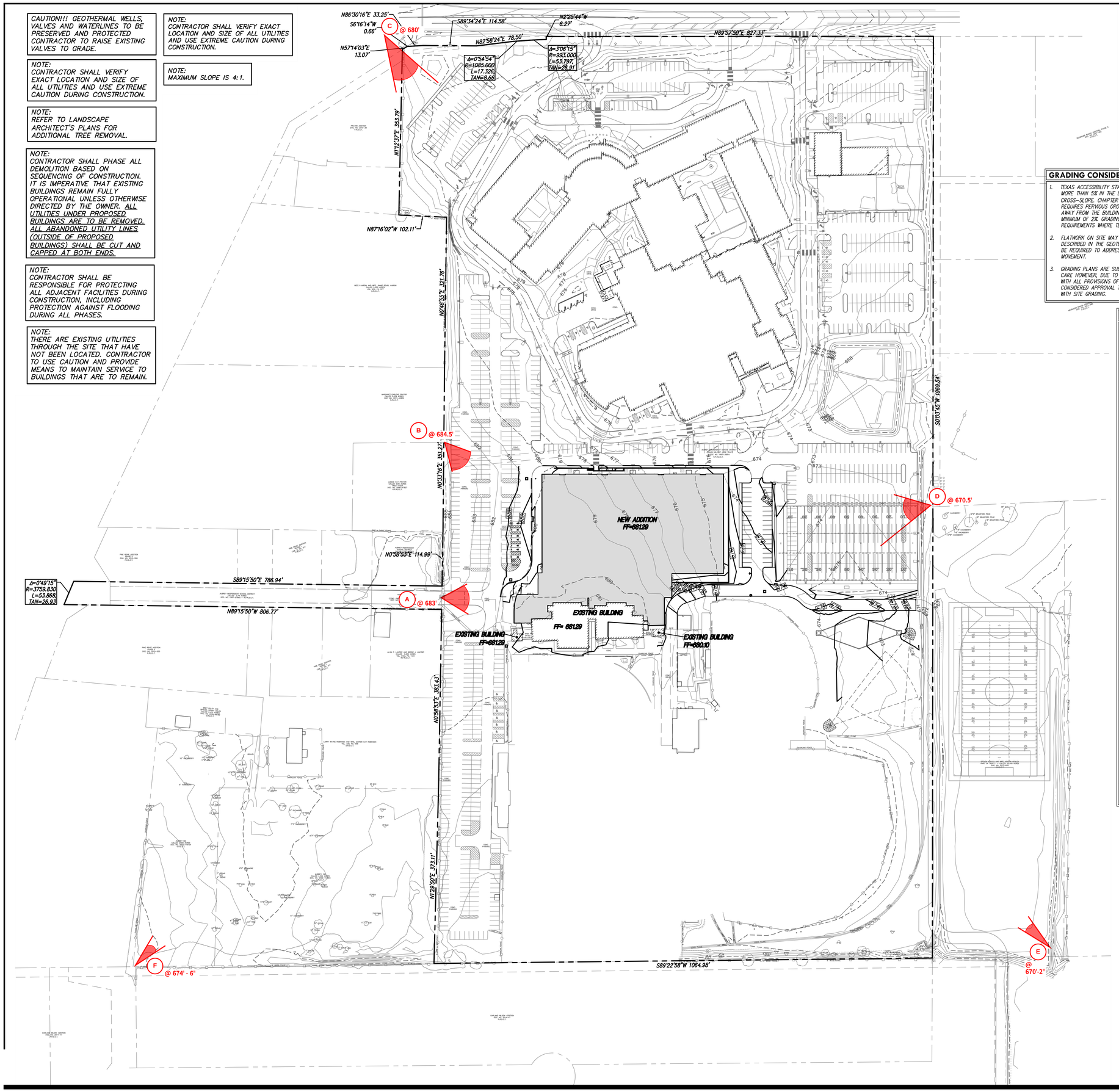
NOTE:
CONTRACTOR SHALL PHASE ALL DEMOLITION BASED ON SEQUENCING OF CONSTRUCTION. IT IS IMPERATIVE THAT EXISTING BUILDINGS REMAIN FULLY OPERATIONAL UNLESS OTHERWISE DIRECTED BY THE OWNER. ALL UTILITIES UNDER PROPOSED BUILDINGS ARE TO BE REMOVED. ALL ABANDONED UTILITY LINES (OUTSIDE OF PROPOSED BUILDINGS) SHALL BE CUT AND CAPPED AT BOTH ENDS.

NOTE:
CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING ALL ADJACENT FACILITIES DURING CONSTRUCTION, INCLUDING PROTECTION AGAINST FLOODING DURING ALL PHASES.

NOTE:
THERE ARE EXISTING UTILITIES THROUGH THE SITE THAT HAVE NOT BEEN LOCATED. CONTRACTOR TO USE CAUTION AND PROVIDE MEANS TO MAINTAIN SERVICE TO BUILDINGS THAT ARE TO REMAIN.

NOTE:
CONTRACTOR SHALL VERIFY EXACT LOCATION AND SIZE OF ALL UTILITIES AND USE EXTREME CAUTION DURING CONSTRUCTION.

NOTE:
MAXIMUM SLOPE IS 4:1.



tnp

GRAPHIC SCALE

80 0 40 80 160

GRAPHIC SCALE: 1" = 80'

GRADING CONSIDERATIONS:

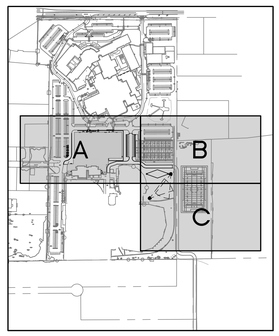
1. TEXAS ACCESSIBILITY STANDARDS (TAS) REQUIRE ACCESSIBLE ROUTES SLOPE NO MORE THAN 5% IN THE DIRECTION OF TRAVEL WITH A MAXIMUM OF 2% CROSS-SLOPE. CHAPTER 18 OF THE INTERNATIONAL BUILDING CODE (IBC) REQUIRES PERVIOUS GROUND IMMEDIATELY ADJACENT TO THE FOUNDATION SLOPE AWAY FROM THE BUILDING AT 5% MINIMUM SLOPE AND IMPERVIOUS GROUND AT MINIMUM OF 2% GRADING AS SHOWN ON THIS PLAN IS PROVIDED TO MEET THESE REQUIREMENTS WHERE TECHNICALLY FEASIBLE.
2. FLATWORK ON SITE MAY BE SUBJECT TO POTENTIAL VERTICAL MOVEMENT AS DESCRIBED IN THE GEOTECHNICAL REPORT FOR THE PROJECT. MAINTENANCE MAY BE REQUIRED TO ADDRESS FLATWORK CHANGES DUE TO POTENTIAL VERTICAL MOVEMENT.
3. GRADING PLANS ARE SUBMITTED IN ACCORDANCE WITH INDUSTRY STANDARD OF CARE HOWEVER, DUE TO ABOVE THE ABOVE TAS RESTRICTIONS, MAY NOT COMPLY WITH ALL PROVISIONS OF CHAPTER 18 OF THE IBC. APPROVAL OF THESE PLANS IS CONSIDERED APPROVAL TO DEVIATIONS FROM CHAPTER 18 OF THE IBC ASSOCIATED WITH SITE GRADING.

LEGEND

(79.20) •	EXISTING SPOT ELEVATION
79.20 •	PROPOSED SPOT ELEVATION
5%	PROPOSED PERCENT OF GRADE
655	PROPOSED CONTOUR
	GRADE BREAK/RIDGE LINE
	PROPOSED SWALE LINE
	PROPOSED DAYLIGHT LINE
5:1	PROPOSED SLOPE RATIO
× 79.20	EXISTING SPOT GRADE
6.33	EXISTING CONTOURS

NOTES

1. THE GRADING OF THE DIFFERENT AREAS SHOWN ON THE SITE SHALL BE COMPACTED IN STRICT ACCORDANCE WITH THE SPECIFICATIONS WHICH SHALL BE CONSIDERED AS PART OF THESE DRAWINGS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FINE GRADING TO THE SUBGRADE OF ALL PAVED AREAS TO ALLOW FOR THE PAVEMENT SECTIONS. CONTRACTOR SHALL GRADE AND COMPACT ALL AREAS UNDER PAVEMENT TO ALLOW FOR THE RESPECTIVE PAVING SECTIONS AND SHALL MAINTAIN THESE FINISHED GRADES AS SHOWN UNTIL FINAL ACCEPTANCE.
3. CONTRACTOR IS REQUIRED TO INSTALL AND MAINTAIN EROSION CONTROL AT ALL TIMES THROUGHOUT THE PROJECT.
4. THE SPREADING AND COMPACTION OF ANY WASTE OR EXCESS MATERIAL NOT SUITABLE FOR FILLING, SUCH AS LARGE ROCK, CONCRETE, TREES, TRASH AND VEGETATION, SHALL BE DISPOSED OFFSITE AT THE CONTRACTOR'S EXPENSE ONLY IN THOSE AREAS APPROVED FOR DISPOSING OF WASTE MATERIAL. THE CONTRACTOR SHALL NOT DISPOSE OF ANY WASTE MATERIAL ON ADJACENT PROPERTY OWNER'S OR OTHER AREAS WHICH ARE NOT LEGALLY ACCEPTED BY THE CITY. NO BURNING OF ANY MATERIAL AT ANY TIME SHALL BE ALLOWED ON THIS SITE UNLESS PERMITTED BY CITY ORDINANCES.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL SAFETY LAWS IN ACCORDANCE WITH THE CITY, STATE AND FEDERAL LAWS WHICH GOVERN CONSTRUCTION.
6. ALL AREAS TO BE FILLED SHALL BE FILLED IN STRICT ACCORDANCE WITH THE SPECIFICATIONS. ALL VEGETATION, TREES, ROCKS AND OBJECTIONABLE MATERIALS SHALL BE REMOVED BY THE CONTRACTOR FROM THE SURFACE OF WHICH THE FILL IS PLACED. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PLACE, SPREAD, WATER AND COMPACT THE FILL IN STRICT ACCORDANCE WITH THE SPECIFICATIONS FOR THIS PROJECT.
7. ALL DRIVE, PARKING AREAS, CUT AND FILL SLOPES, BUILDING PADS AND OPEN SPACE AREAS SHALL BE TRIMMED AND COMPACTED TO THE FINISHED GRADE TO PRODUCE SMOOTH SURFACES AND UNIFORM CROSS-SECTIONS. THE SLOPES OF ALL EXCAVATIONS AND EMBANKMENTS SHALL BE LEFT IN A NEAT AND ORDERLY CONDITION. ALL STONES, ROOTS, TREES, AND OTHER WASTE MATERIAL SHALL BE REMOVED AND DISPOSED OFF SITE. ALL VOIDS SHALL BE FILLED AND ANY SOFT SPOTS OCCURRING ON THIS SITE SHALL BE RECOMPACTED PER THE SPECIFICATIONS. VERIFY ALL GRADES TO AVOID PONDING OF WATER.
8. NO ADJUSTMENT OF GRADES WILL BE PERMITTED TO ANY STRUCTURES, PAVEMENT OR WALK SURFACES. SHOULD THE CONTRACTOR DETERMINE THERE IS A DEFICIENCY OF MATERIAL, THEN ALLOWANCE WILL MADE IN THE CONTRACT TO IMPORT A CLEAN MATERIAL SUITABLE FOR FILLING. THE OWNER'S LABORATORY WILL BE ALLOWED TO TEST AND INSPECT THE BORROW SITE PRIOR TO BEGINNING HIS FILLING OPERATIONS. EXCESS EXCAVATED MATERIAL SHALL BE DISPOSED OFFSITE AS REQUIRED.
9. THE CONTRACTOR SHALL VISIT THE SITE TO DETERMINE THE EXACT SCOPE OF WORK. THE CONTRACTOR SHALL REMOVE ALL VEGETATION FROM THE LIMITS OF THE PROPOSED IMPROVEMENTS. ALL TREES OUTSIDE THE LIMITS OF CONSTRUCTION SHALL REMAIN UNLESS NOTED ON THE PLANS TO BE REMOVED OR APPROVED BY THE OWNER.
10. ALL WALKS SHALL NOT EXCEED THE MAXIMUM SLOPES ALLOWED BY THE TEXAS ACCECCIBILITY STANDARDS (TAS), UNLESS INDICATED. THE MAXIMUM CROSS SLOPE IS 2% AND THE MAXIMUM DIRECTIONAL SLOPE IS 5%
11. ALL SPOT GRADES ARE FOR PROPOSED EDGE OF PAVEMENT OR GUTTER ELEVATIONS, UNLESS INDICATED OTHERWISE.
12. ALL AREAS SHALL BE TRIMMED AND COMPACTED TO THE FINISHED GRADE TO PRODUCE SMOOTH SURFACES AND UNIFORM CROSS- SECTIONS. THE SLOPES OF ALL EXCAVATIONS AND EMBANKMENTS SHALL BE LEFT IN A NEAT AND ORDERLY CONDITION. ALL STONES, ROOTS, TREES, AND OTHER WASTE MATERIAL SHALL BE REMOVED AND DISPOSED OFF SITE. ALL VOIDS SHALL BE FILLED AND ANY SOFT SPOTS OCCURRING ON THIS SITE SHALL BE RECOMPACTED PER THE SPECIFICATIONS. VERIFY ALL GRADES TO AVOID PONDING OF WATER.
13. EXISTING DEPRESSED AREAS, WHICH HOLD SURFACE WATER, SHALL BE PUMPED DRY. EXISTING SOGGY MATERIALS SHALL BE EXCAVATED AND REMOVED UNTIL A STABLE DRY MATERIAL IS AVAILABLE. THIS EXPOSED MATERIAL SHALL BE COMPACTED TO 95% STD PROCTOR. ON SITE MATERIAL SHALL BE PLACED IN 8" MAX LIFTS AND COMPACTED TO MAX 95% STD PROCTOR AT OPTIMUM MOISTURE CONTENT.
14. IN THE EVENT THE CONTRACTOR WILL BE STOCKPILING DIRT ON SITE, THE LOCATION OF THE STOCKPILE SHALL BE PLACED IN A LOCATION SO AS NOT TO CAUSE A DIVERSION OR CHANGE OF THE DRAINAGE PATTERNS THAT WILL IMPACT OFFSITE PROPERTIES.



KEYPLAN

SCALE 1"=500'

TNP PROJECT NO. HUC24091
TNP TBPELS REGISTRATION NO. F-230

Revision / Date

Project:

AUBREY HIGH SCHOOL INDOOR PRACTICE FACILITY AND FIELD HOUSE ADDITION/RENOVATION
FOR
AUBREY I.S.D.
AUBREY, TEXAS

tnp
teague nall & perkins
5237 N Riverside Drive, Suite 100
Fort Worth, Texas 76137
817.336.5773 ph 817.336.2813 fx
TBPELS: ENGR F-230;
SURV 10011600, 10011601, 10194381
GBPE: PEF007431; TBAE: BR 2673
www.tnpinc.com

This document is for interim review and is not intended for construction, bidding or permit purposes.

AMANDA M. MULLEN, P.E. Date: MAY 2024

Tx. Reg. # 123232

Huckabee
AUSTIN • DALLAS • FORT WORTH
HOUSTON • SAN ANTONIO • WACO
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800.687.229

OVERALL GRADING PLAN

PACKAGE 1	VOLUME 1
Job No. 1916-05-01	Sheet No. 50% CD
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Date: 05/14/2024	

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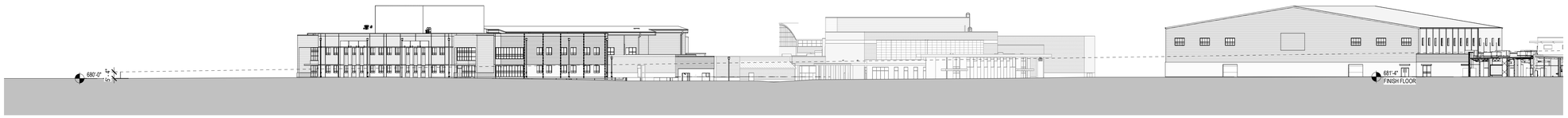

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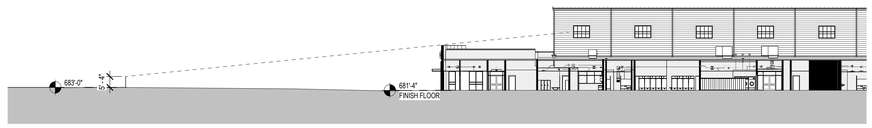
5 SECTION B
1" = 30'-0"



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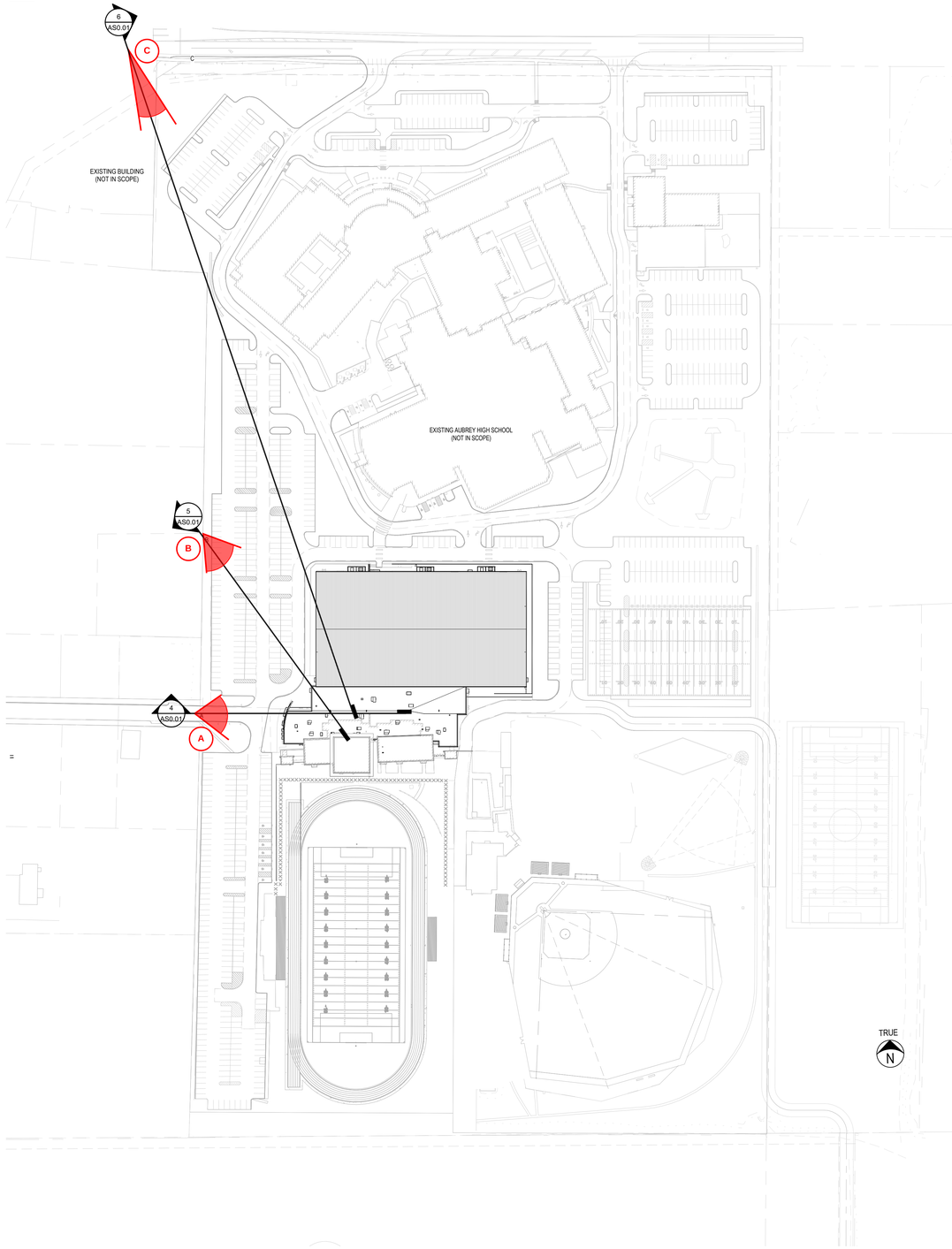

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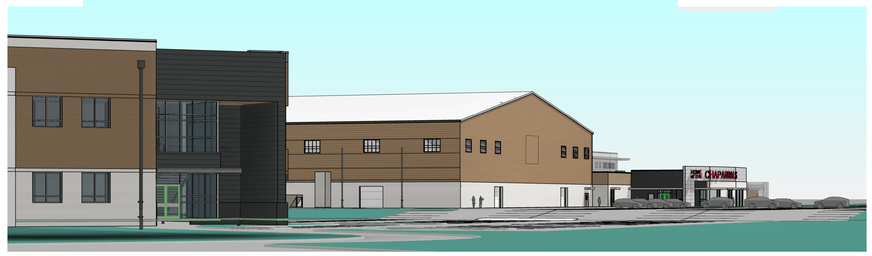

3 SIGHTLINE C

2 SIGHTLINE B

1 SIGHTLINE A

Revision / Date

Project:
AUBREY HIGH SCHOOL INDOOR PRACTICE FACILITY
AND FIELD HOUSE ADDITION/RENOVAT ION
FOR
AUBREY ISD
AUBREY, TEXAS

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SIGHTLINES

VOLUME

Job No. 01916-07-01
Sheet No. AS0.01
Drawn By: Author
Date: 07.01.24

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Autodesk Docs://AUBREY ISD - INDOOR PRACTICE FACILITY/01916-07-01 Aubrey ISD Indoor Practice Facility - ARCH_v23.rvt

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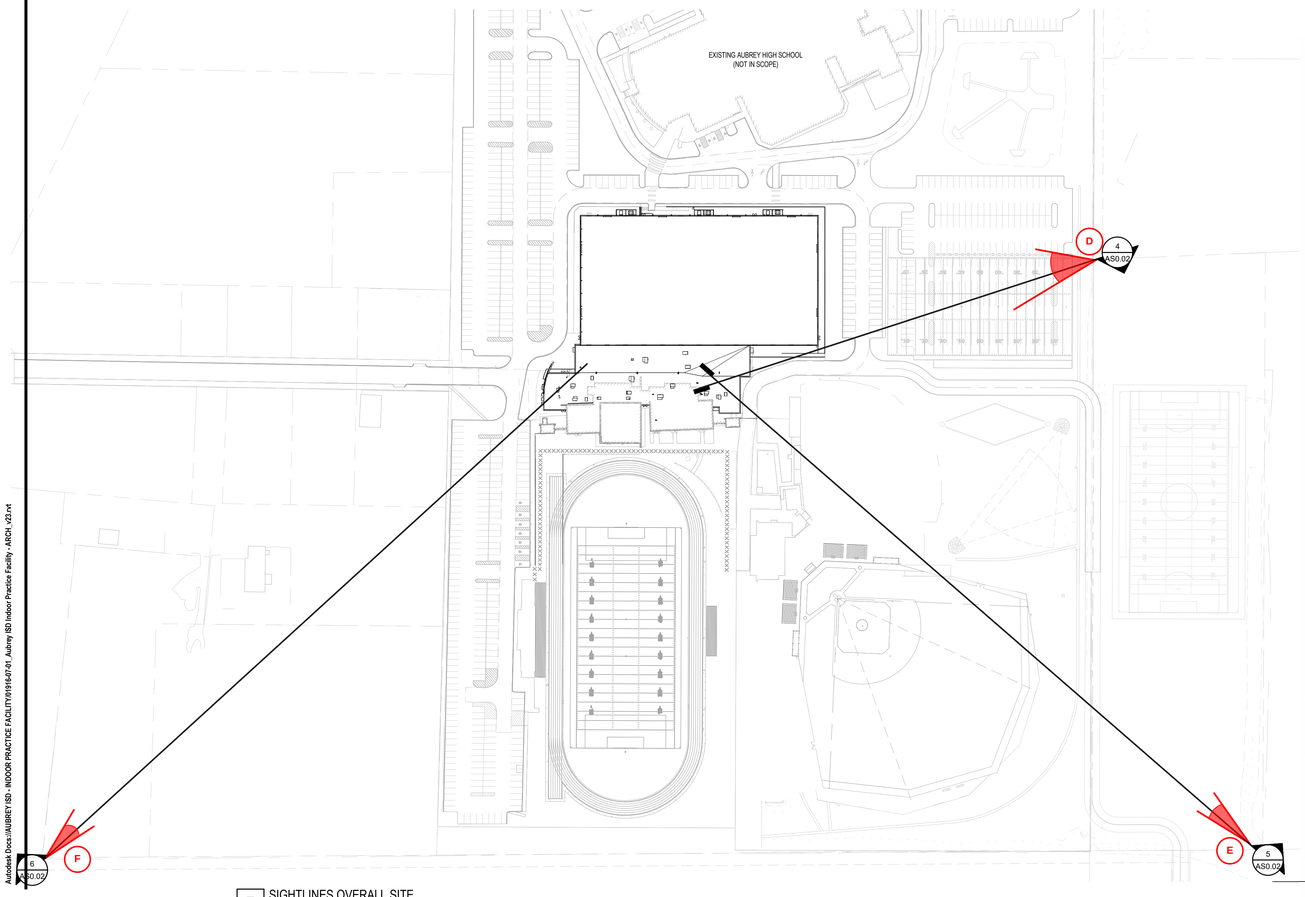
6 SECTION F
1" = 30'-0"

5 SECTION E
1" = 50'-0"

4 SECTION D
1" = 30'-0"



7 SIGHTLINES OVERALL SITE
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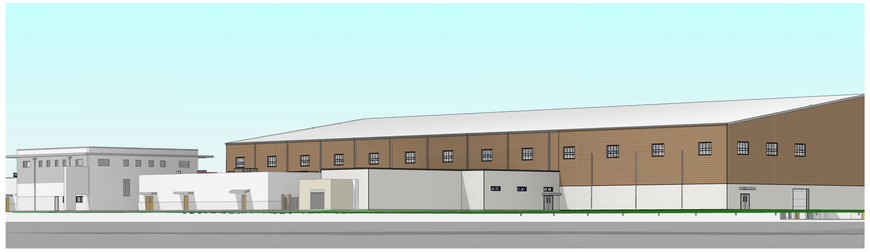

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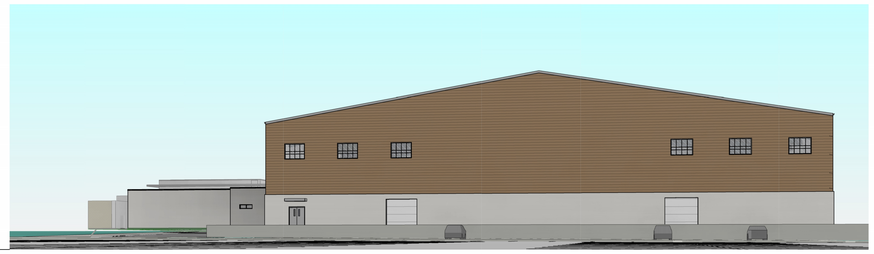

1 SIGHTLINE D

Revision / Date

Project:
AUBREY HIGH SCHOOL INDOOR PRACTICE FACILITY
AND FIELD HOUSE ADDITION/RENOVAT ION
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SIGHTLINES

VOLUME

Job No. 01916-07-01	Sheet No. AS0.02
Drawn By: Author	
Date: 07.01.24	

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Autodesk Docs://AUBREY ISD - INDOOR PRACTICE FACILITY/01916-07-01_Aubrey ISD Indoor Practice Facility - ARCH_v23.rvt

Case Report –Final Plat Application – Aubrey High School
Planning and Zoning Commission – August 8, 2024
City Council – August 22, 2024

To: Mayor, City Council, Planning and Zoning Commission

From: Helen-Eve Beadle, AICP, HE Planning+Design, LLC

Request: Consideration and action a Final Plat application for Lot 1, Block A, Aubrey High School Addition, being approximately 63.613 acres out of the Francisco Trevino Survey, Abstract 1243 generally located south of FM 428 (Spring Hill Road) and east of U.S. Highway 377, City of Aubrey, Denton County, Texas. *(AISD)*

Owner:	Aubrey Independent School District
Engineer:	Teague Nall & Perkins, Inc. (Amanda Mullen, PE)
Application Date:	July 10, 2024
Location:	The property is generally located south of FM 428 (Spring Hill Road) and east of U.S. Highway 377
Zoning:	SF-75-Single Family Residential
Future Land Use Plan:	School & Civic
Current Use:	Aubrey High School
Analysis:	A Final Plat was approved in December of 2020 and in January of 2024 for the Aubrey High School site. Aubrey Independent School District has been working on improvements and additions to accommodate the updates to the site. A Final Plat has been submitted illustrating one (1) 66.613 acre lot and includes associated easements and right-of-way dedications. There is no floodplain on the site and water and sewer is provided by the City of Aubrey. The site will be served by access points to FM 428/Spring Hill Road and US 377 and a 24-foot fire lane easement.
Recommendation:	The Final Plat for Aubrey High School is recommended for approval subject to the following conditions: 1. The Final Plat is in review and approval is subject to subsequent review comments by the City Planner and City Engineer. Other requirements for filing: Signed Final Plat, tax certificate for filing, and filing fees.

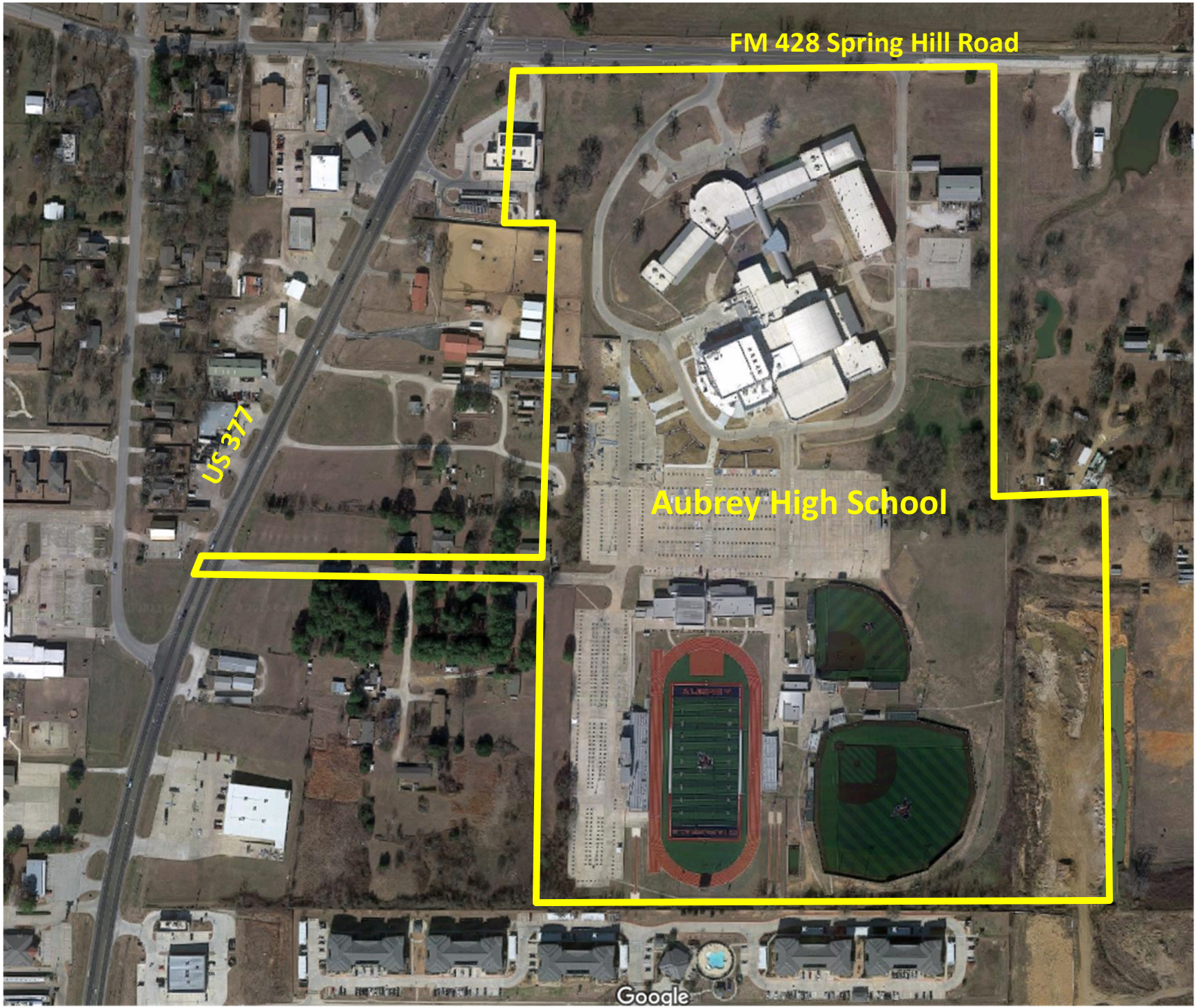
The Planning & Zoning Commission unanimously recommended approval of the Final Plat for Aubrey High School at their August 8, 2024 meeting with the one (1) condition listed above.

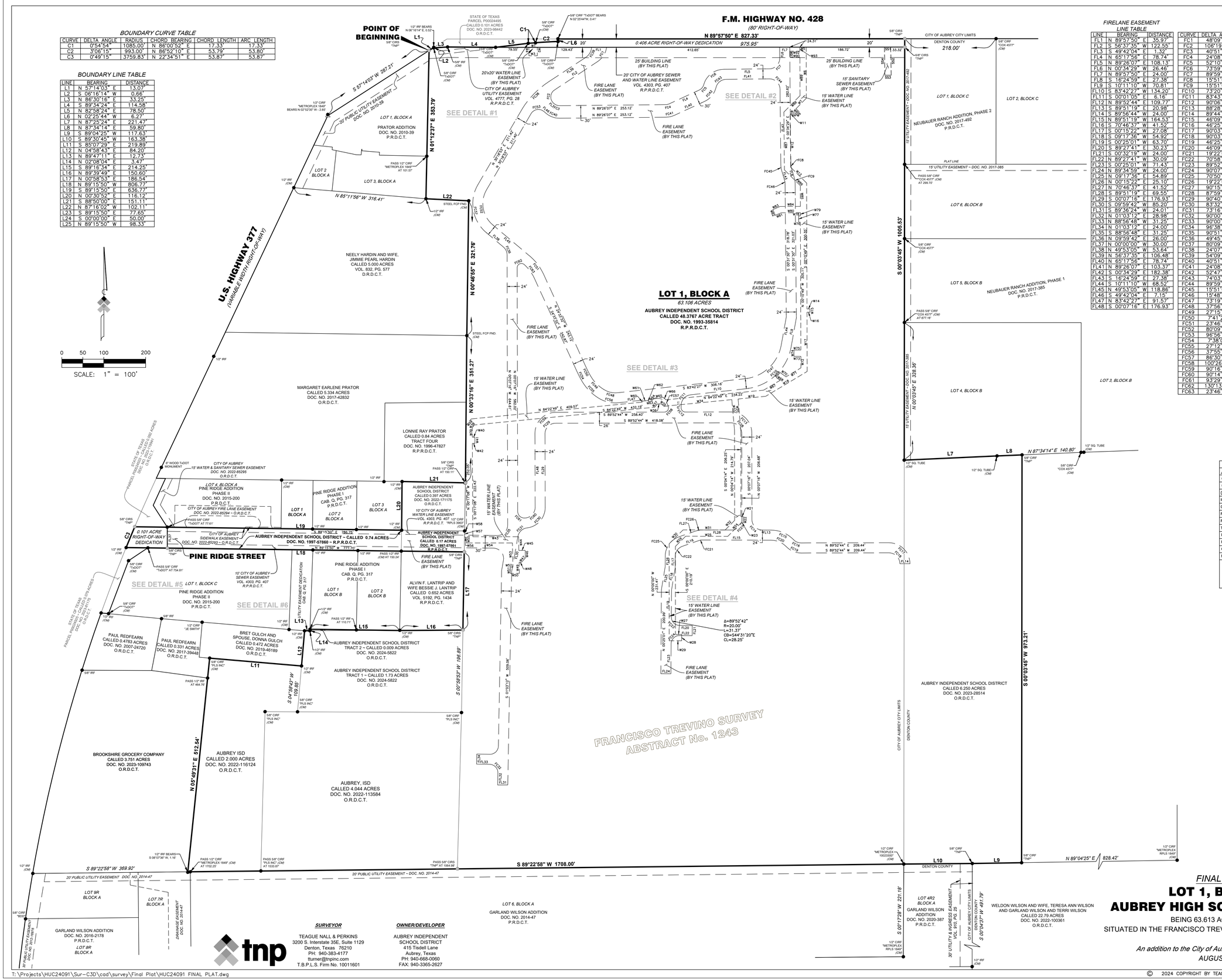
The City Council may:

1. Approve the Final Plat;
2. Approve the Final Plat with conditions; or
3. Deny the Final Plat.

Attachments:

Location Map
Final Plat for Aubrey High School


FM 428 Spring Hill Road
US 377
Aubrey High School
Google



BOUNDARY CURVE TABLE

CURVE	DELTA ANGLE	RADIUS	CHORD BEARING	CHORD LENGTH	ARC LENGTH
C1	0°54'54"	1085.00'	N 86°00'52" E	17.33'	17.33'
C2	3°06'15"	993.00'	N 86°52'10" E	53.79'	53.80'
C3	0°49'15"	3759.83'	N 22°34'51" E	53.87'	53.87'

BOUNDARY LINE TABLE

LINE	BEARING	DISTANCE
L1	N 57°14'03" E	13.07'
L2	S 06°16'14" W	0.66'
L3	N 86°30'16" E	33.25'
L4	S 89°34'24" E	114.58'
L5	N 82°58'24" E	78.50'
L6	N 02°25'44" W	6.27'
L7	N 87°25'24" E	221.47'
L8	N 87°34'14" E	59.80'
L9	S 89°04'25" W	117.63'
L10	S 89°30'45" W	163.38'
L11	S 85°07'29" E	219.89'
L12	N 04°58'43" E	84.20'
L13	N 89°47'11" E	12.73'
L14	N 02°08'04" E	3.47'
L15	S 89°16'34" E	214.25'
L16	N 89°39'49" E	150.60'
L17	N 00°58'53" E	186.54'
L18	N 89°15'50" W	806.77'
L19	S 89°15'50" E	636.77'
L20	N 00°30'52" E	116.12'
L21	S 88°50'00" E	151.11'
L22	N 87°16'02" W	102.11'
L23	S 89°15'50" E	77.65'
L24	S 00°00'00" E	50.00'
L25	N 89°15'50" W	98.33'

FIRELANE EASEMENT LINE TABLE

LINE	BEARING	DISTANCE
FL1	N 89°57'50" E	35.97'
FL2	S 56°37'35" W	122.55'
FL3	S 49°42'04" E	1.32'
FL4	N 65°17'56" E	78.74'
FL5	N 89°26'07" E	108.13'
FL6	N 00°34'29" W	26.46'
FL7	N 89°57'50" E	24.00'
FL8	S 16°24'59" E	27.38'
FL9	S 10°11'10" W	70.81'
FL10	S 83°42'27" W	134.20'
FL11	S 00°01'05" E	6.16'
FL12	N 89°52'44" E	109.77'
FL13	S 89°51'19" E	20.98'
FL14	S 89°56'44" W	24.00'
FL15	N 89°51'19" W	164.53'
FL16	S 70°46'37" W	41.52'
FL17	S 00°15'22" W	27.08'
FL18	S 09°17'36" W	54.92'
FL19	S 00°25'01" W	63.70'
FL20	S 89°27'41" E	30.23'
FL21	S 00°32'19" W	24.00'
FL22	N 89°27'41" W	30.09'
FL23	S 00°25'01" W	71.43'
FL24	N 89°34'59" W	24.00'
FL25	N 09°17'36" E	54.89'
FL26	N 00°15'22" E	25.10'
FL27	N 70°46'37" E	41.52'
FL28	S 89°51'19" E	69.55'
FL29	S 00°07'16" E	176.93'
FL30	S 09°59'42" W	85.20'
FL31	S 89°36'24" W	24.01'
FL32	N 01°03'12" E	28.98'
FL33	N 88°56'48" W	31.25'
FL34	N 01°03'12" E	24.00'
FL35	S 88°56'48" E	31.25'
FL36	N 09°59'42" E	26.00'
FL37	N 00°00'00" W	30.00'
FL38	N 49°53'05" W	53.64'
FL39	N 56°37'35" E	106.48'
FL40	N 65°17'56" E	78.74'
FL41	N 89°26'07" E	103.37'
FL42	S 00°34'29" E	182.38'
FL43	S 16°24'59" E	27.38'
FL44	S 10°11'10" W	68.52'
FL45	N 49°53'05" W	118.86'
FL46	S 49°42'04" E	7.15'
FL47	N 83°42'27" E	91.57'
FL48	S 00°07'16" E	176.93'

FIRELANE EASEMENT CURVE TABLE

CURVE	DELTA ANGLE	RADIUS	CHORD BEARING	CHORD LENGTH	ARC LENGTH
FC1	48°09'13"	50.00'	S 32°32'01" W	40.82'	42.05'
FC2	106°19'39"	20.00'	S 03°27'46" W	32.01'	37.12'
FC3	40°51'49"	20.00'	S 70°07'58" E	13.96'	14.26'
FC4	24°08'11"	20.00'	N 77°22'02" E	8.36'	8.43'
FC5	52°10'41"	20.00'	N 39°12'36" E	17.59'	18.21'
FC6	73°59'27"	50.00'	N 53°14'37" E	60.18'	64.57'
FC7	89°59'05"	25.00'	N 44°24'51" E	35.35'	39.26'
FC8	15°51'07"	10.00'	S 08°29'26" E	2.76'	2.77'
FC9	15°51'07"	49.00'	S 08°29'26" E	13.51'	13.56'
FC10	73°20'28"	122.00'	S 47°02'13" W	145.72'	156.17'
FC11	83°43'32"	25.00'	S 41°50'41" W	33.37'	36.53'
FC12	90°06'11"	10.00'	S 45°04'10" E	14.15'	15.73'
FC13	88°28'13"	50.00'	S 44°12'46" E	69.76'	77.20'
FC14	89°44'03"	25.00'	S 44°59'17" E	35.27'	39.15'
FC15	46°09'52"	74.00'	S 66°46'23" E	58.02'	59.62'
FC16	46°25'49"	25.00'	S 66°54'21" E	19.71'	20.26'
FC17	90°03'59"	50.00'	S 45°05'16" E	70.75'	78.60'
FC18	90°03'59"	26.00'	N 45°05'16" W	36.79'	40.87'
FC19	46°25'49"	49.00'	N 66°54'21" W	38.63'	39.71'
FC20	46°09'52"	50.00'	N 66°46'23" W	39.21'	40.29'
FC21	19°22'04"	25.00'	S 80°27'39" W	8.41'	8.45'
FC22	70°58'50"	25.00'	S 35°17'12" W	29.03'	30.97'
FC23	89°52'42"	20.00'	S 44°11'00" E	28.25'	31.37'
FC24	90°07'18"	20.00'	S 45°28'40" W	28.31'	31.46'
FC25	70°50'57"	49.00'	N 35°21'09" E	56.80'	60.59'
FC26	19°22'04"	49.00'	N 80°27'39" E	16.48'	16.56'
FC27	90°15'57"	25.00'	N 45°00'43" E	35.44'	39.39'
FC28	87°59'16"	25.00'	N 46°08'26" W	34.73'	38.39'
FC29	90°40'44"	25.00'	S 47°09'27" W	35.56'	39.56'
FC30	83°32'37"	49.00'	S 41°39'24" W	65.28'	71.45'
FC31	73°16'04"	25.00'	S 46°47'35" W	29.83'	31.97'
FC32	90°00'00"	20.00'	N 43°56'48" W	28.28'	31.42'
FC33	90°00'00"	20.00'	N 46°03'12" E	28.28'	31.42'
FC34	96°38'43"	25.00'	N 40°56'28" W	37.35'	42.17'
FC35	90°51'26"	25.00'	N 45°18'27" E	35.62'	39.64'
FC36	49°45'49"	25.00'	N 25°00'10" W	21.04'	21.71'
FC37	80°09'05"	90.00'	N 09°48'47" W	115.88'	125.90'
FC38	24°07'13"	211.48'	N 44°34'58" E	88.37'	89.03'
FC39	54°09'26"	30.00'	N 29°37'53" E	27.31'	28.36'
FC40	40°51'49"	50.00'	S 70°07'58" E	34.91'	35.66'
FC41	24°08'11"	50.00'	N 77°22'02" E	20.91'	21.06'
FC42	52°47'18"	50.00'	N 38°54'17" E	44.45'	46.07'
FC43	74°03'46"	25.00'	N 52°27'19" E	30.11'	32.92'
FC44	89°59'24"	25.00'	S 45°34'11" E	35.35'	39.27'
FC45	15°51'07"	34.00'	S 08°29'26" E	9.38'	9.41'
FC46	15°48'49"	25.00'	S 08°30'35" E	6.88'	6.90'
FC47	73°19'13"	98.00'	S 47°02'51" W	117.03'	125.41'
FC48	37°56.33"	52.63'	N 76°50'52" W	34.22'	34.85'
FC49	27°15'38"	91.88'	N 44°53'39" W	43.30'	43.71'
FC50	7°41'25"	195.45'	N 27°14'32" W	26.21'	26.23'
FC51	23°46'51"	124.60'	N 36°28'47" W	51.35'	51.72'
FC52	80°09'05"	66.00'	N 09°48'47" W	84.98'	92.33'
FC53	96°56'58"	20.00'	N 81°19'31" E	29.95'	33.84'
FC54	7°38'03"	219.45'	S 27°16'47" E	29.22'	29.24'
FC55	27°12'52"	115.88'	S 44°51'08" E	54.52'	55.04'
FC56	37°55'06"	76.63'	S 76°56'27" E	49.79'	50.71'
FC57	86°30'27"	25.00'	S 53°02'17" E	34.26'	37.75'
FC58	100°26'04"	10.00'	S 40°26'16" W	15.37'	17.53'
FC59	90°16'49"	50.00'	S 44°52'36" W	70.88'	78.78'
FC60	90°14'47"	25.00'	S 45°00'59" W	35.43'	39.38'
FC61	93°29'31"	15.50'	N 46°52'28" W	22.58'	25.29'
FC62	130°13'56"	10.00'	N 64°59'42" E	18.14'	22.73'
FC63	23°46'51"	100.60'	S 36°28'47" E	41.46'	41.76'

SANITARY SEWER EASEMENT LINE TABLE

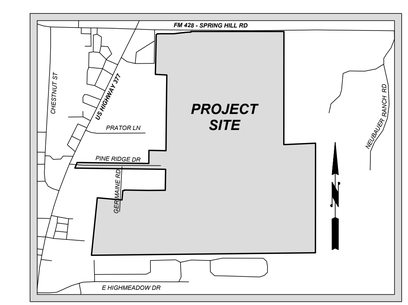
LINE	BEARING	DISTANCE
SS1	N 89°57'50" E	13.00'
SS2	S 00°56'11" E	67.01'
SS3	N 89°57'50" W	15.00'
SS4	N 00°56'11" W	67.01'

WATER EASEMENT LINE TABLE

LINE	BEARING	DISTANCE
W1	N 89°57'50" E	20.00'
W2	S 00°02'10" E	20.00'
W3	S 89°57'50" W	20.00'
W4	N 00°02'10" W	20.00'
W5	N 89°57'50" E	15.00'
W6	S 00°10'49" E	121.76'
W7	S 44°26'07" W	35.45'
W8	S 48°37'28" E	10.13'
W9	S 41°22'32" W	15.00'
W10	N 48°37'28" W	10.93'
W11	S 44°26'07" W	4.61'
W12	S 00°33'53" E	125.51'
W13	S 45°10'49" E	53.51'
W14	N 89°55'44" E	7.28'
W15	S 00°00'00" E	8.00'
W16	S 89°53'44" W	7.26'
W17	S 00°10'49" E	141.22'
W18	S 59°04'39" W	115.36'
W19	S 84°22'49" W	66.22'
W20	S 04°59'49" E	74.60'
W21	N 90°00'00" E	5.75'
W22	S 00°00'00" E	15.00'
W23	N 90°00'00" W	5.39'
W24	S 44°35'05" W	45.02'
W25	N 89°51'19" W	100.52'
W26	S 45°01'33" W	34.45'
W27	N 90°00'00" E	14.86'
W28	S 00°00'00" E	15.00'
W29	N 90°00'00" W	29.86'
W30	N 45°01'33" E	46.90'
W31	S 89°51'19" E	100.45'
W32	N 44°35'05" E	32.07'
W33	N 04°59'49" W	73.80'
W34	S 84°22'49" W	162.69'
W35	N 49°55'41" W	9.46'
W36	S 84°22'49" W	8.73'
W37	S 39°03'29" W	9.52'
W38	S 39°11'15" W	8.23'
W39	S 00°17'08" E	22.83'
W40	N 90°00'00" E	6.23'
W41	S 00°00'00" E	15.00'
W42	S 90°00'00" W	6.16'
W43	N 90°00'00" E	109.16'
W44	S 01°12'48" E	32.88'
W45	N 88°47'12" E	15.00'
W46	S 01°12'48" E	18.58'
W47	S 42°30'34" W	13.30'
W48	S 88°47'12" W	5.81'
W49	S 01°12'48" E	26.54'
W50	S 88°47'12" W	21.00'
W51	N 01°12'48" W	15.00'
W52	N 88°47'12" E	6.00'
W53	N 01°12'48" W	57.92'
W54	N 90°00'00" W	109.40'
W55	N 00°17'08" W	13.51'
W56	N 89°15'50" W	4.88'
W57	N 00°58'53" E	15.00'
W58	S 89°15'50" E	4.55'
W59	N 39°11'15" E	19.85'
W60	N 08°04'34" W	2.01'
W61	N 81°32'44" E	15.00'
W62	S 08°03'51" E	2.75'
W63	N 84°22'49" E	7.59'
W64	N 39°03'29" E	9.52'
W65	N 84°22'49" E	21.31'
W66	S 49°55'41" E	9.46'
W67	N 59°04'39" E	45.71'
W68	N 54°21'17" W	11.21'
W69	N 36°05'36" E	15.00'
W70	S 54°21'17" E	17.59'
W71	N 59°04'39" E	41.41'
W72	N 00°10'49" W	27.62'
W73	N 90°00'00" W	16.33'
W74	N 00°00'00" W	15.00'
W75	N 90°00'00" E	16.28'
W76	S 89°49'11" W	4.27'
W77	N 00°10'49" W	15.00'
W78	N 89°49'11" E	4.27'
W79	N 00°10'49" W	7.63'
W80	S 89°49'11" W	45.35'
W81	S 66°45'40" W	15.68'
W82	N 23°14'20" W	15.00'
W83	N 66°45'40" E	18.74'
W84	N 89°49'11" E	48.41'
W85	N 00°10'49" W	49.47'
W86	N 45°10'49" W	53.45'
W87	N 00°33'53" W	137.88'
W88	N 44°26'07" E	55.13'
W89	N 00°10'49" W	91.15'
W90	S 89°29'20" W	23.49'
W91	N 00°10'49" W	15.00'
W92	N 89°29'20" E	23.49'
W93	N 00°10'49" W	9.49'

LEGEND

△	CALCULATED POINT
●	1/2" IRON ROD FOUND (UNLESS NOTED OTHERWISE)
◎	5/8" IRON ROD SET WITH CAP STAMPED "TNP"
(CM)	CONTROLLING MONUMENT
IRF	IRON ROD FOUND
CIRF	CAPPED IRON ROD FOUND
FCP	FENCE CORNER POST
FND.	FOUND
TxDOT	CAP STAMPED "TXDOT SURVEY MARKER RIGHT OF WAY MONUMENT"
D.R.D.C.T.	DEED RECORDS DENTON COUNTY TEXAS
P.R.D.C.T.	PLAT RECORDS DENTON COUNTY TEXAS
O.R.D.C.T.	OFFICIAL RECORDS DENTON COUNTY TEXAS
R.P.R.D.C.T.	REAL PROPERTY RECORDS DENTON COUNTY TEXAS
	PLAT BOUNDARY LINE
	RIGHT-OF-WAY LINE
	PROPERTY LINE
	EASEMENT LINE



VICINITY MAP
NOT TO SCALE

SURVEYOR

TEAGUE NALL & PERKINS
3200 S. Interstate 35E, Suite 1129
Denton, Texas 76210
PH: 940-383-4177
tturner@tnpinc.com
T.B.P.L.S. Firm No. 10011601

OWNER/DEVELOPER

AUBREY INDEPENDENT
SCHOOL DISTRICT
415 Tisdell Lane
Aubrey, Texas
PH: 940-668-0060
FAX: 940-3365-2627

FINAL PLAT

LOT 1, BLOCK A
AUBREY HIGH SCHOOL ADDITION

BEING 63.613 ACRES OF LAND
SITUATED IN THE FRANCISCO TREVINO SURVEY, ABSTRACT NO. 1243

An addition to the City of Aubrey, Denton County, Texas
AUGUST 2024

PAGE 1 OF 2

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OWNER'S CERTIFICATE

STATE OF TEXAS §
COUNTY OF DENTON §

WHEREAS AUBREY INDEPENDENT SCHOOL DISTRICT, is the owner of a 63.613 acre tract of land situated in the Francisco Trevino Survey, Abstract No. 1243, City of Aubrey, Denton County, Texas, and being known as all of those certain tracts of land conveyed to Aubrey Independent School District (AISD) by Deeds recorded in Document No. 1993-35814, Document No. 1997-57860 and Document No. 1997-57861 of the Real Property Records of Denton County, Texas, and Document No. 2022-113594, Document No. 2022-116124, Document No. 2022-171175, Document No. 2023-28514 and Document No. 2024-5822 of the Official Records of Denton County, Texas, and being more particularly described as follows:

BEGINNING at a 5/8 inch iron rod with cap stamped "TNP" set for the most Westerly Northwest corner of that certain 48.3767 acre tract of land described in the above cited Deed recorded in Document No. 1993-35814 and the Northeast corner of Lot 1, Block A per the Final Plat of Prator Addition, as recorded in Document No. 2010-39 of the Plat Records of Denton County, Texas, said point also being in a flare in the East line of U.S. Highway 377, a variable width right-of-way;

THENCE North 57°14'03" East along said flare in the East line of said U.S. Highway 377, for a distance of 13.07 feet to a point in the West line of a called 0.101 acre tract of land described as Parcel P00024495 in a Deed to the State of Texas, as recorded in Document No. 2023-98442 of the Official Records of Denton County, Texas, from which a 1/2 inch iron rod found for the most Westerly Northwest of said Parcel P00024495 bears North 06°16'14" East a distance of 0.52 feet;

THENCE South 06°16'14" West along the West line of said Parcel P00024495, for a distance of 0.66 feet to a 5/8 inch iron rod with cap stamped "TxDOT Survey Marker Right of Way Monument" found for the Southwest corner of said Parcel P00024495;

THENCE North 86°30'16" East along the South line of said U.S. Highway No. 377 and said Parcel P00024495, for a distance of 33.25 feet to a 5/8 inch iron rod found for an angle point;

THENCE South 89°34'24" East continuing along the South line of said U.S. Highway No. 377 and said Parcel P00024495, for a distance of 114.58 feet to a 5/8 inch iron rod with cap stamped "TxDOT Survey Marker Right of Way Monument" found for an angle point;

THENCE North 82°58'24" East continuing along the South line of said U.S. Highway No. 377 and said Parcel P00024495, for a distance of 78.50 feet to a 5/8 inch iron rod with cap stamped "TxDOT Survey Marker Right of Way Monument" found for the beginning of a non-tangent curve to the left;

THENCE in an Easterly direction, continuing along the South line of said U.S. Highway No. 377 and said Parcel P00024495, and along said non-tangent curve to the left having a central angle of 00°54'54", a radius of 1085.00 feet, a chord bearing of North 86°00'52" East, a chord distance of 17.33 feet and an arc length of 17.33 feet to a 5/8 inch iron rod with cap stamped "TxDOT Survey Marker Right of Way Monument" found for the beginning of a reverse curve to the right;

THENCE in an Easterly direction, continuing along the South line of said U.S. Highway No. 377 and said Parcel P00024495, and along said reverse curve to the right having a central angle of 03°06'15", a radius of 993.00 feet, a chord bearing of North 86°52'10" East, a chord distance of 53.79 feet and an arc length of 53.80 feet to a 5/8 inch iron rod with cap stamped "TxDOT Survey Marker Right of Way Monument" found for the end of said curve, same being the Southeast corner of said Parcel P00024495;

THENCE North 02°25'44" West along the East line of said Parcel P00024495, for a distance of 6.27 feet to a point in the South line of F.M. Highway No. 428, an 80' wide right-of-way, from which a 5/8 inch iron rod with cap stamped "TxDOT Survey Marker Right of Way Monument" found for the Northeast corner of said Parcel P00024495 bears North 02°25'44" West a distance of 0.41 feet;

THENCE North 89°57'50" East along the South line of said F.M. Highway No. 428, for a distance of 827.33 feet to a 5/8 inch iron rod with cap stamped "TNP" set for the Northeast corner of said 48.3767 acre tract, same being the Northwest corner of Lot 1, Block C per the Final Plat of Neubauer Ranch Addition, Phase 2, as recorded in Document No. 2017-492 of the Plat Records of Denton County, Texas, from which a 5/8 inch iron rod capped "Cox 4577" found for the Northeast corner of said Lot 1 bears North 89°57'50" East a distance of 218.00 feet;

THENCE South 00°03'45" West along the East line of said 48.3767 acre tract and the West line of said Lot 1, passing a 5/8 inch iron rod capped "Cox 4577" found for the Southwest corner of said Lot 1 and the Northwest corner of Lot 6, Block B per the Final Plat of Neubauer Ranch Addition, Phase 1, as recorded in Document No. 2017-385 of the Plat Records of Denton County, Texas, at a distance of 299.70 feet, and continuing along the East line of said 48.3767 acre tract and the West line of said Block B, passing a 5/8 inch iron rod capped "Cox 4577" found for the common West corner of Lots 4 and 5, Block B, per said Plat of Neubauer Ranch Addition, Phase 1, at a distance of 677.16 feet, and continuing along the East line of said AISD tract and the West line of said Block B, for a total distance of 1005.53 feet to a 1/2 inch square tube found for the Southwest corner of said Block B and the Northwest corner of that certain 6.250 acre tract of land described in the above cited Deed to Aubrey Independent School District, as recorded in Document No. 2023-28514;

THENCE North 87°25'24" East along the North line of said 6.250 acre tract and the South line of said Lot 4, for a distance of 221.47 feet to a 1/2 inch square tube found for an angle point;

THENCE North 87°34'14" East continuing along the North line of said 6.250 acre tract and the South line of said Lot 4, for a distance of 59.80 feet to a 5/8 inch iron rod with cap stamped "TNP" found for the Northeast corner of said 6.250 acre tract, from which a 5/8 inch iron rod capped "Cox 4577" found for the Southeast corner of said Lot 4 bears North 87°34'14" East a distance of 140.80 feet;

THENCE South 00°03'45" West along the East line of said 6.250 acre tract, for a distance of 973.21 feet to a 5/8 inch iron rod with cap stamped "TNP" found for the Southeast corner of said 6.250 acre tract, same being in the North line of a called 22.79 acre tract described in a Deed to Weldon Wilson and wife, Teresa Ann Wilson and Garland Wilson and Terri Wilson, as recorded in Document No. 2022-100361 of the Official Records of Denton County, Texas, from which a 1/2 inch iron rod capped "Metroplex RPLS 1849" found for the Southeast corner of that certain 25.018 acre tract of land described as Tract I in a Deed to Steven Kenley and wife, Kristin Kenley, as recorded in Document No. 2013-605 of the Official Records of Denton County, Texas, bears North 89°04'25" East a distance of 828.42 feet;

THENCE South 89°04'25" West along the South line of said 6.250 acre tract and the North line of said 22.79 acre tract, for a distance of 117.63 feet to a 5/8 inch iron rod with cap stamped "TNP" found for an angle point, same being the Northwest corner of said 22.79 acre tract and the Northeast corner of Lot 4R2, Block A per the Replat of Garland Wilson Addition, as recorded in Document No. 2020-387 of the Plat Records of Denton County, Texas, from which a 1/2 inch iron rod found for the Southeast corner of said Lot 4R2 bears South 00°04'37" West a distance of 491.79 feet;

THENCE South 89°30'45" West along the South line of said 6.250 acre tract and the North line of said Lot 4R2, for a distance of 163.38 feet to a 1/2 inch iron rod capped "Metroplex 10023300" found for the Southwest corner of said 6.250 acre tract and the Southeast corner of said 48.3767 acre tract, same being the common North corner of said Lot 4R2 and Lot 6, Block A, per the Final Plat of Garland Wilson Addition, as recorded in Document No. 2014-47 of the Plat Records of Denton County, Texas, from which a 1/2 inch iron rod capped "Metroplex RPLS 1849" found for an interior ell corner of said Lot 4R2 bears South 00°17'28" West a distance of 221.18 feet;

THENCE South 89°22'58" West along the South line of said 48.3767 acre tract and the North line of said Lot 6, passing a 5/8 inch iron rod with cap stamped "TNP" set for the Southwest corner of said 48.3767 acre tract and the Southeast corner of that certain 4.044 acre tract described in the above cited Deed to Aubrey Independent School District recorded in Document No. 2022-113584 at a distance of 1064.98 feet, and continuing along the South line of said 4.044 acre tract and the North line of said Lot 6, passing a 5/8 inch iron rod capped "PLS Inc" found for the Southwest corner of said 4.044 acre tract and the Southeast corner of that certain 2.000 acre tract described in the above Deed to Aubrey Independent School District recorded in Document No. 2022-116124 at a distance of 1533.87 feet, and continuing along the South line of said 2.000 acre tract and the North line of said Lot 6, passing a 1/2 iron rod capped "Metroplex 1849" found for the Northwest corner of said Lot 6 and the Northeast corner of Lot 7R, Block A per Replat of Garland Wilson Addition, as recorded in Document No. 2016-2178 of the Plat Records of Denton County, Texas, at a distance of 1702.25 feet, and continuing along the South line of said 2.000 acre tract and the North line of said Lot 7R, for a total distance of 1708.00 feet to a point for the Southwest corner of said 2.000 acre tract and the Southeast corner of that certain 3.751 acre tract of land described in a Deed to Brookshire Grocery Company, as recorded in Document No. 2023-109743 of the Official Records of Denton County, Texas, from which a 1/2 inch iron rod found for reference bears South 08°07'36" West a distance of 1.16 feet, and a 1/2 inch iron rod found for the Southwest corner of said 3.751 acre tract and the Northwest corner of Lot 9R, Block A per said Replat bears South 89°22'58" West a distance of 369.92 feet;

THENCE North 05°49'31" East along the West line of said 2.000 acre tract and the East line of said 3.751 acre tract, passing a 1/2 inch iron rod found for the Northeast corner of said 3.751 acre tract and the Southeast corner of that certain 0.331 acre tract of land described in a Deed to Paul Redfearn, as recorded in Document No. 2017-394948 of the Official Records of Denton County, Texas, at a distance of 464.76 feet, and continuing along the West line of said 2.000 acre tract and the East line of said 0.331 acre tract for a total distance of 512.54 feet to a 5/8 inch iron rod capped "PLS Inc" found for the Northwest corner of said 2.000 acre tract and the most Southerly Northeast corner of said 0.331 acre tract, same being in the South line of that certain 0.472 acre tract of land described in a Deed to Bret Gulch and spouse, Donna Gulch, as recorded in Document No. 2019-46189 of the Official Records of Denton County, Texas;

THENCE South 85°07'29" East along the North line of said 2.000 acre tract and the South line of said 0.472 acre tract, for a distance of 219.89 feet to a 1/2 inch iron rod found for the Northeast corner of said 2.000 acre tract and the Southeast corner of said 0.472 acre tract, same being in the West line of that certain 1.73 acre tract described as Tract 1 in said Deed to Aubrey Independent School District recorded in Document No. 2024-5822, from which a 5/8 inch iron rod capped "PLS Inc" found for the Southwest corner of said 1.73 acre tract and the most Northerly Southeast corner of said 2.000 acre tract bears South 04°58'43" West a distance of 109.85 feet;

THENCE North 04°58'43" East along the West line of said 1.73 acre tract and the East line of said 0.472 acre tract, for a distance of 84.20 feet to a 1/2" inch iron rod found for the Northwest corner of said 1.73 acre tract and the Northeast corner of said 0.472 acre tract, from which a 1/2 inch iron rod found for the Southwest corner of Lot 1, Block C per the Minor Plat of Pine Ridge Addition, Phase II, as recorded in Document No. 2015-200 of the Plat Records of Denton County, Texas, bears North 85°21'19" West a distance of 37.21 feet;

THENCE North 89°47'11" East along the North line of said 1.73 acre tract, for a distance of 12.73 feet to a 1/2 inch iron rod found for the Southwest corner of that certain 0.009 acre tract of land described as Tract 2 in said Deed to Aubrey Independent School District recorded in Document No. 2024-5822;

THENCE North 02°08'04" East along the West line of said 0.009 acre tract, for a distance of 3.47 feet to a 1/2 inch iron rod found for the Northwest corner of said 0.009 acre tract, same being the Southwest corner of Lot 1, Block B per the Final Plat of Pine Ridge Addition, Phase I, as recorded in Cabinet Q, Page 317 of the Plat Records of Denton County, Texas;

THENCE South 89°16'34" East along the North line of said 0.009 acre tract and the South line of said Lot 1, passing a 1/2 inch iron rod found for the common South corner of said Lot 1 and Lot 2 at a distance of 110.71 feet, and continuing along the North line of said 0.009 acre tract and the South line of said Lot 2, for a total distance of 214.25 feet to a 1/2 inch iron rod found for the Southeast corner of said Lot 2, the East corner of said 0.009 acre tract, and the Southwest corner of that certain 0.652 acre tract of land described in a Deed to Alvin F. Lantrip and wife, Bessie J. Lantrip, as recorded in Volume 5192, Page 1434 of the Real Property Records of Denton County, Texas;

THENCE North 89°39'49" East along the South line of said 0.652 acre tract and the North line of said 1.73 acre tract, for a distance of 150.60 feet to a 5/8 inch iron rod with cap stamped "TNP" set for the Northeast corner of said 1.73 acre tract and the Southeast corner of said 0.652 acre tract, same being in the West line of said 48.3767 acre tract, from which a 5/8 inch iron rod capped "PLS Inc" found for the Southeast corner of said 1.73 acre tract and the Northeast corner of said 4.044 acre tract bears South 00°58'53" West a distance of 196.89 feet;

THENCE North 00°58'53" East along the West line of said 48.3767 acre tract and the East line of said 0.652 acre tract, for a distance of 186.54 feet to a 5/8 inch iron rod with cap stamped "TNP" set for the Northeast corner of said 0.652 acre tract, same being the Southeast corner of that certain 0.17 acre tract described in said Deed to Aubrey Independent School District recorded in Document No. 1997-57861;

THENCE North 89°15'50" West along the South line of said 0.17 acre tract and the North line of said 0.652 acre tract, passing a 1/2 inch iron rod found for the Northwest corner of said 0.652 acre tract, the Southwest corner of said 0.17 acre tract and the Southeast corner of that certain 0.74 acre tract described in said Deed to Aubrey Independent School District recorded in Document No. 1997-57860 at a distance of 150.24 feet, and continuing along the South line of said 0.74 acre tract passing a 5/8 inch iron rod with cap stamped "TxDOT Survey Marker Right of Way Monument" found for the Northeast corner of a called 0.079 acre tract described as Parcel P00024505 in a Deed to the State of Texas, as recorded in Document No. 2023-81175 of the Official Records of Denton County, Texas, at a distance of 754.81 feet, and continuing along the South line of said 0.74 acre tract and the North line of said Parcel P00024505, for a total distance of 806.77 feet to a 1/2 inch iron rod found for the Southwest corner of said 0.74 acre tract and the Northwest corner of said Parcel P00024505, and being in the East line of said U.S. Highway 377;

THENCE in a Northeasterly direction, along the East line of said U.S. Highway 377, and along a non-tangent curve to the right having a central angle of 00°49'15", a radius of 3759.83 feet, a chord bearing of North 22°34'51" East, a chord distance of 53.87 feet and an arc length of 53.87 feet to a 5/8 inch iron rod with cap stamped "TNP" set for the Northwest corner of said 0.74 acre tract, said point also being the Southwest corner of a called 0.092 acre tract of land described as Parcel P00024503 in a Deed to the State of Texas, as recorded in Document No. 2023-119941 of the Official Records of Denton County, Texas;

THENCE South 89°15'50" East departing the East line of said U.S. Highway 377, and along the North line of said 0.74 acre tract and the South line of said Parcel P00024503, passing a 5/8 inch iron rod with cap stamped "TxDOT Survey Marker Right of Way Monument" found for the Southeast corner of said Parcel P00024503 at a distance of 77.61 feet, and continuing along the North line of said 0.74 tract for a total distance of 636.77 feet to a 1/2 inch iron rod found for the Northeast corner of said 0.74 tract, the Southwest corner of that certain 0.397 acre tract of land described in said Deed to Aubrey Independent School District recorded in Document No. 2022-171175, and the Northwest corner of said 0.17 acre tract, from which a 1/2 inch iron rod capped "RPLS 3693" found for the Northeast corner of said 0.17 acre tract and the Southeast corner of said 0.397 acre tract bears South 89°15'50" East a distance of 150.17 feet;

THENCE North 00°30'52" East along the West line of said 0.397 acre tract and the East line of Lot 3, Block A per said Final Plat of Pine Ridge Addition, Phase I, for a distance of 116.12 feet to a 1/2 inch iron rod found for the Northwest corner of said 0.397 acre tract and the Northeast corner of said Lot 3, same being in the South line of that certain 0.84 acre tract of land described as Tract Four in a Deed to Lonnie Ray Prator, as recorded in Document No. 1996-47827 of the Real Property Records of Denton County, Texas;

THENCE South 88°50'00" East along the North line of said 0.397 acre tract and the South line of said 0.84 acre tract, passing a 1/2 inch iron rod capped "RPLS 3693" found at a distance of 150.11 feet, and continuing along said lines for a total distance of 151.11 feet to the Northeast corner of said 0.397 acre tract and the Southeast corner of said 0.84 acre tract, same being in the West line of said 48.3767 acre tract;

THENCE North 00°33'16" East along the West line of said 48.3767 acre tract and the East line of said 0.84 tract, part way, for a distance of 351.27 feet to a steel fence corner post found for the Northeast corner of that certain 5.334 acre tract of land described in a Deed to Margaret Earlene Prator, as recorded in Document No. 2017-42832 of the Official Records of Denton County, Texas and the Southeast corner of that certain 5.000 acre tract of land described in a Deed to Neely Hardin and wife, Jimmie Pearl Hardin, as recorded in Volume 832, Page 577 of the Deed Records of Denton County, Texas;

THENCE North 00°46'55" East continuing along the West line of said 48.3767 acre tract and the East line of said 5.000 acre tract, for a distance of 321.76 feet to a steel fence corner post found for the Northeast corner of said 5.000 acre tract and an interior ell corner of said 48.3767 acre tract;

THENCE North 87°16'02" West along the North line of said 5.000 acre tract and an interior South line of said 48.3767 acre tract, for a distance of 102.11 feet to a 1/2 inch iron rod found for the most Northerly Southwest corner of said 48.3767 acre tract and the Southeast corner of Lot 3, Block A per the above cited Final Plat of Prator Addition;

THENCE North 01°12'37" East along the West line of said 48.3767 acre tract and the East line of said Lot 3, passing a 1/2 inch iron rod capped "Metroplex 1849" found for the common East corner of said Lots 1 and 3 at a distance of 101.57 feet, and continuing along the West line of said 48.3767 acre tract and the East line of said Lot 1, for a total distance of 353.79 feet to the **POINT OF BEGINNING**, and containing 63.613 acres of land, more or less.

NOW, THEREFORE, KNOW ALL MEN BY THESE PRESENTS:

THAT **AUBREY INDEPENDENT SCHOOL DISTRICT** acting herein by and through its duly authorized officers, does hereby adopt this plat designating the hereinabove described property as **LOT 1, BLOCK A, AUBREY HIGH SCHOOL ADDITION**, an addition to the City of Aubrey, Texas, and does hereby dedicate, in fee simple, to the public use forever, the streets and alleys shown thereon. The streets and alleys are dedicated for street purposes. The easements and public use areas, as shown, are dedicated for the public use forever, for the purposes indicated on this plat. In addition, utility easements may also be used for the mutual use and accommodation of all public utilities desiring to use or using the same unless the easement limits the use to particular utilities, said use by public utilities being subordinate to the public's and City of Aubrey's use thereof. The City of Aubrey and public utility entities shall have the right to remove and keep removed all or parts of any buildings, fences, trees, shrubs, or other improvements or growths which may in any way endanger or interfere with the construction, maintenance, or efficiency of their respective systems in said easements. The City of Aubrey and public utility entities shall at all times have the full right of ingress and egress to or from their respective easements for the purpose of constructing, reconstructing, inspecting, patrolling, maintaining, reading meters, and adding to or removing all or parts of their respective systems without the necessity at any time of procuring permission from anyone.

That the undersigned does hereby covenant and agree that he (they) shall construct upon the fire lane easements, as dedicated and shown hereon, a hard surface and that he (they) shall maintain the same in a state of good repair at all times and keep the same free and clear of any structures, fences, trees, shrubs, or other improvements or obstruction, including but not limited to the parking of motor vehicles, trailers, boats, or other impediments to the access of fire apparatus. The maintenance of paving on the fire lane easements is the responsibility of the owner, and the owner shall post and maintain appropriate signs in conspicuous places along such fire lanes, stating "Fire Lane, No Parking." The police or his duly authorized representative is hereby authorized to cause such fire lanes and utility easements to be maintained free and unobstructed at all times for Fire Department and emergency use

AUBREY INDEPENDENT SCHOOL DISTRICT

BY: _____ DATE: _____
Authorized signature

STATE OF TEXAS §
COUNTY OF DENTON §

BEFORE ME, the undersigned authority, on this day personally appeared _____, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that they executed the same for the purpose and considerations therein expressed and in the capacity therein stated.

WITNESS MY HAND AND SEAL OF OFFICE, this the _____ day of _____, 20___.

_____
Notary Public

My commission expires on _____.

SURVEYOR'S CERTIFICATE

I, Todd B. Turner, Registered Professional Land Surveyor, State of Texas, do hereby certify that I prepared this plat from an actual survey of the land and that the corner monuments shown hereon were found or set as described, and that this plat correctly represents the survey made by me or under my direct supervision was prepared in accordance with the Platting Rules and Regulations of the City of Aubrey, Texas.

PRELIMINARY, THIS DOCUMENT IS FOR REVIEW PURPOSES ONLY AND SHALL NOT BE USED OR VIEWED OR RELIED UPON AS A FINAL SURVEY DOCUMENT. TBPELS. RULE §138.33 (e)

THIS DOCUMENT WAS RELEASED ON AUGUST 5, 2024 FOR REVIEW PURPOSES ONLY. BY TODD B. TURNER, RPLS NO. 4859. THIS DOCUMENT SHALL NOT BE RECORDED FOR ANY PURPOSE. TEXAS BOARD OF PROFESSIONAL ENGINEERS AND LAND SURVEYORS RULE §138.33 (e).

_____
Todd B. Turner, R.P.L.S.
Texas Registration Number 4859

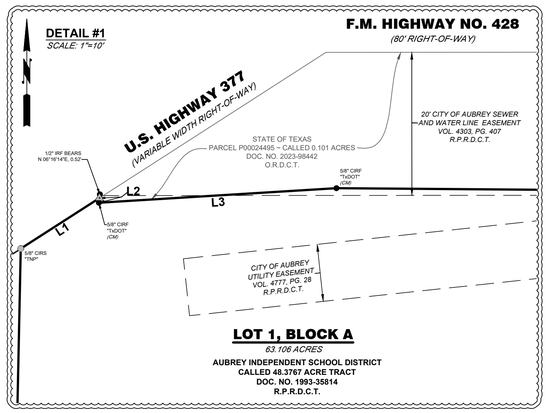
STATE OF TEXAS §
COUNTY OF DENTON §

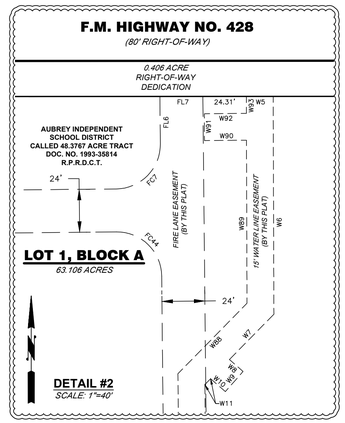
BEFORE ME, the undersigned authority, on this day personally appeared Todd B. Turner, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that they executed the same for the purpose and considerations therein expressed and in the capacity therein stated.

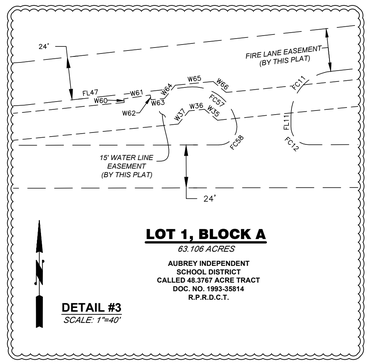
WITNESS MY HAND AND SEAL OF OFFICE, this the _____ day of _____, 20___.

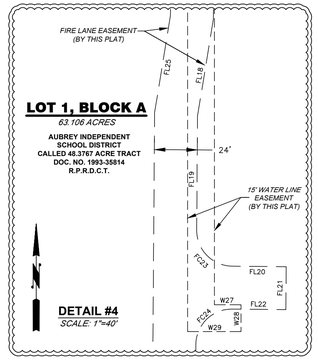
_____
Notary Public

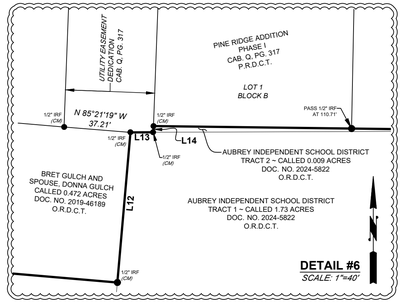
My commission expires on April 4, 2026.

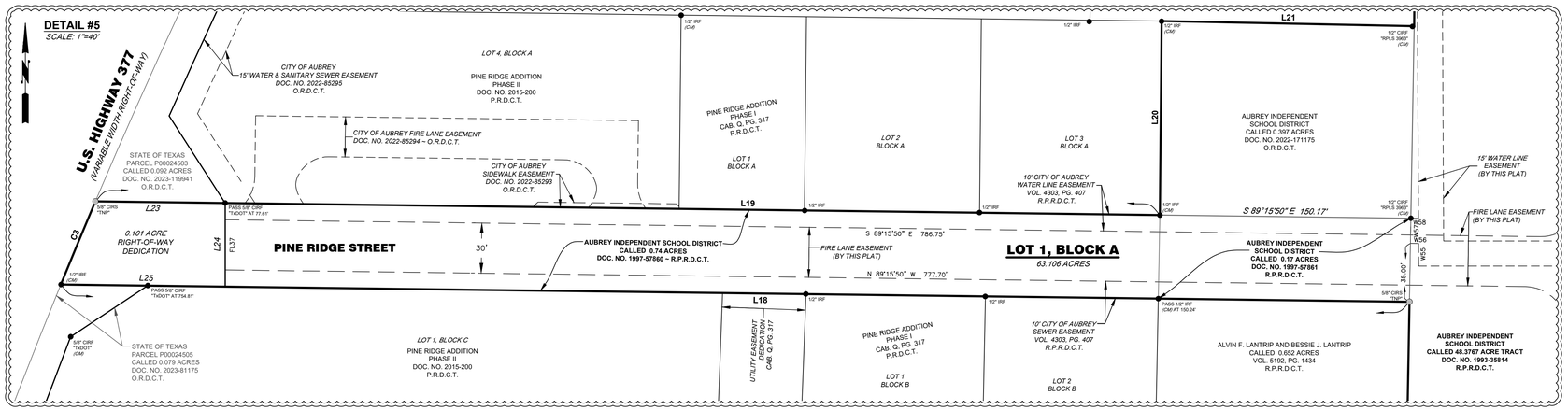












PLAT NOTES:

1. All Lot corners, angle points, PC's and PT's are marked with a 5/8 inch iron rod with cap stamped "TNP" set, unless otherwise noted.
2. Bearings of lines shown hereon are referenced to Grid North of the Texas Coordinate System of 1983 (North Central Zone No. 4202, NAD83 (2011) Epoch 2010), as derived locally from RTK Network continuously operating reference stations (CORS) via real time kinematic (RTK) survey methods. The distances shown hereon represent surface values using a surface adjustment factor of 1.000150630 to scale from grid to surface. The coordinate values shown hereon represent grid values.
3. This property lies within ZONE X (UNSHADED) as determined by the approximate location of ditch centerline and City of Denton GIS contours, as scaled and graphically plotted on FEMA Flood Insurance Rate Map, Community Panel No. 48121C0265G, Map Revision Date April 18, 2011. ZONE X (UNSHADED) - Other Areas is defined as areas determined to be outside the 0.2% annual chance flood plain.
4. This Plat was prepared without the benefit of a current Title Commitment, or Encumbrance Report. Additional easements, rights-of-way and/or other matters of record may affect this tract that are not shown hereon.
5. Utility Services such as electrical, gas, telephone and cable television utility lines, including lateral or service distribution lines, and wires to be placed underground. Feeder and other major transmission lines may remain overhead within the appropriate Easements. There shall be provided at Street intersections underground conduits as approved by the City Engineer for utility public road Right-of-Way crossings. There shall be no other utility road crossings except as authorized by the Director of Public Works or City Engineer. No utilities except those of the city may be installed in the rights-of-way of public roads except as provided in the City's regulations governing Management of Public Rights-of-Way.
6. Water and Wastewater Facility Design shall comply with the following standards:
   a. Applicable regulations of the Texas Commission on Environmental Quality (TCEQ).
   b. Standards in the City's Design Standards.
   c. Fire protection and suppression standards in accordance with the City's policies and ordinances including Fire Code adopted by the City.
7. This tract is subject to City of Aubrey Sewer & Water line easements per document recorded in Vol. 4303, Pg. 407. Parts of this document are not legible and therefore some of the easements are not plottable.

CERTIFICATE OF APPROVAL

Approved this _____ day of _____, _____ by the City Council of the City of Aubrey, Texas.

_____
Mayor

_____
City Secretary or City Manager

SURVEYOR

TEAGUE NALL & PERKINS
3200 S. Interstate 35E, Suite 1129
Denton, Texas 76210
PH: 940-383-4177
tturner@tnpinc.com
T.B.P.L.S. Firm No. 10011601

OWNER/DEVELOPER

AUBREY INDEPENDENT SCHOOL DISTRICT
415 Tisdell Lane
Aubrey, Texas
PH: 940-668-0060
FAX: 940-3365-2627

FINAL PLAT

LOT 1, BLOCK A
AUBREY HIGH SCHOOL ADDITION

BEING 63.613 ACRES OF LAND
SITUATED IN THE FRANCISCO TREVINO SURVEY, ABSTRACT NO. 1243

An addition to the City of Aubrey, Denton County, Texas
JULY 2024

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Case Report –Preliminary Plat Application – Highpointe Commercial
Planning and Zoning Commission – August 8, 2024
City Council – August 22, 2024

To: Mayor, City Council, Planning and Zoning Commission

From: Helen-Eve Beadle, AICP, HE Planning+Design, LLC

Request: Consider and action on a Preliminary Plat application for Lots 1-13, Block A, Highpointe Commercial, being approximately 27.243 acres out of the Francisco Trevino Survey, Abstract 1243 generally located north of FM 428 (Spring Hill Road) and east of U.S. Highway 377, City of Aubrey, Denton County, Texas.

Owner:	Highpointe Corner, LLC
Engineer:	Kimley Horn (Matthew Lucas, PE)
Application Date:	July 10, 2024
Location:	The property is generally located south of FM 428 (Spring Hill Road) and east of U.S. Highway 377
Zoning:	Planned Development District-Shopping Center (PD-SC)
Future Land Use Plan:	Neighborhood Commercial
Current Use:	Undeveloped

Analysis:

Highpointe Ranch is a master planned community located at the northeast corner of US Highway 377 and FM 428 (Spring Hill Road). The property was zoned as a Planned Development District (PD) in September of 2023 and this portion of the overall development is zoned for Shopping Center (SC) uses and development regulations.

The applicant has submitted a Preliminary Plat illustrating 13 commercial lots and associated right-of-way dedication and easements to serve the properties. Floodplain exists on the property and the applicant's engineer and City Engineer are working through studies and required permits prior to a Final Plat being filed.

Water and sewer services are being provided by the City of Aubrey.

The site will be served by access points to FM 428/Spring Hill Road and US 377 and fire lane/access easements. Ingress/egress points have been coordinated with TXDOT.

Site Plan approvals will be required for each lot prior to building permits being issued.

The anticipated development includes restaurant and service type pad users along US 377 and FM 428 (Spring Hill Road), a convenience store

at the immediate corner, and an anchor store.

Recommendation:

The Preliminary Plat is recommended for approval subject to the following conditions:

1. The Preliminary Plat and Utility/Grading/Storm Plans are in review and approval are subject to subsequent review comments by the City Planner and City Engineer.

The Planning & Zoning Commission unanimously recommended the Highpointe Commercial Prelimimary Plat for 13 lots at their August 8, 2024 meeting.

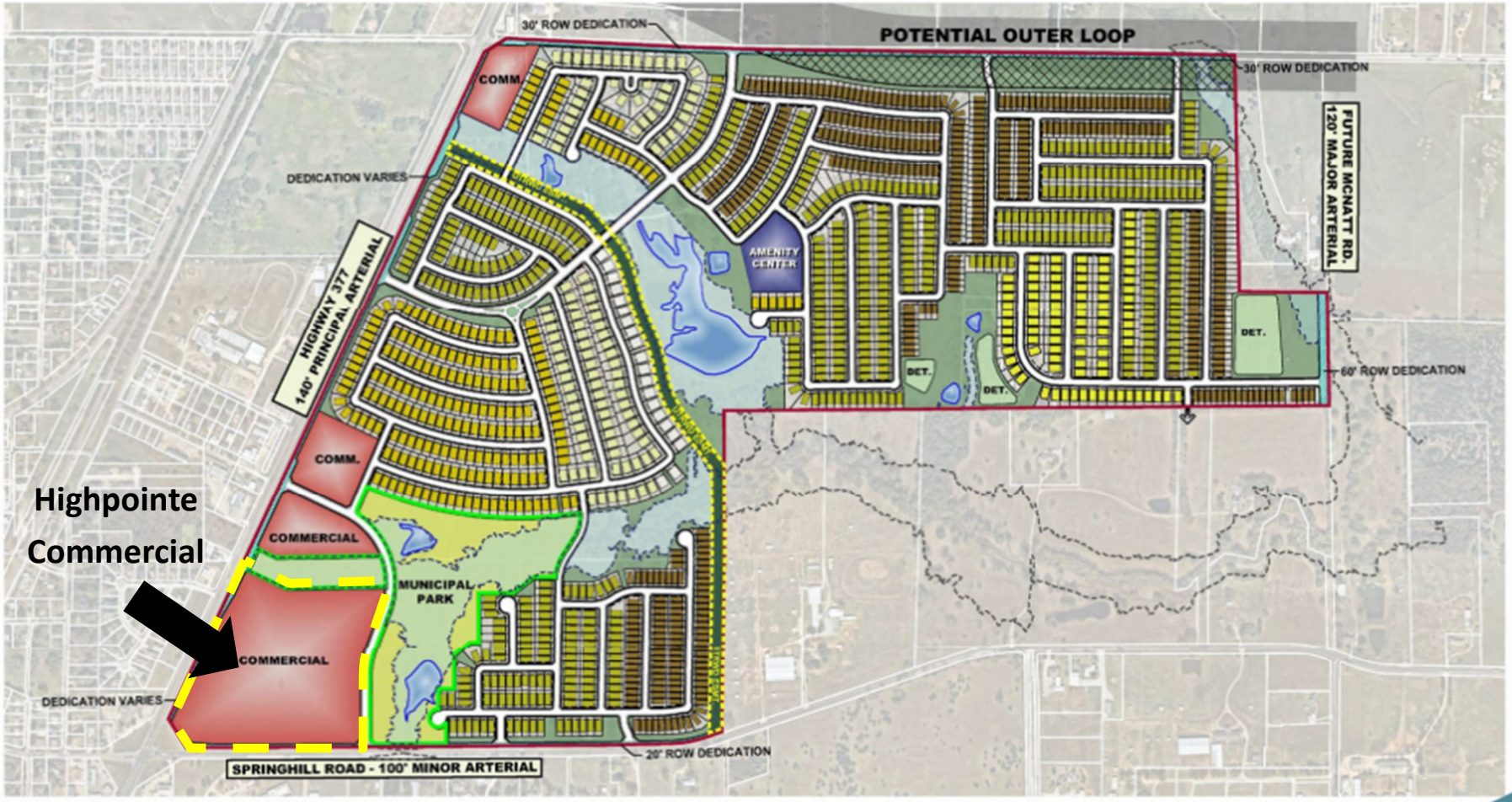
The City Council may:

1. Approve the Preliminary Plat;
2. Approve the Preliminary Plat with conditions; or
3. Deny the Preliminary Plat.

Attachments:

Location Map
HIghpointe Commercial Preliminary Plat and Utility and Drainage Plans

CONCEPT PLAN



Highpointe Ranch

Aubrey Texas
August 2023

Land Use Acreage Summary

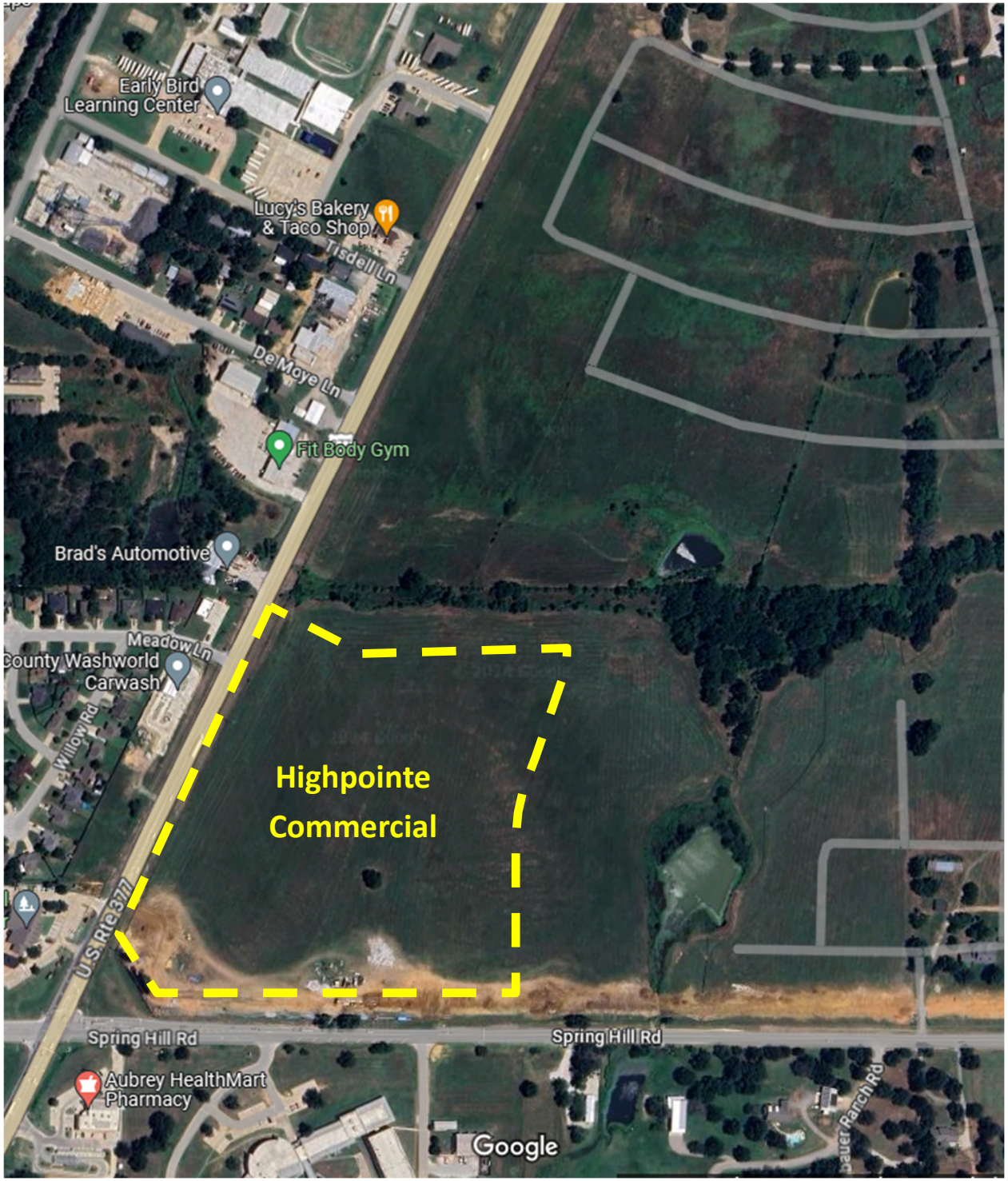
Residential Lots / Residential Rights of Way	297.2	62.3%
Commercial	39.5	8.3%
Right of Way Dedication	9.5	2.0%
Open Space / Floodplain / Detention	82.7	17.3%
Municipal Park	29.8	6.5%
Amenity Center	3.2	0.6%
SPRINGHILL ROAD	8.5	1.8%
Total	468.8	100.0%

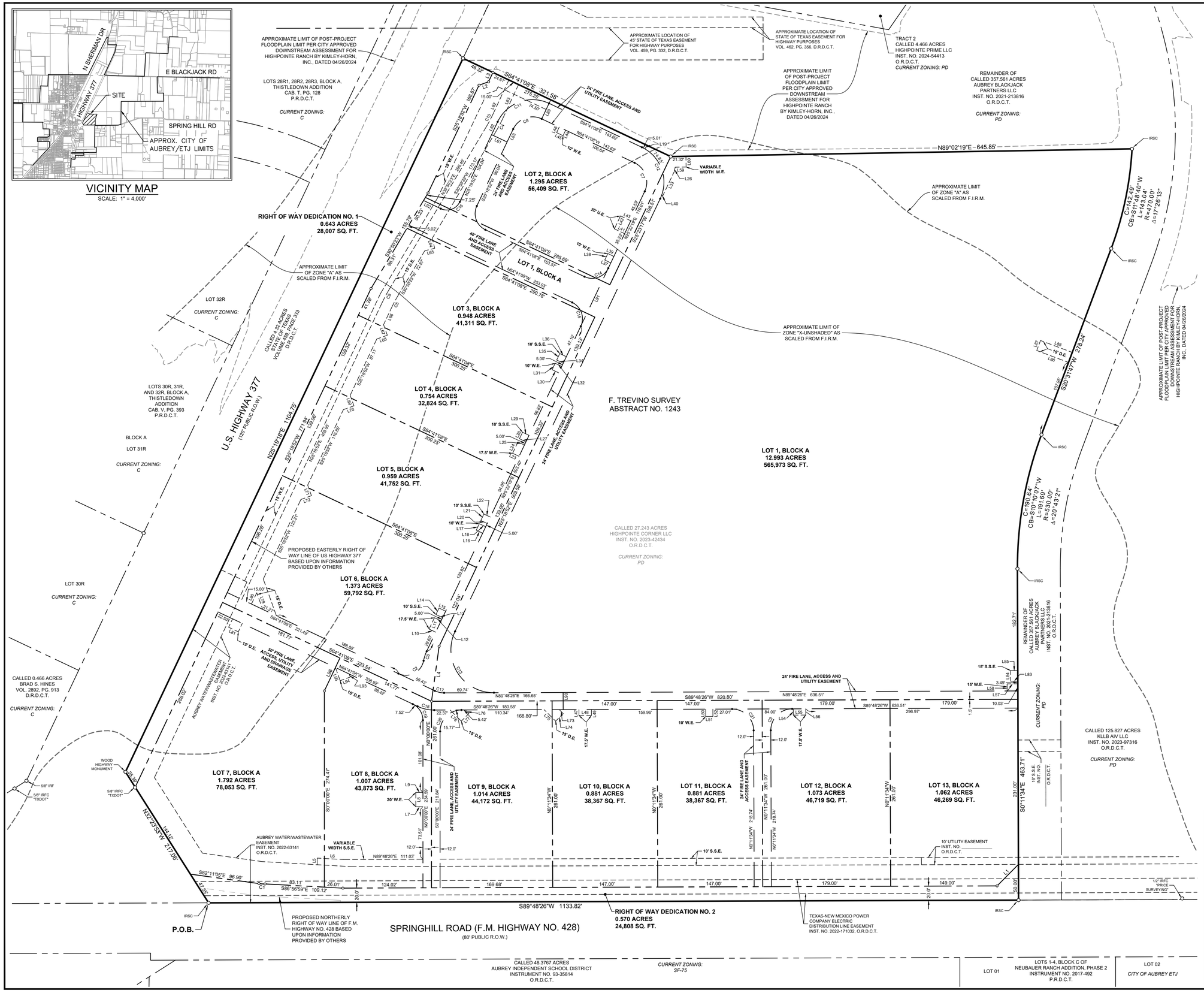
Potential Outer Loop (Over-Far)

Lot Type Summary

50'	444	30.6%
60'	567	39.1%
70'	214	14.5%
80'	92	6.3%
90'	111	7.7%
75'	23	1.4%
Total	1,450	100.0%

Kimley»Horn


Early Bird
Learning Center
Lucy's Bakery
& Taco Shop
Tisdell Ln
De Moye Ln
Fit Body Gym
Brad's Automotive
Meadow Ln
County Washworld
Carwash
Willow Rd
Highpointe
Commercial
U.S. Rte 377
Spring Hill Rd
Spring Hill Rd
Aubrey HealthMart
Pharmacy
Google



VICINITY MAP

SCALE: 1" = 4,000'

Notes :

1. All corners are 5/8" iron rods set with a plastic cap stamped "KHA" unless otherwise noted.
2. Selling a portion of this addition by metes and bounds is a violation of City Ordinance and state law and is subject to fines and withholding of utilities and building permits.
3. All surface drainage easements shall be kept clear of fences, buildings, foundations, plantings and other obstructions to the operation and maintenance of the drainage facility.
4. Blocking the flow of water or constructing improvements in surface drainage easements, and filling or obstructing the floodway is prohibited.
5. The City of Aubrey will not be responsible for any damage, personal injury or loss of life or property occasioned by flooding conditions.
6. The existing creeks or drainage channels traversing along or across the addition will remain as open channels and will be maintained by the individual property owners of the lot or lots that are traversed by or adjacent to the drainage courses along or across the lots.
7. Construction not completed within two years of approval subject to current City of Aubrey Subdivision Rules and Regulations.
8. No construction, without written approval from the City of Aubrey shall be allowed within an identified "FIRM" floodplain area, and then only after a detailed floodplain development permit including engineering plans and studies show that no rise in the Base Flood Elevation (BFE) will result, that no flooding will result, that no obstruction to the natural flow of water will result; and subject to all owners of the property affected by such construction becoming a party to the request. Where construction is permitted, all finish floor elevations shall be a minimum of two foot above the 100-year flood elevation.
9. The City of Aubrey will be responsible for the maintenance of all public infrastructure that is constructed in right-of-way or easements that are dedicated to the public or the City of Aubrey.
10. FLOOD STATEMENT: According to Federal Emergency Management Agency's Flood Insurance Rate Map No. 48121C0265G, for Denton County, Texas and incorporated areas, dated 04/18/2011, this property is located within Zone X (unshaded) defined as "Areas determined to be outside the 0.2% annual chance floodplain" and Zone A defined as "Special flood hazard areas (SFHAs) subject to inundation by the 1% annual chance flood (No Base Flood Elevations determined)". If this site is not within an identified special flood hazard area, this flood statement does not imply that the property and/or the structures thereon will be free from flooding or flood damage. On rare occasions, greater floods can and will occur and flood heights may be increased by man-made or natural causes. This flood statement shall not create liability on the part of the surveyor. Minimum finished floor elevations are at least 2 feet above the 100 year flood plain.
11. Water service to be provided by the City of Aubrey.
12. Sanitary Sewer to be provided by the City of Aubrey.
13. The City of Aubrey shall not be responsible for the maintenance of any private facilities, including but not limited to, HOA or High Pointe Ranch Municipal Utility District No. 1 open space lots, private parks, amenity center(s), development signage and entry features. Maintenance of these facilities shall be the responsibility of either the HOA or High Pointe Ranch Municipal Utility District No. 1, and the HOA and High Pointe Ranch Municipal Utility District No. 1 hold harmless the City of Aubrey, from all claims, damages and loses arising out of or resulting from performance of the obligations said HOA or High Pointe Ranch Municipal Utility District No. 1.
14. All utilities and drainage structures are located in the right-of-way except as shown.
15. All bearings shown are based on grid north of the Texas Coordinate System of 1983, North Central Zone (4202), North American Datum of 1983. All dimensions shown are ground distances. To obtain a grid distance, multiply the ground distance by the Project Combined Factor (PCF) of 0.999855348.
16. Line and Curve table located on Sheet 2.

NORTH

GRAPHIC SCALE IN FEET

60 0 30 60 120

1" = 60' @ 24X36

LEGEND

P.R.D.C.T.	PLAT RECORDS, DENTON COUNTY, TEXAS
R.P.R.D.C.T.	REAL PROPERTY RECORDS, DENTON COUNTY, TEXAS
O.R.D.C.T.	OFFICIAL RECORDS, DENTON COUNTY, TEXAS
P.O.B.	POINT OF BEGINNING
R.O.W.	RIGHT OF WAY
IRFC	CAPPED IRON ROD FOUND
HOA	HOMEOWNER'S ASSOCIATION
B.L.	BUILDING LINE
U.E.	UTILITY EASEMENT
D.E.	DRAINAGE EASEMENT
M.F.F.E.	MINIMUM FINISHED FLOOR ELEVATION

LINE TYPE LEGEND

	BOUNDARY LINE
	EASEMENT LINE
	PHASE LINE
	BUILDING LINE

PRELIMINARY PLAT

HIGHPOINTE COMMERCIAL

27.243 ACRES

LOTS 1 - 13, BLOCK A

13 COMMERCIAL LOTS

F. TREVINO SURVEY, ABSTRACT NO. 1243
CITY OF AUBREY, DENTON COUNTY, TEXAS

Kimley»Horn

6160 Warren Parkway, Suite 210
Frisco, Texas 75034 FIRM # 10193822

Tel. No. (972) 335-3580
Fax No. (972) 335-3779

Scale	Drawn by	Checked by	Date	Project No.	Sheet No.
1" = 60'	CDS	KHA	07/29/2024	063451861	1 OF 2

OWNER:
Highpointe Corner, LLC
2504 Loftsmoor Lane
Plano, Texas 75025
Phone: 214-208-5078
Contact: Bhadresh Trivedi

SURVEYOR:
Kimley-Horn and Associates, Inc.
6160 Warren Pkwy., Suite 210
Frisco, Texas 75034
Phone: 972-335-3580
Contact : Sylviana Gunawan, R.P.L.S.

APPLICANT:
Kimley-Horn and Associates, Inc.
203 W. Nash Street, Suite 100
Terrell, Texas 75160
Phone: 972-770-1300
Contact : Matthew A. Lucas, P.E.

DWG NAME: K:\FRI_SURVEY\064523805-AUBREY PAD DEVELOPMENT\DWG\064523805-PRELIMINARY PLAT.DWG PLOTTED BY GUNAWAN, SYLVIANA 7/29/2024 5:02 PM LAST SAVED 7/29/2024 4:38 PM Copyright © 2024 Kimley-Horn and Associates, Inc. All rights reserved

OWNER'S CERTIFICATE

STATE OF TEXAS §

COUNTY OF DENTON §

WHEREAS HIGHPOINTE CORNER LLC, is the owner of a tract of land situated in the F. Trevino Survey, Abstract No. 1243, Denton County, Texas, and being all of a called 27.243 acre tract of land described in a Special Warranty Deed with Vendor's Lien to Highpointe Corner LLC, as recorded in Instrument No. 2023-42434 of the Official Records of Denton County, Texas, and being more particularly described as follows:

BEGINNING at a 5/8 inch iron rod with plastic cap stamped "KHA" set for the southerly southwest corner of said 27.243 acre tract, common to the south end of a corner clip at the intersection of the northerly right-of-way line of Springhill Road (F.M. Highway No. 428), an 80 foot wide right-of-way, with the easterly right-of-way line of U.S. Highway 377, a 120 foot wide right-of-way;

THENCE North 32°23'53" West, departing the northerly right-of-way line of said Springhill Road, along a southwesterly line of said 27.243 acre tract and said corner clip, a distance of 217.06 feet to a wooden highway monument found for the northerly southwest corner of said 27.243 acre tract, common to the north end of said corner clip, being on the easterly right-of-way line of said U.S. Highway 377;

THENCE North 25°19'18" East, along a westerly line of said 27.243 acre tract and the easterly right-of-way line of said U.S. Highway 377, a distance of 1104.75 feet to a 5/8 inch iron rod with plastic cap stamped "KHA" set for the northwest corner of said 27.243 acre tract;

THENCE South 64°41'08" East, departing the easterly right-of-way line of said U.S. Highway 377 and along the northerly line of said 27.243 acre tract, a distance of 321.58 feet to a 5/8 inch iron rod with plastic cap stamped "KHA" set for corner;

THENCE North 89°02'19" East, continuing along the northerly line of said 27.243 acre tract, a distance of 645.85 feet to a 5/8 inch iron rod with plastic cap stamped "KHA" set for the northeast corner of said 27.243 acre tract, and at the beginning of a non-tangent curve to the right with a radius of 470.00 feet, a central angle of 17°26'13", and a chord bearing and distance of South 11°48'40" West, 142.49 feet;

THENCE along the easterly line of said 27.243 acre tract, the following courses and distances:

In a southwesterly direction, with said non-tangent curve to the right, an arc distance of 143.04 feet to a 5/8 inch iron rod with plastic cap stamped "KHA" set for corner;

South 20°31'47" West, a distance of 278.24 feet to a 5/8 inch iron rod with plastic cap stamped "KHA" set at the beginning of a tangent curve to the left with a radius of 530.00 feet, a central angle of 20°43'21", and a chord bearing and distance of South 10°10'07" West, 190.64 feet;

In a southwesterly direction, with said tangent curve to the left, an arc distance of 191.69 feet to a 5/8 inch iron rod with plastic cap stamped "KHA" set for corner;

South 00°11'34" East, a distance of 463.71 feet to a 5/8 inch iron rod with plastic cap stamped "KHA" set for the southeast corner of said 27.243 acre tract, being on the northerly right-of-way line of said Springhill Road;

THENCE South 89°48'26" West, along the southerly line of said 27.243 acre tract and the northerly right-of-way line of said Springhill Road, a distance of 1,133.82 feet to the **POINT OF BEGINNING** and containing 27.243 (1,186,697 square feet) acres of land, more or less.

OWNER'S CERTIFICATIONS

STATE OF TEXAS §

COUNTY OF DENTON §

NOW, THEREFORE KNOW ALL MEN BY THESE PRESENTS:

THAT **HIGHPOINTE CORNER LLC,** acting herein by and through its duly authorized officer, does hereby adopt this plat designating the hereinabove described property as **Highpointe Commercial**, an addition to the City of Aubrey, Texas, and do hereby dedicate, in fee simple, to the public use forever, the streets and alleys shown thereon. The streets and alleys are dedicated for street purposes. The easements and public use areas, as shown, are dedicated for the public use forever, for the purposes indicated on this plat. In addition, utility easements may also be used for the mutual use and accommodation of all public utilities desiring to use or using the same unless the easement limits the use to particular utilities, said use by public utilities being subordinate to the public's and City of Aubrey's use thereof. The City of Aubrey and public utility entities shall have the right to remove and keep removed all or parts of any buildings, fences, trees, shrubs, or other improvements or growths which may in any way endanger or interfere with the construction, maintenance, or efficiency of their respective systems in said easements. The City of Aubrey and public utility entities shall at all times have the full right of ingress and egress to or from their respective easements for the purpose of constructing, reconstructing, inspecting, patrolling, maintaining, reading meters, and adding to or removing all or parts of their respective systems without the necessity at any time of procuring permission from anyone.

Witness this _____ day of _____, _____.

BY: **HIGHPOINTE CORNER LLC**, a Texas limited liability company

BY: _____

Name: _____

Title: _____

STATE OF TEXAS §

COUNTY OF _____ §

On this _____ day of _____, 2024, before me personally appeared _____ (name of signer), whom I know personally, and acknowledged that he/she executed the same.

_____

Notary Public, State of Texas

SURVEYOR'S CERTIFICATION

KNOW ALL MEN BY THESE PRESENTS:

That I, Sylviana Gunawan, do hereby certify that a survey was made on the ground of the property described hereon under my personal supervision and the iron rods were placed in accordance with the subdivision rules and regulations of the City of Aubrey, Texas.

_____

Sylviana Gunawan
Registered Professional Land Surveyor No. 6461
Kimley-Horn and Associates, Inc.
6160 Warren Pkwy., Suite 210
Frisco, Texas 75034
Phone 972-335-3580

PRELIMINARY

THIS DOCUMENT SHALL NOT BE RECORDED FOR ANY PURPOSE AND SHALL NOT BE USED OR VIEWED OR RELIED UPON AS A FINAL SURVEY DOCUMENT

STATE OF TEXAS §

COUNTY OF COLLIN §

BEFORE ME, the undersigned, a Notary Public in and for The State of Texas, on this day personally appeared Sylviana Gunawan, known to me to be the person and officer whose name is subscribed to the foregoing instrument, and acknowledged to me that she executed the same for the purposes and considerations therein expressed and in the capacity therein stated.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this the _____ day of _____, _____.

_____

Notary Public, State of Texas

CERTIFICATE OF FINAL PLAT APPROVAL

This Preliminary Plat was reviewed and approved by the City Council of the City of Aubrey, Texas the _____ day of _____, 20____.

_____

CHRIS RICH, MAYOR
CITY OF AUBREY, TEXAS

LINE TABLE			LINE TABLE			LINE TABLE			LINE TABLE		
NO.	BEARING	LENGTH	NO.	BEARING	LENGTH	NO.	BEARING	LENGTH	NO.	BEARING	LENGTH
L1	S44°48'26"W	42.43'	L31	N25°18'52"E	10.00'	L61	N64°41'08"W	24.00'	L91	N25°22'19"E	90.00'
L2	S70°18'52"W	14.14'	L32	S64°41'08"E	10.17'	L62	N25°18'52"E	19.97'	L92	S64°41'08"E	26.68'
L3	S25°18'52"W	14.43'	L33	S25°22'19"W	37.63'	L63	S24°52'48"W	52.28'	L93	S19°41'08"E	4.57'
L4	N07°53'47"E	77.79'	L34	S64°41'08"E	10.17'	L64	S14°09'37"E	14.39'	L94	S70°18'52"W	15.00'
L5	S00°00'00"E	9.25'	L35	N25°18'52"E	10.00'	L65	S75°50'23"W	14.39'	L95	N19°41'08"W	19.57'
L6	S86°56'59"E	37.03'	L36	S64°41'08"E	10.18'	L66	S25°18'52"W	27.07'	L96	S25°18'52"W	51.09'
L7	S90°00'00"W	10.00'	L37	N64°37'52"W	9.33'	L67	S19°41'08"E	15.71'			
L8	N00°00'00"E	20.00'	L38	N25°18'52"E	10.00'	L68	S70°18'52"W	15.71'			
L9	N90°00'00"E	10.00'	L39	N64°37'52"W	9.34'	L69	S19°41'08"E	15.71'			
L10	S64°41'08"E	10.26'	L40	N64°37'41"W	1.73'	L70	S70°18'52"W	15.71'			
L11	N25°18'52"E	17.50'	L41	S64°37'41"E	15.87'	L71	S19°41'08"E	15.71'			
L12	S64°41'08"E	10.27'	L42	N25°18'52"E	20.00'	L72	S70°18'52"W	15.71'			
L13	S64°41'08"E	10.28'	L43	S64°37'41"E	15.89'	L73	S45°07'19"E	7.79'			
L14	N25°18'52"E	10.00'	L44	S25°18'52"W	8.50'	L74	S44°52'41"W	15.00'			
L15	S64°41'08"E	10.29'	L45	N64°41'08"W	10.00'	L75	N45°07'19"W	22.75'			
L16	S64°41'08"E	9.91'	L46	N25°18'52"E	8.50'	L76	S45°07'19"E	7.08'			
L17	N25°18'52"E	10.00'	L47	N00°11'34"W	8.24'	L77	S44°52'41"W	15.00'			
L18	S64°41'08"E	9.92'	L48	N89°48'26"E	17.50'	L78	N45°07'19"W	22.04'			
L19	S25°18'52"W	5.73'	L49	N00°11'34"W	8.24'	L79	N19°41'08"W	24.70'			
L20	S64°41'08"E	9.92'	L50	N00°11'34"W	10.24'	L80	S25°18'52"W	17.46'			
L21	N25°18'52"E	10.00'	L51	N89°48'26"E	10.00'	L81	N64°41'08"W	15.00'			
L22	S64°41'08"E	9.93'	L52	N00°11'34"W	10.24'	L82	N24°52'48"E	52.28'			
L23	S64°41'08"E	10.03'	L53	S25°18'52"W	19.97'	L83	N89°48'26"E	10.00'			
L24	N25°18'52"E	17.50'	L54	N00°11'34"W	8.74'	L84	S00°11'34"E	15.00'			
L25	S64°41'08"E	10.05'	L55	N89°48'26"E	17.50'	L85	S89°48'26"W	10.00'			
L26	S12°10'36"W	6.31'	L56	N00°11'34"W	8.74'	L86	S69°28'13"E	47.50'			
L27	S64°41'08"E	10.05'	L57	N89°48'26"E	15.00'	L87	S20°31'47"W	15.00'			
L28	N25°18'52"E	10.00'	L58	S00°11'34"E	10.03'	L88	N69°28'13"W	47.50'			
L29	S64°41'08"E	10.06'	L59	N89°02'19"E	15.29'	L89	N25°18'52"E	24.00'			
L30	S64°41'08"E	10.16'	L60	N00°57'41"W	15.00'	L90	S00°11'34"E	24.00'			

CURVE TABLE					
NO.	DELTA	RADIUS	LENGTH	CHORD BEARING	CHORD
C1	8°28'18"	58.00'	8.58'	S86°25'13"E	8.57'
C2	104°41'04"	25.00'	45.68'	N62°58'20"E	39.58'
C3	90°00'00"	30.00'	47.12'	S44°48'26"W	42.43'
C4	5°57'35"	207.50'	21.58'	N27°51'36"E	21.57'
C5	5°31'31"	192.50'	18.56'	S28°04'38"W	18.56'
C6	14°44'31"	54.00'	13.89'	S18°00'04"W	13.86'
C7	90°03'27"	30.00'	47.15'	N19°39'24"W	42.45'
C8	90°00'00"	30.00'	47.12'	S70°18'52"W	42.43'
C9	5°31'31"	207.50'	20.01'	S28°04'38"W	20.00'
C10	5°57'35"	192.50'	20.02'	N27°51'36"E	20.01'
C11	90°00'00"	54.00'	84.82'	S70°18'52"W	76.37'
C12	90°03'27"	54.00'	84.88'	N19°39'24"W	76.41'
C13	115°33'53"	60.00'	121.02'	S32°24'37"E	101.52'
C14	89°56'33"	25.00'	39.24'	N70°20'36"E	35.34'
C15	90°03'27"	25.00'	39.29'	N19°39'24"W	35.37'
C16	90°00'00"	20.00'	31.42'	N70°18'52"E	28.28'
C17	25°30'26"	30.00'	13.36'	S77°26'21"E	13.25'
C18	25°30'26"	54.00'	24.04'	S77°26'21"E	23.84'
C19	64°41'08"	25.00'	28.22'	N32°20'34"W	26.75'
C20	89°48'26"	30.00'	47.02'	S44°54'13"W	42.36'
C21	90°00'00"	30.00'	47.12'	N45°11'34"W	42.43'

LOT TABLE		
LOT NO.	ACRES	SQ. FT.
LOT 1, BLOCK A	12.993	565,973
LOT 2, BLOCK A	1.295	56,409
LOT 3, BLOCK A	0.948	41,311
LOT 4, BLOCK A	0.754	32,824
LOT 5, BLOCK A	0.959	41,752
LOT 6, BLOCK A	1.373	59,792
LOT 7, BLOCK A	1.792	78,053
LOT 8, BLOCK A	1.007	43,873
LOT 9, BLOCK A	1.014	44,172
LOT 10, BLOCK A	0.881	38,367
LOT 11, BLOCK A	0.881	38,367
LOT 12, BLOCK A	1.073	46,719
LOT 13, BLOCK A	1.062	46,269
RIGHT OF WAY DEDICATION NO. 1	0.643	28,007
RIGHT OF WAY DEDICATION NO. 2	0.570	24,808

PRELIMINARY PLAT

HIGHPOINTE COMMERCIAL

27.243 ACRES

LOTS 1 - 13, BLOCK A

13 COMMERCIAL LOTS

F. TREVINO SURVEY, ABSTRACT NO. 1243
CITY OF AUBREY, DENTON COUNTY, TEXAS

Kimley»Horn

6160 Warren Parkway, Suite 210
Frisco, Texas 75034
Tel. No. (972) 335-3580
FIRM # 10193822
Fax No. (972) 335-3779

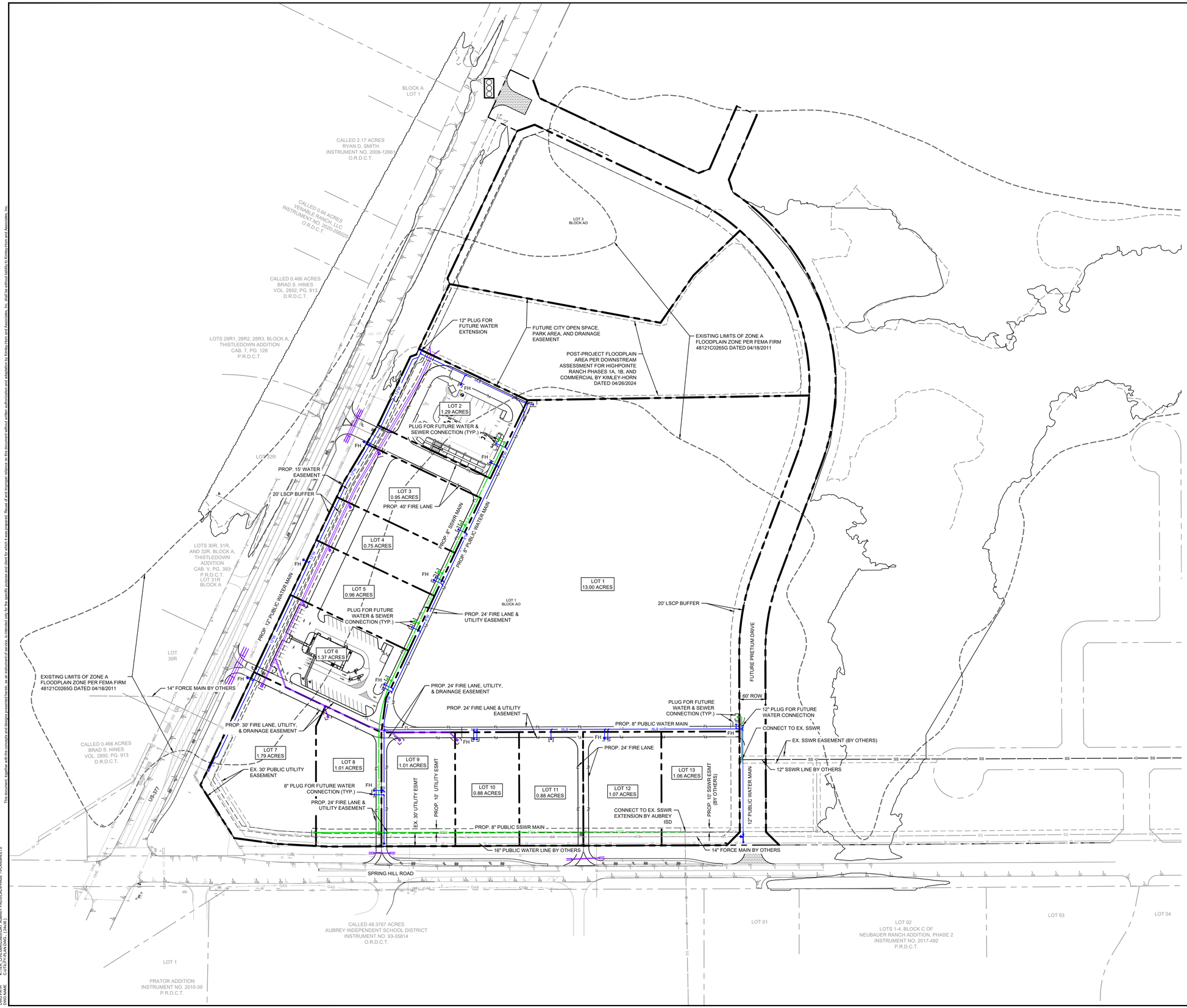
Scale	Drawn by	Checked by	Date	Project No.	Sheet No.
N/A	CDS	KHA	07/29/2024	063451861	2 OF 2

OWNER:
Highpointe Corner, LLC
2504 Loftsmoor Lane
Plano, Texas 75025
Phone: 214-208-5078
Contact: Bhadresh Trivedi

SURVEYOR:
Kimley-Horn and Associates, Inc.
6160 Warren Pkwy., Suite 210
Frisco, Texas 75034
Phone: 972-335-3580
Contact : Sylviana Gunawan, R.P.L.S.

APPLICANT:
Kimley-Horn and Associates, Inc.
203 W. Nash Street, Suite 100
Terrell, Texas 75160
Phone: 972-770-1300
Contact : Matthew A. Lucas, P.E.

DWG NAME: K:\FRI_SURVEY\063452805-AUBREY PAD DEVELOPMENT\DWG\063452805-PRELIMINARY PLAT.DWG PLOTTED BY GUNAWAN, SYLVIANA 7/29/2024 5:02 PM LAST SAVED 7/29/2024 4:38 PM Copyright © 2024 Kimley-Horn and Associates, Inc. All rights reserved



NORTH

GRAPHIC SCALE IN FEET
0 50 100 200

UTILITY LEGEND

	PROPERTY LINE
8" W	PROPOSED 8" PUBLIC WATER LINE
12" W	PROPOSED 12" PUBLIC WATER LINE
8" SS	PROPOSED 8" SANITARY LINE
	PROPOSED PHASE 1 STORM LINE
	PROPOSED PHASE 2 STORM LINE
OHE	EXISTING POWER LINE
	EXISTING POWER POLE
W	EXISTING WATER LINE
SS	EXISTING SANITARY LINE
	EXISTING STORM
JB	PROPOSED JUNCTION BOX
CI	PROPOSED CURB INLET
	PROPOSED TYPE-Y INLET
STMH	PROPOSED STORM MANHOLE
SSMH	PROPOSED SANITARY SEWER MANHOLE
FH	PROPOSED FIRE HYDRANT

UTILITY NOTES

GENERAL NOTES

1. REFER TO CITY OF AUBREY DESIGN GUIDELINES AND STANDARD CONSTRUCTION DETAILS FOR ALL WATER AND SANITARY SEWER REQUIREMENTS
2. CONTRACTOR TO VERIFY LOCATION OF EXISTING UTILITIES.
3. EXTENSION OF WATER AND SEWER UTILITIES IS REQUIRED TO SERVE THIS PROJECT. THE 16" WATERLINE ALONG SPRINGHILL ROAD TO BE PROVIDED BY THE CITY OF AUBREY. THE 12" SEWER LINE TO BE PROVIDED BY THE DEVELOPER OF HIGH POINT RANCH PHASE 1A. THE 12' AUBREY ISD SANITARY SEWER MAIN TO BE CONSTRUCTED BY OTHERS. THIS MAIN IS TO SERVE THE SUBJECT SITE PER DISCUSSION WITH THE CITY AND THE AUBREY ISD REPRESENTATIVE ON 5/21/2024.
4. FUTURE UTILITY AND DRAINAGE DESIGN SHALL BE DETERMINED BY THE END-USER OF EACH LOT. UTILITY CONNECTIONS HAVE BEEN PROVIDED FOR EACH LOT AS WELL, SIZED FOR FULLY DEVELOPED CONDITIONS.
5. GATE VALVES SHALL BE ASSUMED TO BE INCLUDED AT ALL CONNECTIONS TO EXISTING WATER, FIRE HYDRANT CONNECTIONS, TEE CONNECTIONS, AND STUBS FOR FUTURE CONNECTIONS.
6. PRETIUM DRIVE AND ASSOCIATED WATER, WASTEWATER,A ND STORM SEWER IMPROVEMENTS ARE TO BE CONSTRUCTED WITH LOT 1 DEVELOPMENT.

SANITARY

1. CONTRACTOR SHALL NOTIFY ENGINEER IF EXISTING FLOWLINE ELEVATIONS DO NOT MATCH THOSE SHOWN ON THE PLAN.
2. REFER TO CITY OF AUBREY STANDARD CONSTRUCTION DETAILS FOR ALL SANITARY MANHOLES AND CLEANOUTS.
3. THE MINIMUM WASTEWATER PIPELINE SIZE FOR ALL DEVELOPMENTS (OTHER THAN SERVICE LINES) SHALL BE 8".
4. NO SEWER LINE SHALL BE LOCATED NEARER THAN 5' FROM ANY TREE OR STRUCTURE, NOR ANY CLOSER THAN 10' FROM ANY WATER SERVICE OR MAIN.
5. PIPE USED FOR WASTEWATER COLLECTION SYSTEMS SHALL BE PVC PIPE CONFORMING TO THE STANDARDS SPECIFICATIONS FOR CONSTRUCTION. THE WASTEWATER PIPELINE SHALL CONFORM TO ASTM D3034 FOR SEWER PIPES AND FITTINGS FROM 4" TO 15" IN DIAMETER AND SHALL HAVE A EARTH COVER OF 3'. FOR DEPTHS OF 10' OR GREATER, THE WASTEWATER SHALL BE A MINIMUM PIPE STIFNESS OF 115-PSI (SDR 26).

WATER

1. REFER TO CITY OF AUBREY DESIGN GUIDELINES FOR ALL WATER METER AND FIRE HYDRANT DETAILS.
2. ALL FITTING SHALL BE OF DOMESTIC MANUFACTURE AND SHALL BE MECHANICALLY RESTRAINED.
3. ALL GATE VALVES SHALL BE CONFORM TO AWWA C-509 STANDARDS MANUFACTURED BY MUELLER, OR AN APPROVED EQUAL WITH RESILIENT SEAT AND AMERICAN MADE FITTINGS AND VALVE BODIES ONLY AND SHALL CONFORM TO AND SHALL BE INSTALLED ACCORDING TO THE STANDARD SPECIFICATION FOR CONSTRUCTION.
4. 4" THROUGH 12" DIAMETER WATER PIPELINES SHALL BE PVC PIPE CONFORMING TO THE STANDARD SPECIFICATIONS FOR CONSTRUCTION. IN GENERAL, THE WATER PIPELINES SHALL BE AWWA STANDARD C-900 (MIN. DR 18 - CLASS 150) WITH CAST-IRON OUTSIDE DIMENSIONS, AND INSTALLED WITH A MIN. OF 4' OF COVER, UNLESS OTHERWISE APPROVED BY THE CITY.
5. 16" THROUGH 24" DIAMETER WATER LINES SHALL BE AWWA C905 (DR 18 - 235 PSI) OR DUCTILE IRON AWWA C151 (CLASS 150) WITH CEMENT MORTAR LINED INTERIOR AND POLYETHYLENE ENCASED EXTERIOR, AND INSTALLED WITH A MIN. OF 6' OF COVER.
6. ALL WATER SERVICES UNDER PAVEMENT SHALL BE SLEEVED IN A MIN. 2" DIAMETER SDR 21 PVC ENCASEMENT PIPE OR APPROVED EQUIVALENT.
7. FIRE HYDRANT ASSEMBLY INSTALLED PER CITY STANDARDS AND WITH A 6" GATE VALVE.
8. ALL WATER PIPE SHALL BE INSTALLED WITH A "TRACER TAPE" BLUE IN COLOR OVER THE TOP OF THE PIPE. THE TAPE SHALL BE TERRA TAPE "D" DETECTABLE AS SUPPLIED BY GRIFFOLYN CO., INC. OF HOUSTON, TEXAS OR APPROVED EQUAL. LOCATOR MARKER PADS SHALL BE INSTALLED AT 250 FEET ALONG WATER LINES.

No.	REVISIONS	DATE	BY

Kimley»Horn
13455 NOEL RD. TWO GALLERIA OFFICE TOWER
SUITE 700 DALLAS, TX 75240
PHONE: 972-770-1300 FAX: 972-239-3820
WWW.KIMLEY-HORN.COM TX F-928
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PRELIMINARY
FOR REVIEW ONLY
Not for construction or permit purposes.
Kimley»Horn
Engineer MATTHEW A. LUCAS
P.E. No. 108727 Date 7/29/2024

KHA PROJECT 064523805
DATE 7/29/2024
SCALE AS SHOWN
DESIGNED BY MJF
DRAWN BY WV
CHECKED BY MAL

DRT AUBREY COMMERCIAL
NEC OF US-377 & SPRINGHILL ROAD
CITY OF AUBREY, TX

PRELIMINARY UTILITY PLAN

SHEET NUMBER
EX-2

This document together with the concepts and designs presented herein, as an instrument of service, is intended only for the specific purpose and client for which it was prepared. Reuse of and improper reliance on this document without written authorization and adaptation by Kimley-Horn and Associates, Inc. shall be without liability to Kimley-Horn and Associates, Inc.

IMAGES: EPSG2276_Dallas20240115_L453.30142_Lon-96.979070_Mag0.075
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LAST SAVED: 7/29/2024 4:29 PM
PLOTTED BY: FEATHER, MIKE
PLOTTED ON: 7/29/2024 4:31 PM
DWG NAME: C:\AUBREY FA2\SD\CAD\PHASE 1\PLANSHEETS C-UTILITY-PLAN.DWG (24x36)

DRAINAGE GENERAL NOTES

1. THESE PLANS ARE PRELIMINARY IN NATURE AND SUBJECT TO APPROVAL OF THE PRELIMINARY PLAT BY THE CITY OF AUBREY. SITE PLAN IS FOR ILLUSTRATIVE PURPOSES ONLY.
2. ALL GRADING AND STORM SEWER INFRASTRUCTURE ASSOCIATED WITH PRETIUM DRIVE TO BE DESIGNED AND CONSTRUCTED BY LOT 1 END-USER.
3. OFF-SITE GRADING AND OFF-SITE STORM INFRASTRUCTURE DESIGNED PER THE APPROVED DOWNSTREAM ASSESSMENT FOR HIGHPOINTE RANCH PHASES 1A, 1B, AND COMMERCIAL DATED 4/26/2024. STORM AND GRADING DESIGN IS SUBJECT TO FINAL APPROVAL BY THE CITY OF AUBREY FOR CIVIL CONSTRUCTION DRAWINGS AND IS SHOWN FOR REFERENCE ONLY.

BENCH MARK LIST

CITY OF AUBREY CONTROL POINT LIBRARY
BM SET FLUSH WITH NATURAL GROUND, 3' EAST OF CONCRETE WALK, 3.8' SOUTH OF BACK OF CURB TO NORTH, 4.5' NORTH OF BACK OF CURB TO SOUTH.

ELEV: 676.28' (NAVD88)

BM #40 BOX CUT SET ON CONCRETE HEAD WALL, WEST SIDE OF DRIVEWAY TO 558 SPRINGHILL ROAD, SOUTH SIDE OF ROAD.

ELEV: 667.73' (NAVD88)

No.	REVISIONS	DATE	BY

Kimley»Horn
13455 NOEL RD. TWO GALLERIA OFFICE TOWER
SUITE 700 DALLAS, TX 75240
PHONE: 972-770-1300 FAX: 972-239-3820
WWW.KIMLEY-HORN.COM TX F-928

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PRELIMINARY
FOR REVIEW ONLY
Not for construction or permit purposes.
Kimley»Horn
Engineer MATTHEW A. LUCAS
P.E. No. 108727 Date 7/29/2024

KHA PROJECT	064523805
DATE	7/29/2024
SCALE	AS SHOWN
DESIGNED BY	MJF
DRAWN BY	WV
CHECKED BY	MAL

DRT AUBREY COMMERCIAL
NEC OF US-377 & SPRINGHILL ROAD
CITY OF AUBREY, TX

PRELIMINARY DRAINAGE PLAN

SHEET NUMBER
EX-3

This document, together with the concepts and designs presented herein, as an instrument of service, is intended only for the specific purpose and client for which it was prepared. Reuse of and improper reliance on this document without written authorization and adaptation by Kimley-Horn and Associates, Inc. shall be without liability to Kimley-Horn and Associates, Inc.

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PLOTTED BY: FEATHER, MIKE 7/29/2024 4:17 PM
DWG NAME: 064523805 - AUBREY PAD\SCAD\PHASE 1\EXHIBITS 2024\EX-4_GRADING AND STORM PLAN.DWG [EX-3]

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Conduct the first public hearing in accordance with Texas Local Government Code Section 43.063(a) and other applicable law, to consider testimony and provide members of the public an opportunity to be heard on the proposed annexation of a portion of FM 2931, beginning at the intersection of FM 2931 and Frontier Parkway, continuing north to the intersection of FM 2931 and Spring Hill Road, and any additional adjacent right-of-way, Denton County, Texas.

Staff Contact
Charles Kreidler, City Manager
kreidler@aubreytx.gov
940-440-9343

Summary
This item is the first public hearing for an annexation of a portion of FM 2931, beginning at the intersection of FM 2931 and Frontier Parkway, continuing north to the intersection of FM 2931 and Spring Hill Road, and any additional adjacent right-of-way,

---

Financial Summary
None

Staff Recommended Motion

Conditions
N/A

MESSER ★ FORT
THE MUNICIPAL LAW FIRM
FRISCO | DALLAS | AUSTIN | ABILENE

July 26, 2024

Via CMRRR #9589 0710 5270 0920 7020 81
and via First Class Mail
Texas Department of Transportation
Right-of-Way Division
125 E. 11th Street
Austin, Texas 78701-2483

RE: City of Aubrey, Texas; ROW Annexation Notice of ±40 acres

Dear Sir or Madam,

The purpose of this letter is to notify you that certain right-of-way is included in a proposed annexation by the City of Aubrey, Texas (the "City"). Under state law, the City may annex the area after following certain notice and hearing procedures contained in Chapter 43 of the Texas Local Government Code. The City will provide all necessary services to the property upon annexation.

Section 43.1056 requires that the City provide written notice of the annexation to the owner of the right-of-way not later than the sixty-first (61st) day before the date of the proposed annexation. Therefore, notice is hereby given that the City Council of the City proposes to annex ±40 acres of right-of-way owned by the State of Texas (the "State") on **September 26, 2024, at 6:00 p.m.** at Aubrey City Hall, located at **107 S. Main Street, Aubrey, Texas 76227.** A large majority of the right-of-way is located in the extraterritorial jurisdiction ("ETJ") of the city with less than 10% being located in the county which the City intends to annex into the City's ETJ so the road segment is completely located in the city limits. Any objection to the annexation by the owner of the right-of-way must be in writing and must be received by the municipality prior to the date of the proposed annexation. The proposed annexations by the City are described below:

> **A tract of land known as the portion of FM 2931, beginning at the intersection of FM 2931 and Frontier Parkway, continuing north to the intersection of FM 2931 and Spring Hill Road, and any additional adjacent right-of-way, Denton County, Texas.**

Enclosed please find a map showing the property proposed for annexation as described above. Please do not hesitate to call if you have any questions.

Sincerely,

Kaira Cabranes

KAIRA CABRANES
PARALEGAL

Encl.

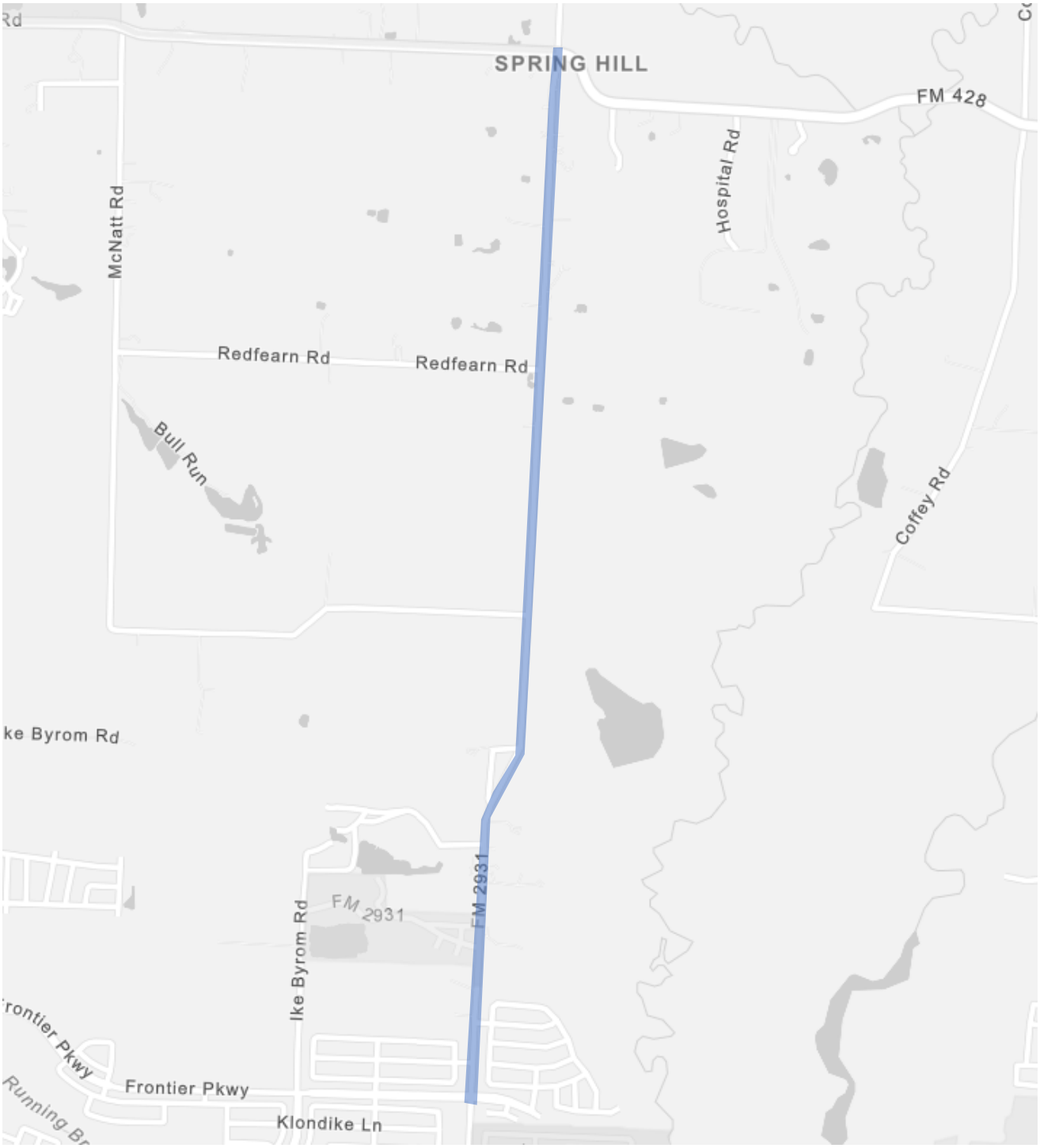
SPRING HILL
FM 428
Hospital Rd
McNatt Rd
Redfearn Rd
Redfearn Rd
Bull Run
Coffey Rd
ke Byrom Rd
FM 2931
FM 2931
Ike Byrom Rd
rontier Pkwy
Frontier Pkwy
Klondike Ln

EXHIBIT "A"
METES AND BOUNDS DESCRIPTION
FOR ANNEXATION INTO THE CITY LIMITS OF THE CITY OF AUBREY, TEXAS IN THE F. H. POLLARD SURVEY, ABSTRACT 995, THE F. TREVINO SURVEY, ABSTRACT NO. 1243, THE WM. LUMPKIN SURVEY, ABSTRACT NO. 730, AND THE J. BRIDGES SURVEY, ABSTRACT NO. 36, DENTON COUNTY, TEXAS

Being a 29.95 acre tract of land, for annexation into the City Limits of the City of Aubrey, Texas, and being the full right-of-way width of Farm to Market Road 2931 (FM 2931) (a variable width right-of-way) as it exists today, or as it may exist in the future, from the existing Aubrey City Limits line as defined by Aubrey Annexation Ordinance 220, dated March 15, 1996, and recorded in Instrument Number 1996-19494 of the Deed Records of Denton County, Texas (D.R.D.C.T.), to the existing Aubrey City Limits line as defined by Aubrey Annexation Ordinance 750, dated July 26, 2022, and recorded in Instrument Number 2022-113314 of the Official Public Records of Denton County, Texas (O.P.R.D.C.T.), said 29.95 acre tract, in the F. H. Pollard Survey, Abstract No. 995, the F. Trevino Survey, Abstract No. 1243, the WM. Lumpkin Survey, Abstract No. 730, and the J. Bridges Survey, Abstract No. 36, Denton County, Texas, said 29.95 acre tract being more particularly described as follows:

BEGINNING at a point for corner, said point being on the south right-of-way (ROW) line of FM 428 (a variable width right-of-way), and the west right-of-way line of said FM 2931, said point also being on the Existing City Limits of the City of Aubrey as established by said Aubrey annexation ORD. 220, dated 3/15/1996;

THENCE, S43°12'59"E, along the west right-of-way line of FM 2931 a distance of 97.40 feet to a point for corner, said point also being the beginning of a curve to right, having a central angle of 09 degrees 06 minutes 00 seconds, a radius of 1090.88 feet and being subtended by a chord bearing of S06°20'01"W, a chord distance of 173.08 feet;

THENCE, along the west right-of-way line of said FM 2931, and along said curve to the right, an arc distance of 173.26 feet to a point for corner;

THENCE, S10°53'01"W, continuing along the west right-of-way line of said FM 2931 a distance of 67.70 feet to a point for corner, said point also being the beginning of a curve to left, having a central angle of 09 degrees 24 minutes 00 seconds, a radius of 1200.90 feet and being subtended by a chord bearing of S06°11'01"W, a chord distance of 196.80 feet;

THENCE, along the west right-of-way line of said FM 2931, and along said curve to the left, an arc distance of 197.02 feet to a point for corner;

THENCE, S01°29'01"W, continuing along the west right-of-way line of said FM 2931 a distance of 116.50 feet to a point for corner;

THENCE, S01°22'44"E, continuing along the west right-of-way line of said FM 2931 a distance of 100.12 feet to a point for corner;

THENCE, S01°29'01"W, continuing along the west right-of-way line of said FM 2931 a distance of 400.00 feet to a point for corner;

THENCE, S07°11'39"W, continuing along the west right-of-way line of said FM 2931 a distance of 100.5 feet along the west ROW line of FM 1358 to a point for corner;

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THENCE, S01°29'01"W, continuing along the west right-of-way line of said FM 2931 a distance of 200.00 feet to a point for corner;

THENCE, S04°13'37"E, continuing along the west right-of-way line of said FM 2931 a distance of 100.5 feet to a point for corner;

THENCE, S01°29'01"W, continuing along the west right-of-way line of said FM 2931 a distance of 600.00 feet to a point for corner;

THENCE, S07°11'39"W, continuing along the west right-of-way line of said FM 2931 a distance of 100.5 feet to a point for corner;

THENCE, S01°29'01"W, continuing along the west right-of-way line of said FM 2931 a distance of 200.00 feet to a point for corner,;

THENCE, S04°33'40"E, continuing along the west right-of-way line of said FM 2931 a distance of 94.96 feet to a point for corner;

THENCE, S01°52'01"W, continuing along the west right-of-way line of said FM 2931 a distance of 1405.23 feet to a point for corner;

THENCE, S07°34'39"W, continuing along the west right-of-way line of said FM 2931 a distance of 100.50 feet to a point for corner;

THENCE, S01°52'01"W, continuing along the west right-of-way line of said FM 2931 a distance of 100.00 feet to a point for corner;

THENCE, S03°50'37"E, continuing along the west right-of-way line of said FM 2931 a distance of 100.50 feet to a point;

THENCE, S01°52'01"W, continuing along the west right-of-way line of said FM 2931 a distance of 248.07 feet to a point for corner;

THENCE, S46°49'31"W, continuing along the west right-of-way line of said FM 2931 a distance of 99.07 feet to a point for corner;

THENCE, S43°10'29"E, continuing along the west right-of-way line of said FM 2931 a distance of 98.92 feet to a point for corner;

THENCE, S01°52'01"W, continuing along the west right-of-way line of said FM 2931 a distance of 3111.93 feet to a point for corner;

THENCE, S07°34'39"W, continuing along the west right-of-way line of said FM 2931 a distance of 100.5 feet to a point for corner;

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THENCE, S01°52'01"W, continuing along the west right-of-way line of said FM 2931 a distance of 172.52 feet to a point for corner;

THENCE, S46°52'44"W continuing along the west right-of-way line of said FM 2931, a distance of 84.83 feet to a point for corner;

THENCE, S44°07'16"E, continuing along the west right-of-way line of said FM 2931 a distance of 99.02 feet to a point for corner;

THENCE, S01°52'01"W, continuing along the west right-of-way line of said FM 2931 a distance of 1553.47 feet to a point for corner, said point also being the beginning of a curve to right, having a central angle of 25 degrees 30 minutes 00 seconds, a radius of 516.92 feet and being subtended by a chord bearing of S14°37'01"W, a chord distance of 228.17 feet;

THENCE, along the west right-of-way line of said FM 2931, and along said curve to the right, an arc distance of 230.06 feet to a point for corner;

THENCE, S54°25'59"W, continuing along the west right-of-way line of said FM 2931 a distance of 109.17 feet to a point for corner;

THENCE, S38°41'52"E, continuing along the west right-of-way line of said FM 2931 a distance of 84.10 feet to a point for corner, said point also being the beginning of a curve to right, having a central angle of 25 degrees 30 minutes 00 seconds, a radius of 264.44 feet and being subtended by a chord bearing of S14°37'01"W, a chord distance of 116.72 feet;

THENCE, along the west right-of-way line of said FM 2931, and along said curve to the right, an arc distance of 117.69 feet to a point for corner;

THENCE, S27°22'01"W, continuing along the west right-of-way line of said FM 2931 a distance of 616.6 feet to a point for corner, said point also being the beginning of a curve to left, having a central angle of 26 degrees 27 minutes 00 seconds, a radius of 1195.93 feet and being subtended by a chord bearing of S14°08'30"W, a chord distance of 547.20 feet;

THENCE, along the west right-of-way line of said FM 2931, and along the said curve to the left, an arc distance of 552.09 feet to a point for corner;

THENCE, S00°55'01"W, continuing along the west right-of-way line of said FM 2931 a distance of 744.33 feet to a point for corner;

THENCE, S02°42'01"W, continuing along the west right-of-way line of said FM 2931 a distance of 428.98 feet to a point for corner, said point also being on the Existing Unincorporated City Limits of the City of Aubrey as established by Aubrey annexation ORD. 750, dated 7/26/2022;

THENCE, S88°34'36"E, across the right-of-way of said FM 2931 a distance of 93.43 feet to a point for corner on the east right-of-way line of said FM 2931;

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THENCE, N02°42'01"E, continuing along the east right-of-way line of said FM 2931 a distance of 421.89 feet to a point for corner;

THENCE, N00°55'01"E, continuing along the east right-of-way line of said FM 2931 a distance of 745.87 feet to a point for corner, said point also being the beginning of a curve to right, having a central angle of 26 degrees 27 minutes 00 seconds, a radius of 1095.92 feet and being subtended by a chord bearing of N14°08'31"E, a chord distance of 501.44 feet;

THENCE, along the east right-of-way line of said FM 2931, and along said curve to the right, an arc distance of 505.92 feet to a point for corner;

THENCE, N27°22'01"E, continuing along the east right-of-way line of said FM 2931 a distance of 616.60 feet to a point for corner, said point also being the beginning of a curve to left, having a central angle of 25 degrees 30 minutes 00 seconds, a radius of 1195.93 feet and being subtended by a chord bearing of N14°37'01"E, a chord distance of 527.88 feet;

THENCE, along the east right-of-way line of said FM 2931, and along said curve to the left, an arc distance of 532.26 feet to a point for corner;

THENCE, N01°52'01"E, continuing along the east right-of-way line of said FM 2931 a distance of 1456.00 feet to a point for corner;

THENCE, N07°34'39"E, continuing along the east right-of-way line of said FM 2931 a distance of 100.50 feet to a point corner;

THENCE, N01°52'01"E, continuing along the east right-of-way line of said FM 2931 a distance of 300.00 feet to a point for corner;

THENCE, N03°50'37"W, continuing along the east right-of-way line of said FM 2931, a distance of 100.5 feet to a point for corner;

THENCE, N01°52'01"E, continuing along the east right-of-way line of said FM 2931 a distance of 5205.57 feet to a point for corner;

THENCE, N01°29'01"E, continuing along the east right-of-way line of said FM 2931 a distance of 894.77 feet to a point for corner;

THENCE, N12°47'37"E, continuing along the east right-of-way line of said FM 2931 a distance of 101.98 feet to a point for corner;

THENCE, N01°29'01"E, continuing along the east right-of-way line of said FM 2931 a distance of 200.00 feet to a point for corner;

THENCE, N04°13'37"W, continuing along the east right-of-way line of said FM 2931 a distance of 100.50 feet to a point for corner;

EXHIBIT "A"
METES AND BOUNDS DESCRIPTION
FOR ANNEXATION INTO THE CITY LIMITS OF THE CITY OF AUBREY, TEXAS IN THE F. H. POLLARD SURVEY, ABSTRACT 995, THE F. TREVINO SURVEY, ABSTRACT NO. 1243, THE WM. LUMPKIN SURVEY, ABSTRACT NO. 730, AND THE J. BRIDGES SURVEY, ABSTRACT NO. 36, DENTON COUNTY, TEXAS

THENCE, N01°29'01"E, continuing along the east right-of-way line of said FM 2931 a distance of 500.00 feet to a point for corner;

THENCE, N06°20'58"W, continuing along the east right-of-way line of said FM 2931 a distance of 73.38 feet to a point for corner;

THENCE, N01°29'01"E, continuing along the east right-of-way line of said FM 2931 a distance 143.81 feet to a point for corner, said point also being the beginning of a curve to right, having a central angle of 09 degrees 24 minutes 00 seconds, a radius of 1095.93 feet and being subtended by a chord bearing of N06°11'00"E, a chord distance of 179.80 feet;

THENCE, along the east right-of-way line of said FM 2931, and along said curve to the right, an arc distance of 179.80 feet to a point for corner;

THENCE, N10°53'01"E, continuing along the east right-of-way line of said FM 2931 a distance 67.70 feet to a point for corner, said point also being the beginning of a curve to left, having a central angle of 09 degrees 06 minutes 00 seconds, a radius of 1195.97 feet and being subtended by a chord bearing of N06°20'01"E, a chord distance of 189.75 feet;

THENCE, along the east right-of-way line of said FM 2931, and along said curve to the left, an arc distance of 189.95 feet to a point for corner;

THENCE, N46°47'01"E, continuing along the east right-of-way line of said FM 2931 a distance of 69.32 feet to a point for corner, said point also being the beginning of a curve to left, having a central angle of 13 degrees 08 minutes 05 seconds, a radius of 384.44 feet and being subtended by a chord bearing of N76°13'24"W, a chord distance of 87.94 feet;

THENCE, along the north right-of-way line of said FM 2931, and along said curve to the left, an arc distance of 88.13 feet to a point for corner, said point also being the beginning of a curve to left, having a central angle of 02 degrees 28 minutes 53 seconds, a radius of 424.44 feet and being subtended by a chord bearing of N84°01'53"W, a chord distance of 18.38 feet;

THENCE, along the north right-of-way line of said FM 2931, and along said curve to the left, an arc distance of 18.38 feet to a point for corner;

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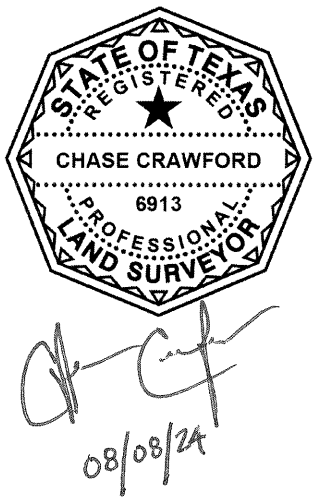
THENCE, N88°06'00"W, continuing along the north right-of-way line of said FM 2931 a distance of 118.54 feet to the POINT OF BEGINNING, said annexation tract containing 29.95 acres (1,304,793.52 square feet) of land, more or less.

Notes:

1. This document was prepared under 22 TAC § 663.21, and does not reflect the results of an on the ground survey, and is not to be used to convey or establish interests in real property except those right and interests implied or established by the creation or reconfiguration of the boundary of the political subdivision for which it was prepared.
2. Basis of Bearings & Distances: TxDOT Right-of-way strip map for F.M. 2931 from JCT FM 428 & FM 2931 south to SH 24 (US 380), dated 6-30-1969, Control 2979, Section 1, Job 2. Rotated 00°29'59" counterclockwise to match Denton County Parcel Map
3. A Plat of even date herewith accompanies this Metes and Bounds Description.

Chase Crawford, R.P.L.S.
Texas Registration No. 6913
Birkhoff, Hendricks & Carter, L.L.P.
TBPLS Firm No. 100318-00
11910 Greenville Ave., Suite 600
Dallas, Texas 75243



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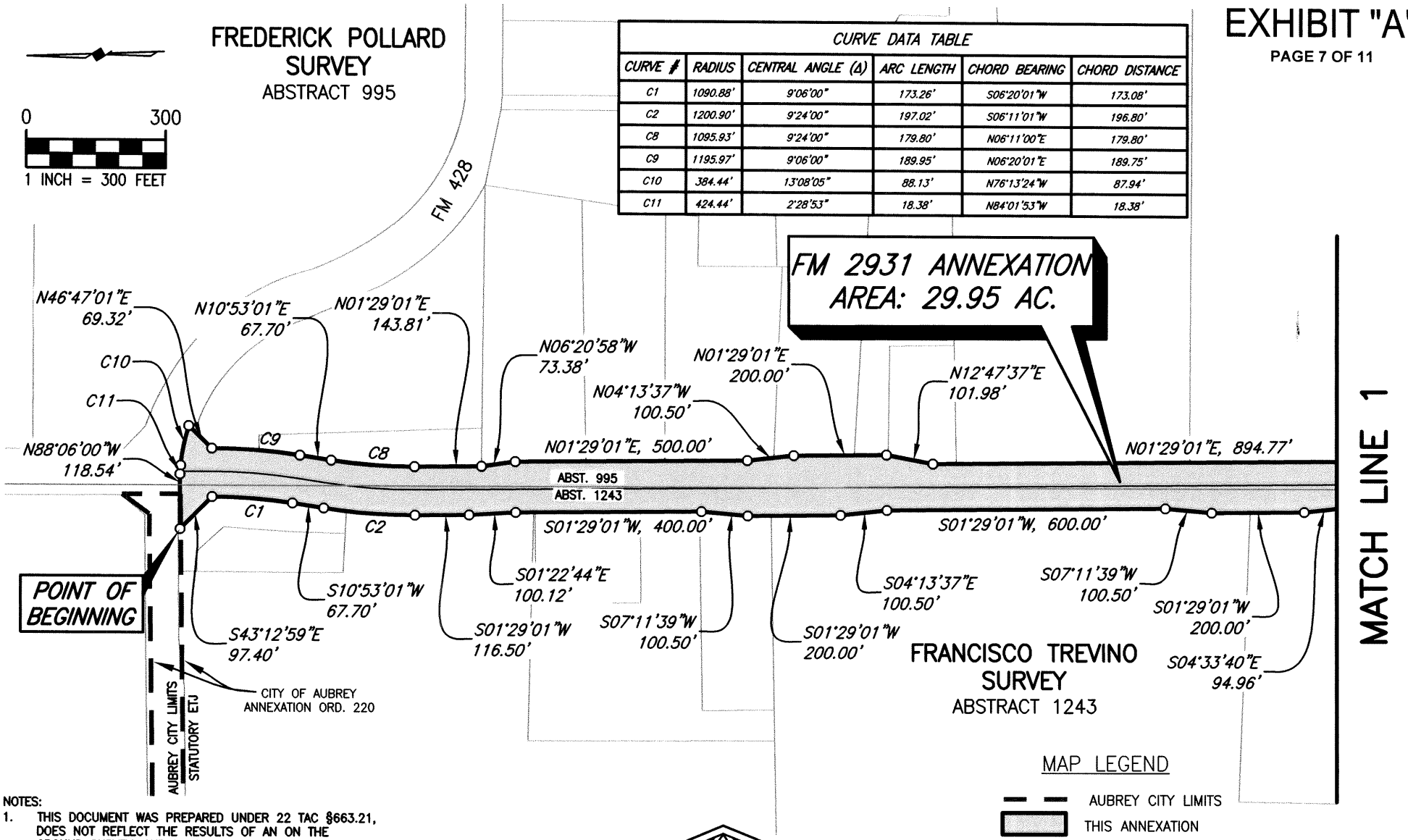

CURVE DATA TABLE					
CURVE #	RADIUS	CENTRAL ANGLE (Δ)	ARC LENGTH	CHORD BEARING	CHORD DISTANCE
C1	1090.88'	9°06'00"	173.26'	S06°20'01"W	173.08'
C2	1200.90'	9°24'00"	197.02'	S06°11'01"W	196.80'
C8	1095.93'	9°24'00"	179.80'	N06°11'00"E	179.80'
C9	1195.97'	9°06'00"	189.95'	N06°20'01"E	189.75'
C10	384.44'	13°08'05"	88.13'	N76°13'24"W	87.94'
C11	424.44'	2°28'53"	18.38'	N84°01'53"W	18.38'

NOTES:

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3. A METES AND BOUNDS DESCRIPTION OF EVEN DATE HEREWITH ACCOMPANIES THIS EXHIBIT.

08/08/24

STATE OF TEXAS REGISTERED CHASE CRAWFORD 6913 PROFESSIONAL LAND SURVEYOR

CITY OF AUBREY, TEXAS

FM 2931 RIGHT-OF-WAY ANNEXATION

29.95 ACRES, F. H. POLLARD SURVEY, ABSTRACT NO. 995, AND
F. TREVINO SURVEY, ABSTRACT NO. 1243, DENTON COUNTY, TEXAS

BIRKHOFF, HENDRICKS & CARTER, L.L.P.
PROFESSIONAL ENGINEERS
TBPELS PE Firm 526; Survey Firm 10031800
11910 Greenville Ave., Suite 600 Dallas, Texas 75243 (214) 361-7900

AUGUST 2024

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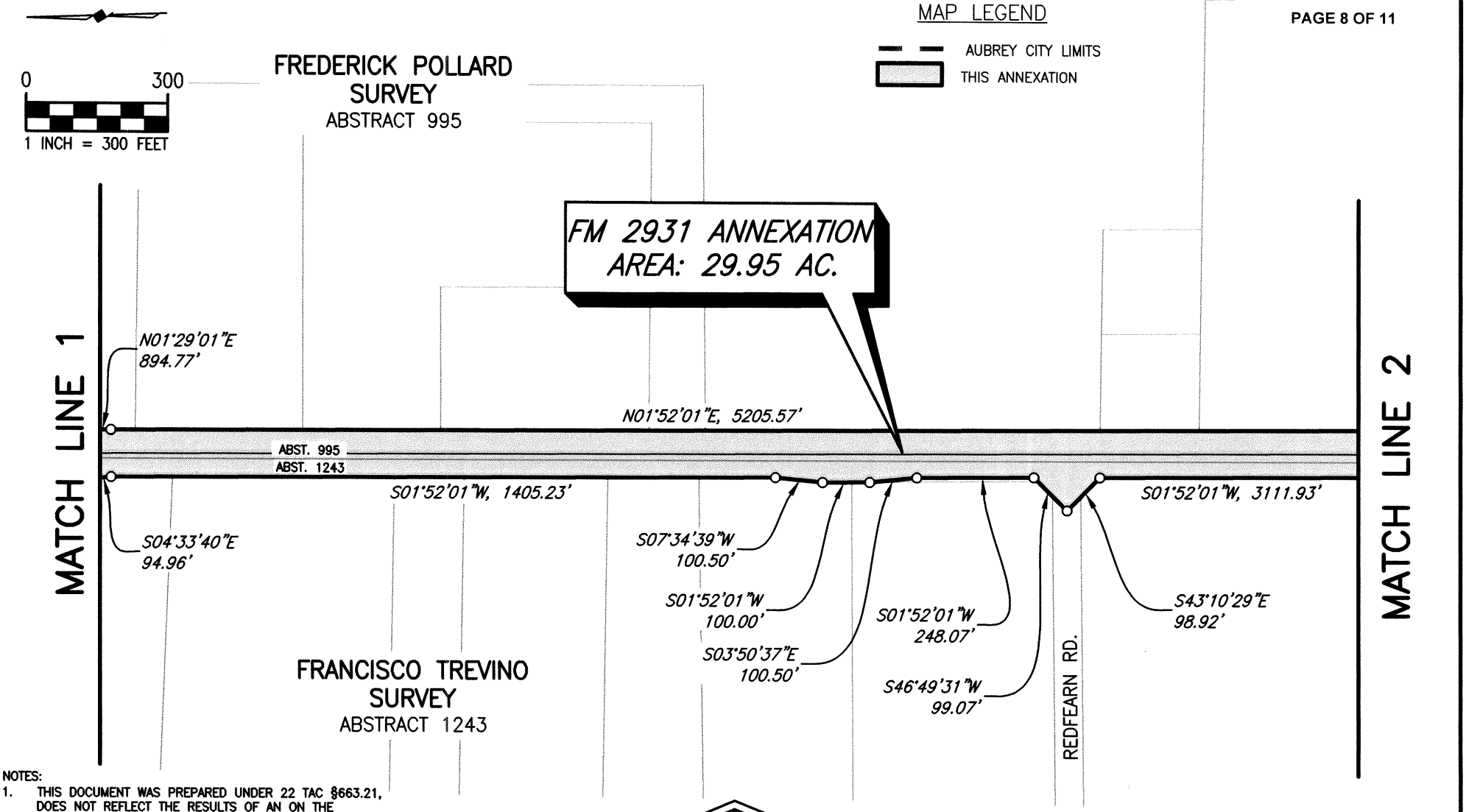

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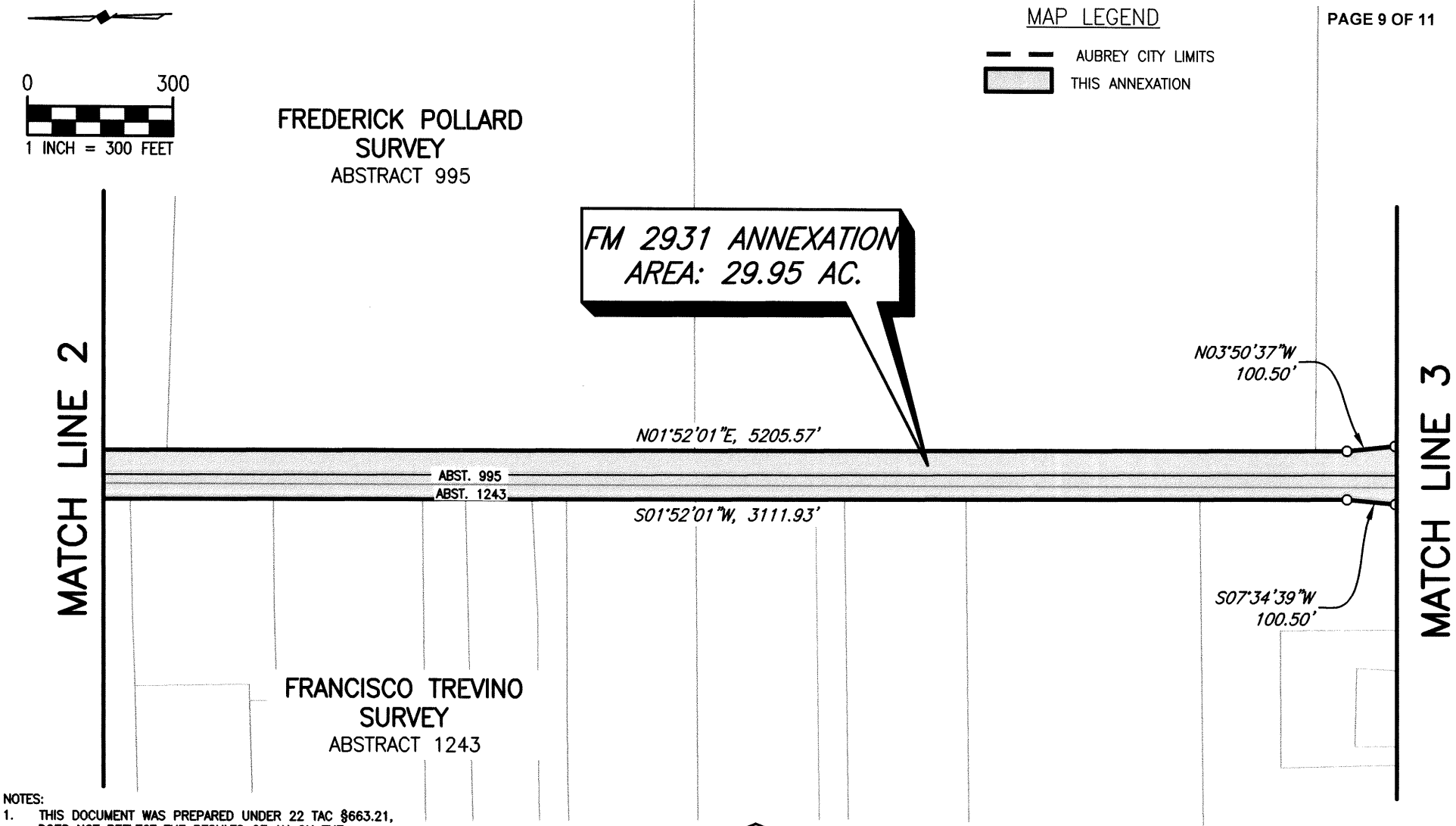

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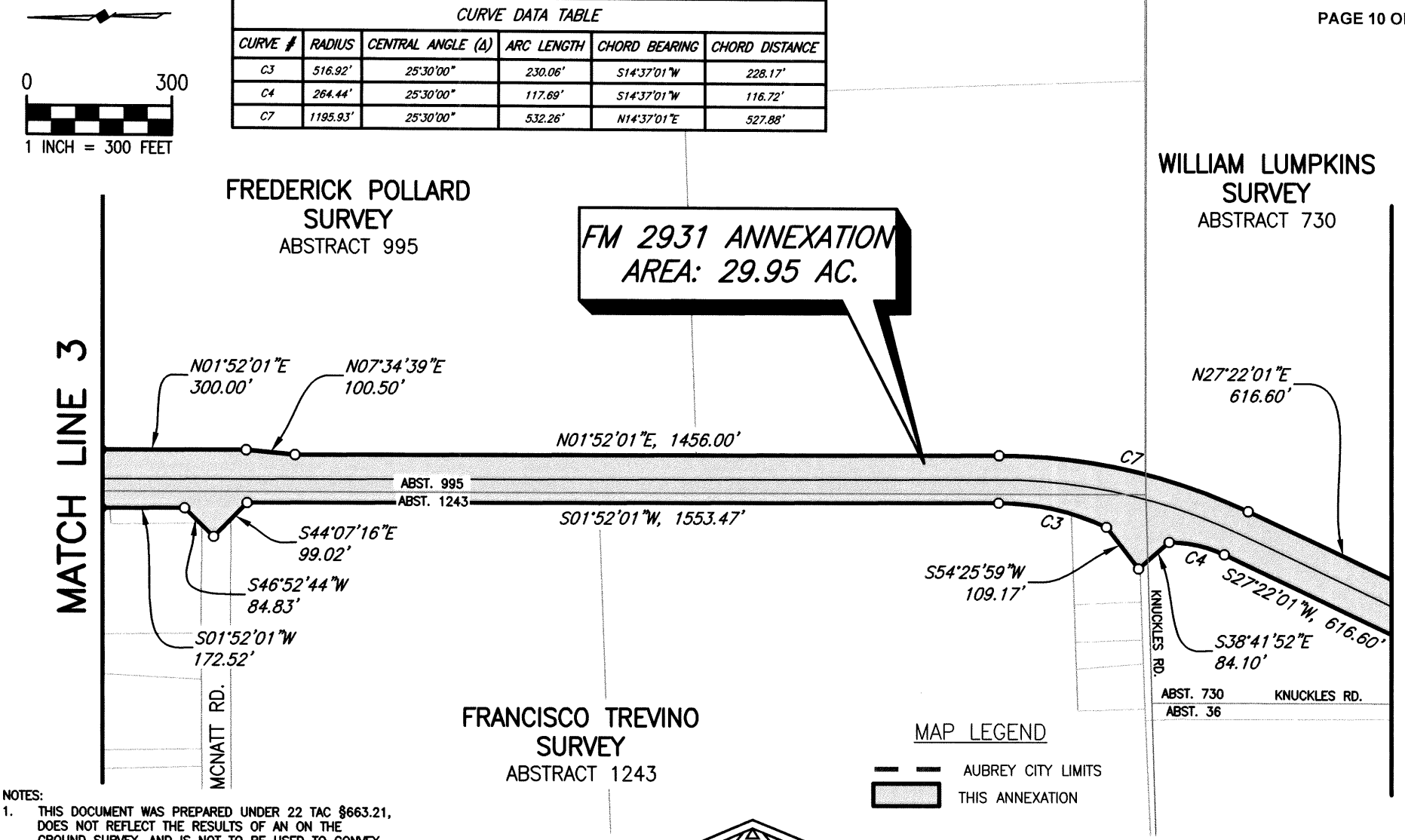
CURVE DATA TABLE					
CURVE #	RADIUS	CENTRAL ANGLE (Δ)	ARC LENGTH	CHORD BEARING	CHORD DISTANCE
C3	516.92'	25°30'00"	230.06'	S14°37'01"W	228.17'
C4	264.44'	25°30'00"	117.69'	S14°37'01"W	116.72'
C7	1195.93'	25°30'00"	532.26'	N14°37'01"E	527.88'



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CURVE DATA TABLE					
CURVE #	RADIUS	CENTRAL ANGLE (Δ)	ARC LENGTH	CHORD BEARING	CHORD DISTANCE
C5	1195.93'	26°27'00"	552.09'	S14°08'30"W	547.20'
C6	1095.92'	26°27'00"	505.92'	N14°08'31"E	501.44'	

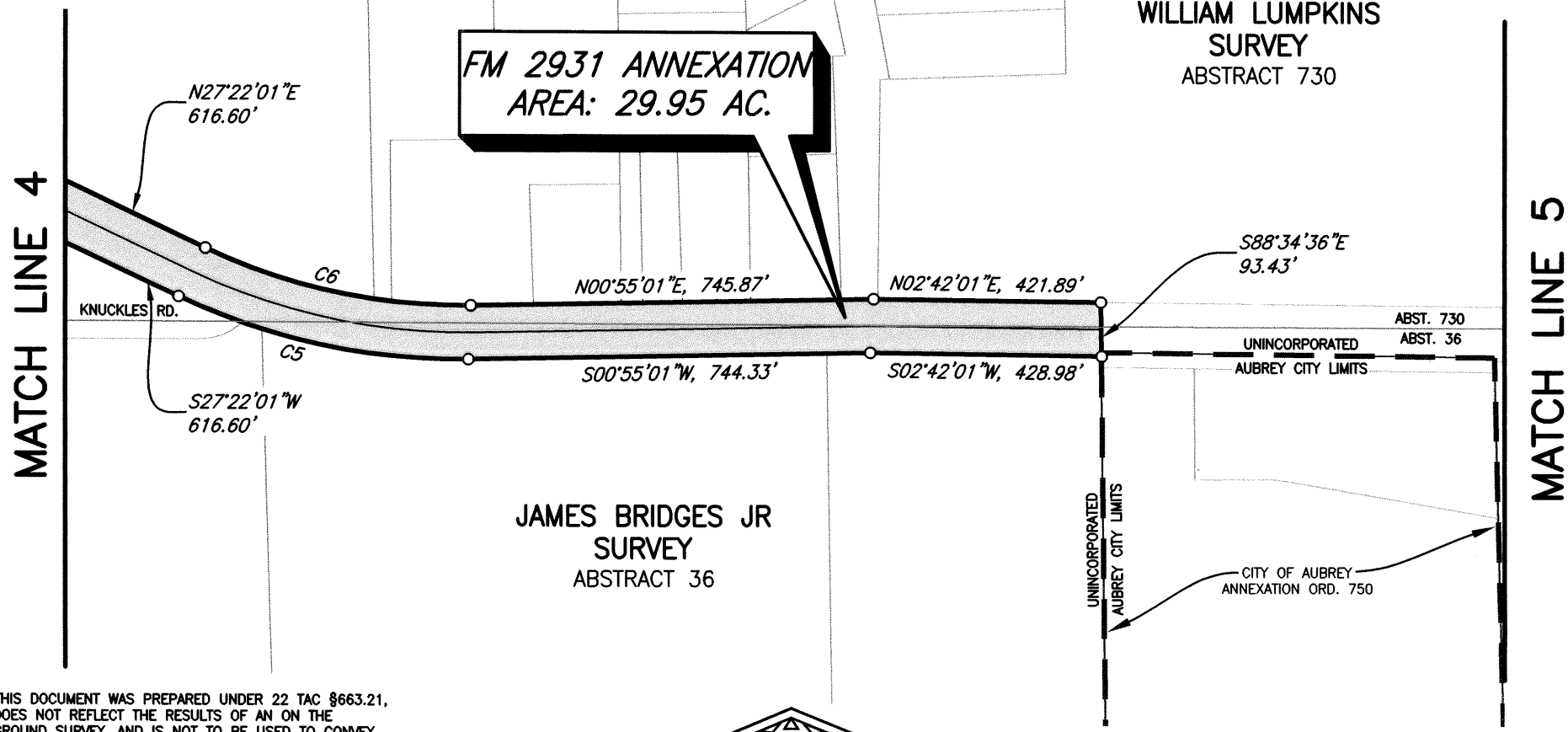
MAP LEGEND

AUBREY CITY LIMITS

THIS ANNEXATION

0 300

1 INCH = 300 FEET



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REVISED: 8/8/24 - CCRAWFORD

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Update and discussion on the Final Plan of Finance to fund project cost of FY 2024-2025 Utility Capital Improvement Projects.

Staff Contact
Mike English, Finance Director
menglish@aubreytx.gov
940-440-9343

Summary
At the July 25, 2024 City Council meeting, Jim Sabonis of Hilltop Securities presented the initial plan of finance for the 2024/2025 Debt Funded Utility CIP (Waste Water Treatment Plant and other utility system projects). We prepared the plan using the best information available at the time, which was prior to receiving bids from the construction firms. Not knowing the final outcome of the bidding process, we included an item on the plan of finance timeline to approve the plan of finance just in case the bids came in higher than our estimates. Fortunately, the actual bid amounts were lower than the estimates, and we were able to lower the borrowing amount and conserve cash reserves. The plan of finance has been updated to reflect the lower requirement.

Taking into account the lower cost, the final plan of finance reflects a total project cost of $62.0 million, compared to $70.25 million in the initial plan of finance. The following table compares the initial plan to the final plan.

	Plan of Finance		
	Initial Plan	Final Plan	Improvement
	7/25/2024	8/22/2024	
Total Project Cost	$ 70,250,000	$ 62,000,000	$ 8,250,000
Financing Cost:			
Amortization	25 years	25 years	No Change
All-in True Interest Cost	4.36%	4.36%	No Change
Total 2024 C/O P&I	$ 97,393,284	$ 89,220,798	$ 8,172,486
Avg Annual 2024 C/O P&I	$ 3,895,731	$ 3,568,832	$ 326,899
Total Existing and New Max Annual P&I	$ 5,082,984	$ 4,662,156	$ 420,828

Since this updated plan of finance is lower than the plan approved at the July 25, 2024 Council meeting, no further action is needed.

For reference, the following is the initial plan of finance presented on July 25, 2024.

This item is a presentation of the initial plan of finance to fund Projected Cost of 2024/2025 Utility Capital Improvement Projects (CIP). The main component of this CIP is the new 2.25 million gallon waste water treatment plant (WWTP). The total estimated cost of the CIP is approximately $70,250,000 and anticipated funding will be made from utility system cash reserves ($2m), developer cash contributions ($10m) and debt funding ($58.25m). Projected system revenue and impact fees will be utilized for projected debt service payments.

The City Council will be asked to approve the initial projected plan of finance at this meeting (July 25, 2024) and to direct staff and financial advisors to finalize cost and timing at August 1st Utility Bid Opening. Additionally, the Council will consider and approve a resolution to authorize Publication of Notice of Intent to Issue Certificates of Obligation, Series 2024 (not to exceed amount based on projected maximum cost, to be adjusted by August 1st Utility best bid amount).

Financial Summary
See financial table above.

Staff Recommended Motion

Conditions
N/A

Contacts:

Jim Sabonis
Managing Director
717 N. Harwood St., Suite 3400
Dallas, TX 75201
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Andre Ayala
Managing Director
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Fax: 214.953.4050
andre.ayala@hilltopsecurities.com

Jorge Delgado
Senior Vice President
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Dallas, TX 75201
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Fax: 214.953.4050
jorge.delgado@hilltopsecurities.com

Plan of Finance

2024 / 2025 Debt Funded Utility CIP

August 22, 2024

Summary

Sources and Uses of Funds	
Par Amount of Bonds	$52,940,000
Less: Cost of Issuance	($410,600)
Less: Underwriter's Discount	($529,400)
Bond Funded Project Fund	$52,000,000
Plus: City Cash on Hand	$0
Plus: Developer Funds	$10,000,000
Total Project Fund	$62,000,000

Debt Structure and Cost	
Amortization	25 years
All-in True Interest Cost(1)	4.36%
Total 2024 C/O P&I	$89,220,798
Avg Annual 2024 C/O P&I	$3,568,832
Total Existing and New Max Annual P&I	$4,662,156

Notes:

Assumes "AA-" Rated Insured Rates plus 0.25% as of 6/27/2024. Subject to change at any time.

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Utility Fund Cash Flow Available for Debt Service

City of Aubrey, Texas

Operating Statement	2023 Audit	2024 Budget		
		Water	Sewer	Total
Charges for Services	$3,080,833	$2,403,886	$1,396,560	$3,800,446
Misc. Income	$14,798	$2,000	$0	$2,000
Interest Income	$353,255	$65,000	$40,000	$105,000
Impact Fees	$0	($300,000)	($300,000)	($600,000)
Total Revenues	$3,448,886	$2,170,886	$1,136,560	$3,307,446
Operating Expenses	($2,892,100)	($2,643,651)	($881,803)	($3,525,454)
Add Back: Debt Service	$0	$715,000	$0	$715,000
Add Back: Depreciation	$468,030	$450,000	$0	$450,000
Add Back: Capital	$0	$10,000	$55,000	$65,000
Less: Total Op. Expenses	($2,424,070)	($1,468,651)	($826,803)	($2,295,454)
Cash Flow Avail for Debt Service	$1,024,816	$702,235	$309,757	$1,011,992
			Current Customers	1,581
			Cash Flow per Customer	$640

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Projected New Customer Incremental Operating Profit

Fiscal Year				Cash Flow	Cash Flow
Building	Utility			Per New	Generated by
Permit[1]	Customer [1]	Annual	Cummulative	Customer [2] [3]	New Customers
2024	2025	211	211	$640	$135,040
2025	2026	589	800	$608	$486,400
2026	2027	673	1,473	$578	$850,805
2027	2028	672	2,145	$549	$1,177,004
2028	2029	517	2,662	$521	$1,387,658
2029	2030	509	3,171	$495	$1,570,342
2030	2031	417	3,588	$470	$1,688,006
2031	2032	815	4,403	$447	$1,967,859
2032	2033	765	5,168	$425	$2,194,276
2033	2034	716	5,884	$403	$2,373,368
2034	2035	715	6,599	$383	$2,528,682
2035	2036	562	7,161	$364	$2,606,834
2036	2037	562	7,723	$346	$2,670,849
2037	2038	514	8,237	$329	$2,706,175
2038	2039	514	8,751	$312	$2,731,292
2039	2040	514	9,265	$297	$2,747,132
2040	2041	510	9,775	$282	$2,753,432
2041	2042	510	10,285	$268	$2,752,235
2042	2043	510	10,795	$254	$2,744,274
2043	2044	510	11,305	$242	$2,730,229
2044	2045	510	11,815	$229	$2,710,727
2045	2046	510	12,325	$218	$2,686,350
2046	2047	510	12,835	$207	$2,657,634
2047	2048	510	13,345	$197	$2,625,074
2048	2049	177	13,522	$187	$2,526,896
2049	2050	17	13,539	$178	$2,403,570
					$56,412,143

Notes:

1) Per City Staff June 27, 2024

2) Fiscal 2025 = $640 per customer based on 2024 Fiscal Budget

3) Fiscal 2026 to 2050 decline 5% per year

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Projected Net Impact Fees

Fiscal Year	Net Impact Fee Revenue[1]		
	Water	Sewer	Total
2024	$736,812	$836,615	$1,573,427
2025	$272,376	$1,102,270	$1,374,646
2026	$436,500	$1,785,200	$2,221,700
2027	$0	$1,774,614	$1,774,614
2028	$0	$991,250	$991,250
2029	$0	$547,170	$547,170
2030	$1,204,740	$2,191,302	$3,396,042
2031	$1,775,100	$3,228,730	$5,003,830
2032	$1,484,100	$2,699,430	$4,183,530
2033	$1,187,280	$2,159,544	$3,346,824
2034	$1,181,460	$2,148,958	$3,330,418
2035	$296,820	$539,886	$836,706
2036	$291,000	$529,300	$820,300
2037	$3,864,490	$7,029,164	$10,893,654
2038	$3,864,490	$7,029,164	$10,893,654
2039	$3,864,490	$7,029,164	$10,893,654
2040	$3,841,210	$6,986,820	$10,828,030
2041	$3,841,210	$6,986,820	$10,828,030
2042	$3,841,210	$6,986,820	$10,828,030
2043	$3,841,210	$6,986,820	$10,828,030
2044	$3,841,210	$6,986,820	$10,828,030
2045	$3,841,210	$6,986,820	$10,828,030
2046	$3,841,210	$6,986,820	$10,828,030
2047	$3,841,210	$6,986,820	$10,828,030
2048	$1,903,150	$3,461,682	$5,364,832
2049	$1,583,057	$2,879,494	$4,462,551
	$54,675,545	$103,857,497	$158,533,042

Notes:

1) Per City Staff June 27, 2024

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Projected Utility Debt Issuance and Utility System Cash Flow Available for Debt Service

FYE 30-Sep	Existing Utility Fund GO Supported Debt Service [1]	$57,350,000 CO, Series 2024A AIC = 4.36% [2] Total D/S	Total Utility Fund Debt Service	Utility Fund Cashflow Available for Debt Service: 2024 Budget [3]	Generated by New Customers [4]	Total	Net Impact Fees [5]: Water	Sewer	Total	Total Annual Utility Fund Cashflow and Impact Fees	Utility Fund Cashflow Coverage Annual Debt Service	Utility Fund and Impact Fees Cashflow Coverage Debt Service: Annual	Cumulative
2024	$715,006	$0	$715,006	$1,011,992	$0	$1,011,992	$0	$0	$0	$1,011,992	$296,986	$1,011,992	$1,011,992
2025	$722,606	$1,798,934	$2,521,541	$1,011,992	$135,040	$1,147,032	$736,812	$836,615	$1,573,427	$2,720,459	($1,374,509)	$198,918	$1,210,910
2026	$748,381	$2,165,941	$2,914,322	$1,011,992	$486,400	$1,498,392	$272,376	$1,102,270	$1,374,646	$2,873,038	($1,415,930)	($41,284)	$1,169,626
2027	$782,956	$2,656,941	$3,439,897	$1,011,992	$850,805	$1,862,797	$436,500	$1,785,200	$2,221,700	$4,084,497	($1,577,100)	$644,600	$1,814,226
2028	$786,631	$2,639,091	$3,425,722	$1,011,992	$1,177,004	$2,188,996	$0	$1,774,614	$1,774,614	$3,963,610	($1,236,726)	$537,888	$2,352,114
2029	$784,931	$2,621,441	$3,406,372	$1,011,992	$1,387,658	$2,399,650	$0	$991,250	$991,250	$3,390,900	($1,006,722)	($15,472)	$2,336,642
2030	$782,931	$2,603,741	$3,386,672	$1,011,992	$1,570,342	$2,582,334	$0	$547,170	$547,170	$3,129,504	($804,338)	($257,168)	$2,079,473
2031	$785,556	$3,872,352	$4,657,908	$1,011,992	$1,688,006	$2,699,998	$1,204,740	$2,191,302	$3,396,042	$6,096,040	($1,957,910)	$1,438,132	$3,517,606
2032	$782,806	$3,876,022	$4,658,828	$1,011,992	$1,967,859	$2,979,851	$1,775,100	$3,228,730	$5,003,830	$7,983,681	($1,678,978)	$3,324,852	$6,842,458
2033	$784,531	$3,877,180	$4,661,711	$1,011,992	$2,194,276	$3,206,268	$1,484,100	$2,699,430	$4,183,530	$7,389,798	($1,455,442)	$2,728,088	$9,570,546
2034	$785,656	$3,875,817	$4,661,473	$1,011,992	$2,373,368	$3,385,360	$1,187,280	$2,159,544	$3,346,824	$6,732,184	($1,276,113)	$2,070,711	$11,641,256
2035	$786,322	$3,871,419	$4,657,741	$1,011,992	$2,528,682	$3,540,674	$1,181,460	$2,148,958	$3,330,418	$6,871,092	($1,117,067)	$2,213,351	$13,854,607
2036	$786,519	$3,873,670	$4,660,189	$1,011,992	$2,606,834	$3,618,826	$296,820	$539,886	$836,706	$4,455,532	($1,041,363)	($204,657)	$13,649,950
2037	$759,400	$3,901,209	$4,660,609	$1,011,992	$2,670,849	$3,682,841	$291,000	$529,300	$820,300	$4,503,141	($977,768)	($157,468)	$13,492,482
2038	$754,900	$3,903,785	$4,658,685	$1,011,992	$2,706,175	$3,718,167	$3,864,490	$7,029,164	$10,893,654	$14,611,821	($940,517)	$9,953,137	$23,445,618
2039	$759,600	$3,902,124	$4,661,724	$1,011,992	$2,731,292	$3,743,284	$3,864,490	$7,029,164	$10,893,654	$14,636,938	($918,440)	$9,975,214	$33,420,832
2040	$758,400	$3,900,316	$4,658,716	$1,011,992	$2,747,132	$3,759,124	$3,864,490	$7,029,164	$10,893,654	$14,652,778	($899,592)	$9,994,062	$43,414,895
2041	$756,400	$3,902,426	$4,658,826	$1,011,992	$2,753,432	$3,765,424	$3,841,210	$6,986,820	$10,828,030	$14,593,454	($893,402)	$9,934,628	$53,349,523
2042	$758,500	$3,903,405	$4,661,905	$1,011,992	$2,752,235	$3,764,227	$3,841,210	$6,986,820	$10,828,030	$14,592,257	($897,678)	$9,930,352	$63,279,875
2043	$759,600	$3,898,555	$4,658,155	$1,011,992	$2,744,274	$3,756,266	$3,841,210	$6,986,820	$10,828,030	$14,584,296	($901,889)	$9,926,141	$73,206,017
2044	$759,700	$3,902,456	$4,662,156	$1,011,992	$2,730,229	$3,742,221	$3,841,210	$6,986,820	$10,828,030	$14,570,251	($919,935)	$9,908,095	$83,114,112
2045	$758,800	$3,902,561	$4,661,361	$1,011,992	$2,710,727	$3,722,719	$3,841,210	$6,986,820	$10,828,030	$14,550,749	($938,642)	$9,889,388	$93,003,500
2046	$756,900	$3,903,707	$4,660,607	$1,011,992	$2,686,350	$3,698,342	$3,841,210	$6,986,820	$10,828,030	$14,526,372	($962,264)	$9,865,766	$102,869,266
2047	$758,900	$3,902,791	$4,661,691	$1,011,992	$2,657,634	$3,669,626	$3,841,210	$6,986,820	$10,828,030	$14,497,656	($992,065)	$9,835,965	$112,705,230
2048	$754,800	$3,904,468	$4,659,268	$1,011,992	$2,625,074	$3,637,066	$3,841,210	$6,986,820	$10,828,030	$14,465,096	($1,022,202)	$9,805,828	$122,511,058
2049	$0	$4,660,448	$4,660,448	$1,011,992	$2,526,896	$3,538,888	$1,903,150	$3,461,682	$5,364,832	$8,903,720	($1,121,560)	$4,243,272	$126,754,330
2050	$0	$0	$0	$1,011,992	$2,403,570	$3,415,562	$1,583,057	$2,879,494	$4,462,551	$7,878,113	$3,415,562	$7,878,113	$134,632,443
	$19,130,734	$89,220,798	$108,351,532	$27,323,784	$56,412,143	$83,735,927	$54,675,545	$103,857,497	$158,533,042	$242,268,969	($24,615,606)	$133,917,436	

Notes:

1) Includes Certificates of Obligation, Series 2016 & 2023.

2) Assumes "AA-" Rated Insured Rates plus 0.25% as of 6/27/2024. Subject to change at any time.

3) 2024 Budget - cash flow available for debt service

4) 2025 to 2050 - Cash flow available for debt service fdata from City Staff

5) Impact Fee data from City Staff, available one year after collection

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Proposed Schedule of Events

Date	Regular Scheduled Council Meetings - 6:00 PM the 4th Thursday of every month at City Hall 107 S. Main Street
Thursday, 07/25/24	Regular City Council Meeting 1) Presentation of Initial Plan of Finance to fund Projected Cost of 2024 / 25 Utility CIP 2) City Council approves Initial Projected Plan of Finance and directs Staff and Finance Team to finalize cost and timing after August 1st Utility Bid Opening 3) City Council considers and approves a Resolution to Authorize Publication of Notice of Intent to Issue Certificates of Obligation, Series 2024 (Not to Exceed Amount based on Projected Max. Cost, to be adjusted by August 1st Utility Best Bid Amount)
Thursday, 08/1/24	Open Utility Bids (90 days)
Thursday, 08/22/24	Regular City Council Meeting 1) Presentation of August 1st Utility Bid results 2) City Council approves August 1st Utility Best Bid 3) Presentation of Final Plan of Finance to fund actual cost of 2024 / 25 Utility CIP based on August 1st Best Bid 4) City Council approves Final Plan of Finance based on August 1st Utility Best Bid Amount and directs Staff and Finance Team to Implement
Thursday, 09/26/24	Pricing of Certificates of Obligation, Series 2024 Regular City Council Meeting 1) Presentation of Results of Certificates of Obligation, Series 2024 Sale and Final Transaction Numbers 2) City Council considers and approves a Ordinance approving the issuance of Certificates of Obligation, Series 2024
Prior to Closing	Attorney General Approves issuance of Certificates of Obligation, Series 2024
Wednesday, 10/9/24 (69 days after August 1st)	Closing of Certificates of Obligation, Series 2024 and delivery of funds to the City of Aubrey

Footnotes

1) Agenda Item - Aubrey City Council Formal Action

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Questions and Discussion

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City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Receive a report, hold a discussion, and take action on awarding a bid to Gracon Construction, Inc. for a 2.25 MGD Wastewater Treatment Plant Expansion in the amount not to exceed $39,957,140 and authorize the City Manager to execute necessary documents.

Staff Contact
Leanne Wilson, Director of Public Works and Development Services
lwilson@aubreytx.gov

Summary
The Wastewater Treatment Plant Expansion Project consists of the construction of a 2.25 MGD activated wastewater treatment plant. Treatment improvements include two screening channels each with a Fine Screen and Washer Compactor, Influent Lift Station with five submersible pumps, one Vortex Grit Removal system, two Aeration Basins with three multistage centrifugal blowers, two circular Secondary Clarifiers with three return activated sludge (RAS) and two waste activated sludge (WAS) pumps, two cloth-media Filters, coagulant and hypochlorite storage and dosing equipment, UV Disinfection system with two channels, plant water system, plant drain system, yard piping, Sludge Storage Tank with two positive displacement blowers, two dewatering Screw Presses and emergency Generator. Building improvements include an O&M Building, two Electrical Buildings, a Chemical Building and a Dewatering Building.

The project was advertised for two consecutive weeks beginning on June 14, 2024 in the local newspaper, was posted on our city website and was available through CivCast. Sealed bids were opened and read on Thursday, August 1, 2024. There were only a total of two bids. The two bids differed by approximately $10,000,000. The lowest bidder was Gracon Construction.

Bid Summary

Contractor	Base Bid Amount
Gracon Construction, LLC	$39,957,140.
Thalle Construction Company	$48,376,323.

Mead & Hunt, City Staff and a third party consultant checked Gracon Constructions statement of qualifications, spoke with numerous references including other municipalities and engineering firms with knowledge of their work and found largely positive feedback and good recommendations for conducting the work needed for a successful construction project. Gracon Construction has successfully completed numerous similar type projects and has several projects near completion. Additionally, Mead & Hunt, Plummer Associates and Birkhoff, Hendricks and Carter have previous successful work experience with Gracon.

We have received an award bid recommendation letter from Mead & Hunt and staff recommends awarding the bid to Gracon Construction.

Financial Summary
This project is funded by Certificates of Obligation, Series 2024. The City Council approved the Initial

Projected Plan of Finance and directed staff to finalize costs and timing and considered and approved a Resolution to Authorize Publication of Notice of Intent to Issue Certificates of Obligation, Series 2024 at the July 25, 2024, regular meeting.

Staff Recommended Motion
Approve

Conditions
N/A

CITY OF AUBREY
WASTEWATER TREATMENT PLANT EXPANSION TO 2.25 MGD

Bid Summary

Section 0042 23 Bid Form, Article 6 – Attachments to the Bid

A. 00 42 23 Bid Form – Exhibit A
B. Required Bid Security.
C. 00 42 24 Vendor Compliance to State Law Certificate.
D. Required Bidder Qualification Statement with Supporting Data
E. Section 00 43 33 Proposed Manufacturers Form
F. Section 00 43 36 Proposed Subcontractor Form

Item No.	Description	Gracon Construction	Thalle Construction Company
1	Complete construction and operational completion of the improvements shown on the plans and specifications, ready to operate. Bid amount shall include all excavation, backfilling, pumping, dewatering, drainage, sheeting, shoring and bracing; disposal of any and all surplus materials, protection of all overhead, surface or underground structures; removal and replacement of any pipelines, appurtenances and connections, cleaning up, overhead expense, bonds, public liability and compensation, and property damage insurance, patent fees and royalties, risk due to the elements, and profit, unless otherwise specified, except for work described in subsequent bid items, below.	$38,635,000.00	$47,054,183.00
2	Allowance for UV Disinfection system to be paid to the UV Disinfection equipment Supplier by the awarded General Contractor for all items in Scope of Supply from Xylem Wedeco per 46 66 56 Ultraviolet Disinfection System and drawings.	$412,700.00	$412,700.00
3	Allowance for two Teledyne ISCO refrigerated samplers to be paid to the sampling equipment Supplier by the awarded General Contractor for all items in Scope of Supply from C.C. Lynch.	$25,596.00	$25,596.00
4	Allowance for Instrumentation and Control System hardware and programming for PLCs, HMIs, and SCADA in accordance with Proposal from WHECO.	$833,844.00	$833,844.00
5	Allowance for furniture, equipment and shipping to be paid to up to five vendors selected by the City for provisions the O&M Building and Electrical Buildings.	$50,000.00	$50,000.00
TOTAL AMOUNT BID (ITEMS 1-3)		**$39,957,140.00**	**$48,376,323.00**

August 12, 2024

Leanne Wilson
Director of Public Works and Development
City of Aubrey
107 S. Main Street
Aubrey, TX 76227

Subject: Wastewater Treatment Plant Expansion to 2.25 MGD
Recommendation to Award

Dear Leanne,:

Two bids were publicly opened and read aloud for the Wastewater Treatment Plant Expansion (WWTP) to 2.25 million gallons per day (MGD) project on August 1, 2024, at 2:00 pm. We have evaluated the bids and no irregularities were found in either bid. We recommend award to the lowest responsive bidder, Gracon Construction, Inc. in the amount of $39,957,140.00.

We have worked with Gracon Construction Inc. on several successful projects and have received favorable contractor verifications from provided references. We believe Gracon Construction capable of performing well on this project.

Please contact me if you have any questions.

Sincerely,

MEAD & HUNT, Inc.

Charlotte G. Smith

Charlotte G. Smith, P.E.
Senior Project Manager

CITY OF AUBREY
WASTEWATER TREATMENT PLANT EXPANSION TO 2.25 MGD

Bid Summary

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TOTAL AMOUNT BID (ITEMS 1-3)		**$39,957,140.00**	**$48,376,323.00**

Schedule A - Current Projects

GRACON CONSTRUCTION, INC.

Project Owner	City of Mesquite, Texas		Project name	Matthew Holzapfel Pump Station	
General Description of project	Construction of a new Matthew Holzapfel pump station with a 10.0 MGD initial capacity (30.0 MGD ultimate) and 3.0 million gallon ground storage tank; sitework, 5,712 square foot pump station building, 3.0 million gallon prestressed concrete ground storage tank, yard piping, two 3,000 GPM horizontal split case pumps and 300 HP motors, two 750 GPM end suction closed coupled pumps and 75 HP motors, water disinfection system with building, electrical system including a 1,000 KW emergency generator with building, controls, supply meter and vault, and on-site sanitary septic system				
Project Cost	$13,261,500.81		Date Project	03/19/21	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Sean Graves	Tim Beck	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Justin Stoker, P.E.	Project Engineer	City of Mesquite, Texas	(972) 216-6335	jstoker@cityofmesquite.com
Designer (Engineer)	Kyle Welden, P.E.	Project Engineer	Kimley Horn And Associates, Inc.	(817) 339-2255	kyle.welden@kimley-horn.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

Project Owner	Trinity River Authority		Project name	Mountain Creek RWWTP Exp. From 3.0 to 4.5 Mgd	
General Description of project	Construction of new blower facility and electrical building, demolition of existing surface aerators and installation of fixed grid fine bubble diffusers, construction of diffuser grids and air piping together with electrical, instrumentation, and control enhancements to develop a complete and functional facility, and construction of new primary metering electrical distribution facilities				
Project Cost	$7,558,098.69		Date Project	04/12/21	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Cory Graves	Craig Gagnon	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Tania M. Ho, P.E.	Project Engineer	Trinity River Authority	(817) 467-4341	hotm@trinityra.org
Designer (Engineer)	Lance Klement, P.E.	Project Engineer	Garver Engineering	(972) 377-7480	lpklement@garverusa.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

Project Owner	City of Garland, Texas		Project name	Duck Creek WWTP Standby Generators	
General Description of project	Install new foundations for two new 2500 KW generators, new foundation for new paralleling switchgear building, new driveway foundation for generator access; demolish existing underground cables from S&C switchgear SG-1 to riser pole No. 3, provide new paralleling switchgear and generator control panel, install new electrical building furnished with the paralleling switchgear PSG-2 and all associated equipment, provide two new 2500 KW tier IV prime-rated generators rated at 12.47 KV, provide and install all necessary wire and conduit as shown on the drawings for a complete and operable system, modifications to existing paralleling switchgear No. 1 to operate as a M-T-T-M system, demolish power and communication wires from existing generators to the existing, paralleling switchgear PSG-1; decommission existing generators; run new fiber from new RTU to existing fiber patch panel, coordinate all construction work with owner's operational constraints				
Project Cost	$7,022,300.00		Date Project	04/19/21	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Greg Graves	Kevin Tyner	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Mickey Butler	PM - WWT Department	City of Garland, Texas	(214) 215-9797	Mbutler@garlandtx.gov
Designer (Engineer)	Mazhar Hajizadeh	Project Engineer	Gupta & Associates, Inc.	(972) 490-7661	mhajizadeh@gaiconsulting.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

EJCDC® C-451, Qualifications Statement - Schedule A - Current Projects.
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Project Owner	City of Wills Point, Texas		Project name	WTP Improvements TWDB/DWSRF Project #62798	
General Description of project	Construction of a raw water meter and meter vault, flow control structure, rehabilitation of a 40'0" I.D. flocculation/sedimentation basin #2, rehabilitation of 50'0" I.D. flocc./sed. basin #1, rehabilitation of two 10'0" x 13'0" mixed-media filters, construction of mixed-media filter #3, extension of the filter building and filter pipe gallery, removal and replacement of approximately 600 LF of plant drain piping, backwash pond lift station and forcemain improvements, rehabilitation of the chlorination and chemical feed facilities				
Project Cost	$4,968,913.20		Date Project	06/05/22	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Greg Graves	John Dye	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Pam Pearson	PCED	City of Wills Point, Texas	(903) 560-8146	ppearson@willspointtx.gov
Designer (Engineer)	Jeremy White	Project Engineer	Schaumburg & Polk, Inc.	(972) 563-0205	jwhite@spi-eng.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

Project Owner	City of Desoto, Texas		Project name	Hampton Rd. Pump Station Booster Pump Station Imps	
General Description of project	New pump station with electrical and chemical feed rooms, installation of new pumps and associated electrical equipment, piping, modifications to the existing ground storage tank, chemical feed improvements, backup power, removal of existing pumps, demolition of the existing electrical building, construction of new access drive, new electric gate, and new perimeter site fencing				
Project Cost	$6,789,575.36		Date Project	08/01/22	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Greg Graves	Benjamin Gutierrez	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Louis Martinez	Managing Director - Public Utilities	City of Desoto, Texas	(972) 274-2489	lmartinez@desototexas.gov
Designer (Engineer)	Markay Brown	Project Engineer	Garver Engineering	(214) 451-2983	mbrown@garverusa.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

Project Owner	City of Tyler, Texas		Project name	Tyler WWTP (De)Chlorination Improvements	
General Description of project	Replacement of chlorine and sulfur dioxide chemical storage and feed systems, installation of water supply improvements, installation of an emergency gas scrubber, replacement of gates, enclosure of chlorine storage area, replacement of doors, windows, and lighting, paving and site improvements				
Project Cost	$3,411,620.00		Date Project	09/01/22	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Sean Graves	Craig Gagnon	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Mike Norris	Plant Manager	City of Tyler, Texas	(903) 581-9635	mnorris@tylertexas.com
Designer (Engineer)	Tracy Hicks, P.E.	Project Engineer	KSA Engineers, Inc.	(903) 530-1919	thicks@ksaeng.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

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Project Owner	Trinity River Authority		Project name	Mountain Creek RWWS Exp. From 4.5 To 6.0 MGD	
General Description of project	Construction of a new influent pump station and installation of new pumps; modifications to the existing influent pump station including coatings and interconnections to the new pump station will also be constructed; construction of a new elevated headworks facility including drum screens and grit removal as well as new secondary treatment splitter box; conversion of existing solids holding tanks to selector zones including new baffle walls and submersible mixers; construction of new RAS/WAS pump station; installation of new disk filter in the existing filter facility and associated appurtenances and piping; construction of new UV disinfection facility and effluent flow metering structure; construction of new non-potable water (W3) pumping system and associated appurtenances and piping; construction of new aerated sludge holding tanks and new solids dewatering building with installation of two (2) new belt filter press units; construction of three (3) new electrical buildings (headworks/influent pump station, RAS/WAS pump station, UV disinfection); construction of required improvements to electrical distribution system to provide power to new facilities; installation of SCADA improvements throughout the project; associated civil work including new access road through facility and yard piping improvements				
Project Cost	$49,729,339.09		Date Project	12/01/22	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Greg Graves	Ken Beck	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Tania M. Ho, P.E.	Project Engineer	Trinity River Authority	(817) 467-4341	hotm@trinityra.org
Designer (Engineer)	Kevin Flinn, P.E.	Project Engineer	Garver Engineering	(682) 747-5389	kflinn@garverusa.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

Project Owner	City of Tioga, Texas		Project name	1.0 MSD WWTP	
General Description of project	Construction of new orbal wastewater treatment plant rated to an average daily flow of 1.0 MGD				
Project Cost	$10,463,582.00		Date Project	TBD	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Sean Graves	Kirk Newman	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Jim Hale		City of Tioga, Texas	(940) 437-2351	tiogawwt@tiogatx.gov
Designer (Engineer)	Kevin Vanhoozier	Project Engineer	Hayter Engineering	(903) 785-0303	kevinvanhoozier@haytereng.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

Project Owner	North Texas Municipal Water District (NTMWD)		Project name	Floyd Branch RWWTP Peak Flow and UV Imps	
General Description of project	Construction of a new UV disinfection facility through modifications to an existing structure; two new UV channels, new canopy, controls, and electrical				
Project Cost	$3,370,730.00		Date Project	06/15/23	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Cory Graves	Tim Beck	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	David Terrill	Project Engineer	North Texas Municipal Water District	9722075520	dterrill@ntmwd.com
Designer (Engineer)	Madeline J. Kull	Project Engineer	CDM Smith, Inc.	(817) 916-2905	kullm@cdmsmith.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

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Project Owner	City of Tyler, Texas		Project name	Golden Road WTP Clarifier and Filter Rehabilitation	
General Description of project	Clarifier rehabilitation including removal and replacement of existing clarifier mechanism, effluent weirs, isolation gates, and associated electrical and controls in clarifiers 3 and 4; filter rehabilitation including removal/disposal of existing filter media, filter underdrains, and installation of new filter media, underdrain systems, surface wash system, and appurtenances in filters 11 - 14				
Project Cost	$4,201,280.00		Date Project	08/18/23	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Sean Graves	Robert Freeman	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Kate Dietz	Project Engineer	City of Tyler, Texas	(903) 253-5905	kdietz@tylertexas.com
Designer (Engineer)	Chris Aylor	Project Engineer	KSA Engineers, Inc.	(903) 581-8140	caylor@ksaeng.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

Project Owner	City of Granbury, Texas		Project name	Granbury East WWTP Improvements	
General Description of project	Construction of new 1.0 million gallons per day (MGD) WWTP, including pre-treatment utilizing screening, grit removal and flow equalization, secondary treatment utilizing biological nutrient removal (BNR) and membrane bioreactor (MBR), post-treatment using UV disinfection, solids storage and dewatering, electrical, supervisory control and data acquisition (SCADA)				
Project Cost	$31,972,000.00		Date Project	11/22/23	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Greg Graves	Ken Beck	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Chester Nolen	Director of Public Works	City of Granbury, Texas	(817) 573-7030	cnolen@granbury.org
Designer (Engineer)	Jordan Hibbs	Project Engineer	Enprotec/Hibbs & Todd, Inc.	(325) 698-5560	jordan.hibbs@e-ht.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

Project Owner	City of Willow Park, Texas		Project name	Willow Park Wastewater Treatment Plant Improvements	
General Description of project	Construction of a new wastewater treatment plant				
Project Cost	$12,713,435.00		Date Project	03/18/24	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Sean Graves	Robert Freeman	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Michelle Guelker	Director of Public Works	City of Willow Park, Texas	(817) 441-7708	mguelker@willowpark.org
Designer (Engineer)	Derek Turner	Project Engineer	Jacob & Martin, LLC	(817) 594-9880	adt@jacobmartin.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

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Project Owner	South Tawakoni Water Supply Corporation (STWSC)		Project name	South Tawakoni WSC Water Plant Rehabilitation	
General Description of project	Construction of water system improvements including but not limited to: erection of containment for plant components under construction, and protection of plant components to remain operational; removal and disposal of clarifier and filter media; demolition and removal of existing air wash and underdrain; blasting of all surfaces interior to vessels, and spot brushing of exterior surfaces; installation of structural repairs including steel, welding and spot repairs, as needed; painting of all surfaces; installation of new underdrain and air wash systems; installation of new media; disinfection; and startup				
Project Cost	$736,756.85		Date Project	01/22/24	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Greg Graves	John Dye	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Kenneth Roberts	General Manager	South Tawakoni Water Supply Corporation (STWSC)	(903) 873-2509	stwsc@yahoo.com
Designer (Engineer)	Bryan Mahlke	Project Engineer	The C.T. Brannon Corporation	(903) 597-2122	Mahlke@BrannonCorp.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

Project Owner	City of Desoto, Texas		Project name	Westmoreland PS 54" Valve Installation	
General Description of project	Installation of an owner provided 54" butterfly valve into an existing 54" bar wrapped concrete pipe header; work will include cutting the concrete for access, removal of soil, preparation for and dewatering the header where the valve is to be installed with welded contractor provided adapters, installation of the valve, backfill, and concrete drive repair				
Project Cost	$252,583.34		Date Project	02/27/24	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Cory Graves	Benjamin Gutierrez	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Louis Martinez	Managing Director - Public Utilities	City of Desoto, Texas	(972) 274-2489	lmartinez@desototexas.gov
Designer (Engineer)	Markay Brown	Project Engineer	Garver Engineering	(214) 451-2983	mbrown@garverusa.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

Project Owner	Cash Special Utility District		Project name	New Ground Storage Tank at Fate Pump Station	
General Description of project	1 million gallon welded steel ground storage tank, foundation, site work, painting with HDPE door hatch and vent; remove existing fence and install 8' masonry fencing and gate with concrete mow strip; 18" DR-18 C900 PVC water line; 12" DR-18 C900 PVC water line; gate vales, boxes, and signage; 12" x 2" tapping sleeve; mechanical joint ductile iron short body fittings; retaining glands and accessories; tank mural; fiberglass building with concrete foundation, gas chlorine system and liquid ammonia sulfate system; install relocated concrete vault with relocated 12" discharge meter; install relocated concrete vault with sample taps, injection points and static mixer; remove existing concrete manhole with existing 12" discharge meter; fill-in area North of the plant with excavation from the proposed storage tank; lights, light poles, and conduits				
Project Cost	$3,403,270.00		Date Project	05/27/24	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Sean Graves	Benjamin Gutierrez	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Clay Hodges	General Manager	Cash Special Utility District	(903) 883-2695	customers@cashwater.org
Designer (Engineer)	Tyler Hendrickson	Project Engineer	Velvin & Weeks Consulting Engineers	(903) 675-3903	then@velvin-weeks.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

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Project Owner	City of Buffalo, Texas		Project name	Buffalo Treatment Plant Improvements	
General Description of project	Provide all labor, materials, and equipment necessary to demolish and dispose of offsite Treatment Units #1 & #2 and equipment inside the existing Treatment Unit #3 and indicated interior concrete walls; construct new sludge holding basins; construct a new 0.32 MGD wastewater treatment plant including but not be limited to: the construction of concrete rapid mix basin and aeration treatment tanks, 26' diameter clarifiers, chlorine contact basins, non-potable water basin, blowers (2 each), pumps, piping, valves, supports, gates, stairways, walkways, railings, concrete stair landings, blowers, air piping, diffusers, 2-15 amp 480V/277V, 3 phase 4 wire pump control panels with VFDs for WAS pumps and one 15 amp 480V/277V 3 phase 4 wire pump control panel with VFDs for scum pumps, lights, receptacles, and instrumentation; construct a new Chlorine, Lab, MCC, Blower Building and associated equipment including but not be limited to: the construction of building, installation of the equipment, electrical service, HV panel, secondary low voltage transformer, low voltage panel, blower control panel, VFDs, piping, valves, supports, utilities, and HVAC; modify the existing Parshall flume and furnish and install new equipment including but not be limited to: installation of new flow monitoring device, installation of dissolved oxygen sensor, electric and controls; furnish a new 800 amp, 480V/277V, 3 Phase, 4 Wire electrical service from the local electrical utility including, but not be limited to: coordination with electrical utility, raceway trenching, and concrete equipment pads; furnish underground electrical and control raceways including by not be limited to: trenching, new underground raceways, fittings, conductors, and spacers				
Project Cost	$8,892,750.00		Date Project	07/08/24	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Cory Graves	Benjamin Gutierrez	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Jerrod Jones	Mayor	City of Buffalo, Texas	(903) 332-4741	mayor@buffalotex.com
Designer (Engineer)	Susan Hilton	Project Engineer	MRB Group	(254) 771-2054	then@velvin-weeks.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

Project Owner	Walnut Creek Special Utility District (SUD)		Project name	Walnut Creek SUD Surface Water Treatment Plant Expansion	
General Description of project	Furnish, install and construct complete in place, a complete surface water treatment plant based upon WesTech Engineering, Inc., Microfloc Products, Trident Model TR-840A modular treatment units, consisting of two parallel 2-MGD treatment units, constructing a high service booster pump station, combined with all piping, valves, equipment, excavation, electrical, painting, protective coatings and complete integration into the Walnut Creek S.U.D. SCADA system for remote operation, to include all labor, tools, equipment, supplies and incidentals, storm water pollution prevention plan and erosion control measures				
Project Cost	$3,998,000.00		Date Project	07/19/24	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Sean Graves	Craig Gagnon	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	James Blackwood	General Manager	Walnut Creek Special Utility District	(817) 220-7707	james.blackwood@walnutcreeksud.org
Designer (Engineer)	Bill Lohrke	Project Engineer	E.S. & C.M., Inc.	(817) 268-0408	freddie@hamiltonduffy.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

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Schedule B - Previous Experience with Similar Projects

GRACON CONSTRUCTION, INC.

Project Owner	City of Huntsville, Texas		Project name	AJ Brown WWTP Improvements	
General Description of project	Removal of sludge/debris and transfer to existing sludge drying beds of sludge/debris from all existing process units; furnish new screening system, furnish new grit removal, furnish and install motor actuators for pneumatic flush valves for the SBR system, furnish and install, complete and in-place, SCADA system				
Project Cost	$17,617,124.65		Date Project	07/05/18	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Greg Graves	Ken Beck	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Billie F. Smith, CPPO	Purchasing Manager	City of Huntsville, Texas	(936) 291-5400	bsmith@huntsvilletx.gov
Designer (Engineer)	Jordan Hibbs	Project Engineer	Enprotec/Hibbs & Todd, Inc.	(325) 698-5560	jordan.hibbs@e-ht.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

Project Owner	City of Celina, Texas		Project name	Celina WWTP Improvements	
General Description of project	Double disc pumps, rotary fan press, asphalt pavement including compacted base, bollards including excavation, concrete, and backfill, concrete pavement including compacted base, curb and gutter including compacted base, demolition of chlorine contact basin No. 2, demolition of drying beds, polymer facilities, demolition of oxidation ditch, construction of vactor truck unloading, construction of sludge storage tanks, blower facilities, sludge transfer pumping facilities, screenings washers and compactors				
Project Cost	$9,365,387.47		Date Project	12/03/18	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Greg Graves	Robert Freeman	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Alan Fourmentin	Director of Public Works	City of Celina, Texas	(972) 382-2682	afourmentin@celina-tx.gov
Designer (Engineer)	Lance Klement	Project Engineer	Garver Engineering	(214) 619-9047	lpklement@garverusa.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

Project Owner	Walnut Creek Special Utility District (SUD)		Project name	Walnut Creek WTP Expansion	
General Description of project	Furnish, install and construct complete in-place surface water treatment plant consisting of two parallel 2MGD treatment units together with adding raw water pumps at the raw water pump station, constructing a water treatment plant building, high service booster pump station				
Project Cost	$4,755,373.44		Date Project	08/30/19	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Sean Graves	Robert Freeman	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Steve Harris	General Manager	Walnut Creek Special Utility District	(817) 220-7707	steve@walnutcreeksud.org
Designer (Engineer)	Bill Lohrke	Project Engineer	E.S. & C.M., Inc.	(817) 268-0408	blohrke@hamiltonduffy.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

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Schedule B - Previous Experience with Similar Projects

GRACON CONSTRUCTION, INC.

Project Owner	City of Waco, Texas		Project name	WMARRS Central Treatment Plant	
General Description of project	Temporary and permanent bypass systems for the main lift station, replace chlorine disinfection systems, replace sulfur dioxide dechlorination system, install FAS system equipment for sludge digester rehab, erect sludge thickening bldg				
Project Cost	$6,617,751.40		Date Project	01/24/20	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Greg Graves	Kirk Newman	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Michael W. Jones, P.E.	Program Adminstrator - Waco Water Utilities	City of Waco, Texas	(254) 750-8074	mikej@wacotx.gov
Designer (Engineer)	John Marler	Project Engineer	HDR	(512) 912-5400	John.Marler@hdrinc.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

Project Owner	City of The Colony, Texas		Project name	Stewart Creek WWTP Exp Ph. 2A - Dewatering Project	
General Description of project	Construction of a new sludge holding tank, new odor control facility, plant water pumps and piping improvements, new dewatering building with associated electrical, piping, mechanical, site, and civil upgrades and improvements				
Project Cost	$10,686,914.07		Date Project	03/08/21	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Greg Graves	Ken Beck	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Daemeon Stovall	Wastewater Supervisor	City of The Colony, Texas	(972) 624-4441	dstovall@thecolonytx.gov
Designer (Engineer)	Troy Laman, P.E.	Project Engineer	Carollo Engineers	(817) 882-0528	Tlaman@carollo.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

Project Owner	City of Mineola, Texas		Project name	Wastewater Treatment Improvements	
General Description of project	Improvements at the WWTP generally consisting of constructing a new influent lift station, new aeration basin, new blowers, rehabilitating final clarifiers, replacement of UV disinfection system equipment, and demolition of the existing aeration basin				
Project Cost	$6,666,651.21		Date Project	05/02/22	
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name	Sean Graves	Robert Freeman	Joe Graves	Greg Graves	
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/position	Organization	Telephone	E-mail
Owner	Mercy Rushing	City Manager	City of Mineola, Texas	(903) 569-6183	mrushing@mineola.com
Designer (Engineer)	Jeremy Orr	Project Engineer	KSA Engineers, Inc.	(903) 581-8141	jorr@ksaeng.com
Construction Manager	N/A	N/A	N/A	N/A	N/A

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Project Manager			
Name of Individual		Greg Graves	
Years of experience as project manager		19	
Years of experience with this organization		24	
Number of similar projects as project manager		18	
Number of similar projects in other positions		4	
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Mountain Creek RWWS Exp. from 4.5 to 6.0 MGD		30%	10/07/25
Granbury East WWTP Improvements		40%	02/19/26
Buffalo WWTP Improvements		30%	02/23/26
Reference Contact Information (listing names indicates approval to contract named individuals as a reference)			
Name	Lance Klement	Name	Troy Laman
Title/Position	Project Engineer	Title/Position	Project Engineer
Organization	Garver Engineering	Organization	Carollo Engineers
Telephone	(972) 377-7480	Telephone	(817) 882-0528
Email	lpklement@garverusa.com	Email	Tlaman@carollo.com
Project	Celina WWTP Improvements	Project	Stewart Creek WWTP Exp Ph. 2A - Dewatering Project
Candidate's role on project	Project Manager	Candidate's role on project	Project Manager
Resume			
Greg Graves is a Vice President and pending shareholder of Gracon Construction. He also serves as senior project manager and quality control manager over all major construction projects. Greg has been employed since 2000. During which he has served as a laborer, foreman, superintendent, and project manager. The list of his completed projects is too lengthy for this exhibit. However, completed projects and references shall be made available upon request.			

Project Superintendent			
Name of Individual		Kevin Tyner	
Years of experience as project superintendent		21	
Years of experience with this organization		26	
Number of similar projects as project superintendent		7	
Number of similar projects in other positions		0	
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Duck Creek WWTP Standby Generators		5%	09/02/22
Wills Point WTP Improvements		10%	12/03/23
Mountain Creek RWWS Expansion from 4.5MGD to 6.0MGD		85%	07/18/25
Reference Contact Information (listing names indicates approval to contract named individuals as a reference)			
Name	Charlotte G. Smith	Name	Sharon Miller
Title/Position	Project Engineer	Title/Position	Project Engineer
Organization	Perkins Engineering Consultants, Inc.	Organization	Perkins Engineering Consultants, Inc.
Telephone	(817) 330-0489	Telephone	(817) 719-0372
Email	csmith@perkinsconsultants.com	Email	smiller@perkinsconsultants.com
Project	Duck Creek WWTP Odor Abatement & Aeration Improvements	Project	Sabine Creek Regional WWTP 3.0
Candidate's role on project	Project Superintendent	Candidate's role on project	Project Superintendent
Resume			
Kevin Tyner has been employed by Gracon Construction for 26 years. With an extensive background in water and wastewater construction, Kevin has supervised small repair jobs to the current $53.6M 6.0MGD Mountain Creek expansion project. Kevin lives in Rockwall, Texas with his wife and daughter.			

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Safety Manager		
Name of Individual	Joe Graves	
Years of experience as safety manager	36	
Years of experience with this organization	47	
Number of similar projects as safety manager	54	
Number of similar projects in other positions	54	
Current Project Assignments		
Name of assignment	Percent of time used for this project	Estimated project completion date
Joe Graves is a current Owner and Vice President of Gracon Construction. He also serves as general superintendent and safety manager over all major construction projects. Joe has been employed at Gracon since 1976. During which he has served as a laborer, foreman, superintendent, and project manager. The list of his completed projects is too lengthy for this exhibit. However, completed projects and references shall be made available upon request.		
Reference Contact Information (listing names indicates approval to contract named individuals as a reference)		
See statement above.		

Quality Control Manager		
Name of Individual	Greg Graves	
Years of experience as quality control manager	19	
Years of experience with this organization	24	
Number of similar projects as quality control manager	21	
Number of similar projects in other positions	20	
Current Project Assignments		
Name of assignment	Percent of time used for this project	Estimated project completion date
See resume above.		
Reference Contact Information (listing names indicates approval to contract named individuals as a reference)		
See Project Manager information above.		

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CITY OF AUBREY, TEXAS

SPECIFICATIONS AND CONTRACT DOCUMENTS
WASTEWATER TREATMENT PLANT EXPANSION TO 2.25 MGD

VOLUME 1
DIVISION 00 to 10

May 2024

BID SET for **INTERNAL REVIEW**

Mead&Hunt
TBPELS FIRM NO. F-9593

In Association with:

MBROH ENGINEERING
TBPE FIRM NO. 9439

JQ Infrastructure
TBPELS Firm F-7986

rawls·culver
ARCHITECTS, LP

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SPECIFICATIONS AND CONTRACT DOCUMENTS

CITY OF AUBREY
WASTEWATER TREATMENT PLANT EXPANSION

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26 24 14	Low Voltage Distribution Switchboards (Compartmentalized)
26 24 16	Panelboards
26 24 19	Low Voltage Motor Control Centers
26 27 26	Light Switches and Receptacles
26 28 16	Low Voltage Enclosed Circuit Breakers and Disconnect Switches
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SPECIFICATIONS AND CONTRACT DOCUMENTS

CITY OF AUBREY
WASTEWATER TREATMENT PLANT EXPANSION

THESE DOCUMENTS ARE FOR INTERIM REVIEW ONLY
AND ARE NOT TO BE USED FOR REGULATORY
APPROVAL, PERMITTING, OR CONSTRUCTION.

CHARLOTTE G. SMITH
TEXAS PE 90300
MAY 19, 2024

MEAD & HUNT, INC.
TBPELS FIRM NO. 9593

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WASTEWATER TREATMENT PLANT EXPANSION

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JOSHUA BRONSTAD
TEXAS PE 111301
MAY 19, 2024

JQ INFRASTRUCTURE, INC.
TBPELS FIRM NO. 7986

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HANS POURES
TEXAS PE 131630
MAY 19, 2024

MBROH ENGINEERING
TBPELS FIRM NO. 9439

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40 91 08	Analyzers Dissolved Oxygen (DO)

00 01 20 INVITATION FOR BIDS

The City of Aubrey is soliciting proposals for the construction of the following project:

Wastewater Treatment Plant Expansion to 2.25

Proposals must be delivered to the Office of the City Secretary, Aubrey City Hall, 107 South Main Street, Aubrey, Texas 76227 no later than **Thursday, July 11, 2024 at 2:00 PM** to be accepted. The proposals will be publicly opened and read aloud at this time and place. Bids received after this time will be returned unopened.

The electronic version of the Contract Documents may be obtained without charge from the CivCast website at www.civcastusa.com.

A non-mandatory pre-bid conference for the project will be held on Wednesday, June 19, 2024 at 10:00 AM at the City of Aubrey Wastewater Treatment Plant located at 514 Bluebonnet Drive, Aubrey, Texas 76227**.** In case of inclement weather, the bad weather makeup day for the pre-bid conference will be Friday, June 21, 2024 at 10:00 AM.

Direct questions regarding the design of the project to Charlotte Smith, Mead & Hunt, Inc. through the CivCast website. Ms. Smith may also be reached via email at charlotte.smith@meadhunt.com. All questions must be submitted in writing through the CivCast website prior to seventy two (72) hours before the bid opening.

This project includes improvements at the City of Aubrey Wastewater Treatment Plant to increase the design capacity to 2.25 MGD. Treatment improvements include of two screening channels each with a Fine Screen and Washer Compactor, Influent Lift Station with five submersible pumps, one Vortex Grit Removal system, two Aeration Basins with three multistage centrifugal blowers, two circular Secondary Clarifiers with three return activated sludge (RAS) and two waste activated sludge (WAS) pumps, two cloth-media Filters, coagulant and hypochlorite storage and dosing equipment, UV Disinfection system with two channels, plant water system, plant drain system, yard piping, Sludge Storage Tank with two positive displacement blowers, two dewatering Screw Presses and emergency Generator. Building improvements include an O&M Building, two Electrical Buildings, a Chemical Building and a Dewatering Building. A more detailed description of the work is included in Section 01 11 00, Summary of Work.

Bidders must submit a cashier's check, certified check, or acceptable bidder's bond with their proposal as a guarantee that the Bidder will enter into a contract for the project with the Owner within fifteen (15) days of Notice of Award of the contract. The security must be payable to the City of Aubrey in the amount of five (5%) percent of the bid submitted. Contractor must execute the contract, bonds and certificates of insurance on the forms provided in the Contract Documents.

Performance and Payment Bonds are required, each in an amount of not less than one-hundred percent (100%) of the contract price, conditioned upon the faithful performance of the contract and upon payment of all persons supplying labor or furnishing materials.

The City of Aubrey reserves the right to adopt the most advantageous interpretation of the bids submitted, to reject any or all bids, and/or waive formalities. Bids may not be withdrawn within sixty (60) days from date on which bids are opened.

Dates of Advertisement: May 24 and 31, 2024.

00 21 16 INSTRUCTIONS TO BIDDERS

1.00 GENERAL

1.01 DEFINED TERMS

Terms used in these Instructions to Bidders have the meanings assigned to them in the General Conditions.

1.02 QUALIFICATIONS OF BIDDERS

A. Submit documentation required in Section 00 45 16 Statement of Qualifications with the Bid to demonstrate that the Contractor is qualified by experience and capability to successfully construct the project within the Contract Time and for the Contract Amount.

B. Owner may conduct investigations as considered necessary to establish the responsibility, qualifications and financial ability of the Bidders, proposed Subcontractors and other persons and organizations to do the work in accordance with the Contract Documents, to Owner's satisfaction, and within the prescribed time. Owner may reject the Bid of any Bidder who does not meet any such evaluation to Owner's satisfaction.

1.03 EXAMINATION OF CONTRACT DOCUMENTS AND SITE

A. Examine Contract Documents, make observations and investigations, correlate knowledge and observations with the requirements of the Contract Documents and consider these in preparation of a bid for the project.

1. Read the Contract Documents and related technical data and reports thoroughly. Use a complete set of Contract Documents in preparing Bids. Assume responsibility for errors or misinterpretations resulting from the use of partial or incomplete contract documents.
2. Visit the site to become familiar with general, local and site conditions that may affect cost, progress or performance of the work in any manner.
3. Become familiar with federal, state and local laws, ordinances, rules and regulations affecting cost, progress or performance of the work.

B. Surveys and investigation reports of subsurface or latent physical conditions at the site, or conditions or situations affecting the design of the Project used by the Engineer in preparing the Contract Documents are referenced in the Supplementary Conditions.

1. These reports are available for information only and neither the Owner nor Engineer guarantees their accuracy or that any opinions expressed in the report are correct.
2. Make additional surveys and investigations as necessary to determine the bid price for performance of the work in compliance with the terms of the Contract Documents before submitting a bid.
3. Cost for these investigations is to be paid by the Bidders.

C. Acknowledge sole responsibility for job site safety, including trench excavation and confined space entry safety, by the submission of a Bid for this project.

D. The submission of a Bid is incontrovertible representation by the Bidder that he has complied with every requirement of this Section.

E. A non-mandatory pre-bid meeting has been scheduled for the time and date set forth in the Invitation for Bids.

1.04 INTERPRETATIONS

A. Submit all questions about the meaning or intent of the Contract Documents to the Engineer in writing. Replies are issued by Addenda to all parties recorded by Engineer as having received the bidding documents. Only questions answered by formal written Addenda are binding. Oral and other interpretations or clarifications will be without legal effect. Questions received less than two days prior to the date for opening of Bids may not be answered.

1.05 BID SECURITY

A. Submit a bid security in the amount of five (5%) percent of the amount of the maximum total bid as a guarantee that the Bidder will promptly enter into a Contract and execute a Performance **and** Payment Bonds on the forms included in the Contract Documents if awarded the contract.

B. Acceptable Bid securities are:
   1. Certified or cashier's check made payable to the Owner, City of Aubrey.
   2. An approved Bidder's Bond underwritten by a surety named in the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Federal Register by the Audit Staff Bureau of Accounts, U.S. Treasury Department.

C. Bid securities will be returned to bidders when the contract award is made or bids are rejected.

1.06 CONTRACT TIME

Construction project duration is 26 months. This project is to be substantially complete and ready for operation within 730 consecutive calendar days from the date of the Notice to Proceed. Final Completion of the project shall be achieved within 60 days of the Substantial Completion Date. Liquidated damages are set forth in the Agreement.

1.07 BID FORM

A. Submit bids on the Bid forms provided with the Contract Documents for each contract Bid. Include supplemental data to be furnished in the same sealed envelope with Bid.

B. Bid forms must be completed in ink. The Bid price of each item on the form must be stated in words and/or numerals. Words take precedence in case of a conflict. In the case of a conflict between the unit price indicated and the extended amount shown, the unit price indicated multiplied by the stated quantity shall govern.

C. Execute bids by corporations in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign.

The corporate address and state of incorporation shall be shown below the signature.

D. Execute bids by partnerships in the partnership name. Forms are to be signed by a partner. Print the name below the signature. Write the title of the Partner and show the official address of the partnership shown below the signature.

E. Acknowledge receipt of all Addenda on the bid form by signing beside the Addenda number.

1.08 SUBMISSION OF BIDS

A. Submit bids at the time and place indicated in the Invitation for Bids. Submit bids in a sealed envelope, marked with the Project title and name and address of the Bidder. Include the Bid security and other required documents in the envelope.

1.09 MODIFICATION AND WITHDRAWAL OF BIDS

A. Modify or withdraw bids by submitting an appropriate document executed in the manner that a Bid must be executed. Deliver the modification or withdrawal to the place where Bids are to be submitted at any time prior to the opening of Bids.

1.10 OPENING OF BIDS

A. Bids will be opened as indicated in the Invitation for Bids.

B. All Bids shall remain open for the period of time set forth in the Invitation for Bids, but Owner may, in his sole discretion, release any Bid and return the Bid Security prior to that date.

1.11 AWARD OF CONTRACT

A. Owner may reject Bids, waive formalities, or disregard nonconforming, conditional Bids or counter proposals.

B. Owner may consider the following in evaluating the bids and awarding the contract:
   1. Contractor's qualifications and ability to demonstrate current capability to complete the project in conformance with the requirements of the contract documents.
   2. Compliance of the Bids with requirements of the Contract Documents
   3. Alternates and unit prices if requested in the Bid forms.
   4. The amount bid.
   5. Proposed date of completion and the ability to meet intermediate milestones that may have been established for the project.

C. The contract will be awarded to the Bidder whose evaluation by Owner indicates that the award will provide best value to the Owner if a contract is to be awarded.

D. Each Bidder agrees to waive any claim it has or may have against the Owner, the Engineer, and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any bid.

1.12 EXECUTION OF CONTRACT

A. The successful Bidder must execute the formal Contract Agreement and required bonds on the forms prepared and submitted by the Owner within fifteen (15) days after the Notice of Award.

B. A Notice to Proceed authorizing the Contractor to commence work will be issued after the Contract Documents have been executed.

1.13 WAGE RATES

Contractor must pay no less than the general prevailing rates for the Project location as determined in accordance with statutory requirements. The minimum rates for various labor classifications as established by the Owner are included in the Contract Documents.

1.14 BONDS

Performance and Payment are required for this project and shall be provided in accordance with the General Conditions.

1.15 SALES TAXES

The Owner qualifies as an exempt agency as defined by the statutes of the State of Texas. Owner's purchasing department will issue exemption certificates. Comply with all statutes and rulings of the State Comptroller.

END OF SECTION

00 42 23 BID FORM

ARTICLE 1 - BID RECIPIENT

1.01 This Bid is submitted to:

City of Aubrey
107 S Main St, Aubrey, TX 76227
Attention: Purchasing Dept.

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 - BIDDER'S ACKNOWLEDGMENTS

2.01 Bidder accepts all the terms and conditions of the Invitation for Bids and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. The Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

2.02 Bidder accepts the provisions of the Agreement as to liquidated damages in the event of its failure to complete Work in accordance with the schedule set forth in the Agreement.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents, as set forth in the Agreement, that:

A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of all of which is hereby acknowledged.

Addendum No.	Addendum Date	Signature Acknowledging Receipt

B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress and the furnishing of Goods and Special Services.

D. Bidder has obtained and carefully studied all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions including surface, subsurface and Underground Facilities at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents to be employed by Bidder, and safety precautions and programs incident thereto or accepts the consequences for not doing so.

E. Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the prices bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.

F. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

G. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.

H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.

I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.

J. Bidder will submit written evidence of its authority to do business in the state where the Project is located not later than the date of its execution of the Agreement.

K. Bidder further represents that this Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any individual or entity to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

ARTICLE 4 – BASIS OF BID

4.01 Bidder will complete the Work in accordance with the Contract Documents for the prices shown in the attached Bid Form:

A. Bidder acknowledges that the estimated quantities are not guaranteed, and final payment for all Unit Price Bid items will be based on actual quantities provided, measured as provided in the contract documents

B. Unit Price and figures column will be used to compute the actual bid price.

ARTICLE 5 – TIME OF COMPLETION

5.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with the General and Supplemental Conditions within the number of calendar days indicated in the Agreement.

ARTICLE 6 – ATTACHMENTS TO THIS BID

6.01 The following documents are attached to and made a condition of this Bid:

A. 00 42 23 Bid Form – Exhibit A
B. Required Bid Security.
C. 00 42 24 Vendor Compliance to State Law Certificate.
D. Required Bidder Qualification Statement with Supporting Data

ARTICLE 7 – DEFINED TERMS

7.01 The terms used in this Bid have the meanings indicated in the General Conditions and the Supplementary Conditions. The significance of terms with initial capital letters is described in the General Conditions.

ARTICLE 8 – VENUE

8.01 Bidder agrees that venue shall lie exclusively in Denton County, Texas for any legal action.

ARTICLE 9 – BID SUBMITTAL

9.01 This Bid submitted by:

If Bidder is:

An Individual

Name: _____
(typed or printed)

By _____
(Individual's Signature)

Doing business as: _____

Business address: _____

_____

Phone: _____ E-mail _____

Bid Submitted on the following Date _____

A Partnership

Partnership Name: _____
(typed or printed)

Name of General Partner: _____
(typed or printed)

By _____
(Signature of general partner -- attach evidence of authority to sign)

Doing business as: _____

Business address: _____

_____

Phone: _____ E-mail _____

Bid Submitted on the following Date _____

A Corporation

Corporation Name: _____

(typed or printed)

State of Incorporation: _____

Type: _____

(General Business, Professional, Service, Limited Liability)

Date of Qualification to do business in Texas is _____

By _____

(Signature -- attach evidence of authority to sign)

Name: _____

(typed or printed)

Title: _____

Attest: _____

(Signature of Corporate Secretary)

Business address: _____

_____

Phone: _____ E-mail _____

Bid Submitted on _____

Joint Venture

Joint Venturer Name: _____
(typed or printed)

By _____
(Signature of joint venture partner -- attach evidence of authority to sign)

Name: _____
(typed or printed)

Title: _____

Business address: _____

_____

Phone: _____ E-mail _____

Bid Submitted on _____

Joint Venturer Name: _____
(typed or printed)

By _____
(Signature of joint venture partner -- attach evidence of authority to sign)

Name: _____
(typed or printed)

Title: _____

Business address: _____

_____

Phone: _____ E-mail _____

Bid Submitted on _____

Contact for receipt of official communications

Name: _____
(typed or printed)

Business address: _____

_____

Phone: _____ E-mail _____

Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.

Bid Form Exhibit A

Item No.	Description	Unit	Est. Quantity	Unit Price	Extended Amount
1	Complete construction and operational completion of the improvements shown on the plans and specifications, ready to operate. Bid amount shall include all excavation, backfilling, pumping, dewatering, drainage, sheeting, shoring and bracing; disposal of any and all surplus materials, protection of all overhead, surface or underground structures; removal and replacement of any pipelines, appurtenances and connections, cleaning up, overhead expense, bonds, public liability and compensation, and property damage insurance, patent fees and royalties, risk due to the elements, and profit, unless otherwise specified, except for work described in subsequent bid items, below.	LS	1		
2	Allowance for UV Disinfection system to be paid to the UV Disinfection equipment Supplier by the awarded General Contractor for all items in Scope of Supply from Xylem Wedeco per 46 66 56 Ultraviolet Disinfection System and drawings.	LS	1	$412,700.00	$412,700.00
3	Allowance for two Teledyne ISCO refrigerated samplers to be paid to the sampling equipment Supplier by the awarded General Contractor for all items in Scope of Supply from C.C. Lynch.	LS	1	$25,596.00	$25,596.00
4	Allowance for Instrumentation and Control System hardware and programming for PLCs, HMIs, and SCADA in accordance with Proposal from WHECO.	LS	1	See Addendum 1	See Addendum 1
5	Allowance for furniture, equipment and shipping to be paid to up to five vendors selected by the City for provisions the O&M Building and Electrical Buildings.	LS	1	$50,000.00	$50,000.00
	TOTAL AMOUNT BID (ITEMS 1-3)				

00 42 24 VENDOR COMPLIANCE TO STATE LAW

Chapter 2252 of the Texas Government Code applies to the award of government contract to non-resident bidders. This law provides that:

> "A governmental entity may not award a governmental contract to a nonresident bidder unless the nonresident underbids the lowest bid submitted by a responsible resident bidder by an amount that is not less than the amount by which a resident bidder would be required to underbid the nonresident bidder to obtain a comparable contract in: (1) the state in which the nonresident's principal place of business is located; or (2) a state in which the nonresident is a resident manufacturer."
>
> "Nonresident Bidder" refers to a person who is not a resident of Texas
>
> "Resident bidder" refers to a person whose principal place of business is in this state, including a contractor whose ultimate parent company or majority owner has its principal place of business in this state.

Check the statement that is correct for Bidder.

[___] Non-resident bidders in _____(give state), our principal place of business, are required to be _____ percent lower than resident bidders by State law. A copy of the statute is attached.

[___] Non-resident bidders in _____(give state), our principal place of business, are not required to under bid resident bidders.

[___] Our principal place of business or corporate offices are in the State of Texas.

Bidder:

Company Name: _____
(typed or printed)

By _____
(Signature -- attach evidence of authority to sign)

Name: _____
(typed or printed)

Title: _____
(Signature of Corporate Secretary)

Business address: _____

_____

Phone: _____ E-Mail _____

UV Proposal

Aubrey, TX

Prepared for:

Mead & Hunt
Charlotte Smith PE

April 16, 2024

Xylem Water Solutions USA, Inc.
4828 Parkway Plaza Blvd Suite 200
Charlotte, NC 28217

April 16, 2024

Mead & Hunt
Charlotte Smith PE

Project Name: Aubrey, TX
Project Number: J23071215056
Revision Number: 1

Dear Charlotte Smith PE,

We are pleased to submit the following proposal for the Aubrey, TX UV opportunity based on the information provided within your inquiry.

The Duron system is a modular open channel UV system that offers owners best in class operational efficiency and an entirely operator-oriented design. We would like to highlight a few key items with our proposal provided:

- **45° Vertical Incline Design -** WEDECO has used our 30+ years of experience in the UV industry to develop this staggered lamp array design, combining the advantages of vertical and horizontal designs. This design results in better hydraulics and decreased footprint.
- **Latest lamp technology** - Our system includes our latest low-pressure, high-intensity Ecoray lamps which have a guaranteed life of 14,000 hours. At 600 watts per lamp, the Duron system also requires fewer lamps and associated replacement components.
- **Redundancy/Reliability** – The wiping and lifting systems are electrically powered and independent of each other which eliminates the need for an external hydraulics system. Further if one electric motor fails, it does not prevent all other systems from operating like a hydraulically driven lifting and wiping system does.
- **True "intensity based" dose pacing control** - WEDECO is unique in the marketplace by taking into account real-time sensor readings of UV intensity, as a function of lamp output, aging and sleeve fouling. This is combined with real-time UV transmittance data to offer true dose pacing for all effluent conditions.
- **TotalCare** - WEDECO's established and proven TotalCare Program provides our customers with proactive services all designed to minimize the cost of ownership to operate and maintain a UV system. TotalCare services can provide our customers with system health checks, efficiency audits, training and preventative maintenance contracts.

Please refer to our local representative Derek Wilms of EI2, 214-636-2283 or us if you have any questions. We look forward to working with you on this exciting project.

Sincerely,

Chadd Matthewson - Central US
Territory Manager
(980) 384-6959

Josiah Wallace
Lead Applications Engineer

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1 Xylem Overview

Xylem is a leading global water technology provider, enabling customers to transport, treat, test and efficiently use water in public utility, residential and commercial building services, industrial and agricultural settings. The company does business in more than 150 countries through a number of market-leading product brands, and its people bring broad applications expertise with a strong focus on finding local solutions to the world's most challenging water and wastewater problems.

Xylem's treatment business offers a portfolio of products and systems designed to effectively meet the demands and challenges of treating water and wastewater. From smarter aeration to advanced filtration to chemical-free disinfection, Xylem leverages its well-known Treatment brands, Flygt, Leopold, Sanitaire, and Wedeco, to offer hundreds of solutions backed by a comprehensive, integrated portfolio of services designed to ensure we can meet our customers' needs in a number of different industries including municipal water and wastewater, aquaculture, biogas and agriculture, food and beverages, pharmaceuticals, and mining.

Our scientists and engineers utilize their deep applications expertise and continually listen and learn from our customers' situations to create solutions that not only use less energy and reduce life-cycle costs, but also promote the smarter use of water.

Wedeco has accepted the challenge of the 21st century. With the Wedeco brand for UV Disinfection, ozone oxidation & AOP solutions, we own the advanced technologies for chemical-free and environmentally friendly treatment of drinking water, wastewater and process water as well as further industrial treatment processes. We constantly invest a large portion of our energy in the development of high-tech components, systems and equipment, as well as in the study of new areas of application for UV, ozone & AOP. In doing so, we have always given special attention to the increase in energy efficiency of our Products equipped with our unique UV lamps and ozone electrodes.

The special characteristics of the Wedeco Ecoray UV lamp are its special doping and the unique long-life coating. Because of these features, a constantly high UV light yield is achieved with a substantially extended lamp service life at the same time. In addition, by using this technology it is not necessary to apply liquid mercury inside the lamp. Wedeco UV lamps cannot be surpassed in economic efficiency.

In relation to expenditure of energy, the High-Intensity/Low-Pressure Technology provides a light yield three times higher than comparable UV lamps of widely used Medium Pressure Technology. A higher light yield also means a lower heat generation at the same time.

Thanks to this, Wedeco UV lamps become less susceptible to varying water temperatures. Even the formation of deposits on the quartz sleeves as well as lamp aging is considerably lower than with alternative UV lamp technologies in Herford and Essen.

WEDECO Ecoray UV lamp

Xylem's Wedeco ozone systems combine maximum flexibility and reliable operating characteristics for small to large ozone capacities. The ozone generator system and control unit can be combined and supplemented with option sets that allow for various application requirements.

Effizon evo 2G ozone electrodes are the core of our technology and achieve an unmatched level of reliability and energy efficiency. The electrodes are manufactured completely from inert materials, without the need for fuses or coatings, making them highly resistant to corrosion. This means that the Wedeco ozone generators are practically maintenance free with no need for regular cleaning or replacement of the electrodes.

We rely on consistently high-quality standards in all divisions of the company. Moreover, product quality and manufacturing operations are constantly monitored and optimized in continuous improvement processes. Established quality controls give Xylem and you the security of knowing that Wedeco UV, Ozone & AOP systems will always operate reliably.

WEDECO Effizon® evo 2G Ozone electrode

For more information please visit us at
http://www.xylem.com/treatment/

Xylem, Inc.
www.xylem.com/treatment

2 General Process Description

2.1 DESIGN

• Design Flow Rates	
– Peak 2-Hr Design Flow	9.0 MGD
– Average Design Flow	2.25 MGD
• Total Suspended Solids (Maximum)	<10 mg/l
• Allowable Effluent Temperature Range	41-86°F
• UV Transmittance at 253.7 nm	65%, minimum
• Effluent Disinfection Standard	
– E. Coli (30 day geometric mean)	200 E. Coli/100 mL
• UV Dose	
– Minimum Design UV Dose (based on NWRI 2012 (MS2) bioassay)	30 mJ/cm²

2.2 PROCESS DESCRIPTION

The proposed Duron UV system has been designed to disinfect secondary effluent to the permit values stated above. The system will be comprised of two (2) channels with each channel containing three (3) banks (two (2) duty and one (1) standby). Level control will be maintained by a fixed finger weir which will be sized for the Phase 2 flow condition.

3 Technical Description

CONFIGURATION:	Duron6 16 i 1 - 3 x 2 eW eL	
DESCRIPTION	**UNITS**	**VALUE**
Total Number of lamps		96
Number of lamps per channel		48
Number of channels		2
Number of banks per channel (Phase 1)		3 (2 Duty, 1 Standby)
Number of modules per bank		1
Number of lamps per module		16
CHANNEL DIMENSIONS:	Inches	
Width along UV banks		39.0
Width along level control		60.0
Design water depth @ influent		43.7-Weir
Overall channel height		74.8
Approx. length		35'-5"
HEADLOSS (at peak flow):	Inches	
Across UV Banks		0.6
Across level control		1.9
Recommended min freeboard		4.0
Total Head loss		7.5
POWER CONSUMPTION:	kW	
Total Connected System Power		68.4
(All Lamps on @ 100% Power)		

4 Technical Clarification & Deviations

ITEM	CLAUSE	COMMENT
1	Section , Item	
2	Section , Item	
3	Section , Item	

5 Price & Scope of Supply

5.1 WEDECO SCOPE OF SUPPLY

5.1.1 **UV Modules**: Six (6) modules will be supplied completely assembled containing UV lamps, quartz sleeves, wiping equipment, and support framework for installation into the channels.

Material: Stainless steel 316 frame

5.1.2 **Lamp Cables**: Ninety-Six (96) lamp-to-ballast cables of max length (82 feet) will be supplied. **Field terminations of these cables are the responsibility of the installing CONTRACTOR**.

5.1.3 **Instrumentation Control Automation (ICA)**: One (1) ICA-200 UL unit will be supplied to monitor and control the UV system and shall contain the PLC system together with the operator interface. The PLC will include a communication module to import and export all UV plant data from/to the SCADA system viaEthernet/IP. A UPS has been included to provide 30 minutes of back-up power to the PLC, HMI and I/O. Enclosure to use heavy-duty 30mm buttons, lights & switches.

Model & Make:	Allen Bradley CompactLogix PLC
Operator interface:	Allen Bradley Panel View Plus 7 10"
Rating, Cooling & Material:	Type 12, Painted Steel
Dimensions:	31.5”W x 23.6”D x 86.6”H (ICA 100/200)

5.1.4 **Ballast 48:** All required Ballast 48 cabinets will be supplied completely assembled containing the ballast that will operate the UV lamps. All units will be equipped with fan for cooling. One Ballast 48 will serve Banks A&B and the second will serve Bank C which will have the ability to serve the future Bank D. Enclosure to use heavy-duty 30mm buttons, lights & switches.

Quantity:	Four (4) Total
Rating, Cooling & Material:	Type 12, Fan-cooled, Painted Steel
Dimensions:	31.5”W x 23.6”D x 82.8”H (Type 12)

5.1.5 **UV Intensity Monitoring & Control System:** UV intensity monitoring and control system will be provided with one (1) sensor per bank.

5.1.6 **Full Automatic Lifting Device**: Full automatic motorized lifting device will be provided for individual module lifting, including accessory control box(es):

a. **Module Lift Control Box (MLC)**: Lift control boxes will be supplied, providing controls for the fully automatic module lifting system. Enclosure to use heavy-duty 30mm buttons, lights & switches.

Material:	Type 4X, 304 Stainless Steel
Quantity:	Two (2) per channel

Mounting: Side by Side

5.1.7 **Automatic Electric Wiping System**: An automatic mechanical wiping system, electric motor-driven, will be supplied including accessory control box(es):

a. **Electric Wipe Control Box**: Electric wipe control boxes will be supplied, providing controls for the electric wiping system. Enclosure to use heavy-duty 30mm buttons, lights & switches.

Material: Type 4X, 304 Stainless Steel
Quantity: Two (2) per channel
Mounting: Side by Side

5.1.8 **Water Level Sensor**: Low water level sensor(s) will be supplied to indicate low water level conditions to the UV PLC.

Make & Model: Endress+Hauser Liquipoint T FTW31
Quantity: One (1) per channel

5.1.9 **On-line Transmittance Monitor:** An on-line transmittance monitor shall be provided for continuous measurement of UV transmittance. Includes the air cleaning system kit, mounting brackets, sensor cable, controller & probe.

Make: YSI
Model: DIQ/S 282 Controller with IQ UVT-254 Probe
Power: 120V / 1Ph / 60Hz (By Others)
Quantity: One (1) Total

5.1.10 **Spare Parts and Safety Equipment**: The following spare parts and safety equipment will be supplied with the UV system:

- Five (5) UV Lamps
- Five (5) Quartz Sleeves
- One (1) Ballast
- Two (2) Face Shields
- One (1) LMX Flex Board
- One (1) Ecotouch Controller
- One (1) TERD Board
- One (1) Wiper Control Board
- One (1) Lift Control Board

5.1.11 **Harmonic Analysis:** calculations to show the UV system meets IEEE 519 requirements which will be conducted by a professional engineer registered in the State of TX.

5.1.12 **Field Services**: WEDECO will provide the services of a qualified technician for the following:

- Fifteen (15) site days, Five (5) trip(s) for installation inspection, start-up, commissioning, and operator training.
- Six (6) site days, Two (2) trip(s) for 1 year and 2 years after final acceptance to review UV Disinfection System performance, operations, and maintenance.
- Additional days as required will be made available on a per diem rate plus travel.

5.2 CONTRACTOR SCOPE OF SUPPLY

5.2.1 The CONTRACTOR is responsible for all field terminations and electrical conduits. The field terminations include the lamp cable to ballast terminations within the ballast enclosures. There are ninety-six (96) lamp cables, with four (4) terminations per lamp cables. Any additional terminations and conduits are also the responsibility of the contractor.

5.2.2 The CONTRACTOR is responsible for ballast card installation; there are a total of forty-eight (48) ballasts (estimated 1-2 minutes per ballast card).

5.2.3 The CONTRACTOR is responsible for supplying and installing an influent flow measurement to the UV system PLC (4 – 20 mA signal).

5.2.4 The CONTRACTOR is responsible for setting in place and anchoring all electrical enclosure(s) and accessory box(es) as indicated in the drawings. The CONTRACTOR shall also be responsible for the power feed(s) to the Ballast 48 Enclosure(s):

- 480 V, 3-phase, 4 wire plus ground (wye), 60 Hz

All conduits and conductors are the responsibility of the CONTRACTOR.

5.2.5 The CONTRACTOR is responsible for setting in place and anchoring the ICA as indicated in the drawings. The CONTRACTOR shall also be responsible for the power feed to the ICA.

- 120 V, 1-phase, 60 Hz

All conduits and conductors are the responsibility of the CONTRACTOR.

5.2.6 The CONTRACTOR is responsible for setting in place and anchoring the components as indicated in the drawings.

5.2.7 The CONTRACTOR is responsible for concrete work including foundations, bases, anchor bolts and fasteners, floor openings, sumps, basins, grout, trenches and concrete embedment.

5.2.8 The CONTRACTOR is responsible for supplying and installing the fixed weir water level control device(s) to the channel walls and bottom ensuring water tightness.

5.2.9 The CONTRACTOR is responsible for setting in place and anchoring the water level sensor(s) indicated in the drawings. Size of the conduit to be the responsibility of the contractor.

5.2.10 The CONTRACTOR is responsible for supplying a climate-controlled building (maximum ambient air temperature = 104°F) for all electrical enclosures and ancillary equipment. Building shall be located within 40-50 feet of the UV channel(s).

5.2.11 The CONTRACTOR is responsible for the unloading of all the components supplied by WEDECO. The CONTRACTOR is also responsible for storage of all the components if required in a clean, dry environment.

5.2.12 The CONTRACTOR is responsible for supplying and installing any required inlet slide gate(s).

5.2.13 The CONTRACTOR is responsible for supplying and installing a light-tight covering for the channel(s).

5.2.14 The CONTRACTOR is responsible for video-taping of training if required.

5.3 PRICE SUMMARY

DESCRIPTION	PRICE
UV System Model Duron as defined in scope of supply	**Included**
TOTAL:	**$ 412,700**

NOTES:

1. Freight, Incoterms 2020 DAP destination. Title and risk of loss will transfer to buyer upon delivery. Offloading and arrangement of the equipment is not included.
2. Price quoted is firm and valid for 90 days. WEDECO reserves the right to adjust price after 90 days.
3. Price is based upon the following payment terms (net 30 days):
    a. 10% net 30 days upon initial submittal of mechanical/electrical drawings for approval
    b. 80% net 30 days from the date of the respective shipments of the product
    c. 5% installation of the Xylem equipment, NTE 150 days after shipment (whichever comes first)
    d. 5% start-up / training on the Xylem equipment, NTE 180 days after shipment (whichever comes first)
4. Please make purchase orders out to:
    Xylem Water Solutions USA, Inc.
    4828 Parkway Plaza Blvd. Suite 200
    Charlotte, NC 28217
    704-409-9700
    Fax 704-409-9839
5. WEDECO does not provide for any process utility requirements including electrical power.
6. If not specifically requested, typical commissioning and training services have been included in firm proposal.
7. This firm proposal is based upon WEDECO's General Terms of Business.
8. No taxes of any kind have been included in this firm proposal.

6 Commercial Terms & Conditions

6.1 DELIVERY SCHEDULE

6.1.1 Delivery time

- Submittals are available within 8-10 weeks after acceptance of purchase order.
- Equipment delivery is within 24-28 weeks after approved submittals.
- Delivery times are based upon an approval period of four (4) weeks, which approval shall not be unreasonably withheld.

6.2 TERMS AND CONDITIONS

This proposal is governed by and subject to Terms and Conditions of Sales-Xylem Americas effective on the date the order is accepted which terms are available at http://www.xyleminc.com/en-us/Pages/terms-conditions-of-sale.aspx and incorporated herein by reference and made a part of the agreement between the parties.

QUOTATION

Quote #	00014832 V1
Date	1/31/2024
Prepared By	Ken Dillard
Email	ken@cclynch.com
Est. Shipment	5-6 Weeks ARO

Bill To Name	Mead & Hunt - Arlington
Billing Address	6001 Interstate 20 West, Suite 219 Arlington, TX 76017
Shipping Company Name	Mead & Hunt - Arlington
Ship To	6001 Interstate 20 West, Suite 219 Arlington, TX 76017
Shipping Terms	F.O.B.: Origin PP&A
Contact Name	Charlotte Smith
Email	charlotte.smith@meadhunt.com

City of Aubrey WWTP Expansion - Isco 5800 Sampler

Quantity	Manufacturer	Part Number	Description	Sales Price	Total Price
2.00	Isco	685800001	5800 Refrigerated Sampler (115 VAC, 60 Hz). Includes control panel, refrigeration unit, distributor arm, and two pump tubes. To receive a complete system you must also order a bottle configuration kit and suction line with strainer.	$8,943.00	$17,886.00
2.00	Isco	685800009	1-bottle Configuration. Includes one polyethylene 2.5-gallon (10-liter) round bottle, locating base, one cap and two discharge tubes.	$281.00	$562.00
2.00	Isco	685800010	1-bottle Configuration. Includes one glass 2.5-gallon (10-liter) round bottle, one PTFE lined cap, locating base, and two discharge tubes.	$281.00	$562.00
2.00	Isco	685800015	24-bottle Configuration. Includes 24 polypropylene 1-liter wedge shaped bottles with caps, bottle rack and two discharge tubes.	$568.00	$1,136.00
2.00	Isco	685800016	24-bottle Configuration. Includes 24 glass 350-mL round bottles with PTFE line caps, retaining rings, bottle rack and two discharge tubes.	$895.00	$1,790.00
2.00	Isco	685800020	5800 refrigerated sampler multipurpose cable with 16 unterminated leads, 10 ft. (3 m).	$180.00	$360.00
2.00	Isco	606700062	Pump tubing for 5800/4700 and 6700 Series/Avalanche Sampler - quantity 5	$194.00	$388.00
2.00	Isco	681680058	3/8 inch vinyl suction line - 100 ft. Includes tubing coupler.	$131.00	$262.00
1.00	Field Service	Start.Up 1250	Initial Equipment Start-up, Including Instrument Programming, Preparation and Adjusments, Calibration, Operator Training and Certificate of Proper Operation	$1,250.00	$1,250.00

Subtotal	$24,196.00
Shipping and Handling	$1,400.00
Grand Total	$25,596.00

Please address order to:

CC LYNCH & ASSOCIATES, INC.
P.O. Box 836 Pass Christian, MS 39571

800-333-2252 228-452-2563 fax
email: info@cclynch.com

Important:

- **Payment Terms** are **NET 30** unless otherwise negotiated.
- For **Credit Card Payment**, add +3.75% transaction fee.
- **Sales Tax** is not normally quoted due to State & Local variability. If you require Sales Tax to be included in this quotation, please contact us.
- If your organization is a **tax-exempt entity**, please email or fax your tax-exempt certificate to

Terms & Conditions

1. OFFERS. Unless stated otherwise in writing by Seller, all Offers made by Seller shall be valid for a period of no-less-than thirty (30) days from the date of such Offer. Unless accepted by Buyer within the Offer validity period, Seller reserves the right to withdraw and/or revise its Offer. The prices offered by Seller apply only to the specific quantities, specifications, delivery schedules, and terms and conditions set forth in Seller's Offer.

2. ACCEPTANCE. The terms and conditions herein apply to all Offers made by Seller, and all Orders accepted by Seller. Acceptance of Buyer's Order, and any changes or amendments thereto, is strictly conditioned upon Buyer's assent to Seller's terms and conditions. Unless otherwise agreed upon in writing by a duly authorized representative of Seller, Seller objects to, and is not bound by, any terms or conditions that differ from, add to, or modify the terms and conditions herein. Seller's failure to object to any terms and conditions or any other provisions contained in any communication from Buyer, including, but not limited to, Buyer's Order and any changes or amendments thereto, does not waive any of the terms and conditions specified herein. Seller's acceptance of Buyer's Order or Buyer's receipt of Goods, whichever occurs first, shall conclusively evidence Buyer's unconditional acceptance of these terms and conditions. The terms and conditions herein shall be applicable whether or not they are attached to or enclosed with Goods and/or Services sold or to be sold hereunder.

3. PRICES. Unless otherwise agreed in writing by a duly authorized representative of Seller, all prices are stated in United States Dollars, and all invoices issued by Seller and payments made by Buyer shall be in United States Dollars. A minimum Order amount of $50.00 applies to all Orders.

4. PAYMENT TERMS. Subject to Seller approval of Buyer's credit, payment terms for Orders are net thirty (30) days from date of Seller's invoice. All amounts due to Seller but not paid by Buyer on the due date bear interest payable at a rate equal to the lesser of (a) one and one-half percent (1.5%) of the outstanding balance per month, or (b) the maximum interest rate permitted under applicable law. Interest accrues on past due amounts as of the date on which such amounts become due until the date Seller receives payment from Buyer. Buyer shall also be liable to Seller for any expenses incidental to collection of past due amounts, including reasonable attorneys' fees and court costs.

5. TAXES. The amount of any present or future sales, use, excise, import duty, or other tax applicable to the manufacture, sale, or lease of Goods shall be added to Seller's invoice and shall be paid by Buyer, unless Buyer provides Seller a valid tax exemption certificate acceptable to the applicable taxing authority.

6. SHIPPING TERMS, TITLE, AND RISK OF LOSS. Unless shown to be otherwise on the face of this Quotation, all domestic shipments shall be delivered F.O.B. Origin shipping dock in accordance with UCC. Buyer agrees to remit payment to Seller for actual transportation charges or standard shipping and handling charges per Seller's pre-determined standard fee structures, whichever applies.

7. LIMITED WARRANTY. Seller provides Goods that include a Limited Warranty by the Manufacturer. The specific warranty for a given Good is the one in effect on date of shipment. This warranty does not apply to any Goods that, upon examination by Seller, are found to have been (a) mishandled, misused, abused, or damaged by Buyer or Buyer's customer, (b) altered or repaired without Seller's prior written approval, or (c) improperly stored, installed, operated, or maintained in a manner inconsistent with Seller's instructions. Limited warranties do not apply to defects attributed to normal wear and tear.
See specific warranty statements from the manufacturers Goods provided herein.

8. GOVERNING LAW AND VENUE. The performance of the Parties, and any judicial or arbitration proceedings, shall be construed and governed in accordance with the laws of the State of Mississippi, United States of America, excepting its laws and rules relating to conflict of law.

00 43 33 PROPOSED MANUFACTURERS FORM

Bidder shall list the manufacturer or supplier that will furnish selected items of equipment for the Work. Bidder shall identify only one manufacturer or supplier for each piece of equipment identified.

In the event any listed manufacturer or supplier differs from those manufacturers or suppliers specifically named in the specifications, Bidder shall submit complete information demonstrating that such manufacturer or supplier can provide equipment that meets the requirements of the Contract Documents.

Where manufacturer's or supplier's names are listed by the Bidder next to the specific item of equipment listed, this shall be interpreted to mean that such manufacturers and suppliers shall not be changed by the Bidder after the Bid opening, except as follows:

1. The manufacturer or supplier cannot provide equipment that meets the requirements of the Contract Documents, or

2. The manufacturer or supplier is unable to meet the delivery requirements necessary to maintain progress of the Project based upon the accepted construction schedule.

In the event Bidder changes the listed manufacturer or supplier due to reasons outlined above, Bidder shall propose an alternate manufacturer or supplier and submit complete information to demonstrate the alternative equipment meets the requirements of the Contract Documents. Failure by Bidder to list names of manufacturers or suppliers for selected item of equipment in the space provided may be cause for rejection of the Bid. Detailed shop drawings shall be required for all items of equipment identified in the Contract Documents.

Equipment	Manufacturer or Supplier
1. Screens and Washer Compactors	☐ Huber ☐ Duperon ☐ Vulcan ☐ Headworks
2. Influent Lift Station Pumps	☐ Sulzer ABS ☐ KSB ☐ Xylem Flygt
3. Vortex Grit Removal System	☐ Smith & Loveless ☐ Ovivo Water Technologies ☐ Lakeside ☐ Veolia John Meunier
4. Circular Clarification Equipment	☐ Ovivo Water Technologies ☐ Evoqua Water Technologies ☐ WesTech Engineering ☐ Walker Process
5. Filters	☐ Aqua Aerobic ☐ Alfa Laval
6. Dewatering Screw Presss	☐ FKC Co., LTD ☐ Andritz ☐ Huber ☐ Schwing Bioset

BIDDER

_____
(Signature)

_____
(Date)

END OF SECTION

00 43 36 PROPOSED SUBCONTRACTORS FORM

Bidder shall list below the names and location of place of business of each subcontractor who will perform work or who will render service to the prime Contractor, or a subcontractor duly licensed who, under subcontract to the prime Contractor, specially fabricates or installs a portion of the work according to detailed drawings contained in the Contract Documents, in an amount in excess $250,000.

After the opening of Bids, no changes or substitutions will be allowed except as otherwise provided by law. The listing of more than one subcontractor for each item of Work to be performed with the words "and/or" will not be permitted.

Work to be Performed	Subcontractor's Name and Location

Add additional sheets, if necessary.

BIDDER

_____
(Signature)

_____
(Date)

END OF SECTION

"General Decision Number: TX20240016 01/05/2024

Superseded General Decision Number: TX20230016

State: Texas

Construction Type: Heavy

County: Denton County in Texas.

Heavy Construction, Including Treatment Plants (Does not include water/sewer lines)

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/05/2024

ASBE0021-003 06/01/2023

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (Includes application of all insulating materials, protective coverings, coatings, and finishings to all types of mechanical systems)	$ 31.32	7.52

ELEC0020-004 12/01/2023

	Rates	Fringes
Electricians:		
Cable Splicer	$ 29.81	8.84
Electrician	$ 37.15	11.29

ELEC0220-001 06/04/2023

	Rates	Fringes
Line Construction:		
CABLE SPLICERS	$ 17.12 **	14.5%+3.75
EQUIPMENT OPERATORS	$ 25.08	17.50%+7.75
GROUNDMAN	$ 18.72	1.5%+7.81
LINEMAN	$ 39.91	17.5%+8.16
TRUCK DRIVER	$ 22.47	2.0%+7.67

ENGI0178-001 06/01/2020

	Rates	Fringes
Cranes:		
Hydraulic Crane (35 ton & under)	$ 32.35	13.10
Hydraulic over 35 tons,Derricks, Overhead Gentry,Stiffleg,Tower,etc., and Cranes with Piledriving or Caisson attachements	$ 32.60	13.10

IRON0263-010 06/01/2023

	Rates	Fringes
Ironworkers:		
Reinforcing & Structural	$ 27.89	7.93

PLUM0100-002 11/01/2022

	Rates	Fringes
Plumbers and Pipefitters	$ 35.73	13.07

SHEE0068-002 11/01/2012

	Rates	Fringes
Sheet metal worker	$ 27.64	8.84

SUTX1990-039 08/01/1990

	Rates	Fringes
CARPENTER	$ 10.536 **	
Concrete Finisher	$ 9.603 **	
Form Builder	$ 8.036 **	
Form Setter	$ 9.578 **	
Laborers:		
Common	$ 7.25 **	
Utility	$ 7.25 **	
Pipelayer	$ 7.961 **	
Power equipment operators:		
Backhoe	$ 10.971 **	
Bulldozer	$ 9.942 **	
Front end loader	$ 10.771 **	
Mechanic	$ 9.88 **	
Motor Grader	$ 11.633 **	
Oiler	$ 9.183 **	
Scraper	$ 8.00 **	
TRUCK DRIVER	$ 7.465 **	

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($17.20) or 13658 ($12.90). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses

(29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date

for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

ARTICLE 1—GENERAL INFORMATION

1.01 Provide contact information for the Business:

Legal Name of Business:			
Corporate Office			
Name:		Phone number:	
Title:		Email address:	
Business address of corporate office:			
Local Office			
Name:		Phone number:	
Title:		Email address:	
Business address of local office:			

1.02 Provide information on the Business's organizational structure:

Form of Business:	☐ Sole Proprietorship ☐ Partnership ☐ Corporation		
☐ Limited Liability Company ☐ Joint Venture comprised of the following companies:			
	1.		
	2.		
	3.		
Provide a separate Qualification Statement for each Joint Venturer.			
Date Business was formed:		State in which Business was formed:	
Is this Business authorized to operate in the Project location?	☐ Yes ☐ No ☐ Pending		

1.03 Identify all businesses that own Business in whole or in part (25% or greater), or that are wholly or partly (25% or greater) owned by Business:

Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			

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1.04 Provide information regarding the Business's officers, partners, and limits of authority.

Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	

ARTICLE 2—LICENSING

2.01 Provide information regarding licensure for Business:

Name of License:			
Licensing Agency:			
License No:		Expiration Date:	
Name of License:			
Licensing Agency:			
License No:		Expiration Date:	

ARTICLE 3—DIVERSE BUSINESS CERTIFICATIONS

3.01 Provide information regarding Business's Diverse Business Certification, if any. Provide evidence of current certification.

Certification		Certifying Agency	Certification Date
☐ Disadvantaged Business Enterprise			
☐ Minority Business Enterprise			
☐ Woman-Owned Business Enterprise			
☐ Small Business Enterprise			
☐ Disabled Business Enterprise			
☐ Veteran-Owned Business Enterprise			
☐ Service-Disabled Veteran-Owned Business			
☐ HUBZone Business (Historically Underutilized) Business			
☐ Other			
☐ None			

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ARTICLE 4—SAFETY

4.01 Provide information regarding Business's safety organization and safety performance.

Name of Business's Safety Officer:		
Safety Certifications		
Certification Name	Issuing Agency	Expiration

4.02 Provide Worker's Compensation Insurance Experience Modification Rate (EMR), Total Recordable Frequency Rate (TRFR) for incidents, and Total Number of Recorded Manhours (MH) for the last 3 years and the EMR, TRFR, and MH history for the last 3 years of any proposed Subcontractor(s) that will provide Work valued at 10% or more of the Contract Price. Provide documentation of the EMR history for Business and Subcontractor(s).

Year									
Company	EMR	TRFR	MH	EMR	TRFR	MH	EMR	TRFR	MH

ARTICLE 5—FINANCIAL

5.01 Provide information regarding the Business's financial stability. Provide the most recent audited financial statement, and if such audited financial statement is not current, also provide the most current financial statement.

Financial Institution:		
Business address:		
Date of Business's most recent financial statement:		☐ Attached
Date of Business's most recent audited financial statement:		☐ Attached
Financial indicators from the most recent financial statement		
Contractor's Current Ratio (Current Assets ÷ Current Liabilities)		
Contractor's Quick Ratio ((Cash and Cash Equivalents + Accounts Receivable + Short Term Investments) ÷ Current Liabilities)		

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ARTICLE 6—SURETY INFORMATION

6.01 Provide information regarding the surety company that will issue required bonds on behalf of the Business, including but not limited to performance and payment bonds.

Surety Name:			
Surety is a corporation organized and existing under the laws of the state of:			
Is surety authorized to provide surety bonds in the Project location?	☐ Yes ☐ No		
Is surety listed in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" published in Department Circular 570 (as amended) by the Bureau of the Fiscal Service, U.S. Department of the Treasury? ☐ Yes ☐ No			
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

ARTICLE 7—INSURANCE

7.01 Provide information regarding Business's insurance company(s), including but not limited to its Commercial General Liability carrier. Provide information for each provider.

Name of insurance provider, and type of policy (CLE, auto, etc.):	
Insurance Provider	Type of Policy (Coverage Provided)
Are providers licensed or authorized to issue policies in the Project location?	☐ Yes ☐ No
Does provider have an A.M. Best Rating of A-VII or better?	☐ Yes ☐ No
Mailing Address (principal place of business):	
Physical Address (principal place of business):	
Phone (main):	Phone (claims):

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ARTICLE 8—CONSTRUCTION EXPERIENCE

8.01 Provide information that will identify the overall size and capacity of the Business.

Average number of current full-time employees:	
Estimate of revenue for the current year:	
Estimate of revenue for the previous year:	

8.02 Provide information regarding the Business's previous contracting experience.

Years of experience with projects like the proposed project:				
As a general contractor:		As a joint venturer:		
Has Business, or a predecessor in interest, or an affiliate identified in Paragraph 1.03:				
Been disqualified as a bidder by any local, state, or federal agency within the last 5 years? ☐ Yes ☐ No				
Been barred from contracting by any local, state, or federal agency within the last 5 years? ☐ Yes ☐ No				
Been released from a bid in the past 5 years? ☐ Yes ☐ No				
Defaulted on a project or failed to complete any contract awarded to it? ☐ Yes ☐ No				
Refused to construct or refused to provide materials defined in the contract documents or in a change order? ☐ Yes ☐ No				
Been a party to any currently pending litigation or arbitration? ☐ Yes ☐ No				
Provide full details in a separate attachment if the response to any of these questions is Yes.				

8.03 List all projects currently under contract in Schedule A and provide indicated information.

8.04 List a minimum of three and a maximum of six projects completed in the last 5 years in Schedule B and provide indicated information to demonstrate the Business's experience with projects similar in type and cost of construction.

8.05 In Schedule C, provide information on key individuals whom Business intends to assign to the Project. Provide resumes for those individuals included in Schedule C. Key individuals include the Project Manager, Project Superintendent, Quality Manager, and Safety Manager. Resumes may be provided for Business's key leaders as well.

ARTICLE 9—REQUIRED ATTACHMENTS

9.01 Provide the following information with the Statement of Qualifications:

A. If Business is a Joint Venture, separate Qualifications Statements for each Joint Venturer, as required in Paragraph 1.02.

B. Diverse Business Certifications if required by Paragraph 3.01.

C. Certification of Business's safety performance if required by Paragraph 4.02.

D. Financial statements as required by Paragraph 5.01.

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E. Attachments providing additional information as required by Paragraph 8.02.

F. Schedule A (Current Projects) as required by Paragraph 8.03.

G. Schedule B (Previous Experience with Similar Projects) as required by Paragraph 8.04.

H. Schedule C (Key Individuals) and resumes for the key individuals listed, as required by Paragraph 8.05.

I. Additional items as pertinent.

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This Statement of Qualifications is offered by:

Business: _____
(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(date signed)

(If Business is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

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Schedule A—Current Projects

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

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Schedule B—Previous Experience with Similar Projects

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

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Schedule B—Previous Experience with Similar Projects

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

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Schedule C—Key Individuals

Project Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

Project Superintendent			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

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Safety Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

Quality Control Manager			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

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AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT

This Agreement is by and between the City of Aubrey, a Texas home rule municipality ("Owner") and _____, a _____("Contractor").

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions.

For and in consideration of the mutual promises and covenants contained herein, Owner and Contractor hereby agree as follows:

ARTICLE 1-WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

Improvements at the City of Aubrey Wastewater Treatment Plant to increase the design capacity to 2.25 MGD: Treatment improvements include of two screening channels each with a Fine Screen and Washer Compactor, Influent Lift Station with five submersible pumps, one Vortex Grit Removal system, two Aeration Basins with three multistage centrifugal blowers, two circular Secondary Clarifiers with three return activated sludge (RAS) and two waste activated sludge (WAS) pumps, two cloth-media Filters, coagulant and hypochlorite storage and dosing equipment, UV Disinfection system with two channels, plant water system, plant drain system, yard piping, Sludge Storage Tank with two positive displacement blowers, two dewatering Screw Presses, and emergency Generator. Building improvements include an O&M Building, two Electrical Buildings, a Chemical Building and a Dewatering Building.

ARTICLE 2-THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows:

Wastewater Treatment Plant Expansion to 2.25 MGD

ARTICLE 3-ENGINEER

3.1 The Owner has retained Mead & Hunt, Inc. ("Engineer") to act as Owner's representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.

3.2 The part of the Project that pertains to the Work has been designed by Mead & Hunt, Inc.

ARTICLE 4-CONTRACT TIMES

4.1 Time is of the Essence

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract. Contract Times shall commence to run as set forth in the Notice to Proceed.

4.2 Contract Times: Days

A. The Work will be substantially complete within **730 consecutive calendar** days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and shall be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within **790 consecutive calendar days** after the date when the Contract Times commence to run as set forth in the Notice to Proceed.

4.3 Liquidated Damages

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. *Substantial Completion:* Contractor shall pay Owner $500 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.

2. *Completion of Remaining Work:* After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner $500 for each day that expires after such time until the Work is completed and ready for final payment.

3. Liquidated damages for failing to timely attain Milestones, Substantial Completion, and final completion are not additive, and will not be imposed concurrently.

B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive damage remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

ARTICLE 5-CONTRACT PRICE

5.1 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, subject to adjustment under the Contract, **in an amount not to exceed _____($_____):**

A. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

ARTICLE 6-PAYMENT PROCEDURES

6.1 Submittal and Processing of Payments

A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.2 Progress Payments; Retainage

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment monthly during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.

a. 95-percent of the value of the Work completed (with the balance being retainage).

b. 95-percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

6.3 Final Payment

A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

6.4 Consent of Surety

A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

6.5 Interest

A. The Owner is not obligated to pay interest on moneys not paid except as provided in Section 49.276(d) of the Texas Water Code, if applicable.

ARTICLE 7-CONTRACT DOCUMENTS

7.1 Contents

A. The Contract Documents consist of all of the following:

1. This Agreement.

2. Bonds:

a. Performance bond (together with power of attorney).

b. Payment bond (together with power of attorney).

c. Maintenance bond (together with power of attorney).

3. General Conditions.

4. Supplementary Conditions.

5. Specifications as listed in the table of contents of the project manual (copy of list attached).

6. Drawings listed on the associated sheet index.
7. Addenda
8. Exhibits to this Agreement (enumerated as follows):
    a. Contractor's Bid.
    b. Documentation submitted by Contractor prior to Notice of Award.
9. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
    a. Notice to Proceed.
    b. Work Change Directives.
    c. Change Orders.
    d. Field Orders.
    e. Warranty Bond, if any.

B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 7.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8-REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.1 Contractor's Representations

A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:

1. Contractor has examined and carefully studied the Contract Documents, including Addenda.
2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

8. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.2 Contractor's Certifications

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.2:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

8.3. Contractor's Compliance with Statutory Requirements and Declarations.

A. Contractor affirms that it has submitted the necessary forms to comply with Texas Gov't Code Section 2252.908, Certificate of Interested Parties (Form 1295)(https://www.ethics.state.tx.us/forms/1295.pdf) and Chapter 176, Texas Local Gov't Code, Conflict of Interest Questionnaire (Form CIQ)(https://www.ethics.state.tx.us/forms/CIQ.pdf) and has returned a fully executed copy of the former as an attachment to this executed contract and proof of the latter to the City after filing with the Texas Ethics Commission as required by the referenced provision of the Texas Government Code.

B. Verification Regarding Energy Company Boycotts. To the extent this Agreement constitutes a contract for goods or services for which a written verification is required under § 2276.002, TEX. GOV'T. CODE, , Contractor hereby verifies that it and its parent company, wholly- or majority-owned subsidiaries, and other affiliates, if any, do not boycott energy companies and, will not boycott energy companies during the term of this Agreement. The foregoing verification is made solely to comply with § 2276.002, TEX. GOV'T. CODE, as amended, to the extent § 2276.002, TEX. GOV'T. CODE does not contravene applicable Texas or federal law. As used in the foregoing verification, "boycott energy companies" shall have the meaning assigned to the term "boycott energy company" in § 809.001, TEX.GOV'T.CODE. Contractor understands "affiliate" to mean an entity that controls, is controlled by, or is under common control with the Underwriter and exists to make a profit.

C. Verification Regarding Firearm Entities or Trade Associations. To the extent this Agreement constitutes a contract for goods or services for which a written verification is required under § 2274.002 (b) TEX. GOV'T. CODE, (N) the Contractor verifies that it does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association; and (ii) the Contractor will not discriminate during the term of the contract against a firearm entity or firearm trade association. The foregoing verification is made solely to comply with Chapter 2274, TEX. GOV'T. CODE, to the extent the appliable provision in Chapter 2274.002, TEX. GOV'T. CODE does not contravene applicable Texas or federal law. As used in the foregoing verification, "firearm entity or firearm trace association" shall have the meaning assigned to the terms in § 2274.001 (6), (7), TEX.GOV'T.CODE. Contractor understands "affiliate" to mean an entity that controls, is controlled by, or is under common control with the Underwriter and exists to make a profit.

D. Certification Regarding Terrorist Organizations. To the extent this Agreement constitutes a contract for goods or services for which a written verification is required under §§ 2252.151-.154 TEX. GOV'T. CODE, Contractor hereby certifies that it and its parent company, wholly or majority- owned subsidiaries, and other affiliates, if any, is not a company identified on the Texas Comptroller's list of companies known to have contracts with, or provide supplies or services to, a foreign organization designated as a Foreign Terrorist Organization by the U.S. Secretary of State under federal law.

E. Verification No Boycott of Israel. To the extent this Agreement constitutes a contract for goods or services for which a written verification is required under Sections 2271.001-002 TEX. GOV'T. CODE, Contractor and its parent company, wholly or majority- owned subsidiaries, and other affiliates, if any, further certifies and verifies that it does not boycott Israel and agrees that it will not boycott Israel during the term of this Agreement. For purposes of this Agreement, the term "boycott" shall mean and include terminating business activities or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory. (TEX. GOV'T. CODE §§ 2270.001-.002, 808.001-.006, .051-.057, .101-.102) The foregoing verification is made solely to comply with Chapter 2271, TEX. GOV'T. CODE, to the extent the appliable provision in Chapter 2271.001, TEX. GOV'T. CODE does not contravene applicable Texas or federal law. As used in the foregoing verification, "boycott Israel" shall have the meaning assigned to such term in § 808.001(1), TEX. GOV'T. CODE. Contractor understands "affiliate" to mean an entity that controls, is controlled by, or is under common control with the Underwriter and exists to make a profit.

F. Liability for breach of any such foregoing verifications during the term of this Agreement shall survive until barred by the applicable statute of limitations and shall not be liquidated or otherwise limited by any provision of this Agreement, notwithstanding anything in this Agreement to the contrary.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on the date of approval of this Agreement by the Aubrey City Council (which is the Effective Date of the Contract).

Owner:	Contractor:
_____	_____
(typed or printed name of organization)	*(typed or printed name of organization)*
By: _____	By: _____
(individual's signature)	*(individual's signature)*
Date: _____	Date: _____
(date signed)	*(date signed)*
Name: _____	Name: _____
(typed or printed)	*(typed or printed)*
Title: _____	Title: _____
(typed or printed)	*(typed or printed)*
	(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)
Attest: _____	Attest: _____
(individual's signature)	*(individual's signature)*
Title: _____	Title: _____
(typed or printed)	*(typed or printed)*

Address for giving notices:

_____

_____

_____

Designated Representative:

Name:_____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

License No.: _____
(where applicable)

State: _____

BID BOND (PENAL SUM FORM)

Bidder	**Surety**
Name: Address *{principal place of business)*:	Name: Address *{principal place of business)*:
Owner Name: City of Aubrey Address *{principal place of business)*: City of Aubrey 107 S Main Street Aubrey, Texas 76227	**Bid** Project *{name and location)*: Expansion to 2.25 MGD City of Aubrey Wastewater Treatment Plant Bid Due Date:
Bond Penal Sum: Date of Bond:	
Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.	

Bidder	Surety
_____ *{Full formal name of Bidder)*	_____ *{Full formal name of Surety) {corporate seal)*
By: _____ *{Signature)*	By: _____ *{Signature) {Attach Power of Attorney)*
Name: _____ *{Printed or typed)*	Name: _____ *{Printed or typed)*
Title: _____	Title: _____
Attest: _____ *{Signature)*	Attest: _____ *{Signature)*
Name: _____ *{Printed or typed)*	Name: _____ *{Printed or typed)*
Title:	Title:

Notes: {1) Note: Addresses are to be used for giving any required notice. {2) Provide execution by any additional parties, such as joint venturers, if necessary.

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1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond will be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder occurs upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation will be null and void if:
   3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
   3.2. All Bids are rejected by Owner, or
   3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions does not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action will be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder must be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond will be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute governs and the remainder of this Bond that is not in conflict therewith continues in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

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PERFORMANCE BOND

STATE OF TEXAS §
§ **Bond No.** _____
COUNTY OF DENTON §

KNOW ALL MEN BY THESE PRESENTS: That _____, whose address is _____, hereinafter called Principal, and _____ _____ a corporation organized and existing under the laws of the State of _____, and fully licensed to transact business in the State of Texas, hereinafter called "Surety", are jointly and severally held and firmly bound unto the **CITY OF AUBREY, TEXAS**, a home rule municipal corporation, hereinafter called "Beneficiary", in the penal sum **of** _____ **Dollars ($00.00)** lawful money of the United States, to be paid in the City of Aubrey, Denton County, Texas, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents. The penal sum of this Bond shall automatically be increased by the amount of any Change Order or Supplemental Agreement which increases the Contract price, and such increase shall occur automatically without further notice to the Surety, but in no event shall a Change Order or Supplemental Agreement which reduces the Contract price decrease the penal sum of this Bond.

THE OBLIGATION TO PAY SAME is conditioned as follows: Whereas, the Principal entered into a certain Contract with the City of Denton, the Beneficiary, dated on or about _____ which is incorporated herein and made a part hereof by reference, for the construction of certain public improvements that are generally described as follows:

WASTEWATER TREATMENT PLANT EXPANSION TO 2.25 MGD

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform and fulfill all of the undertakings, covenants, terms, conditions and agreements of such Contract in accordance with the plans, specifications and contract documents during the original term thereof and any extension thereof which may be granted by the Beneficiary, with or without notice to the Surety, and during the life of any guaranty or warranty required under this Contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of such Contract that may hereafter be made, notice of which modifications to the Surety being hereby waived; and, if the Principal shall fully indemnify and save harmless the Beneficiary from all costs and damages which Beneficiary may suffer by reason of failure to so perform herein and shall fully reimburse and repay Beneficiary all outlay and expense which the Beneficiary may incur in making good any default or deficiency, then this obligation shall be void; otherwise, it shall remain in full force and effect.

PROVIDED FURTHER, that if any legal action be filed on this Bond, exclusive Venue shall lie in Denton County, Texas.

AND PROVIDED FURTHER, that such Surety, for value received, hereby stipulates and agrees that no change, extension of time, increase in Contract price by Supplemental Agreement or Change Order, alteration or addition to the terms of the Contract or to the Work to be performed thereunder or the Specifications accompanying the same shall in anywise affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract, or to the Work or to the Specifications.

This Bond is given pursuant to the provisions of V.T.C.A., Government Code Section 2253.001, et seq., and any other applicable statutes of the State of Texas.

The undersigned and designated agent is hereby designated by the Surety herein as the Resident Agent in Denton County to whom any requisite notices may be delivered and on whom service of process may be had

in matters arising out of such suretyship, as provided by V.A.T.S., Insurance Code Article 7.19-1.

IN WITNESS WHEREOF, this instrument is executed in __ copies, each one of which shall be deemed an original, this, the ____ day of ___, _____.

PRINCIPAL:

BY: _____

ATTEST:
_____

TITLE: _____

SURETY: _____

BY: _____
Name

ATTEST:
_____

TITLE:_____

The Resident Agent of the Surety in Denton County, Texas, for delivery of notice and service of process is:

NAME: _____
STREET ADDRESS: _____
CITY, STATE, ZIP: _____

NOTE: Date on ***Page 1*** of Performance Bond must be ***same date that City Council awarded Contract***. Date on ***Page 2*** of Performance Bond must be ***after the date that City Council awarded the Contract***. If Resident Agent is not a corporation, give a person's name.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. The Surety's obligation under this Bond will arise after:

   3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;

   3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

   3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

   5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

   5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

   5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

   5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, which investigation period shall not exceed sixty (60) days, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial in writing.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

   7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

   7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

   7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.

12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such

statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions

    14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

    14.2. *Construction Contract*-The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

    14.3. *Contractor Default*-Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

    14.4. *Owner Default*-Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

    14.5. *Contract Documents*-All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

16. Modifications to this Bond are as follows: None

PAYMENT BOND

STATE OF TEXAS §
§ **Bond No. _____**
COUNTY OF DENTON §

KNOW ALL MEN BY THESE PRESENTS:
That_____whose address is _____ hereinafter called "Principal", and _____, a corporation organized and existing under the laws of the State of _____, and fully licensed to transact business in the State of Texas, hereinafter "Surety", are jointly and severally held and firmly bound unto the **CITY OF AUBREY, TEXAS**, a home rule municipal corporation, hereinafter called "Beneficiary", and unto all persons, firms, and corporations who may furnish materials for, or perform labor upon the building or improvements described below, in the penal sum of _____**Dollars ($00.00)** in lawful money of the United States, to be paid in Denton County, Texas, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors jointly and severally, firmly by these presents. The penal sum of Bond shall automatically be increased by the amount of any Change Order or Supplemental Agreement which increases the Contract price, and such increase shall occur automatically without further notice to the Surety, but in no event shall a Change Order or Supplemental Agreement which reduces the Contract price decrease the penal sum of this Bond.

WHEREAS, the Principal entered into a certain Contract with the Beneficiary, dated on or about _____which is incorporated herein and made a part hereof by reference, for the construction of certain public improvements that are generally described as follows:

WASTEWATER TREATMENT PLANT EXPANSION TO 2.25 MGD

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties and make prompt payment to all persons, firms, subcontractors, corporations and claimants supplying labor and/or material in the prosecution of the Work provided for in such Contract and any and all duly authorized modifications of such Contract that may hereafter be made, notice of which modification to the Surety is hereby expressly waived, then this obligation shall be void; otherwise it shall remain in full force and effect.

PROVIDED FURTHER, that if any legal action be filed on this Bond, exclusive Venue shall lie in Denton County, Texas.

AND PROVIDED FURTHER, that such Surety, for value received, hereby stipulates and agrees that no change, extension of time, increase in Contract price by Supplemental Agreement or Change Order, alteration or addition to the terms of the Contract or to the Work to be performed thereunder or the Specifications accompanying the same shall in anywise affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract, or to the Work or to the Specifications.

This Bond is given pursuant to the provisions of V.T.C.A., Government Code Section 2253.001, et seq., and any other applicable statutes of the State of Texas.

The undersigned and designated agent is hereby designated by the Surety herein as the Resident Agent in Denton County to whom any requisite notices may be delivered and on whom service of process may be had in matters arising out of such suretyship, as provided by V.A.T.S., Insurance Code Article 7.19-1.

IN WITNESS WHEREOF, this instrument is executed in ___ copies, each one of which shall be deemed an original, this the _____ day of _____, _____.

PRINCIPAL:

BY: _____

ATTEST:
_____

TITLE: _____

SURETY: _____

BY: _____
Name

ATTEST:
_____

TITLE: _____

The Resident Agent of the Surety in Denton County, Texas, for delivery of notice and service of the process is:

NAME: _____
STREET ADDRESS: _____
CITY, STATE, ZIP: _____

NOTE: Date on ***Page 1*** of Payment Bond must be ***same date that City Council awarded Contract***. Date on ***Page 2*** of Payment Bond must be ***after the date that City Council awarded the Contract***. If Resident Agent is not a corporation, give a person's name.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. The Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety's obligations to a Claimant under this Bond will arise after the following:

   5.1. Claimants who do not have a direct contract with the Contractor

      5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

      5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).

   5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

   7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

   7.2. Pay or arrange for payment of any undisputed amounts.

   7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

    16.1. *Claim*-A written statement by the Claimant including at a minimum:

        16.1.1. The name of the Claimant;

        16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;

        16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;

        16.1.4. A brief description of the labor, materials, or equipment furnished;

16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;

16.1.7. The total amount of previous payments received by the Claimant; and

16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2. *Claimant*-An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3. *Construction Contract*-The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4. *Owner Default*-Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5. *Contract Documents*-All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

18. Modifications to this Bond are as follows: None

MAINTENANCE BOND

STATE OF TEXAS §
§ **Bond No.**
COUNTY OF DENTON §

KNOW ALL MEN BY THESE PRESENTS: That _____., whose address is _____ hereinafter called "Principal", and _____, a corporation organized under the laws of the State of _____ and authorized to do business in the State of _____, hereinafter called "Surety", are jointly and severally held and firmly bound unto the **CITY OF AUBREY, TEXAS**, a home rule municipal corporation located in Denton County, Texas, hereinafter called "Beneficiary", in the amount of _____**Dollars ($00.00)** in lawful money of the United States, to be paid in the City of Aubrey, Denton County, Texas, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors and assigns, jointly and severally; and firmly by these presents. This Bond shall automatically be increased by the amount of any Change Order or Supplemental Agreement which increases the Contract price, and such increase shall occur automatically without further notice to the Surety, but in no event shall a Change Order or Supplemental Agreement which reduces the Contract price decrease the penal sum of this Bond.

WHEREAS, Principal entered into a certain written Contract with the City of Aubrey, Texas, dated _____ which is made a part hereof by reference, to furnish all materials, equipment, labor, supervision, and other accessories necessary for:

WASTEWATER TREATMENT PLANT EXPANSION TO 2.25 MGD

in the City of Aubrey, Texas, as more particularly described and designated in the above-referenced contract such contract being incorporated herein and made a part hereof as fully and to the same extent as if written herein word for word.

NOW, THEREFORE, if Principal will maintain and keep in good repair the work herein contracted to be done and performed for a period of two (2) years from the date of final acceptance and do and perform all necessary work and repair any defective condition, it being understood that the purpose of this section is to cover all defective conditions arising by reason of defective materials, work or labor performed by Principal; then this obligation shall be void, otherwise it shall remain in full force and effect; and in case Principal shall fail to do so it is agreed that the City may do such work and supply such materials and charge the same against Principal and Surety on this obligation.

PROVIDED, FURTHER, that if any legal action be filed on this Bond, exclusive venue shall lie in Denton County, Texas.

AND PROVIDED FURTHER, that such Surety, for value received, hereby stipulates and agrees that no change, extension of time, increase in Contract price by Supplemental Agreement or Change Order, alteration or addition to the terms of the Contract or to the Work to be performed thereunder or the Specifications accompanying the same shall in anywise affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract, or to the Work or to the Specifications.

The undersigned and designated agent is hereby designated by Surety as the resident agent in Denton County to whom all requisite notice may be delivered and on whom service of process may be had in matters arising out of this suretyship.

IN WITNESS WHEREOF, this instrument is executed on this the _____ day of _____, ____.

PRINCIPAL: _____

BY: _____

ATTEST:
_____

TITLE: _____

SURETY: _____

BY: _____
Name

ATTEST:
_____

TITLE:_____

The Resident Agent of the Surety in Denton County, Texas, for delivery of notice and service of the process is:

NAME: _____
STREET ADDRESS: _____
CITY, STATE, ZIP: _____

NOTE: Date on ***Page 1*** of Maintenance Bond must be ***same date that City Council awarded Contract***. Date on ***Page 2*** of Maintenance Bond must be ***after date that City Council awarded the Contract***. If Resident Agent is not a corporation, give a person's name.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to maintain and keep in good repair the work herein contracted to be done and performed for a period of two (2) years from the date of final acceptance and do and perform all necessary work and repair any defective condition in accordance with the Construction Contract, which is incorporated herein by reference.

2. If the Contractor promptly maintains and keeps in good repair, including replacement as necessary, the Work performed under the Construction Contract for a period of two (2) years from the date of final acceptance of the Work by City, , then the Surety and the Contractor shall have no obligation under this Bond.
3. The Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of defects in the Work performed under the Construction Contract in accordance with the bond terms.
4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

CERTIFICATE OF INSURANCE

Within ten (10) days of award of the contract, Contractor shall provide Certificate(s) of Insurance to the Owner evidencing compliance with the insurance requirements of the Contract Documents. Certificate(s) will be included in the documents to be executed by the Owner and in the conformed construction contract documents. A certificate of insurance shall be provided on an Acord Standard Form and shall be included as an attachment to this Section entitled "Certificate of Insurance" incorporated into this Section.

STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1-DEFINITIONS AND TERMINOLOGY

1.1 Defined Terms

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*-The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*-The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*-The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

    a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*-The entire and integrated written contract between Owner and Contractor concerning the Work.

13. *Contract Documents*-Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*-The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*-The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*-See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*-Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*-Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.

23. *Field Order*-A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. *Hazardous Environmental Condition*-The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*-Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. *Milestone*-A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. *Notice of Award*-The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

29. *Notice to Proceed*-A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. *Owner*-The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. *Progress Schedule*-A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

32. *Project*-The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. *Samples*-Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

35. *Schedule of Submittals*-A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. *Site*-Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

39. *Specifications*-The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *Subcontractor*-An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. *Submittal*-A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *Substantial Completion*-The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended as evidenced by issuance of a Certification of Substantial Completion by Owner's designated representative. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.*Successful*

Bidder-The Bidder to which the Owner makes an award of contract.

43. *Supplementary Conditions*-The part of the Contract that amends or supplements these General Conditions.

44. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

45. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

46. *Underground Facilities*-All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

47. *Unit Price Work*-Work to be paid for on the basis of unit prices.

48. *Work*-The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

49. *Work Change Directive*-A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.2 Terminology

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;
2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
3. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. Furnish, Install, Perform, Provide

1. The word "furnish," when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
2. The word "install," when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
3. The words "perform" or "provide," when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.
4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. *Contract Price or Contract Times*: References to a change in "Contract Price or Contract Times" or "Contract Times or Contract Price" or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term "or both" is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2-PRELIMINARY MATTERS

2.1 Delivery of Performance and Payment Bonds; Evidence of Insurance

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond, and maintenance bond on the form provided in this Agreement.

B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. *Intentionally Deleted.*

2.2 Copies of Documents

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.3 Before Starting Construction

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work

into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.4 Preconstruction Conference; Designation of Authorized Representatives

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.5 Acceptance of Schedules

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.6 Electronic Transmittals

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

ARTICLE 3-CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.1 Intent

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.2 Reference Standards

A. Standards Specifications, Codes, Laws and Regulations

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility

inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.3 Reporting and Resolving Discrepancies

A. Reporting Discrepancies

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. Resolving Discrepancies

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

   a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

   b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.4 Requirements of the Contract Documents

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.5 Reuse of Documents

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4-COMMENCEMENT AND PROGRESS OF THE WORK

4.1 Commencement of Contract Times; Notice to Proceed

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.2 Starting the Work

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.3 Reference Points

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the

established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.4 Progress Schedule

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.5 Delays in Contractor's Progress

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions;

3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.

D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;

2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5-SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.1 Availability of Lands

A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.2 Use of Site and Other Areas

A. Limitation on Use of Site and Other Areas

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment

and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.3 Subsurface and Physical Conditions

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;
2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and
3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;
2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;
3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or
4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.4 Differing Subsurface or Physical Conditions

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;
2. is of such a nature as to require a change in the Drawings or Specifications;
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. Possible Price and Times Adjustments

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in

Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.5 Underground Facilities

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. Possible Price and Times Adjustments

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.6 Hazardous Environmental Conditions at Site

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures

of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. **To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.**

J. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6-BONDS AND INSURANCE

6.1 Performance, Payment, and Other Bonds

A. Contractor shall furnish a performance bond, a payment bond, and a maintenance bond each in an amount at least equal to the Contract Price and increased amounts based upon approved change orders, on the forms provided herein, as security for the faithful performance and payment of Contractor's obligations under the Contract and for the maintenance of the Work. The performance and payment bonds shall remain in effect until one (1) year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract. The term of the maintenance bond shall be for a period of two (2) years from the date of final acceptance by Owner.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.2 Insurance-General Provisions

A. Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Intentionally Deleted .

F. Failure of Owner to demand such certificates or other evidence of tContractor's full compliance with these insurance requirements, or failure of Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the Contractor’s obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at

Owner's sole discretion and option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.3 Contractor's Insurance

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;
2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;
3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;
4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and
5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner, and any individuals or entities identified as additional insureds in the Supplementary Conditions;
2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;
3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.4 Builder's Risk and Other Property Insurance

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.5 Property Losses; Subrogation

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against

Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.

2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.6 Receipt and Application of Property Insurance Proceeds

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7-CONTRACTOR'S RESPONSIBILITIES

7.1 Contractor's Means and Methods of Construction

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.2 Supervision and Superintendence

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.3 Labor; Working Hours

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.

B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.4 Services, Materials, and Equipment

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.5 "Or Equals"

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that the proposed item:

1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) has a proven record of performance and availability of responsive service; and

4) is not objectionable to Owner.

b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.6 Substitutes

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:

   a. will certify that the proposed substitute item will:

      1) perform adequately the functions and achieve the results called for by the general design;

      2) be similar in substance to the item specified; and

      3) be suited to the same use as the item specified.

   b. will state:

      1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

      2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

      3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

   c. will identify:

      1) all variations of the proposed substitute item from the item specified; and

      2) available engineering, sales, maintenance, repair, and replacement services.

   d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.7 Concerning Subcontractors and Suppliers

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.8 Patent Fees and Royalties

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.9 Permits

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 Taxes

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11 Laws and Regulations

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 Record Documents

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.13 Safety and Protection

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 Hazard Communication Programs

A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 Emergencies

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 Submittals

A. Shop Drawing and Sample Requirements

1. Before submitting a Shop Drawing or Sample, Contractor shall:

   a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

   b. determine and verify:

      1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

      2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

      3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

   c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

   a. Contractor shall submit the number of copies required in the Specifications.

   b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

   a. Contractor shall submit the number of Samples required in the Specifications.

   b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will

document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. Resubmittal Procedures for Shop Drawings and Samples

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

   a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

   b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

   c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 Contractor's General Warranty and Guarantee

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

2. Recommendation by Engineer or payment by Owner of any progress or final payment;

3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. Use or occupancy of the Work or any part thereof by Owner;

5. Any review and approval of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 Indemnification

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 Delegation of Professional Design Services

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;
2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and
3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8-OTHER WORK AT THE SITE

8.1 Other Work

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.2 Coordination

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.3 Legal Relationships

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9-OWNER'S RESPONSIBILITIES

9.1 Communications to Contractor

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.2 Replacement of Engineer

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.3 Furnish Data

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.4 Pay When Due

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.5 Lands and Easements; Reports, Tests, and Drawings

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.6 Insurance

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.7 Change Orders

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.8 Inspections, Tests, and Approvals

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.9 Limitations on Owner's Responsibilities

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 Undisclosed Hazardous Environmental Condition

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 Evidence of Financial Arrangements

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 Safety Programs

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.1 Owner's Representative

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.2 Visits to Site

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.3 Resident Project Representative

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.4 Engineer's Authority

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.5 Determinations for Unit Price Work

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.6 Decisions on Requirements of Contract Documents and Acceptability of Work

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.7 Limitations on Engineer's Authority and Responsibilities

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.8 Compliance with Safety Program

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

ARTICLE 11—CHANGES TO THE CONTRACT

11.1 Amending and Supplementing the Contract

A. The Contract may only be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (1) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.2 Change Orders

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.3 Work Change Directives

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.4 Field Orders

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.5 Owner-Authorized Changes in the Work

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.6 Unauthorized Changes in the Work

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.7 Change of Contract Price

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);
2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or
3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or
2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

   a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;

   b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;

   c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

   d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

   e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

   f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.8 Change of Contract Times

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.9 Change Proposals

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. Change Proposal Procedures

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

   a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

   b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

   The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 Notification to Surety

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.1 Claims

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge

and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. Mediation

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.1 Cost of the Work

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

   a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

   b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are

consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. Contractor's Fee

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.2 Allowances

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.3 Unit Price Work

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision

thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. Adjustments in Unit Price

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

   a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

   b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14-TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.1 Access to Work

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.2 Tests, Inspections, and Approvals

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
3. by manufacturers of equipment furnished under the Contract Documents;
4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.3 Defective Work

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,

losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.4 Acceptance of Defective Work

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.5 Uncovering Work

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.6 Owner May Stop the Work

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work,

or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.7 Owner May Correct Defective Work

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.1 Progress Payments

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. Applications for Payments

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. Review of Applications

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

    a. to supervise, direct, or control the Work;

    b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

    c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

    d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

    e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

    a. the Work is defective, requiring correction or replacement;

    b. the Contract Price has been reduced by Change Orders;

    c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

    e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. Payment Becomes Due

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. Reductions in Payment by Owner

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

    a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.2 Contractor's Warranty of Title

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.3 Substantial Completion

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time

submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.4 Partial Use or Occupancy

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without

significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.5 Final Inspection

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.6 Final Payment

A. Application for Payment

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

d. a list of all duly pending Change Proposals and Claims; and

e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.7 Waiver of Claims

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.8 Correction Period

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;
2. correct such defective Work;
3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.1 Owner May Suspend Work

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work. General conditions damages shall not be allowed during the suspension period.

16.2 Owner May Terminate for Cause

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to consistently supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Intentionally Deleted.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,

attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B.

16.3 Owner May Terminate for Convenience

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, including without limitation, a claim upon Contractor bonds, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work; and

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses.

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B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, general conditions damages, or other economic loss arising out of or resulting from such termination.

16.4 Contractor May Stop Work or Terminate

A. If, through no act or fault of Contractor, except for force majeure, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until

payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.1 Methods and Procedures

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and
2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;
2. agree with the other party to submit the dispute to another dispute resolution process; or
3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.1 Giving Notice

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;
2. by registered or certified mail, postage prepaid, to the recipient's place of business; or
3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.2 Computation of Times

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.3 Cumulative Remedies

A. The duties and obligations imposed by these General Conditions and the rights and remedies

available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.4 Limitation of Damages

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.5 No Waiver

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.6 Survival of Obligations

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.7 Controlling Law

A. This Contract is to be governed by the law of the state in which the Project is located.

18.8 Assignment of Contract

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.9 Successors and Assigns

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 Headings

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

These Supplementary Conditions amend or supplement Standard General Conditions of the Construction Contract provided herein. The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added-for example, "Paragraph SC-4.05."

ARTICLE 1-DEFINITIONS AND TERMINOLOGY

No Supplementary Conditions in this Article.

ARTICLE 2-PRELIMINARY MATTERS

2.2 Copies of Documents

SC-2.02 Delete Paragraph 2.02.A in its entirety and insert the following new paragraph in its place:

A. Owner shall furnish the Contractor one copy in electronic portable document format (PDF) of conformed Contract Documents incorporating and integrating all Addenda and any amendments negotiated prior to the Effective Date of the Contract and one printed copy of the fully signed counterpart of the Agreement.

2.06 *Electronic Transmittals*

SC-2.06 Delete Paragraphs 2.06.B and 2.06.C in their entirety and insert the following in their place:

B. *Electronic Documents Protocol:* The parties shall conform to the following provisions in Paragraphs 2.06.B and 2.06.C, together referred to as the Electronic Documents Protocol ("EDP" or "Protocol") for exchange of electronic transmittals.

1. Basic Requirements

a. To the fullest extent practical, the parties agree to and will transmit and accept Electronic Documents in an electronic or digital format using the procedures described in this Protocol. Use of the Electronic Documents and any information contained therein is subject to the requirements of this Protocol and other provisions of the Contract.

b. The contents of the information in any Electronic Document will be the responsibility of the transmitting party.

c. Electronic Documents as exchanged by this Protocol may be used in the same manner as the printed versions of the same documents that are exchanged using non-electronic format and methods, subject to the same governing requirements, limitations, and restrictions, set forth in the Contract Documents.

d. Except as otherwise explicitly stated herein, the terms of this Protocol will be incorporated into any other agreement or subcontract between a party and any third party for any portion of the Work on the Project, or any Project-related services, where that third party is, either directly or indirectly, required to exchange Electronic Documents with a party or with Engineer. Nothing herein will modify the requirements of the Contract regarding communications between and among the parties and their subcontractors and consultants.

e. When transmitting Electronic Documents, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the receiving party's use of software application packages, operating systems, or computer hardware differing from those established in this Protocol.

f. Nothing herein negates any obligation 1) in the Contract to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations; 2) to comply with any applicable Law or Regulation governing the signing and sealing of design documents or the signing and electronic transmission of any other documents; or 1) to comply with the notice requirements of Paragraph 18.01 of the General Conditions.

2. *System Infrastructure for Electronic Document Exchange*

a. Each party will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions ("System Infrastructure") at its own cost and sufficient for complying with the EDP requirements. With the exception of minimum standards set forth in this EDP, and any explicit system requirements specified by attachment to this EDP, it is the obligation of each party to determine, for itself, its own System Infrastructure.

1) The maximum size of an email attachment for exchange of Electronic Documents under this EDP is 10 MB. Attachments larger than that to be exchanged using large file transfer functions.

2) Each Party assumes full and complete responsibility for any and all of its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, or otherwise enabling its System Infrastructure, including operating systems and software, for use with respect to this EDP.

b. Each party is responsible for its own system operations, security, back-up, archiving, audits, printing resources, and other Information Technology ("IT") for maintaining operations of its System Infrastructure during the Project, including coordination with the party's individual(s) or entity responsible for managing its System Infrastructure and capable of addressing routine communications and other IT issues affecting the exchange of Electronic Documents.

c. Each party will operate and maintain industry-standard, industry-accepted, ISO-standard, commercial-grade security software and systems that are intended to protect the other party from: software viruses and other malicious software like worms, trojans, adware; data breaches; loss of confidentiality; and other threats in the transmission to or storage of information from the other parties. To the extent

that a party maintains and operates such security software and systems, it shall not be liable to the other party for any breach of system security.

d. In the case of disputes, conflicts, or modifications to the EDP required to address issues affecting System Infrastructure, the parties shall cooperatively resolve the issues; but, failing resolution, the Owner is authorized to make and require reasonable and necessary changes to the EDP to effectuate its original intent. If the changes cause additional cost or time to Contractor, not reasonably anticipated under the original EDP, Contractor may seek an adjustment in price or time under the appropriate process in the Contract.

e. Each party is responsible for its own back-up and archive of documents sent and received during the term of the contract under this EDP, unless this EDP establishes a Project document archive, either as part of a mandatory Project website or other communications protocol, upon which the parties may rely for document archiving during the specified term of operation of such Project document archive. Further, each party remains solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract, or after termination of the Project document archive, if one is established, for as long as required by the Contract and as each party deems necessary for its own purposes.

f. If a receiving party receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission.

g. The parties will bring any non-conforming Electronic Documents into compliance with the EDP. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.

h. The Engineer will operate a Project information management system (also referred to in this EDP as "Project Website") for use of Owner, Engineer and Contractor during the Project for exchange and storage of Project-related communications and information. Except as otherwise provided in this EDP or the General Conditions, use of the Project Website by the parties as described in this Paragraph will be mandatory for exchange of Project documents, communications, submittals, and other Project-related information. The following conditions and standards will govern use of the Project Website:

   1) Describe the period of time during which the Project Website will be operated and be available for reliance by the parties;

   2) Provide any minimum system infrastructure, software licensing and security standards for access to and use of the Project Website;

   3) Describe the types and extent of services to be provided at the Project Website (such as large file transfer, email, communication and document archives, etc.); and

   4) Include any other Project Website attributes that may be pertinent to Contractor's use of the facility and pricing of such use.

C. Software Requirements for Electronic Document Exchange; Limitations

1. Each party will acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic Documents received from the other party (and if relevant from third parties), using the software formats required in this section of the EDP.

    a. Prior to using any updated version of the software required in this section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or adjust its transmission to comply with this EDP.

2. The parties agree not to intentionally edit, reverse engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes any Electronic Document or information contained therein that was transmitted in a software data format, including Portable Document Format (PDF), intended by sender not to be modified, unless the receiving party obtains the permission of the sending party or is citing or quoting excerpts of the Electronic Document for Project purposes.

3. Software and data formats for exchange of Electronic Documents will conform to the requirements set forth in Exhibit A to this EDP, including software versions, if listed.

SC-2.06 Supplement Paragraph 2.06 of the General Conditions by adding the following paragraph:

D. Requests by Contractor for Electronic Documents in Other Formats

1. Release of any Electronic Document versions of the Project documents in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be at the sole discretion of the Owner.

2. To extent determined by Owner, in its sole discretion, to be prudent and necessary, release of Electronic Documents versions of Project documents and other Project information requested by Contractor ("Request") in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be subject to the provisions of the Owner's response to the Request, and to the following conditions to which Contractor agrees:

    a. The content included in the Electronic Documents created by Engineer and covered by the Request was prepared by Engineer as an internal working document for Engineer's purposes solely, and is being provided to Contractor on an "AS IS" basis without any warranties of any kind, including, but not limited to any implied warranties of fitness for any purpose. As such, Contractor is advised and acknowledges that the content may not be suitable for Contractor's application, or may require substantial modification and independent verification by Contractor. The content may include limited resolution of models, not-to-scale schematic representations and symbols, use of notes to convey design concepts in lieu of accurate graphics, approximations, graphical simplifications, undocumented intermediate revisions, and other devices that may affect subsequent reuse.

    b. Electronic Documents containing text, graphics, metadata, or other types of data that are provided by Engineer to Contractor under the request are only for convenience of Contractor. Any conclusion or information obtained or derived from such data will be at the Contractor's sole risk and the Contractor waives any claims against Engineer or Owner arising from use of data in Electronic Documents covered by the Request.

c. Contractor shall indemnify and hold harmless Owner and Engineer and their subconsultants from all claims, damages, losses, and expenses, including attorneys' fees and defense costs arising out of or resulting from Contractor's use, adaptation, or distribution of any Electronic Documents provided under the Request.

d. Contractor agrees not to sell, copy, transfer, forward, give away or otherwise distribute this information (in source or modified file format) to any third party without the direct written authorization of Engineer, unless such distribution is specifically identified in the Request and is limited to Contractor's subcontractors. Contractor warrants that subsequent use by Contractor's subcontractors complies with all terms of the Contract Documents and Owner's response to Request.

3. In the event that Owner elects to provide or directs the Engineer to provide to Contractor any Contractor-requested Electronic Document versions of Project information that is not explicitly identified in the Contract Documents as being available to Contractor, the Owner shall be reimbursed by Contractor on an hourly basis (at $145 per hour) for any engineering costs necessary to create or otherwise prepare the data in a manner deemed appropriate by Engineer.

ARTICLE 3-CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

SC-3.01 Delete Paragraph 3.01.C in its entirety.

ARTICLE 4-COMMENCEMENT AND PROGRESS OF THE WORK

4.05 *Delays in Contractor's Progress*

SC-4.05 Amend Paragraph 4.05.C by adding the following subparagraphs:

5. Weather-Related Delays

a. If "abnormal weather conditions" as set forth in Paragraph 4.05.C.2 of the General Conditions are the basis for a request for an equitable adjustment in the Contract Times, such request must be documented by data substantiating each of the following: 1) that weather conditions were abnormal for the period of time in which the delay occurred, 2) that such weather conditions could not have been reasonably anticipated, and 3) that such weather conditions had an adverse effect on the Work as scheduled.

b. The existence of abnormal weather conditions will be determined on a month-by-month basis.

ARTICLE 5-SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS

5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Date of Report	Technical Data
Geotechnical Engineering Study Wastewater treatment Plant Aubrey, Texas	September 2023	Geotechnical evaluation of 11 borings

F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
Field Survey by Birkhoff, Hendricks & Carter, LLC	March 2019	Survey information

G. Contractor may examine copies of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents at Mead & Hunt, Inc. during regular business hours, or may request copies from Engineer.

5.06 *Hazardous Environmental Conditions*

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

4. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely:

Report Title	Date of Report	Technical Data
None		

5. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
None		

ARTICLE 6-BONDS AND INSURANCE

Intentionally Deleted.

6.3 Contractor's Insurance

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

D. *Other Additional Insureds:* As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability and automobile liability policies must include as additional insureds the following:

E. City of Aubrey, Texas, its officials, officers, employees, contractors, agents, and representatives *Workers' Compensation and Employer's Liability:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance, including, as applicable, United States Longshoreman and Harbor Workers' Compensation Act, Jones Act, stop-gap employer's liability coverage for monopolistic states, and foreign voluntary workers' compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

Workers' Compensation and Related Policies	**Policy limits of not less than:**
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Employer's Liability	
Each accident	$500,000
Each employee	$500,000
Policy limit	$500,000

F. *Commercial General Liability-Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
2. damages insured by reasonably available personal injury liability coverage, and
3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

G. *Commercial General Liability-Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage.
   a. Such insurance must be maintained for three years after final payment.
   b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
2. Blanket contractual liability coverage, including but not limited to coverage of

Contractor's contractual indemnity obligations in Paragraph 7.18.

3. Severability of interests and no insured-versus-insured or cross-liability exclusions.

4. Underground, explosion, and collapse coverage.

5. Personal injury coverage.

6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements subject to Owner's written approval.

H. *Commercial General Liability-Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).

2. Any exclusion for water intrusion or water damage.

3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.

4. Any exclusion of coverage relating to earth subsidence or movement.

5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).

6. Any limitation or exclusion based on the nature of Contractor's work.

7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I. Commercial General Liability-Minimum Policy Limits

Commercial General Liability	**Policy limits of not less than:**
General Aggregate	$2,000,000
Products-Completed Operations Aggregate	$2,000,000
Personal and Advertising Injury	$1,000,000
Bodily Injury and Property Damage-Each Occurrence	$1,000,000

J. *Automobile Liability:* Contractor shall purchase and maintain automobile liability insurance for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy must be written on an occurrence basis.

Automobile Liability	**Policy limits of not less than:**
Bodily Injury	
Each Person	$500,000
Each Accident	$500,000
Property Damage	
Each Accident	$500,000
[or]	
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	$1,000,000

K. Contractor shall meet or exceed the Insurance and Bonding Requirements set forth herein.

6.4 Builder's Risk and Other Property Insurance

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

F. *Builder's Risk Requirements:* The builder's risk insurance must:

1. be written on a builder's risk "all risk" policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; flood; earthquake, volcanic activity, and other earth movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).

   a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.

   b. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake, volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance will be provided through other insurance policies acceptable to Owner and Contractor.

2. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent

constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of contractors, engineers, and architects).

4. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier). If this coverage is subject to a sublimit, such sublimit will be a minimum of $500,000.5. extend to cover damage or loss to insured property while in transit. If this coverage is subject to a sublimit, such sublimit will be a minimum of $500,000.

6. allow for the waiver of the insurer's subrogation rights, as set forth in this Contract.

7. allow for partial occupancy or use by Owner by endorsement, and without cancellation or lapse of coverage.

8. include performance/hot testing and start-up, if applicable.

9. be maintained in effect until the Work is complete, as set forth in Paragraph 15.06.D of the General Conditions, or until written confirmation of Owner's procurement of property insurance following Substantial Completion, whichever occurs first.

10 include as named insureds the Owner, Contractor, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be insured under such builder's risk policy. For purposes of Paragraphs 6.04, 6.05, and 6.06 of the General Conditions, and this and all other corresponding Supplementary Conditions, the parties required to be insured will be referred to collectively as "insureds." In addition to Owner, Contractor, and Subcontractors of every tier, include as insureds the following:

   a. None

11. include, in addition to the Contract Price amount, the value of the following equipment and materials to be installed by the Contractor but furnished by the Owner or third parties:

   a. None

12. If debris removal in connection with repair or replacement of insured property is subject to a coverage sublimit, such sublimit will be a minimum of $100,000.

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

G. *Builder's Risk and Other Property Insurance Deductibles:* The purchaser of any required builder's risk, installation floater, or other property insurance will be responsible for costs not covered because of the application of a policy deductible.

1. The builder's risk policy (or if applicable the installation floater) will be subject to a deductible amount of no more than $1,000 for direct physical loss in any one occurrence.

ARTICLE 7-CONTRACTOR'S RESPONSIBILITIES

7.3 Labor; Working Hours

SC-7.03 Add the following new subparagraphs immediately after Paragraph 7.03.C:

1. Regular working hours will be 7:00 a.m. and 6:00 p.m.
2. Owner's legal holidays are New Year, President's Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the day after Thanksgiving and Christmas Eve and Christmas Day.

SC-7.03 Amend the first and second sentences of Paragraph 7.03.C to state "All Work at the Site must be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday without the prior written permission of Owner."

7.10 Taxes

SC-7.10 Add a new paragraph immediately after Paragraph 7.10.A:

A. Owner is exempt from payment of sales and compensating use taxes of the State of Texas and of cities and counties thereof on all materials to be incorporated into the Work.

1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the Work.
2. Owner's exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into the Work.

ARTICLE 8-OTHER WORK AT THE SITE

No Supplementary Conditions in this Article.

ARTICLE 9-OWNER'S RESPONSIBILITIES

No Supplementary Conditions in this Article.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.03 *Resident Project Representative*

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.B:

C. The Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:

1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.

2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.

3. *Liaison*

   a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

   b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

   c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.

4. *Review of Work; Defective Work*

   a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.

   b. Observe whether any Work in place appears to be defective.

   c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.

5. *Inspections and Tests*

   a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.

   b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.

6. *Payment Requests:* Review Applications for Payment with Contractor.

7. *Completion*

   a. Participate in Engineer's visits regarding Substantial Completion.

   b. Assist in the preparation of a punch list of items to be completed or corrected.

   c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.

   d. Observe whether items on the final punch list have been completed or corrected.

D. The RPR will not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.

5 Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Authorize Owner to occupy the Project in whole or in part.

ARTICLE 11—CHANGES TO THE CONTRACT

No Supplementary Conditions in this Article.

ARTICLE 12—CLAIMS

No Supplementary Conditions in this Article.

ARTICLE 13—COST OF WORK; ALLOWANCES, UNIT PRICE WORK

13.1 Cost of the Work

SC-13.01 Supplement Paragraph 13.01.B.5.c.(2) by adding the following sentence:

The equipment rental rate book that governs the included costs for the rental of machinery and equipment owned by Contractor (or a related entity) under the Cost of the Work provisions of this Contract is the most current edition of Rental Rate Blue Book for Construction Equipment, or the AED Green Book: Rental Rates & Specifications for Construction Equipment.

SC-13.01 Supplement Paragraph 13.01.C.2 by adding the following definition of small tools and hand tools:

a. For purposes of this paragraph, "small tools and hand tools" means any tool or equipment whose current price if it were purchased new at retail would be less than $500.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

No Supplementary Conditions in this Article.

ARTICLE 15—PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

No Supplementary Conditions in this Article.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

No Supplementary Conditions in this Article.

ARTICLE 17—INTENTIONALLY DELETED

ARTICLE 18—MISCELLANEOUS

No Supplementary Conditions in this Article.

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01 11 00 SUMMARY OF WORK

1.00 GENERAL

1.01 WORK INCLUDED

A. Construct work as described in the Contract Documents.

1. Provide the materials, equipment, and incidentals required to make the project completely operable.
2. Provide the labor, equipment, tools, and consumable supplies required for a complete project.
3. Provide the civil, architectural, structural, mechanical, electrical, instrumentation and all other work required for a complete and operable project.
4. Test and place the completed project in operation.
5. Provide the special tools, spare parts, lubricants, supplies, or other materials as indicated in Contract Documents for the operation and maintenance of the Project.
6. Drawings and specifications do not indicate or describe all of the work required to complete the project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with the Engineer.

1.02 JOB CONDITIONS

A. The General Conditions, the Supplementary Conditions, and General Requirements apply to each specification sections.

B. Comply with all applicable state and local codes and regulations pertaining to the nature and character of the work being performed.

1.03 DESCRIPTION OF WORK

A. Work is described in general, non-inclusive terms as:

1. Onsite interceptor with influent flow meter
2. Two screening channels each with a Fine Screen and Washer Compactor
3. Influent Lift Station with five submersible pumps
4. One Vortex Grit Removal system
5. Two Aeration Basins with three multistage centrifugal blowers and fine bubble diffused aeration
6. Two circular Secondary Clarifiers
7. Three return activated sludge (RAS)
8. Two waste activated sludge (WAS) pumps
9. Two cloth-media Filters
10. Coagulant and hypochlorite storage and dosing equipment
11. UV Disinfection system with two channels
12. Effluent flow meter
13. Outfall
14. Plant water system
15. Plant drain system
16. Yard piping

17. Sludge Storage Tank with two positive displacement blowers and fine bubble diffused aeration
18. Two dewatering Screw Presses each with sludge pump, polymer dosing system and screw conveyor
19. Emergency Generator
20. O&M Building
21. Two CMU Electrical Buildings
22. Chemical Building
23. Dewatering Building

1.04 WORK UNDER OTHER CONTRACTS

A. The following items of work are not included in this contract, but may impact construction scheduling, testing, and start up:

1. No anticipated construction under other contracts

In the case of a disagreement between the above list and those specified elsewhere in the Contract Documents, the Contractor is to base his bid on the most expensive listing.

B. Completion of the work described in this contract may impact the construction and testing of the items listed above.

1.05 WORK BY OWNER

A. The Owner plans to perform the following items of work which are not included in this contract, but may impact construction scheduling, testing, and start up:

1. No anticipated construction under other contracts

B. Completion of the work described in this contract may impact the construction and testing of the items listed above.

1. Coordinate construction activities through the Owner.
2. Pay claims for damages which result from the late completion of the project or any specified milestones.

C. Owner will provide normal operation and maintenance of the existing facilities during construction, unless otherwise stated.

1.06 OWNER-SELECTED PRODUCTS

A. None

1.07 OWNER-PROVIDED PRODUCTS

A. None

1.08 CONSTRUCTION OF UTILITIES

A. Existing utilities will be used for this project.

1.09 OCCUPANCY

A. As soon as any portion of the structure and equipment are ready for use, the Owner shall have the right to operate the portion upon written notice to the Contractor.

B. Testing of equipment and appurtenances including specified test periods, training, and start-up does not constitute acceptance for operation.

C. Owner may accept the facility for continued use after start-up and testing at the option of the Owner. If acceptance is delayed at the option of the Owner, shut down facilities per approved Operation and Maintenance procedures.

D. The execution of bonds is understood to indicate the consent of the surety to these provisions.

E. Provide an endorsement from the insurance carrier permitting occupancy of the structures and use of equipment during the remaining period of construction.

F. Conduct operations to insure the least inconvenience to the Owner and general public.

2.00 PRODUCTS

2.01 MATERIALS

Provide materials and products per the individual sections of the specifications.

END OF SECTION

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01 14 00 WORK RESTRICTIONS

1.00 GENERAL

1.01 SUMMARY

A. Section includes: Requirements for sequencing and scheduling the Work affected by existing site and facility, work restrictions, and coordination between construction operations and plant operations.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
   3. Section 01 35 00 Special Procedures

1.02 SUBMITTALS

A. Baseline Schedule.

B. Progress Schedule.

1.03 GENERAL CONSTRAINTS ON SEQUENCE AND SCHEDULING OF WORK

A. Wastewater projects:
   1. Conduct Work in a manner that will not impair the operational capabilities of essential elements of the treatment process or reduce the capacity of the entire treatment plant below levels sufficient to treat the quality of raw wastewater to the water quality limitations specified in the discharge permit.
   2. Conduct commissioning and process start-up activities as specified in a manner that will not impair the operational capabilities of essential elements of the treatment process or reduce the capacity of the entire treatment plant below levels sufficient to treat the quality of raw wastewater to the water quality limitations specified in the discharge permit.
   3. The status of the treatment plant shall be defined as "operational" when it is capable of treating the entire quantity of wastewater received to the water quality limits specified in the discharge permit.

B. Work sequence and constraints:
   1. Utilize description of critical events in work sequence in this Section as a guideline for scheduling and undertaking the Work.
   2. Work sequence and constraints presented do not include all items affecting completion of the Work, but are intended to describe critical events necessary to minimize disruption of the existing facilities and to ensure compliance with National Pollutant Discharge Elimination System permit requirements.

1.04 SHUTDOWN AND CONSTRUCTION CONSTRAINTS

A. General shutdown constraints:
   1. Execute the Work while the existing facility is in operation.

2. Some activities may be accomplished without a shutdown.
3. Apply to activities of construction regardless of process or work area.
4. Activities that disrupt plant or utilities operations must comply with these shutdown constraints.
5. Organize work to be completed in a minimum number of shutdowns.
6. Provide thorough advanced planning, including having required equipment, materials, and labor on hand at time of shutdown.
7. Where required to minimize treatment process interruptions while complying with specified sequencing constraints, provide temporary pumping, power, lighting, controls, instrumentation, and safety devices.
8. Final determination of the permitting of shutdowns will be the sole judgment of the Owner.
9. Owner maintains the ability to abort on the day of the scheduled shutdown.
10. Contractor shall provide a minimum of 14 days notification to the Owner prior to a scheduled shutdown.

B. Perimeter Fencing:
   1. The Contractor shall always maintain restricted plant access throughout construction. This may include temporary perimeter fencing provided by the Contractor. Fencing shall be as specified and detailed.

C. Road Access:
   1. Contractor shall maintain plant access throughout the construction period, and shall maintain accessibility of the gate and roadway to the plant's outfall site for Owner vehicular access.

D. Unit process availability work limitations:
   1. Shutdowns and tie-ins or other activities that disrupt plant operations are prohibited unless approved in writing by the Engineer.

E. Shutdown activities:
   1. Scheduling:
      a. Shutdown activities must be coordinated with Plant Staff. Submit notification of required shutdowns of existing facilities at least 14 days prior to the planned date of shutdown, unless specified herein.
   2. Unplanned shutdowns due to emergencies are not addressed in this Section.

F. Dewatering of existing process and disposal of residue:
   1. When the Owner has turned the process unit over to the Contractor for modification or temporary use, the Contractor is responsible for costs and procedures required to dewater and dispose of liquid, solids, etc. in the process unit.
      a. Drainage and disposal of process unit liquids, solids, etc. into another treatment process unit on the plant site may be allowed if approved in advance by the Engineer and Owner, and is conducted in accordance with Owner's requirements.
      b. Costs for dewatering, disposal of solids and residuals, and preparation of surfaces for the Work are Contractor's responsibility.
         1) Includes tipping fees for the removal and disposal of the grit/debris.
      c. Dewatering of grit/debris to meet landfill requirements is the responsibility of the Contractor.

d. Contractor shall provide adequate time in schedules for draining and cleanup of basins and channels.
e. Contractor shall provide all equipment necessary to dewater and remove debris. All dewatering and cleaning equipment shall be at no additional cost to the Owner.

1.05 COMPLIANCE WITH NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

A. The existing facility is operating under the terms of a Texas Pollutant Discharge Elimination System permit issued by the Texas Commission on Environmental Quality (TCEQ). This permit specifies the water quality limits that the plant must meet prior to discharge of effluent. A copy of the existing permit is on file for review at the RCWWTP Administrative Office.

B. Perform work in a manner that will not prevent the existing facility from achieving the finished water quality requirements established by regulations.

C. Bear the cost of penalties imposed on the Owner for discharge violations caused by actions of the Contractor.

1.06 REQUIREMENTS FOR SAFE WORKING ATMOSPHERE

A. Provide temporary ventilation, including all necessary electrical and mechanical provisions, as needed at any facility as required for a safe working environment for the entire duration of the Work.

B. Prior to interruption of existing ventilation in any area of the Work, provide temporary ventilation sized to maintain a minimum of six air changes per hour in each individual room or space that would be impacted.

C. Temporary ventilation shall not interfere with new construction.

1.07 REQUIREMENTS FOR OPERATION OF PLANT AND MAINTAINING CONTINUOUS OPERATION OF EXISTING FACILITIES

A. Conduct the Work and provide temporary facilities required to keep the existing plant continuously operational within limits described in Section 01 35 00 Special Procedures.

B. Do not remove or demolish existing facilities required to keep the existing plant operational at the capacities specified until the existing facilities are replaced by temporary, new, or upgraded facilities or equipment.

1.08 OPERATIONS AND MAINTENANCE ACCESS

A. Provide safe, continuous access to process control equipment for plant operations personnel.

B. Provide access on 1-hour advance notice to process control equipment for plant maintenance personnel and associated maintenance equipment.

1.09 UTILITIES

A. Provide advance notice to and utilize services of Texas811 or Lonestar811 for location and marking of underground utilities operated by utility agencies other than the Owner.

B. Maintain electrical, telephone, water, gas, sanitary facilities, and other utilities within existing facilities in service. Provide temporary utilities when necessary.

C. New yard utilities were designed using existing facility drawings.
   1. Field verification of utilities locations was not performed during design.
   2. Services crossed or located nearby by new yard utilities may require relocation and possible shutdowns.
   3. Pipe alignments as indicated on the Drawings.

1.10 COORDINATION OF WORK

A. Maintain overall coordination of the Work.

B. Obtain construction schedules from subcontractors and suppliers, and assume responsibility for correctness.

C. Incorporate schedules from subcontractors and suppliers into Progress Schedule to plan for and comply with sequencing constraints.

1.11 WORK BY OTHERS

A. Where proper execution of the Work depends upon work by others, inspect and promptly report discrepancies and defects.

1.12 WORK SEQUENCE

A. Contractor shall submit an outline of work sequence for review and approval by Owner and Engineer prior to construction.

1.13 TEMPORARY SERVICES, MATERIALS, AND EQUIPMENT

A. As specified in Section 01 50 00 Temporary Facilities and Controls.

2.00 PRODUCTS

Not Used.

3.00 EXECUTION

Not Used.

END OF SECTION

01 29 00 PAYMENT PROCEDURES

1.00 GENERAL

1.01 WORK INCLUDED

A. Payments for Work shall conform to the provisions of the General Conditions, the Supplementary Conditions, the Agreement, and this Section.

B. Submit Applications for Payment at the prices indicated in the Agreement

1. Prices for each item in the Agreement shall include but not be limited to cost for:
   a. Mobilization, demobilization, cleanup, bonds, and insurance,
   b. Professional services including but not limited to engineering and legal fees,
   c. The products to be permanently incorporated into the project,
   d. The products consumed during the construction of the project,
   e. The labor and supervision to complete the project,
   f. The equipment, including tools, machinery, and appliances required to complete the project,
   g. The field and home office administration and overhead costs related directly or indirectly to the project, and
   h. Any and all kinds, amount or class of excavation, backfilling, pumping or drainage, sheeting, shoring and bracing, disposal of any and all surplus materials, permanent protection of all overhead, surface or underground structures; removal and replacement of any poles, conduits, pipelines, fences, appurtenances and connections, cleaning up, overhead expense, bond, public liability and compensation and property damage insurance, patent fees, and royalties, risk due to the elements, and profits, unless otherwise specified.
2. Provide work not specifically set forth as an individual payment item but required to provide a complete and functional system. These items are a subsidiary obligation of the Contractor and are to be included in the Contract Price.
3. Payment will be made for materials on hand.
   a. Store materials properly on site per Section 01 31 00, Project Management and Coordination.
      1) Payment will be made for the invoice amount less the specified retainage.
      2) Provide invoices at the time materials are included on the materials-on-hand tabulation.
   b. Provide documentation of payment for materials-on-hand with the next payment request. Adjust payment to the amount actually paid if this differs from the invoice amount. Remove items from the materials on hand tabulation if this documentation is not provided so payment will not be made.
   c. Payment for materials-on-hand is provided for the convenience of the Contractor and does not constitute acceptance of the product.
4. The work covered by progress payments becomes the property of the Owner at the time of payment.

1.02 SCHEDULE OF VALUES AND PAYMENTS

A. Submit a detailed Schedule of Values for the Work to be performed on the project.

1. Submit schedule within 10 days prior to submitting the first Application for Payment.
2. Line items in the Agreement are to be used as line items in the schedule.

3. Payment will be made on the quantity of Work completed per Contract Documents during the payment period and as measured per this Section.
   a. Payment amount is the Work quantity measured multiplied by the unit prices for that line item in the Agreement.
   b. Payment on a unit price basis will not be made for work outside finished dimensions shown in the Contract Documents.
   c. Partial payments will be made for lump sum line items in the Agreement.
      1) Lump sum line items in the Agreement are to be divided into smaller unit prices to allow more accurate determination of the percentage of the item that has been completed.
         a) Provide adequate detail to allow more accurate determination of the percentage of work completed for each item.
         b) Provide prices for items that do not exceed $50,000.00. An exception may be made for equipment packages that cannot be subdivided into units or subassemblies.
         c) Separate product costs and installation costs.
            1. Product costs include cost for product, delivery and unloading costs, royalties and patent fees, taxes, and other cost paid directly to the Subcontractor or Supplier.
            2. Installation costs include cost for the supervision, labor and equipment for field fabrication, erection, installation, start-up, initial operation and Contractor's overhead and profit. For equipment or systems that exceed $50,000 the costs reported for startup activation shall not be less than 10 percent of the total item cost.
         d) Lump sum items may be divided into an estimated number of units.
            1. The estimated number of units times the cost per unit must equal the lump sum amount for that line item.
            2. Contractor will receive payment for all of the lump sum line item.
         e) Include a directly proportional amount of Contractor's overhead and profit for each line item.
         f) Divide principal subcontract amounts into an adequate number of line items to allow determination of the percentage of work completed for each item.
      2) These line items may be used to establish the value of work to be added or deleted from the project.
      3) Correlate line items with other administrative schedules and forms:
         a) Progress schedule,
         b) List of Subcontractors,
         c) Schedule of allowances,
         d) Schedule of alternatives,
         e) List of products and principal Suppliers, and
         f) Schedule of Submittals
      4) Costs for mobilization shall be listed as a separate line item and shall be actual cost for:
         a) Bonds and insurance,
         b) Transportation and setup for equipment,
         c) Transportation and/or erection of all field offices, sheds and storage facilities,
         d) Salaries for preparation of submittals required before the first Application for Payment,
         e) Salaries for field personnel assigned to the project related to the mobilization of the project,

Mobilization may not exceed 5 percent of the total contract amount (less retainage specified elsewhere in the contract). Cost for mobilization may be submitted only for work completed

5) The sum of all values listed in the schedule must equal the total contract amount.

4. Submit a schedule indicating the anticipated schedule of payments to be made by the Owner. Schedule shall indicate:
   a. The Application for Payment number,
   b. Date the request is to be submitted, and
   c. Anticipated amount of payment to be requested.
5. Update the Schedule of Values quarterly or more often if necessary to provide a reasonably accurate indication of the funds that the Owner will need to have available to make payment to the Contractor for the Work performed.

B. Provide written approval of the Schedule of Values, Application for Payment form, and method of payment by the Surety Company providing performance, **and** payment bonds prior to submitting the first Application for Payment. Payment will not be made without this approval.

1.03 PAYMENT PROCEDURES

A. Submit Applications for Payment per the procedures indicated in Section 01 33 00, Submittals. Submit a Schedule of Values in the Application for Payment format to be used.

B. Applications for Payment may be submitted on a pre-printed form as indicated in Section 01 31 13 13, Forms or may be generated by computer. Computer generated payment requests must have the same format and information indicated in the pre-printed form and be approved by the Engineer.

   a. Indicate the total contract amount and the work completed to date on the Tabulation of Values for Original Contract Performed (Attachment "A".)
   b. Include only approved Change Order items in the Tabulation of Extra Work on Approved Change Orders (Attachment "B".)
   c. List all materials on hand that are presented for payment on the Tabulation of Materials on Hand (Attachment "C".) Once an item has been entered on the tabulation it is not to be removed.
   d. Include the Project Summary Report (Attachment "D") with each Application for Payment. Data included in the Project Summary Report are to be taken from the other tabulations. Include a completed summary as indicated in with each Applications for Payment submitted.
      1) Number each application sequentially and indicate the payment period.
      2) Show the total amounts for value of original contract performed, extra work on approved Change Orders, and materials on hand on the Project Summary Report. Show total amounts that correspond to totals indicated on the attached tabulation for each.
      3) Note the number of pages in tabulations in the blank space on the Project Summary Report to allow a determination that all sheets have been submitted.
      4) Execute Contractor's certification by the Contractor's agent of authority and notarize for each Application for Payment.
   5. Do not alter the schedule of values and the form for the submission of requests without the written approval of the Engineer once these have been approved by the Engineer.
   6. Final payment requires additional procedures and documentation per Section 01 70 00, Execution and Closeout Requirements.

C. Progress payments shall be made as the work progresses on a monthly basis.

1. End the payment period on the day indicated in the Agreement and submit an Application for Payment for Work completed and materials received since the end of the last payment period.
2. At the end of the payment period, submit a draft copy of the Application for Payment for that month to the Engineer. Agreement is to be reached on:
   a) The percentage of work completed for each lump sum item,
   b) The quantity of work completed for each unit price item,
   c) The percentage of work completed for each approved Change Order item, and
   d) The amount of materials on hand.
3. On the basis of these agreements the Contractor is to prepare a final copy of the Application for Payment and submit it to the Engineer for approval.
4. The Engineer will review the payment request and if appropriate will recommend payment of the request to the Owner.

D. Provide a revised and up-to-date progress schedule per Section 01 32 16 Construction Progress Schedules with each Application for Payment.

E. Provide project photographs per Section 01 32 33, Photographic Documentation with each Application for Payment.

1.04 MEASUREMENT PROCEDURES

A. Measure the Work described in the Agreement for payment. Payment will be made only for the actual measured and/or computed length, area, solid contents, number and weight, unless otherwise specifically provided. No extra or customary measurements of any kind will be allowed.

1.05 BASIS OF PAYMENT BASE BID – DESCRIPTION OF BASE BID ITEMS

A. Bid Item No. 1 – All Work On the Project. Includes all work shown in the drawings or specified in the contract documents, unless a separate bid item is provided, for furnishing of all labor, tools, materials, machinery, appliances, plant and equipment appurtenant to and necessary for the construction and completion in a first class, workmanlike manner of all work as herein specified in strict accordance with these Specifications and accompanying Plans. The bid amount shall also include any and all kinds, amount or class of excavation, backfilling, pumping, dewatering, bypass pumping, or drainage, sheeting, shoring and bracing; disposal of any and all surplus materials, protection of all overhead, surface or underground structures; removal and replacement of any poles, conduits, pipelines, appurtenances and connections, cleaning up, overhead expense, bonds, public liability and compensation, and property damage insurance, patent fees and royalties, risk due to the elements, and profit, unless otherwise specified.

   The bid price shall also include all other incidentals not specifically mentioned above that may be required to fully construct each and every item complete in place in accordance with the intent and meaning of the contract documents.

   If there is not a specific bid item provided for work identified in the plans or in the specifications or for incidental work that is required to complete the project, then that work shall be subsidiary to construction, measurement, and payment of Bid Item 1.

   Measurement and payment for this item shall be on a lump sum basis.

B. Bid Item No. 2 – UV Disinfection Equipment. Includes allowance for payment to manufacturer of UV Disinfection Equipment for all necessary equipment, startup, and training services as delineated in the proposal from Xylem Wedeco. Contractor labor and materials costs associated with the installation of the UV Disinfection Equipment as shown in the construction plans shall be included in Bid Item No. 1.

   Measurement and payment for this item shall be on a lump sum basis.

C. Bid Item No. 2 – Sampling Equipment. Includes allowance for payment to manufacturer of Sampling Equipment for all necessary equipment, startup, and training services as delineated in the proposal from Teledyne ISCO. Contractor labor and materials costs associated with the installation of the Sampling Equipment as shown in the construction plans shall be included in Bid Item No. 1.

   Measurement and payment for this item shall be on a lump sum basis.

D. Bid Item No. 4 – WHECO. Includes allowance for payment to WHECO for all necessary equipment, programming, startup, training services as delineated in the proposal from WHECO. Contractor labor and materials costs associated with the installation of field wiring as shown in the construction plans shall be included in Bid Item No. 1.

   Measurement and payment for this item shall be on a lump sum basis.

E. Bid Item No. 5 – Owner Allowance. Allowance for furniture, equipment and shipping to be paid to up to five vendors selected by the City for provisions the O&M Building and Electrical Buildings. Owner to provide labor and materials costs associated with the installation of the items purchased as part of this Bid Item.

   Measurement and payment for this item shall be paid when furniture and equipment are ordered.

END OF SECTION

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01 31 00 PROJECT MANAGEMENT AND COORDINATION

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish equipment, manpower, products, and other items necessary to complete the Project with an acceptable standard of quality and within the Contract Time. Construct Project in accordance with current safety practices.

B. Manage Site to allow access to Site and control construction operations.

C. Provide labor, materials, equipment and incidentals necessary to construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.

D. Remove temporary controls at the end of the Project.

1.02 QUALITY ASSURANCE

A. Employ competent workmen, skilled in the occupation for which they are employed. Provide Work meeting quality requirements of the Contract Documents.

B. Remove defective Work from the Site immediately unless provisions have been made and approved by the Engineer to allow repair of the product at the Site. Clearly mark the Work as "defective" until it is removed or allowable repairs have been completed.

1.03 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00, Submittals:
   1. Provide copies of Supplier's printed storage instructions prior to furnishing materials or products and installation instructions prior to beginning the installation. Maintain one copy of these documents at the Site until the Project is complete. Incorporate this information into submittals.
   2. Incorporate field notes, sketches, recordings, and computations made by the Contractor in Record Drawings.

1.04 STANDARDS

A. Perform Work to comply with local, State and Federal ordinances and regulations.

1.05 PERMITS

A. Obtain and pay for construction permits and licenses for highway and railroad crossings and other permits.

B. Retain copies of permits and licenses at the Site and observe and comply with all regulations and conditions of the permit or license, including additional insurance requirements.

C. Obtain and pay for all other necessary permits including any and all necessary highway, street and road permits for transporting pipe and/or heavy equipment necessary for construction of the Project.

D. Obtain and pay for other permits necessary to conduct any part of the Work.

E. Arrange for inspections and certification by agencies having jurisdiction over the Work.

F. Make arrangements with private utility companies and pay for fees associated with obtaining services, or for inspection fees.

1.06 COORDINATION

A. Coordinate the Work of various trades having interdependent responsibilities for installing, connecting to, and placing equipment in service.

B. Coordinate requests for substitutions to provide compatibility of space, operating elements, effect on the Work of other trades, and on the Work scheduled for early completion.

C. Coordinate the use of Project space and the sequence of installation of equipment, walks, mechanical, electrical, plumbing, or other Work that is indicated diagrammatically on the Drawings.
   1. Follow routings shown for tubes, pipes, ducts, conduits, and other items as closely as practical, with due allowance for available physical space.
   2. Utilize space efficiently to maximize accessibility for Owner's maintenance and repairs.
   3. Schematics are diagrammatic in nature. Adjust routing of piping, ductwork, utilities, and location of equipment as needed to resolve spatial conflicts between the various trades. Document changes in the indicated routings on the Record Drawings.

D. Conceal ducts, pipes, wiring, and other non-finish items within construction in finished areas, except as otherwise shown. Coordinate locations of concealed items with finish elements.

E. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in sequence required to obtain best results.

F. Make adequate provisions to accommodate items scheduled for later installation, including:
   1. Accepted alternates,
   2. Installation of products purchased with allowances,
   3. Work by others, and
   4. Owner-supplied, Contractor-installed items.

G. Sequence, coordinate, and integrate the various elements of mechanical, electrical, and other systems, materials, and equipment. Comply with the following requirements:
   1. Coordinate mechanical and electrical systems, equipment, and materials installation with other components.

2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings during progress of construction.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components as they are constructed.
5. Install systems, materials, and equipment as permitted by codes to provide the maximum headroom possible where mounting heights are not detailed or dimensioned.
6. Coordinate the connection of systems with exterior underground and overhead utilities and services. Comply with the requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to the greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Adjust routing of piping, ductwork, utilities, and location of equipment as needed to resolve spatial conflicts between the various trades at no additional cost. Document changes in the indicated routings on the Record Drawings.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to structure’s surfaces.
9. Install systems, materials, and equipment to facilitate servicing, maintenance, and repair or replacement of components. As much as practical, connect for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to accessible locations.
10. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

1.07 SAFETY REQUIREMENTS

A. Assume sole responsibility for safety at the Site. Protect the safety and welfare of persons at the Site.

B. Provide safe access to move through the Site. Provide and maintain barricades, guard rails, covered walkways, and other protective devices to warn and protect from hazards at the Site.

C. Comply with latest provisions of the Occupational Health and Safety Administrations and other regulatory agencies in performing Work.

D. Cooperate with accident investigations related to the Site. Provide digital copies of all reports prepared concerning accidents, injury, or death on the Site to the Engineer as Record Data per Section 01 33 00, Submittals.

1.08 CONTRACTOR'S USE OF SITE

A. Limit the use of Site for Work and storage to those areas designated on the Drawings or approved by the Engineer. Coordinate the use of the premises with the Engineer.

B. Repair or correct any damage to existing facilities, including contamination, caused by the Contractor's personnel, visitors, materials, or equipment.

C. Do not permit alcoholic beverages or illegal substances on the Site. Do not allow persons under the influence of alcoholic beverages or illegal substances to enter or remain on the Site at any time. Persons on Site under the influence of alcoholic beverages or illegal substances will be permanently prohibited from returning to the Site. Criminal or civil penalties may also apply.

D. Park construction equipment in designated areas only and provide spill control measures as discussed in paragraph 1.18 POLLUTION CONTROL.

E. Park employees' vehicles in designated areas only.

F. Obtain written permission of the Owner before entering privately-owned land outside of the Owner's property, rights-of-way, or easements.

G. Do not allow the use of loud radios, obnoxious, vulgar or abusive language, or sexual harassment in any form. These actions will cause immediate and permanent removal of the offender from the premises. Criminal or civil penalties may apply.

H. Require Workers to wear clothing that is inoffensive and meets safety requirements. Do not allow sleeveless shirts, shorts, exceedingly torn, ripped or soiled clothing to be worn on the project.

I. Do not allow firearms or weapons of any sort to be brought on to the Site under any conditions. No exception is to be made for persons with concealed handgun permits. Remove any firearms or weapons and the person possessing these firearms or weapons permanently and immediately from the Site.

1.09 POINTS OF ACCESS TO THE SITE

A. Maintain access to the facilities at all times. Do not obstruct roads, pedestrian walks, or access to the various buildings, structures, stairways, or entrances. Provide safe temporary walks or other structures to allow access for normal operations during construction.

B. Provide adequate and safe access for inspections. Leave ladders, bridges, scaffolding and protective equipment in place until inspections have been completed. Construct additional safe access if required for inspections.

C. Provide security at the construction Site as necessary to protect against vandalism and loss by theft.

1.10 PROPERTY PROVISIONS

A. Make adequate provisions to maintain the flow of storm sewers, drains and water courses encountered during the construction. Restore structures which may have been disturbed during construction to their original position as soon as construction in the area is completed.

B. Protect trees, fences, signs, poles, guy wires, and all other property unless their removal is authorized. Restore any property damaged to equal or better condition per Paragraph 1.11 of this Section.

1.11 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. The Drawings show existing piping, valves, manholes, electrical conduits, utility poles, and other facilities based on information from available records. Examine the Site and review the available information concerning the Site.

1. Verify the type, size and location of all existing piping, valves, electrical conduit, telephone cable, and other utilities in the construction area prior to preparation of pipe shop drawings. Advise the Engineer of any utilities not shown or incorrectly shown.
2. Verify the type size and location of streets, driveways, fences, drainage structures, sidewalks, curbs, and gutters. Verify the elevations of the structures adjacent to excavations. Report discrepancies between these elevation and elevations shown on the Drawings to the Engineer before beginning construction.

B. Determine if existing structures, poles, piping, or other utilities at excavations will require relocation or replacement. Coordinate Work with Engineer, local utility company and others. Include cost of demolition and replacement, restoration or relocation of these structures in the Contract Price.

C. Protect buildings, utilities, street surfaces, driveways, sidewalks, curb and gutter, fences, wells, drainage structures, piping, valves, manholes, electrical conduits, and other systems or structures unless they are shown to be replaced or relocated on the Drawings. Restore damage to items to be protected to the satisfaction of the utility owner or governing city without additional compensation from the Owner.

D. Carefully support and protect all structures and/or utilities so that there will be no failure or settlement where excavation or demolition endangers adjacent structures and utilities. Do not take existing utilities out of service unless show in the Contract Documents or approved by the Owner. Notify and cooperate with the utility owner if it is necessary to move services, poles, guy wires, pipelines or other obstructions. Include the cost of relocation of existing utilities in the Contract Price.

E. Protect existing trees and landscaping at the Site.
1. Visit Site with Engineer to identify trees that may be removed during construction.
2. Mark trees to be removed with paint.
3. Protect trees to remain from damage by wrapping trunks with 2 x 4 timbers around the perimeter, securely wired in place, where machinery must operate around existing trees. Protect branches and limbs from damage by equipment.

1.12 DISRUPTION TO SERVICES / CONTINUED OPERATIONS

A. Existing facilities are to continue in service as usual during the construction unless noted otherwise. Owner or utilities must be able to operate and maintain the facilities.Disruptions to existing utilities, piping, process piping, or electrical services shall be kept to a minimum.
1. Do not restrict access to critical valves, operators, or electrical panels.
2. Do not store material or products inside structures.
3. Limit operations to the minimum amount of space needed to complete the specified Work.

4. Maintain storm sewers and sanitary sewers in service at all times. Provide temporary service around the construction or otherwise construct the structure in a manner that the flow is not restricted.

1.13 CLEARING AND GRUBBING

A. Perform all clearing and grubbing necessary for the construction operations or as directed by Owner or indicated on the Drawings.

B. Avoid damage to existing trees that are larger than three inches in diameter (measured four feet above the ground). Protect trees per paragraph 1.11 of this section. Obtain approval from the Owner before removing or trimming any tree larger than three inches in diameter located onsite.

C. Remove and dispose of trees, branches, limbs, and roots leaving the site in a neat and presentable condition. Perform clearing and grubbing without injury or damage to adjacent property. Maintain the blade of equipment used for clearing and grubbing slightly above the ground surface to protect grass roots.

D. Remove all trees, stumps, slashing, brush or other debris removed from the Site before beginning construction. Select locations for dumping, acquire required permits and properly dispose of excess material. Do not allow burning without written approval of Owner.

1.14 FIELD MEASUREMENTS

A. Perform complete field measurements for products required to fit existing conditions prior to purchasing products or beginning construction.

B. Verify pipe class, equipment capacities, existing electrical systems and power sources for existing conditions.

C. Check Shop Drawings and indicate the actual dimensions available where products are to be installed.

D. Include field measurements in record drawings as required in Section 01 31 13, Project Coordination.

1.15 DELIVERY AND STORAGE

A. Deliver products and materials to the Site in time to prevent delays in construction.

B. Deliver packaged products to Site in original undamaged containers with identifying labels attached. Open cartons as necessary to check for damage and to verify invoices. Reseal cartons and store until used. Leave products in packages or other containers until installed.

C. Deliver products that are too large to fit through openings to the Site in advance of the time enclosing walls and roofs are erected. Set in place, raised above floor on cribs.

D. Assume full responsibility for the protection and safekeeping of products stored at the Site.

E. Store products at locations acceptable to the Engineer and to allow Owner access to maintain and operate existing facilities.

F. Store products in accordance with the Supplier's storage instructions immediately upon delivery. Leave seals and labels intact. Arrange storage to allow access for maintenance of stored items and for inspection. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.

G. Obtain and pay for the use of any additional storage areas as needed for construction. Store products subject to damage by elements in substantial weather-tight enclosures or storage sheds. Provide and maintain storage sheds as required for the protection of products. Provide temperature, humidity control and ventilation within the ranges stated in the Supplier's instructions. Remove storage facilities at the completion of the Project.

H. Protect the pipe interior. Keep all foreign materials such as dirt, debris, animals, or other objects out of the pipe during the Work. Cap or plug ends of installed pipe in an approved manner when pipe is not being installed. Wash out pipe sections that become contaminated before continuing with installation. Take precautions to prevent the pipe from floating or moving out of the proper position during or after laying operations. Immediately correct any pipe that moves from its correct positions.

I. Provide adequate exterior storage for products that may be stored out-of-doors.
   1. Provide substantial platforms, blocking, or skids to support materials and products above ground; slope to provide drainage. Protect products from soiling or staining.
   2. Cover products subject to dislocation or deterioration from exposure to the elements, with impervious sheet materials. Provide ventilation to prevent condensation below covering.
   3. Store loose, granular materials on clean, solid surfaces, or on rigid sheet materials, to prevent mixing with foreign matter.
   4. Provide surface drainage to prevent erosion and ponding of water.
   5. Prevent mixing of refuse or chemically injurious materials or liquids with stored materials.
   6. Pipes and conduits stored outdoors are to have open ends sealed to prevent the entrance of dirt, moisture, and other injurious materials. Protect PVC pipe from ultraviolet light exposure.
   7. Store light weight products to prevent wind damage.

B. Protect and maintain mechanical and electrical equipment in storage.
   1. Provide Supplier's service instructions on the exterior of the package.
   2. Service equipment on a regular basis as recommended by the Supplier. Maintain a log of maintenance services. Submit the log as Record Data at the completion of the Project.
   3. Provide power to and energize space heaters for all equipment for which these devices are provided.
   4. Provide temporary enclosures for all electrical equipment, including electrical systems on mechanical devices. Provide and maintain heat in the enclosures until equipment is energized.

C. Maintain storage facilities. Inspect stored products on a weekly basis and after periods of severe weather to verify that:

1. Storage facilities continue to meet specified requirements.
2. Supplier's required environmental conditions are continually maintained.
3. Surfaces of products exposed to the elements are not adversely affected.

J. Replace any stored item damaged by inadequate protection or environmental controls.

K. Payment may be withheld for any products not properly stored.

1.16 BLASTING

A. Blasting for excavations is not allowed.

1.17 ARCHAEOLOGICAL REQUIREMENTS

A. Cease operations immediately and contact the Owner for instructions if an historical or archaeological find is made during construction.

B. Conduct all construction activities to avoid adverse impact on the Sites where significant historical or archaeological Sites have been identified at the Site.
1. Obtain details for Working in these areas.
2. Maintain confidentiality regarding the Site.
3. Adhere to the requirements of the Texas Historical Commission.

B. Do not disturb Archaeological Sites.
1. Obtain the services of a qualified archaeological specialist to instruct construction personnel on how to identify and protect archaeological finds on an emergency basis.
2. Coordinate activities to permit Archaeological Work to take place within the area.
a. Attempt to archaeologically clear areas needed for construction as soon as possible.
b. Provide a determination of priority for such areas.

C. Assume responsibility for any unauthorized destruction that might result to such Sites by construction personnel, and pay all penalties assessed by the State or Federal agencies for non-compliance with these requirements.

D. Contract time will be modified to compensate for delays caused by such archaeological finds. No additional compensation shall be paid for delays.

1.18 STORM WATER POLLUTION CONTROL

A. Comply with the current requirements of TPDES set forth by the Texas Commission on Environmental Quality for the duration of the Project:
1. Develop a Storm Water Pollution Prevention Plan meeting all requirements of the General Storm Water Permit.
2. Submit of a Notice of Intent to the Texas Commission on Environmental Quality.
3. Develop and implement appropriate Best Management Practices as established by local agencies of jurisdiction.
4. Provide all monitoring and/or sampling required for reporting to the Texas Commission on Environmental Quality

5. Submit reports to the Texas Commission on Environmental Quality as required as a condition of the permit
6. Submit copies of the reports to the Engineer as Record Data in accordance with Section 01 33 00 Submittals
7. Retain copies of these documents on site at all times for review and inspection by the Owner or regulatory agencies. Post a copy of the permit as required by regulations.
8. Pay all costs associated with complying with the provisions of the General Storm Water Permit. Assume solely responsible for implementing, updating, and modifying the General Storm Water Permit per regulatory requirements the Storm Water Pollution Prevention Plan and Best Management Practices.

B. Use forms required by the Texas Commission on Environmental Quality to file the Notice of Intent. Submit the Notice of Intent at least two days prior to the start of construction. Develop the Storm Water Pollution Prevention Plan prior to submitting the Notice of Intent. Provide draft copies of the Notice of Intent, Storm Water Pollution Prevention Plan, and any other pertinent Texas Commission on Environmental Quality submittal documents to Owner for review prior to submittal to the Texas Commission on Environmental Quality.

C. Return any property disturbed by construction activities to either specified conditions or pre-construction conditions as set forth in the Contract Documents Provide an overall erosion and sedimentation control system that will protect all undisturbed areas and soil stockpiles/spoil areas. Implement appropriate Best Management Practices and techniques to control erosion and sedimentation and maintain these practices and techniques in effective operating condition during construction. Permanently stabilize exposed soil and fill as soon as practical during the Work.

D. Assume sole responsibility for the means, methods, techniques, sequences, and procedures for furnishing, installing, and maintaining erosion and sedimentation control structures and procedures and overall compliance with the General Storm Water Permit. Modify the system as required to effectively control erosion and sediment.

E. Retain copies of reports required by the General Storm Water Permit for three years from date of final completion.

1.19 POLLUTION CONTROL

A. Prevent the contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations. Provide adequate measures to prevent the creation of noxious air-borne pollutants. Prevent dispersal of pollutants into the atmosphere. Do not dump or otherwise discharge noxious or harmful fluids into drains or sewers, nor allow noxious liquids to contaminate public waterways in any manner.

B. Provide equipment and personnel and perform emergency measures necessary to contain any spillage.
1. Contain chemicals in protective areas and do not dump on soil. Dispose of such materials at off-Site locations in an acceptable manner.
2. Excavate contaminated soil and dispose at an off-Site location if contamination of the soil does occur. Fill resulting excavations with suitable backfill and compact to the density of the surrounding undisturbed soil.

3. Provide documentation to the Owner which states the nature and strength of the contaminant, method of disposal, and the location of the disposal Site.
4. Comply with local, State and Federal regulations regarding the disposal of pollutants.

C. Groundwater or run-off water which has come into contact with noxious chemicals, sludge, or sludge-contaminated soil is considered contaminated. Contaminated water must not be allowed to enter streams or water courses, leave the Site in a non-contained form or enter non-contaminated areas of the Site.
1. Pump contaminated water to holding ponds constructed by the Contractor for this purpose, or discharge to areas on the interior of the Site, as designated by the Engineer.
2. Construct temporary earthen dikes or take other precautions and measures as required to contain the contaminated water and pump to a designated storage area.
3. Wash any equipment used for handling contaminated water or soil within contaminated areas three times with uncontaminated water prior to using such equipment in an uncontaminated area. Dispose of wash water used to wash such equipment as contaminated water.

1.20 EARTH CONTROL

A. Remove excess soil, spoil materials and other earth not required for backfill at the time of generation. Control stock pile material to eliminate interference with Contractor and Owner's operations.

B. Dispose of excess earth off the Site. Pay cost for disposal unless otherwise noted. Provide written approval by the property owner for all disposal on private property, and approval by the Owner if such disposal affects the use of the easements.

C. Place excess excavated material and neatly spread on tracts of land on which the pipeline is being constructed and where the property owner requests such material and the Owner approves.

1.21 MANAGEMENT OF WATER

A. Manage water resulting from rains or ground water at the Site. Maintain trenches and excavations free of water at all times.

B. Lower the water table in the construction area by acceptable means if necessary to maintain a dry and workable condition at all times. Provide drains, sumps, casings, well points, and other water control devices as necessary to remove excess water.

C. Provide continuous operation of water management actions. Maintain standby equipment to provide proper and continuous operation for water management.

D. Ensure that water drainage does not damage adjacent property. Divert water into the same natural watercourse in which its headwaters are located, or other natural stream or waterway as approved by the Owner. Assume responsibility for the discharge of water from the Site.

E. Remove the temporary construction and restore the Site in a manner acceptable to the Engineer and to match surrounding material at the conclusion of the Work.

1.22 CLEANING DURING CONSTRUCTION

A. Provide positive methods to minimize raising dust from construction operations and provide positive means to prevent air-borne dust from disbursing into the atmosphere. Control dust and dirt from demolition, cutting, and patching operations.

B. Clean the Project as Work progresses and dispose of waste materials, keeping the Site free from accumulations of waste or rubbish. Provide containers on Site for waste collection. Do not allow waste materials or debris to blow off of the Site. Control dust from waste materials. Transport waste materials with as few handlings as possible.

C. Comply with codes, ordinances, regulations, and anti-pollution laws. Do not burn or bury waste materials. Remove waste materials, rubbish and debris from the Site and legally dispose of these at public or private dumping areas.

1.23 MAINTENANCE OF ROADS, DRIVEWAYS, AND ACCESS

A. Maintain roads and streets in a manner that is suitable for safe operations of public vehicle during all phases of construction unless the Owner approves a street closing. Submit a written request for Owner's approval of a street closing. The request shall state:
   1. The reason for closing the street.
   2. How long the street will remain closed.
   3. Procedures to be taken to maintain the flow of traffic.

   Do not close public roads overnight.

B. Construct temporary detours, including by-pass roads around construction, with adequately clear width to maintain the free flow of traffic at all times. Maintain barricades, signs, and safety features around the detour and excavations.

C. Maintain road and driveway access to occupied buildings. Coordinate temporary closures or blockage with property owners, utilities, emergency service providers, Owner and Engineer.

D. Maintain barricades, signs, and safety features around the Work in accordance with all provisions of the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD.)

E. Assume responsibility for any damage resulting from construction along roads or drives.

1.24 CUTTING AND PATCHING

A. Perform cutting, fitting, and patching required to complete the Work or to:
   1. Uncover Work to provide for installation of new Work or the correction of defective Work.
   2. Provide routine penetrations of non-structural surfaces for installation of mechanical, electrical, and plumbing Work.
   3. Uncover Work that has been covered prior to observation by the Engineer.

B. Submit written notification to the Engineer in advance of performing any cutting which affects:
   1. Work of any other contractors or the Owner.
   2. Structural integrity of any structure or system of the Project.
   3. Integrity or effectiveness of weather exposed or moisture resistant structure or systems.
   4. Efficiency, operational life, maintenance, or safety of any structure or system.
   5. Appearance of any structure or surfaces exposed occasionally or constantly to view.

C. The notification shall include:
   1. Identification of the Project.
   2. Location and description of affected Work.
   3. Reason for cutting, alteration, or excavation.
   4. Effect on the Work of any separate contractor or Owner.
   5. Effect on the structural or weatherproof integrity of the Project.
   6. Description of proposed Work, including:
      a. Scope of cutting, patching, or alteration.
      b. Trades that will perform the Work.
      c. Products proposed for use.
      d. Extent of refinishing to be performed.
      e. Cost proposal, when applicable.
   7. Alternatives to cutting and patching.
   8. Written authorization from any separate contractor whose Work would be affected.
   9. Date and time Work will be uncovered or altered.

D. Examine the existing conditions, including structures subject to damage or to movement during cutting or patching.
   1. Inspect conditions affecting installation of products or performance of the Work after uncovering the Work.
   2. Provide a written report of unacceptable or questionable conditions to the Engineer. The Contractor shall not proceed with Work until Engineer has provided further instructions. Beginning Work will constitute acceptance of existing conditions by the Contractor.

E. Protect the structure and other parts of the Work and provide adequate support to maintain the structural integrity of the affected portions of the Work. Provide devices and methods to protect adjacent Work and other portions of the Project from damage. Provide protection from the weather for portions of the Project that may be exposed by cutting and patching Work.

F. Execute cutting and demolition by methods which will prevent damage to other Work, and will provide proper surfaces to receive installation of repairs.

G. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.

H. Cut, remove, and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to, the removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the modified Work.

I. Restore Work which has been cut or removed. Install new products to provide completed Work per the Contract Documents.

J. Fit Work air-tight to pipes, sleeves, ducts, conduit, and other penetrations through the surfaces. Where fire rated separations are penetrated, fill the space around the pipe or insert with materials with physical characteristics equivalent to fire resistance requirements of penetrated surface.

K. Patch finished surfaces and building components using new products specified for the original installation.

L. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:
   1. For continuous surfaces, refinish to the nearest intersection.
   2. For an assembly, refinish the entire unit.

1.25 PRELIMINARY OCCUPANCY

A. Owner may deliver, install and connect equipment, furnishings, or other apparatus in buildings or other structures. These actions do not indicate acceptance of any part of the building or structure and does not affect the start of warranties or correction periods.

B. Protect the Owner's property after installation is complete.

C. Owner or Engineer may use any product for testing or determine that the product meets the requirements of the Contract Documents. This use does not constitute acceptance by either the Owner or Engineer. These actions do not indicate acceptance of any part of the product and does not affect the start of warranties or correction periods.

1.26 INITIAL MAINTENANCE

A. Maintain equipment until the Project is accepted by the Owner. Ensure that mechanical equipment is properly maintained as recommended by the Supplier.

B. Prior to acceptance of equipment, provide maintenance and start-up services per Section 01 75 00, Starting and Adjusting.

C. Remove and clean screens and strainers in piping systems.

D. Clean insects from intake louver screens.

2.00 PRODUCTS

2.01 MATERIALS

Provide materials in accordance with the requirements of the individual Sections.

3.00 EXECUTION

Perform the Work per the Supplier's published instructions. Do not omit any preparatory step or installation procedure unless specifically exempted or modified by Field Order.

END OF SECTION

01 31 13 PROJECT COORDINATION

1.00 GENERAL

1.01 WORK INCLUDED

A. Administer contract requirements to construct the project. Provide documentation per the requirements of this Section Provide information as requested by the Engineer or Owner.

1.02 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00, Submittals.

1.03 COMMUNICATION DURING THE PROJECT

A. The Engineer is to be the first point of contact for all parties on matters concerning this project.

B. The Engineer will coordinate correspondence concerning:
   1. Submittals, including Applications for Payment,
   2. Clarification and interpretation of the Contract Documents,
   3. Contract modifications,
   4. Observation of work and testing, and
   5. Claims.

C. The Engineer and Owner will normally communicate only with the Contractor. Any required communication with Subcontractors or Suppliers will only be with the direct involvement of the Contractor.

D. Direct written communications to the Engineer at the address indicated at the Pre-construction Conference. Include the following with communications as a minimum:
   1. Name of the Owner
   2. Project name
   3. Contract title
   4. Project number
   5. Date
   6. A reference statement

1.04 PROJECT MEETINGS

A. Pre-construction Conference
   1. Attend a pre-construction meeting.
   2. The location of the conference will be determined by the Engineer or Owner.
   3. The time of the meeting will be determined by the Engineer or Owner but will be after the Notice of Award and the Notice to Proceed are issued.
   4. The Owner, Engineer, representatives of utility companies, the Contractor's project manager and superintendent, and representatives from major Subcontractors and Suppliers may attend the meeting.
   5. Provide and be prepared to discuss:
      a. Preliminary construction schedule per Section 01 32 16 Construction Progress Schedule.

b. Preliminary submittal schedule per Section 01 33 00, Submittals.
c. Schedule of values and anticipated schedule of payments per Section 01 29 00, Payment Procedures.
d. List of Subcontractors and Suppliers.
e. Contractor's organizational chart as it relates to this project.
f. Letter indicating the agents of authority for the Contractor and the limit of that authority with respect to the execution of legal documents, contract modifications and payment requests.

B. Progress Meetings
1. Attend meetings with the Engineer and Owner.
a. Meet on a monthly basis or as requested by the Owner or Engineer to discuss the project.
b. Meet at the project site or other location as designated by the Owner or Engineer.
c. Contractor's superintendent and other key personnel are to attend the meeting. Other individuals may be requested to attend to discuss specific matters.
2. Provide information as requested by the Engineer or Owner concerning this project.
a. Prepare to discuss:
1) Status of overall project schedule.
2) Contractor's detailed schedule for the next month.
3) Anticipated delivery dates for equipment.
4) Coordination with the Owner.
5) Status of submittals.
6) Information or clarification of the Contract Documents.
7) Claims and proposed modifications to the contract.
8) Field observations, problems, or conflicts.
9) Maintenance of quality standards.
b. Notify the Engineer of any specific items to be discussed a minimum of one week prior to the meeting.
3. Review minutes of meetings and notify the Engineer of any discrepancies within ten days of the date of the minutes.
a. Following that date, the minutes will stand as shown or as corrected.
b. Corrections will be reflected in the minutes of the following meeting. Issues discussed will be documented and old issues will remain on minutes of subsequent meetings until the issue is resolved.

C. Pre-submittal and Pre-installation Meetings
1. Attend pre-submittal and pre-installation meetings as required in the individual technical specifications or as determined necessary by the Engineer or Owner (for example, instrumentation, concrete mix design, etc.).
2. The location of the meeting will be determined by the Engineer or Owner.
3. The time of the meeting will be determined by the Contractor when ready to proceed with the associated work, subject to submission of a Notification by Contractor (NBC) on the form shown in Section 01 31 13.13 Forms and acceptance by the Engineer and Owner of the proposed time.
4. The Owner, Engineer, the Contractor's project manager and superintendent, and representatives from affected Subcontractors and Suppliers shall attend the meeting.

1.05 REQUESTS FOR INFORMATION

A. Submit Request for Information (RFI) to the Engineer to obtain additional information or clarification of the Contract Documents.
   1. Submit a separate RFI for each item in the Contractor's standard format.
   2. Attach adequate information to permit a written response without further clarification. Engineer will return requests that do not have adequate information to the Contractor for additional information. Contractor is responsible for all delays resulting from multiple submittals due to inadequate information.
   3. A response will be made when adequate information is provided. Response will be made on the RFI form or in attached information.

B. Response to an RFI is given to provide additional information, interpretation, or clarification of the requirements of the Contract Documents, and does not modify the Contract Documents.

C. Owner will initiate a Preliminary Contract Modification per Paragraph 1.07 if the RFI indicates that a contract modification is required.

1.06 NOTIFICATION BY CONTRACTOR

A. Notify the Engineer of:
   1. Need for testing,
   2. Intent to work outside regular working hours,
   3. Request to shut down facilities or utilities,
   4. Proposed utility connections,
   5. Required observation by Engineer or inspection agencies prior to covering work and
   6. Training.

B. Provide notification a minimum of two weeks in advance to allow Owner and / or Engineer time to respond appropriately to the notification.

1.07 REQUESTS FOR MODIFICATIONS

A. Submit a request to the Engineer for any change in the Contract Documents.
   1. Assign a number to the Preliminary Contract Modification when issued.
   2. Include with the Preliminary Contract Modification:
      a. A complete description of the proposed modification.
      b. The reason the modification is requested.
      c. A detailed breakdown of the cost of the change (necessary only if the modification requires a change in contract amount). The itemized breakdown is to include:
         1) list of materials and equipment to be installed,
         2) man hours for labor by classification,
         3) equipment used in construction,
         4) consumable supplies, fuels, and materials,
         5) royalties and patent fees,
         6) bonds and insurance,
         7) overhead and profit,
         8) field office costs, and
         9) home office cost,

10) other items of cost.

d. Provide the level of detail outline in the paragraph above for each Subcontractor or Supplier actually performing the Work if work is to be provided by a Subcontractor or Supplier. Indicate appropriate Contractor mark ups for Work provided through Subcontractors and Suppliers. Provide the level of detail outline in the paragraph above for self-performed Work.

e. Provide a revised schedule indicating the effect on the critical path for the project and a statement of the number of days the project may be delayed by the modification.

3. A Preliminary Contract Modification is required for all substitutions or deviations from the Contract Documents that involve potential project cost impacts.

4. The Owner and the Engineer will evaluate the request for a preliminary contract modification.

B. Owner will initiate changes through the Engineer.

1. The Owner or Engineer will prepare a description of proposed modifications to the Contract Documents.

2. Owner will assign a number to the Preliminary Contract Modification when issued.

C. Engineer will issue a Field Order or a Change Order per the General Conditions if a contract modification is appropriate.

1. Modifications to the contract can only be made by a Field Order or a Change Order.

2. Changes in the project will be documented by a Field Order or by a Change Order.

3. Field Orders may be issued by the Engineer for contract modifications that do not change the Contract Price or Contract Time.

4. Any modifications that require a change in Contract Price or Contract Time can only be approved by Change Order.

a. Proposals issued by the Contractor in response to a Preliminary Contract Modification will be evaluated by the Engineer.

b. If the Preliminary Contract Modification is acceptable, the Contractor will be notified in writing. This will constitute the authorization to proceed with the work.

c. Depending on the amounts involved, several Preliminary Contract Modifications may be collected into a contract Change Order.

d. Upon approval of the Change Order, the Owner will prepare the Change Order for execution between the Contractor and the Owner.

5. The Contractor may be informed that the Preliminary Contract Modification is not approved and construction is to proceed in accordance with the Contract Documents.

1.08 RECORD DRAWINGS

A. Maintain at the Site one complete record copy of:

1. Drawings,

2. Specifications,

3. Addenda,

4. Contract modifications,

5. Approved Shop Drawings and record data,
6. Test records,
7. Clarifications and other information provided in Request for Information responses, and
8. Reference standards

B. Store documents and samples in the Contractor's field office.
1. Documents are to remain separate from documents used for construction. Do not use these documents for construction.
2. Provide files and racks for the storage of documents.
3. Provide a secure storage space for the storage of samples.
4. Maintain documents in clean, dry, legible conditions, and in good order.
5. Always make documents and samples available for inspection by the Engineer and Owner.

C. Marking Drawings:
1. Label each document as "Project Record" in large printed letters.
2. Record information as construction is being performed.
a. Do not conceal any Work until the required information is recorded.
b. Mark drawings to record actual construction, including the following:
1) Depths of various elements of the foundation in relation to finished first floor datum or the top of walls.
2) Horizontal and vertical locations of underground utilities and appurtenances constructed and existing utilities encountered during construction.
3) Location of internal utilities and appurtenances concealed in the construction. Refer measurements to permanent structure on the surface. Include the following equipment:
a) Piping,
b) Ductwork,
c) Equipment and control devices requiring periodic maintenance or repair,
d) Valves, unions, traps, and tanks,
e) Services entrance,
f) Feeders, and
g) Outlets.
(1) Changes of dimension and detail,
(2) Changes made by Field Order and Change Order,
4) Details not on the original Drawings. Include field verified dimensions and clarifications, interpretations, and additional information issued in response to Requests for Information.
c. Mark Specifications and Addenda to identify products provided.
1) Record product name, trade name, catalog number, and each Supplier (with address and phone number) of each product and item of equipment actually installed.
2) Record changes made by Field Order and Change Order.
d. Mark additional work or information in erasable pencil.
1) Use red for new or revised indication.
2) Use purple for Work deleted or not installed (lines to be removed).
3) Highlight items constructed per the Contract Documents in yellow.
e. Submit record documents to Engineer for review and acceptance 30 days prior to final completion of the project.

1) Provide one set of marked up drawings.

D. Applications for Payment will not be recommended for payment if record documents are found to be incomplete or not in order. Final payment will not be recommended without complete record documents.

END OF SECTION

01 31 13.13 FORMS

1.00 GENERAL

1.01 WORK INCLUDED

A. Use forms for contract administration, making submittals, and documentation of test results. A digital copy of these forms with project information inserted can be provided to the Contractor at the Contractor's request. Contractor may substitute forms generated by the Contractor with the approval of Engineer if these forms include the information, statements, and certifications and are the same general format as the forms included in this section. Forms to be included are listed below:
   1. Contractor's Modification Request
   2. Notification by Contractor
   3. Request for Information
   4. Submittal Transmittal
   5. Proposed Contract Modification
   6. Equipment Installation Report
   7. Equipment Manufacturer's Certificate of Installation Testing and Instruction

2.00 GENERAL (NOT USED)

3.00 EXECUTION (NOT USED)

END OF SECTION

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01 32 16 CONSTRUCTION PROGRESS SCHEDULE

1.00 GENERAL

1.01 REQUIREMENTS

A. Prepare and submit a progress schedule for the Work and update the schedule on a monthly basis for the duration of the Project.

B. Provide schedule in adequate detail to allow Owner to monitor the work progress, to anticipate the time and amount of Applications for Payment, and to relate submittal processing to sequential activities of the Work.

C. Incorporate and specifically designate the dates of anticipated submission of submittals and the dates when submittals must be returned to the Contractor into the schedule.

D. Assume complete responsibility for maintaining the progress of the Work per the submitted schedule.

E. Take all requirements of Section 01 35 00, Special Procedures into consideration when preparing schedule.

1.02 SUBMITTALS

A. Submit progress schedules in accordance with Section 01 33 00, Submittals. Submit schedules within the following times:
   1. Preliminary schedule within 10 days after the Notice of Award. The schedule is to be available at the pre-construction conference.
   2. Detailed schedule at least 10 days prior to the first payment request.

B. Submit progress schedules with Applications for Payment. Schedules may be used to evaluate the Applications for Payment. Failure to submit the schedule may cause delay in the review and approval of Applications for Payment.

1.03 SCHEDULE REQUIREMENTS

A. Schedule is to be in adequate detail to:
   1. Assure adequate planning, scheduling, and reporting during the execution of the Work.
   2. Assure the coordination of the Work of the Contractor and the various Subcontractors and Suppliers.
   3. Assist in monitoring the progress of the work.
   4. Assist in evaluating proposed changes to Contract Time and project schedule.
   5. Assist the Owner in review of Contractor's Application for Payment.

B. Provide personnel with five (5) years minimum experience in scheduling construction work comparable to this project.

C. Provide the schedule in the form of a time scaled horizontal bar chart which indicates graphically the Work scheduled at any time during the Project. The graph is to indicate:

1. Complete sequence of construction by activity.
2. Identification of the activity by structure, location, and type of Work.
3. Chronological order of the start of each item of work.
4. The activity start and stop dates.
5. The activity duration.
6. Successor and predecessor relationships for each activity. Group related activities or use lines to indicate relationships.
7. A clearly indicated critical path. Indicate only one critical path on the schedule. The subsystem with the longest time of completion is the critical path where several subsystems each have a critical path. Float time is to be assigned to other subsystems.
8. Projected percentage of completion, based on dollar value of the Work included in each activity as of the day Applications for Payment are due of each month.

D. Submit a separate submittal schedule indicating the dates when the submittals are to be sent to the Engineer.
   1. List specific dates submittal is to be sent to the Engineer.
   2. List specific dates submittal must be processed in order to meet the proposed schedule.
   3. Allow a reasonable time to review submittals, taking into consideration the size and complexity of the submittal, the submission of other submittals, and other factors that may affect review time.
   4. Allow time for re-submission of the submittals for each item. Contractor is responsible for delays associated with additional time required to review incomplete or erroneous submittals and for the time lost when submittals are submitted for products that do not meet specification requirements.

E. Update the schedule at the end of each monthly partial payment period to indicate the progress made on the project to that date.

1.04 SCHEDULE REVISIONS

A. Submit a written report if the schedule indicates that the Project is more than thirty (30) days behind schedule. The report is to include:
   1. Number of days Project is behind schedule.
   2. Narrative description of the steps to be taken to bring the Project back on schedule.
   3. Anticipated time required to bring the Project back on schedule.

Submit a revised schedule indicating the action that the Contractor proposes to take to bring the Project back on schedule.

B. Revise the schedule to indicate any adjustments in Contract Time approved by Change Order.
   1. Revised schedule is to be included with Contract Modification Request for which an extension of time is requested.
   2. Failure to submit a revised schedule indicates that the modification shall have no impact on the ability of the Contractor to complete the project on time and that the cost associated with the change of additional plant or work force have been included in the cost proposed for the modification.

C. Updating the project schedule to reflect actual progress is not considered a revision to the project schedule.

D. Applications for Payment will not be recommended for payment without a revised schedule and if required, the report indicating the Contractor's plan for bringing the project back on schedule.

1.05 FLOAT TIME

A. Define float time as the amount of time between the earliest start date and the latest start date of a chain of activities on the construction schedule.

B. Float time is not for the exclusive use or benefit of either the Contractor or Owner.

C. Contract time cannot be changed by the submission of this schedule. Contract Time can only be modified by approved Change Order.

D. Schedule completion date must be the same as the contract completion date. Time between the end of construction and the contract completion date is to be indicated as float time.

END OF SECTION

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01 32 33 PHOTOGRAPHIC DOCUMENTATION

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide a video recording with audio and narration of the Site prior to the beginning of construction. The narration shall describe what is being shown in the video.
   1. Record the condition of all existing facilities in or abutting the construction area (right-of-way) including but not limited to streets, curb and gutter, utilities, driveways, fencing, landscaping, etc.
   2. Record after construction staking is complete but prior to any clearing where possible.
   3. Provide one copy of the recording, dated and labeled to the Construction Manager before the start of construction. Provide additional recording as directed by the Engineer or Owner if the recording provided is not considered suitable for the purpose of recording conditions prior to construction.

B. Provide a video recording with audio and narration of the Site after the completion of construction.

C. Furnish an adequate number of photographs of the Site to clearly depict the completed project.
   1. Provide a minimum of ten different views.
   2. Photograph a panoramic view of the entire project site.
   3. Photograph all significant areas of completed construction.
   4. Completion photographs are not to be taken until all construction trailers, excess materials, trash, and debris have been removed.

D. All photographs, video recordings, and a digital copy of this media are to become the property of the Owner. Photographs or recordings may not be used for publication, or public or private display without the written consent of the Owner.

1.02 QUALITY ASSURANCE

A. Provide clear photographs and recordings taken with proper exposure. View photographs and recordings in the field and take new photographs or recordings immediately if photos of an adequate print quality cannot be produced or video quality is not adequate. Provide photographs with adequate quality and resolution to permit enlargements.

1.03 SUBMITTALS

A. Submit photographic documentation as record data in accordance with Section 01 33 00, Submittals.

PART 2 PRODUCTS

3.01 PHOTOGRAPHS

A. Provide photographs in digital format with a minimum resolution of 1280 X 960, accomplished without a digital zoom.

B. Take photographs at locations acceptable to the Owner.

C. Provide a digital copy of each photograph taken by means of storage as approved by the Owner.

D. Identify each digital file name with:
   1. Project name.
   2. Date, time, location, and orientation of the exposure.
   3. Description of the subject of photograph.

3.02 VIDEO RECORDING

A. Provide digital format that can be played on Windows Media Player in common format in full screen mode.

B. Identifying project on tape by audio or visual means.

END OF SECTION

01 33 00 SUBMITTALS

1.00 GENERAL

1.01 WORK INCLUDED

A. Submit documentation as required by the Contract Documents and as reasonably requested by the Owner and Engineer to:
   1. Record the products incorporated into the Project for the Owner.
   2. Provide information for operation and maintenance of the Project.
   3. Provide information for the administration of the Contract.
   4. Allow the Engineer to advise the Owner if products proposed for the project by the Contractor conform, in general, to the design concepts of the Contract Documents.

B. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the Engineer's review of submittals. Contract modifications may only be approved by Change Order or Field Order.

1.02 CONTRACTOR'S RESPONSIBILITIES

A. Review all submittals prior to submission.

B. Determine and verify:
   1. Field measurements.
   2. Field construction requirements.
   3. Location of all existing structures, utilities and equipment related to the submittals.
   4. Submittals are complete for their intended purpose.
   5. Conflicts between the submittals related to the various Subcontractors and Suppliers have been resolved.
   6. Quantities and dimensions shown on the submittals.

C. Submit information per the procedures described in this section and the detailed specifications.

D. Furnish the following submittals:
   1. As specified in the attached Submittal Schedule.
   2. Schedules, data and other documentation as described in detail in this section or referenced in the General Conditions.
   3. Documentation required for the administration of the Contract per Section 01 31 13, Project Coordination.
   4. Shop Drawings required for consideration of a contract modification per Paragraph 1.08.
   5. Submittals as required in the Specifications.
   6. Submittals not required will be returned without Engineer's review.

E. Submit a schedule indicating the date submittals will be sent to the Engineer and proposed dates that the product will be incorporated into the project. Make submittals promptly in accordance with the schedule so as to cause no delay in the Project.

1. Send submittals to the Engineer allowing a reasonable time for delivery, review and marking submittals. Include time for review of a resubmission if necessary. Allow adequate time for the submittal review process, ordering, fabrication, and delivery of the product so as to not delay progress on the Project.
2. Schedule submittal to provide all information for interrelated work at one time. No review will be performed on submittals requiring coordination with other submittals. Engineer will return submittals for resubmission as a complete package.

F. Submit information for all of the components and related equipment required for a complete and operational system in the same submittal.
1. Include electrical, mechanical, and other information required to indicate how the various components of the system function.
2. Provide certifications, warranties, and written guarantees with the submittal package for review when they are required.

G. Fabrication or installation of any products prior to the approval of Shop Drawings is done at the Contractor's risk. Products not meeting the requirements of Contract Documents are defective and may be rejected at the Owner's option.

H. Payment will not be made for products for which submittals are required until the submittals have been received. Payment will not be made for products for which Shop Drawings or Samples are required until these are approved by the Engineer.

1.03 QUALITY ASSURANCE

A. Submit legible, accurate, complete documents presented in a clear, easily understood manner. Submittals not meeting these criteria will be returned without review.

B. Demonstrate that the proposed products are in full and complete compliance with the design criteria and requirements of the Contract Documents including Drawings and Specifications as modified by Addenda, Field Orders, and Change Orders.

C. Include applicable technical bid specifications with each submittal, with comments verifying conformance and noting deviations to each paragraph.

D. Furnish and install products that fully comply with the information included in the submittal.

E. Review and approve submittals prior to submitting them to the Engineer for review. Submittals will not be accepted from anyone other than the Contractor.

1.04 SUBMITTAL PROCEDURES

A. Deliver submittals to the Engineer at the following email address unless otherwise stated at the pre-construction conference:

Mead & Hunt, Inc.
6001 Interstate 20 West, Suite 219
Arlington, Texas 76017
Attn: Charlotte Smith, P.E.

charlotte.smith@meadhunt.com

B. Transmit all submittals, with a properly completed Submittal Transmittal Form in the Contractor's standard format, as approved.
   1. Use a separate transmittal form for each specific product, class of material, and equipment system.
   2. Submit items specified in different sections of the Specifications separately unless they are part of an integrated system.

C. Assign a Contractor's submittal number to the documents originated to allow tracking of the submittal during the review process.
   1. Assign the number consisting of a prefix, a sequence number, and a letter suffix. Prefixes shall be as follows:

Prefix	Description	Originator
CO	Change Order	Owner
PCM	Preliminary Contract Modification	Contractor
EIR	Equipment Installation Report	Contractor
FO	Field Order	Engineer
O&M	Operation & Maintenance Manuals	Contractor
RFI	Request for Information	Contractor
SD	Shop Drawing	Contractor

   2. Issue sequence numbers in chronological order for each type of submittal.
   3. Issue numbers for resubmittals that have the same number as the original submittal followed by an alphabetical suffix indicating the number of times the same submittal has been sent to the Engineer for processing. For example: SD-025-A represents a shop drawing that is the twenty-fifth submittal of this type and is the second time this submittal has been sent for review.
   4. Clearly note the submittal number on each page or sheet of the submittal.
   5. Correct assignment of numbers is essential since different submittal types are processed in different ways.

D. Submit documents with uniform markings and page sizes.
   1. Paper size shall allow for ease of reproduction.
      a. Submit documents on 8-1/2" X 11" paper where practical.
      b. Use 11" X 17" paper for larger drawings and schematics.
      c. Use full size sheets for fabrications and layout drawings. Reproducible drawings may be submitted in lieu of prints.
   2. Mark submittals to:
      a. Indicate Contractor's corrections in green.
      b. Highlight items pertinent to the products being furnished in yellow and delete items that are not pertinent when the Supplier's standard drawings or information sheets are provided.
      c. Cloud items and highlight in yellow where selections by the Engineer or Owner are required.
      d. Mark dimensions with the prefix FD to indicate field verified dimensions on the drawings.
      e. Provide a blank space 8" x 3" for Contractor's and Engineer's stamp.
   3. Define abbreviations and symbols used in Shop Drawings.
      a. Use terms and symbols in Shop Drawings consistent with the Contract Drawings.

b. Provide a list of abbreviations and their meaning as used in the Shop Drawings.
c. Provide a legend for symbols used on Shop Drawings.

E. Mark submittals to reference the Drawing number and/or section of the Specifications, detail designation, schedule or location that corresponds with the data submitted. Other identification may also be required, such as layout drawings or schedules to allow the reviewer to determine where a particular product is to be used.

F. Deliver samples of all building materials and other products as required by the Specifications to the project site.

G. Construct mock-ups of all building components from the actual products to be used in construction.

H. Submit color charge, samples, and mock-ups for every product requiring color, texture or finish selection. Submit color charts, samples and mock-ups not less than thirty (30) days prior to when these products are to be ordered or released for fabrication to comply with the schedule for construction of the Project.

I. Submit Preliminary Contract Modification per Section 01 31 13, Project Coordination to request modifications to the Contract Documents.

J. Submit an electronic copy in PDF format of each submittal to the Engineer.

1.05 REVIEW PROCEDURES

A. Mark a submittal as "Priority" to place the review for this submittal ahead of submittals previously delivered. Use discretion in the use of "Priority" submittals as this may delay the review of submittals previously submitted. Revise the Schedule of Contractor's Submittals for substantial deviations from the previous schedule.

B. Review procedures vary with the type of submittal as described in Paragraph 1.06.

1.06 SUBMITTAL REQUIREMENTS

A. Shop Drawings are required for those products that cannot adequately be described in the Contract Documents to allow fabrication, erection or installation of the product without additional detailed information from the Supplier.

1. Shop drawings are requested so that the Engineer can:
   a. Compare the proposed features of the product with the specified features so as to advise the Owner that the product does, in general, conform to the Contract Documents.
   b. Compare the performance features of the proposed product with those specified so as to advise the Owner that it appears that the product will meet the designed performance criteria.
   c. Review required certifications, guarantees, warranties, and service agreements for compliance with the Contract Documents.
2. Certify that Contractor has reviewed the Shop Drawings and made all necessary corrections such that the products, when installed, will be in full compliance with the Contract Documents per Section 00 73 00,

Supplementary Conditions. Shop Drawings submitted without this certification will be returned without review.

3. Submit Shop Drawings for:
   a. Products indicated in the submittal schedule following this section.
   b. When a substitution or equal product is proposed in accordance with Paragraph 1.08 of this Section.
4. Include a complete description of the material or equipment to be furnished. Information is to include:
   a. Type, dimensions, size, arrangement, model number, and operational parameters of the components.
   b. Weights, gauges, materials of construction, external connections, anchors, and supports required.
   c. Performance characteristics, capacities, engineering data, motor curves, and other information necessary to allow a complete evaluation of mechanical components.
   d. All applicable standards such as ASTM or Federal specification numbers.
   e. Fabrication and installation drawings, setting diagrams, manufacturing instructions, templates, patterns, and coordination drawings.
   f. Wiring and piping diagrams and related controls.
   g. Mix designs for concrete, asphalt, or other materials proportioned for the Project.
   h. Complete and accurate field measurements for products which must fit existing conditions. Indicate on the submittal that the measurements represent actual dimensions obtained at the site.
5. Provide all required statements of certification, guarantees, extended service agreements, and other related documents with the Shop Drawing. The effective date of these documents shall be the date of acceptance of the work by the Owner.
6. Comments will be made on items called to the attention of the Engineer for review and comment. Any marks made by the Engineer do not constitute a blanket review of the submittal or relieve the Contractor from responsibility for errors or deviations from the Contract requirements.
   a. Submittals that are reviewed will be returned with one or more of the following designations:
      1) Approved - Submittal is found to be acceptable as submitted.
      2) Approved as Noted - Submittal is acceptable with corrections or notations made by Engineer and may be used as corrected.
      3) Revise and Resubmit - Submittal has deviations from the Contract Documents, significant errors, or is inadequate and must be revised and resubmitted for subsequent review.
      4) Not Approved - Products are not acceptable.
   b. Drawings with a significant or substantial number of markings by the Contractor may be marked "Approved as Noted" and "Revise and Resubmit". These drawings are to be revised to provide a clean record of the submittal.

B. Certifications, Warranties and Service Agreements include documents as specified in the detailed specifications, as shown in the submittal schedule or as follows:
   1. Certified Test Reports (CTR) - A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with the specifications. (Refer to Section 01 40 00, Quality Requirements.)

2. Certification of Local Field Service (CLS) - A certified letter stating that field service is available from a factory or supplier approved service organization located within a 50 mile radius of the project site. List names, addresses, and telephone numbers of approved service organizations on or attach to the certificate.
3. Extended Warranty (EW) - A guarantee of performance for the product or system beyond the normal one year correction period described in the General Conditions. Issue the warranty certificate in the name of the Owner.
4. Extended Service Agreement (ESA) - A contract to provide maintenance beyond that required to fulfill requirements for warranty repairs, or to perform routine maintenance for a definite period of time beyond the warranty period. Issue the service agreement in the name of the Owner.
5. Certification of Adequacy of Design (CAD) - A certified letter from the manufacturer of the equipment stating that they have designed the equipment to be structurally stable and to withstand all imposed loads without deformation, failure, or adverse effects to the performance and operational requirements of the unit. The letter shall state that mechanical and electrical equipment is adequately sized to be fully operational for the conditions specified or normally encountered by the product's intended use.
6. Certification of Applicator/Subcontractor (CSQ) - A certified letter stating that the Subcontractor or Supplier proposed to perform a specified function is duly designated as factory authorized and trained for the application of the specified product.

C. Submit record data to provide information to allow the Owner to adequately identify the products incorporated into the project and allow replacement or repair at some future date.
1. Provide record data for all products. Record data is not required for items for which Shop Drawings and/or operations and maintenance manuals are required.
2. Provide information only on the specified products. Submit a Preliminary Contract Modification for approval of deviations or substitutions and obtain approval by Field Order or Change Order prior to submitting record data.
3. Provide the same information required for Shop Drawings.
4. Record data will be received by the Engineer, logged, and provided to Owner for the Project record.
   a. Record data may be reviewed to see that the information provided is adequate for the purpose intended. Inadequate drawings will be returned as unacceptable.
   b. Record data is not reviewed for compliance with the Contract Documents. Comments may be returned if deviations from the Contract Documents are noted during the cursory review performed to see that the information is adequate.

D. Provide Samples for comparison with products delivered to the Site for use on the Project.
1. Samples shall be of sufficient size and quantity to clearly illustrate the functional characteristics of the product, with integrally related parts and attachment devices.
2. Indicate the full range of color, texture, and patterns.

3. Dispose of Samples when related Work has been completed and approved, and disposal is requested by the Engineer. At Owner's option Samples will become the property of the Owner.

E. Construct mock-ups for comparison with the work being performed.
   1. Construct mock-ups of all building components from the actual products to be used in construction of a size or area as needed to represent the finished product or as indicated in the detailed Specifications.
   2. Construct mock-ups complete with texture and finish to represent the finished product.
   3. Protect mock-ups until Work has been completed and accepted by the Owner.
   4. Dispose of mock-ups when related Work has been completed and disposal is approved by the Engineer.

F. Submit Operation and Maintenance (O&M) manuals for all equipment, mechanical devices, or components described in the Contract Documents per Section 01 78 23, Operation and Maintenance Data. Include copies of approved Shop Drawings in the manual.

G. Submit Request for Information (RFI) in accordance with Section 01 31 13, Project Coordination.

H. Submit a Schedule of Values and Application for Payment (AP) in accordance with Section 01 29 00, Payment Procedures.

I. Submit Progress Schedules (SCH) in accordance with Section 01 32 16 Construction Progress Schedule.

J. Submit Certified Test Reports (CTR) from independent testing laboratories.
   1. Submit test reports for material fabricated for this project with Shop Drawings for that product.
   2. Submit test reports produced at the point of production for standard production products with the record data for that product.

K. Submit a list of Suppliers and Subcontractors as record data in accordance with Section 01 31 13, Project Coordination.

L. Submit Equipment Installation Reports (EIR) in accordance with Section 01 75 00, Starting and Adjusting.

M. Submit Notifications by Contractor (NBC) in accordance with Section 01 31 13, Project Coordination.

1.07 REQUESTS FOR DEVIATION

A. Submit requests for deviations from the Contract Documents for any product that does not fully comply with the Contract Documents.

B. Submit request for deviations by Preliminary Contract Modification in the Contractor’s standard format per Section 01 31 13, Project Coordination. Identify the deviations and the reason the change is requested.

C. Include the amount if cost savings to the Owner for deviations that result in a reduction in cost.

D. A Change Order or Field Order will be issued by the Engineer for deviations, if approved. Deviations from the Contract Documents require specific approval by the Owner and the Engineer.

1.08 SUBMITTALS FOR EQUAL NON-SPECIFIED PRODUCTS

A. The products of the listed suppliers are to be furnished where detailed specifications list several manufacturers but do not specifically list "or equal" or "or approved equal" products. Use of any products other than those specifically listed is a substitution and must be approved per Paragraph 1.09.

B. Contractor may submit other manufacturers' products that are in full compliance with the specification where detailed specifications list one or more manufacturers followed by the phase "or equal" or "or approved equal".
   1. Submit Shop Drawings of adequate detail to document that the proposed product is equal or superior to the specified product.
   2. Prove that the product is equal. It is not the Engineer's responsibility to prove the product is not equal.
      a. Indicate on a point by point basis for each specified feature that the product is equal to the Contract Document requirements.
      b. Make a direct comparison with the specified manufacturer's published data sheets and available information. Provide this printed material with the submittal.
      c. Equipment or materials submitted as “or-equal” may be rejected solely on the basis of exceptions taken to the specifications or lack of full and complete compliance with the specifications.
      d. The decision of the Engineer regarding the acceptability of the proposed product is final.
   3. Provide a typewritten certification that, in furnishing the proposed product as an equal, the Contractor:
      a. Has thoroughly examined the proposed product and has determined that it is equal or superior in all respects to the product specified.
      b. Has determined that the product will perform in the same manner as the specified product.
      c. Will provide the same warranties and/or bonds as for the product specified.
      d. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the product into the Work and will waive all claims for additional materials or effort which may be necessary to incorporate the product into the Project.
      e. Will maintain or improve the delivery and installation schedule as for the specified product.
   4. A modification request is not required for any product that is in complete compliance with the Contract Documents.

1.09 SUBMITTALS FOR SUBSTITUTIONS

A. Substitutions are defined as any product that the Contractor proposes to provide for the Project in lieu of the specified product.

B. Submit the following for consideration of approval of a Supplier or product which is not specified:
   1. Submit request for deviation from the Contract Documents per Paragraph 1.07.
   2. Prove that the product is acceptable as a substitute. It is not the Engineer's responsibility to prove the product is not acceptable as a substitute.
      a. Indicate on a point by point basis for each specified feature that the product is acceptable to meet Contract Documents requirements.
      b. Make a direct comparison with the specified Supplier's published data sheets and available information. Provide this printed material with the submittal.
      c. The decision of the Engineer regarding the acceptability of the proposed substitute product is final.
   3. Provide a typewritten certification that, in making the substitution request, the Contractor:
      a. Has determined that the substituted product will perform in substantially the same manner and result in the same ability to meet the specified performance as the specified product.
      b. Will provide the same warranties and/or bonds for the substituted product as specified or as would be provided by the Manufacturer of the specified product.
      c. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the substituted product into the project and will waive all claims for additional Work which may be necessary to incorporate the substituted product into the Project which may subsequently become apparent.
      d. Will maintain the same time schedule as for the specified product.

C. Pay engineering cost for review of substitutions.
   1. Cost for additional review time will be billed to the Owner by the Engineer for the actual hours required for the review and marking of Shop Drawings by Engineer and in accordance with the rates listed in Paragraph SC-14.02, Section 00 73 00, Supplementary Conditions.
   2. Cost for the additional review shall be paid to the Owner by the Contractor on a monthly basis.

1.10 WARRANTIES AND GUARANTEES

A. Submit warranties and guarantees required by the Contract Documents with the Shop Drawings or record data.

B. Provide additional copies for equipment and include this additional copy in the Operation and Maintenance Manuals. Refer to Section 01 78 23, OPERATION AND MAINTENANCE DATA.

C. Provide a separate manual for warranties and guarantees.
   1. Provide a log of all products for which warranties or guarantees are provided, and for all equipment. Index the log by Specification section number on forms provided by the Engineer.
   2. Indicate the start date, warranty or guarantee period and the date upon which the Warranty or guarantee expires for product or equipment which a warranty or guarantee is required.

3. Indicate the date for the start of the correction period specified in the General Conditions for each piece of equipment and the date on which the specified correction period expires.
4. Provide a copy of the warrantee or guarantee under a tab indexed to the log.

1.11 RESUBMISSION REQUIREMENTS

A. Make all corrections or changes in the submittals required by the Engineer and resubmit until approved.

B. For shop drawings:
1. Revise initial drawings or data and resubmit as specified for the original submittal.
2. Highlight in yellow those revisions which have been made in response to the first review by the Engineer.
3. Highlight in blue any new revisions which have been made or additional details of information that has been added since the previous review by the Engineer.

C. For samples:
1. Submit new samples as required for the initial sample.
2. Remove samples which have been rejected.

D. For mock-ups:
1. Construct a new mock-up as initially required.
2. Dispose of mock-ups which have been rejected.

E. Engineering cost for excessive review of shop drawings will be paid by the Contractor.
1. Excessive review of shop drawings is defined as any review required after the original review has been made and the first resubmittal has been checked to see that corrections have been made.
2. Cost for additional review time will be billed to the Owner by the Engineer for the actual hours required for the review and marking of shop drawings by Engineer and in accordance with the rates listed in Item SC-14.02, Section 00 73 00, Supplementary Conditions.
3. Pay cost for the additional review to the Owner on a monthly basis as billed by the Owner.
4. Need for more than one resubmission or any other delay of obtaining Engineer's review of submittals, will not entitle the Contractor to an extension of Contract Time. All costs associated with such delays shall be at the Contractor's expense.

1.12 ENGINEER'S DUTIES

A. Review the submittals and return with reasonable promptness.

B. Affix stamp, indicate approval, rejection, and the need for resubmittal.

C. Distribute documents

END OF SECTION

01 35 00 SPECIAL PROCEDURES

1.00 GENERAL

1.01 CONSTRUCTION SEQUENCE

A. Perform the work as required to complete the entire project addressing the stipulations below:
   1. Operation of the plant takes precedence over construction activities. Coordinate all shutdowns with the Owner a minimum of 14 days in advance of construction activities. High flow or load conditions may require delay of shutdown or shortening of the allowable shutdown time period.
   2. Contractor is encouraged to review diurnal flows with Owner personnel when planning and scheduling work.
   3. Owner can take steps to facilitate plant shutdowns or shutdowns of specific structures to facilitate connections. Contractor shall work with Owner's personnel at least two weeks prior to the first of each type of shutdown to conduct a "dry run" to assess any special requirements needed when plant facilities are shut down to accommodate construction.

B. Perform the work as required to complete entire project within the contract time. Work shall be completed within the specified time for these items:
   1. O&M Building shall be constructed within 540 calendar days following notice to proceed
   2. Demolition of existing WWTP shown on Sheets 01-D-01 to 01-D-10 shall not commence prior to substantial completion of the 2.25 MGD WWTP.

C. Consider the sequences, duration limitations, and governing factors outlined in this Section to prepare the schedule for the work.

D. Perform the work not specifically described in this Section as required to complete the entire project within the contract time.

1.02 SHUTDOWNS AND PLANS OF ACTION

A. Shut-downs of operations or equipment must be planned and scheduled.
   1. Submit a written plan of action for approval for shutting down essential services. These include:
      a. Pipelines
      b. Electrical power
      c. Control power
      d. Process piping
      e. Treatment equipment
      f. Communications equipment
      g. Other designated functions
   2. Describe the following in the Plan of Action:
      a. Construction necessary
      b. Utilities, piping, or services affected
      c. Length of time the service or utility will be disturbed
      d. Procedures to be used to carry out the work
      e. Plan of Action to handle emergencies
      f. Contingency plan that will be used if the original schedule cannot be met

3. Plan must be received by the Engineer and Owner two (2) weeks prior to beginning the work.

B. Work requiring partial and plant shutdowns shall be coordinated to the maximum extent possible to minimize the number of partial and plant shutdowns.

1.03 OWNER ASSISTANCE

A. The Owner will assist the Contractor in draining the existing pipelines and treatment units as much as possible through existing drains, blow-off valves, flanged fittings, or pump inspection ports. The Contractor will be responsible for providing dewatering pumps, etc. required to completely dewater the excavations and facilities and handle any leakage past closed valves. Contractor will be responsible for cleaning the facilities to the extent needed to complete the Work.

END OF SECTION

01 40 00 QUALITY REQUIREMENTS

1.00 GENERAL

1.01 CONTRACTOR'S RESPONSIBILITIES

A. Control the quality of the Work and verify that the Work meets the standards of quality established in the Contract Documents.
   1. Inspect the Work of the Contractor, Subcontractors and Suppliers. Correct defective Work.
   2. Inspect products and materials to be incorporated into the Project. Ensure that Suppliers of raw materials, parts, components, assemblies, and other products have adequate quality control system to ensure that quality products are produced. Provide only products that comply with the Contract Documents.
   3. Provide and pay for the services of an approved professional materials testing laboratory acceptable to the Owner to insure that products proposed for use fully comply with the Contract Documents.
   4. Provide all facilities and calibrated equipment required for quality control tests.
   5. Provide consumable construction materials of adequate quality to provide a finished product that complies with the Contract Documents.
   6. Perform tests as indicated in this and other sections of the specifications. All quality control testing is to be observed by the Owner or Engineer.
   7. Maintain complete inspection and testing records at the site and make them available to Owner and Engineer.

B. Provide and pay for the services of an approved professional materials testing laboratory acceptable to the Owner to insure that Work fully complies with the Contract Documents. Provide services of a testing laboratory capable of performing a full range of testing procedures complying with the standards for testing procedures specified. Provide personnel certified to perform the test required. Obtain Owners' approval for the testing laboratory before testing is performed. All certified test results shall be distributed to the Owner and Engineer.

C. Should requirements of this Section of the specification conflict with the requirements of the technical specifications, the technical specifications shall govern.

1.02 QUALITY ASSURANCE ACTIVITIES BY THE OWNER

A. Owner may perform its own quality assurance test independent of the Contractor’s Quality Control Program or as otherwise described in the Contract Documents. Provide labor, materials, tools, equipment, and related items for testing by the Owner including, but not limited to temporary construction required for testing and operation of new and existing utilities. Assist the Owner, Engineer, and testing organizations in performing quality assurance activities.
   1. Provide access to the Work and to the Supplier's operations at all times Work is in progress.
   2. Cooperate fully in the performance of sampling, inspection, and testing.
   3. Furnish labor and facilities to:
      a. Provide access to the work to be tested.
      b. Obtain and handle samples for testing at the project site or at the source of the product to be tested.

c. Provide calibrate scales and measuring devices for the Owner's use.
d. Facilitate inspections and tests.
e. Provide adequate lighting to allow Owner observations.
f. Store and cure test samples.

4. Furnish copies of the tests performed on materials and products.
5. Provide adequate quantities of representative product to be tested to the laboratory at the designated location.
6. Provide adequate notice before proceeding with work that would interfere with testing.
7. Do not proceed with any work until testing services have been performed and results of tests indicate that the work is acceptable.
8. Provide complete access to the Site and make Contract Documents available.
9. Provide personnel and equipment needed to perform sampling or to assist in making the field tests.
10. Quality assurance testing performed by the Owner will be paid for by the Owner, except for verification testing performed by the Owner, which shall be paid for by the Contractor as described in Paragraph 1.06.

B. Quality assurance activities of the Owner or Engineer through their own forces or through contracts with materials testing laboratories and survey crews are for the purpose of monitoring the results of the Contractor's work to see that it is in compliance with the requirements of the Contract Documents.

C. Quality assurance activities of the Owner and Engineer or non-performance of quality assurance activities:
1. Do not relieve the Contractor of its responsibility to perform Work and furnish materials and products and constructed Work conforming to the requirements of the Contract Documents.
2. Do not relieve the Contractor of its responsibility for providing adequate quality control measures.
3. Do not relieve the Contractor of responsibility for damage to or loss of the material, product or Work before Owner's acceptance.
4. Do not constitute or imply Owner's acceptance.
5. Do not affect the continuing rights of the Owner after Owner's acceptance of the completed Work.

D. The presence or absence of the Owner or Engineer does not relieve the Contractor from any contract requirement, nor is the Owner or Engineer authorized to change any term or condition of the Contract Documents without the Owner's written authorization in a Field Order or Change Order.

E. Failure on the part of the Owner or Engineer to perform or test products or constructed works in no way relieves the Contractor of the obligation to perform work and furnish materials conforming to the Contract Documents.

F. All materials and products are subject to Owner's quality assurance observations or testing at any time during preparation or use. Material or products which have been tested or observed or approved by Owner at a supply source or staging area may be re-observed or re-tested by Owner before or during or after incorporation into the Work, and rejected if they do not comply with the Contract Documents.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 Submittals, and shall include:
   1. A written Quality Management Plan that establishes the methods of assuring compliance with the Contract Documents. Submit this program as Record Data
   2. A Statement of Qualification for the proposed testing laboratory. The statement of qualifications is to include a list of the engineers and technical staff that will provide testing services on the Project, descriptions of the qualifications of these individuals, list of tests that can be performed, equipment used with date of last certification and a list of recent projects for which testing has been performed with references for those projects.
   3. Test reports per Paragraph 1.07, TEST REPORTS of this specification. Reports are to certify that products or constructed Works are in full compliance with the Contract Documents or indicate that they are not in compliance and describe how they are not in compliance.
   4. Provide Certified Test Reports on materials or products to be incorporated into the Project. Reports are to indicate that material or products are in full compliance with the Contract Documents or indicate that they are not in compliance and describe how they are not in compliance.

1.04 STANDARDS

A. Provide a testing laboratory that complies with the ACIL (American Council of Independent Laboratories) "Recommended Requirements for Independent Laboratory Qualifications".

B. Perform testing per recognized test procedures as listed in the various sections of the specifications, standards of the State Department of Highways and Public Transportation, American Society of Testing Materials (ASTM), or other testing associations. Perform tests in accordance with published procedures for testing issued by these organizations.

1.05 DELIVERY AND STORAGE

Handle and protect test specimens of products and construction materials at the Site in accordance with recognized test procedures.

1.06 VERIFICATION TESTING

A. Provide verification testing when tests indicate that materials or the results of construction activities are not in conformance with Contract Documents.

B. Verification testing is to be provided at the Contractor's expense to verify products or constructed works are in compliance after corrections have been made.

C. Tests must comply with recognized methods or with methods recommended by the testing laboratory and approved by the Engineer.

1.07 TEST REPORTS

A. Test reports are to be prepared for all tests.

1. Tests performed by testing laboratories may be submitted on their standard test report forms. These reports must include the following:
    a. Name of the Owner, project title and number, equipment installer and general contractor.
    b. Name of the laboratory, address, and telephone number.
    c. Name and signature of the laboratory personnel performing the test.
    d. Description of the product being sampled or tested.
    e. Date and time of sampling, inspection, and testing.
    f. Date the report was issued.
    g. Description of the test performed.
    h. Weather conditions and temperature at time of test or sampling.
    i. Location at the site or structure where the test was taken.
    j. Standard or test procedure used in making the test.
    k. A description of the results of the test.
    l. Statement of compliance or non-compliance with the Contract Documents.
    m. Interpretations of test results, if appropriate.
2. Submit reports on tests performed by Contractor or his suppliers or vendors in the Contractor's standard format, as approved by Owner.

B. Distribute copies of the test reports within 24 hours of completing the test. Flag tests reports with results that do not comply with Contract Documents for immediate attention.

C. Payment for Work subject to testing may be withheld until the Contractor's quality control test reports of the Work are submitted to the Owner.

1.08 NON-CONFORMING WORK

A. Immediately correct any Work that is not in compliance with the Contract Documents or submit a written explanation of why the Work is not to be corrected immediately and when corrective to the Work will be performed.

B. Payment for non-conforming Work shall be withheld until Work is brought into compliance with the Contract Documents.

1.09 LIMITATION OF AUTHORITY OF THE TESTING LABORATORY

A. The testing laboratory representatives are limited to providing consultation on the test performed and in an advisory capacity.

B. The testing laboratory is not authorized to:
    1. Alter the requirements of the Contract Documents.
    2. Accept or reject any portion of the Work.
    3. Perform any of the duties of the Contractor.
    4. Stop the work.

1.10 QUALITY CONTROL PLAN

A. Submit Contractor's Quality Control Plan that identifies personnel, procedures, control, instructions, tests, records, and forms to be used. Construction will be permitted to begin only after acceptance of the Quality Control Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work

outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a Quality Control Plan or another interim plan containing the additional features of work to be started.

B. Content of the Quality Control Plan. The Quality Control Plan shall include, as a minimum, the following to address all construction operations, both onsite and offsite, including work by Subcontractors and Suppliers:
   1. A description of the quality control organization, including a chart showing lines of authority and acknowledgement that the quality control staff shall implement the quality control program for all aspects of the Work specified.
   2. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a quality control function.
   3. A copy of the letter to the Quality Control Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the Quality Control Manager, including authority to stop work which does not comply with the Contract Documents or will result in Work that does not comply with the Contract Documents. The Quality Control Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities.
   4. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of Subcontractors and Suppliers.
   5. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, person responsible for each test, applicable industry testing standards and laboratory facilities to be used for the test.
   6. Procedures for tracking phases of quality control, verification, and acceptance tests including documentation.
   7. Procedures for tracking construction deficiencies from identification through acceptable corrective action. Indicate how verification that identified deficiencies have been corrected is to be documented.
   8. Reporting procedures, including proposed reporting formats
   9. The name of the proposed testing laboratory along with documentation of qualifications, a list of tests that can be performed, and a list of recent projects for which testing has been performed with references from those projects.

C. Notification of Changes. After submittal of the Quality Control Plan, the Contractor shall notify the Owner in writing of any proposed changes.

D. Coordination Meeting. After the Pre-construction Meeting and before start of construction, the Contractor shall meet with the Owner and Engineer to discuss the Contractor's Quality Control Plan. The Quality Control Plan shall be submitted a minimum of fourteen (14) calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the Quality Control operations, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's management and control with the Owner's Quality Assurance. Revise the Quality Management Plan to reflect comments and recommended changes resulting from this meeting.

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2.00 PRODUCTS

2.01 TESTING APPARATUS

A. Furnish testing apparatus and related accessories necessary to perform the tests.

3.00 EXECUTION

3.01 QUALITY CONTROL PROGRAM

A. Perform quality control observations and testing as required in each section of the specifications and where indicated on the drawings.

Provide a quality control program that includes the following phases for each definable Work task. A definable Work task one which is separate and distinct from other tasks, has separate control requirements, may be provided by different trades or disciplines, or may be work by the same trade in a different environment.

1. Planning Phase. Perform the following before beginning each definable Work task:
   a. Review the contract drawings.
   b. Review submittals and determine that they are complete in accordance with the Contract Documents.
   c. Check to assure that all materials and/or equipment have been tested, submitted, and approved.
   d. Examine the work area to assure that all required preliminary work has been completed and is in compliance with the Contract Documents.
   e. Examine required materials, equipment, and sample work to assure that they are on hand, conform to submittals, and are properly stored.
   f. Review requirements for quality control inspection and testing.
   g. Discuss procedures for controlling quality of the work. Document construction tolerances and workmanship standards for the Work task.
   h. Check that the portion of the plan for the Work to be performed incorporates submittal comments.
   i. Discuss results of planning with the Engineer or Owner. Instruct applicable workers as to the acceptable level of workmanship required in order to meet the requirements of the Contract Documents. Document the results of the preparatory phase actions by separate meeting minutes prepared by the quality control manager and attached to the quality control report.
   j. Do not move to the next phase unless results of investigations required for the planning phase indicate that requirements have been met.
2. Work Phase. Complete this phase after the Planning Phase:
   a. Provide at least 24 hours advance notice of beginning the Work and discuss the review of the planning effort to indicate that requirements have been met.
   b. Check the Work to ensure that it is in full compliance with the Contract Documents.
   c. Verify adequacy of controls to ensure full compliance with Contract Documents. Verify required control inspection and testing is performed.
   d. Verify that established levels of workmanship meet acceptable workmanship standards. Compare with required sample panels as appropriate.

e. Repeat the initial phase for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3. Follow-up Phase. Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements:
   a. Make checks daily and record observations in the quality control documentation.
   b. Conduct follow-up checks to correct all deficiencies prior to the start of additional Work tasks that may be affected by the defective Work. Do not build upon nor conceal non-conforming work.
   c. Conduct a review of the Work one month prior to the expiration of the correction period prescribed in the General Conditions with the Owner and Engineer. Correct defects noted during the review.

B. Conduct additional planning and review if:
   1. The quality of on-going work is unacceptable
   2. Changes are made in applicable quality control staff, onsite production supervision or work crew
   3. Work on a task is resumed after a substantial period of inactivity
   4. Other quality problems develop.

3.02 CAST-IN-PLACE CONCRETE TESTING

A. Test cast-in-place concrete in accordance with Section 03 30 00 Cast-in-Place Concrete.

3.03 PROTECTIVE COATINGS

A. Test protective coatings per Division 09.

3.04 LEAKAGE TESTS FOR STRUCTURES

A. Test structures that will contain water on a full time or intermittent basis for leaks. Perform tests prior to installing equipment or materials within the structure. In the event that the structure fails to pass the test, drain the structure, repair the leaks, re-fill, and re-test the structure. Repeat tests until the structure passes the test. The Owner may repeat the test at any time during the correction period established in the General Conditions.

B. Test the structure for leakage using the following procedure:
   1. Determine the evaporation allowance for loss of water.
      a. Use a standard circular pan procedure established by the U.S. Weather Bureau to measure evaporation rate.
      b. Calculate evaporation allowance by multiplying the evaporation rate in gallons per 24 hours per square foot of surface are by the open surface area of the water in the structure.
   2. Calculate the allowable leakage for the structure. Allowable leakage is calculated as 0.03 gallons per square foot of concrete area in contact with the water per 24 hours.
   3. Fill the structure to the overflow level with water at a rate not to exceed 2 feet per hour.
   4. Allow the structure to set for three (3) days.
   5. Observe the perimeter of the structure and identify all leaks.

6. Repair structure walls and floors where leaks have been identified.
7. Mark the water level at the structure wall. Measure the fall in water level over a 24-hour period to the nearest 1/8" at least twice a day to determine the quantity of water lost. Provide a stilling well for measurement if required to allow accurate measurement.
8. Calculate the amount of water lost during this time period.
9. Compare the amount of water lost to the allowable loss.

C. Drain the structure, determine the sources of leakage and repair if the amount of water lost exceeds the allowable leakage plus the evaporation allowance.

3.05 PIPING SYSTEMS

A. TEST REQUIREMENTS
1. Perform test on piping systems including piping installed between or connected to existing pipe.
2. Conduct tests on buried pipe to be hydrostatically tested after the trench is completely backfilled. If field conditions permit and if approved by the Engineer, partially backfill the trench and leave the joints open for inspection and conducting of the initial service leak test. Do not conduct the acceptance test until backfilling is complete.
3. Pneumatically test the buried piping and expose joints of the buried piping for the acceptance test.
4. Conduct the test on exposed piping after the piping is completely installed, including supports, hangers, and anchors, but prior to insulation and coating application.
5. Do not perform testing on pipe with concrete thrust blocking until the concrete has cured at least five (5) days.
6. Determine and remedy the cause of the excessive leakage for any pipe failing to meet the specified requirements for water or air tightness.
7. Tests must be successfully completed and reports filed before piping is accepted.
8. Submit a comprehensive plan and schedule for testing to the Engineer for review at least 10 days prior to starting each type of testing.
9. Remove and dispose of temporary blocking material and equipment after completion and acceptance of the piping test.
10. Repair any damage to the pipe coating.
11. Clean pipelines so they are totally free flowing prior to final acceptance.
12. Test piping independently from tests on structures.
13. Test method and test pressure depend upon the application of the piping.
    a. Pressure pipe is defined as piping that is part of a pumped or pressurized system. Perform test for pressure pipe per the procedures indicated in Paragraph B of this section.
    b. Gravity pipe is defined as piping that depends upon the force of gravity for flow through the pipe, with the exception of process piping described in paragraph d. Perform test for gravity pipe per the procedures indicated in Paragraph C, D, or E of this section.
    c. Chemical processing lines are to be tested as pressure pipe regardless of the operating conditions. The test pressure is to be 1.5 times the pressure rating of the pipe.
    d. Process piping between hydraulic structures is to be considered as pressure pipe. Perform the test for this pipe per Paragraph B of this

section. The test pressure is to be the maximum hydrostatic head plus 10'. The maximum hydrostatic head is the difference in elevation of the pipe at it lowest point and the maximum top of the wall.

B. PRESSURE AND LEAKAGE TESTS OF PRESSURE PIPING

1. Perform hydrostatic pressure and leakage tests using methods, and per performance requirements of Section 5 of AWWA C-600 regardless of pipe material tested.
   a. The pressure required for hydrostatic pressure test shall be the pipe pressure rating.
   b. Provide temporary plugs and blocking necessary to maintain the required test pressure. Where piping is cast in the walls for a structure, brace the walls prior to testing as required to prevent load of test pressure from being imposed upon the structure.
   c. Provide corporation cocks at least 3/4" in diameter, pipe riser, and angle globe valves at each pipe dead-end in order to bleed air from the line.
   d. Duration of pressure test shall be at least 4 hours.
   e. Repair any visible leaks regardless of the total leakage shown by the test.
   f. Repair pipelines which fail to meet the test and retest as necessary until the results conform to the test requirements.
   g. Remove and replace defective materials, pipes, valves, and accessories.
   h. Test the pipelines in sections by shutting valves or installing temporary plugs as necessary.
   i. Fill the pipeline with water and remove the air.
   j. Maintain the test pressure in the pipe for the entire test period by means of a force pump.
   k. Accurately measure the water required to maintain the pressure. The amount of water required is a measure of the leakage.
2. The maximum allowable leakage is determined by the following formula:

$$L = \frac{SD(P)^{1/2}}{F}$$

Equation Term	Represents	Measure
L	Maximum allowable leakage	gallons per hour
S	Length of pipe tested	feet
D	Nominal diameter of the pipe	inches
P	Test pressure	pounds per square inch gauge
F	Pipe factor	
	Use 148,000 Ductile Iron Pipe and PVC Pipe.	
	Use 133,200 for all other pipe types.	

Leakage is defined as the volume of water provided to maintain the test pressure after the pipe has been filled with water, the air expelled and the pipe brought to test pressure.

3. Pipe with visible leaks or leakage exceeding the maximum allowable leakage is considered defective and must be corrected.

C. HYDROSTATIC LEAK TEST-GRAVITY FLOW SEWER LINES

1. Perform hydrostatic leak tests after backfilling.
2. The length of the pipe to be tested shall be such that the head over the crown of the upstream end is not less than 2' or 2' above the ground water level whichever is higher and the head over the downstream crown is not more than 6'.
3. Plug the pipe by pneumatic bags or mechanical plugs so that the air can be released from the pipe while it is being filled with water.
4. Continue the test for one hour and make provisions for measuring the amount of water required to maintain the water at a constant level during this period.
5. Remove the jointing material, and remake the joint if any joint shows any visible leakage or infiltration.
6. Remove and replace any defective or broken pipes.
7. Determine the maximum allowable leakage or infiltration by the following formula:

$$L = \frac{C\,D\,S}{26{,}720}$$

Equation Term	Represents	Measure
L	Maximum allowable leakage	gallons per hour
S	Length of pipe tested	feet
D	Nominal diameter of the pipe	inches
C	Infiltration / exfiltration rate	
	Use 50 for C outside of 25 year floodplain.	
	Use 10 for C within 25 year floodplain.	

8. Determine the rates of infiltration by means of V-Notch weirs, pipe spigot, or plugs in the end of the pipe. Methods, times, and locations are subject to the Engineer's approval.
9. Pipe with visible leaks or infiltration or exceeds the maximum allowable leakage or infiltration is considered defective and must be corrected.

D. LOW PRESSURE AIR TEST- GRAVITY FLOW SEWER LINES
1. Use air test in lieu of the hydrostatic test if desired, or if pipeline grades do not allow filling the entire pipeline segment or manhole to the indicated depth.
2. Perform low-pressure air tests, using equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. Test is to conform to procedure described in ASTM F-1417 except for testing times. The following test times are required:

Pipe Diameter (inches)	Minimum Time (seconds)	Length for Minimum Time (feet)	Time for Long Length (seconds)
6	340	398	0.855 (L)
8	454	298	1.520 (L)
10	567	239	2.374 (L)
12	680	199	3.419 (L)
15	850	159	5.342 (L)
18	1020	133	7.693 (L)
21	1190	114	10.471 (L)

24	1360	100	13.676 (L)
27	1530	88	17.309 (L)
30	1700	80	21.369 (L)
33	1870	72	25.856 (L)

a. Provide the equipment with an air regulator valve or air safety valve set to an internal air pressure in the pipeline that cannot exceed 6 psig.
b. Pass air through a single control panel.
c. Provide pneumatic plugs that have a sealing length equal to or greater than the circumference of the pipe to be tested.
d. Provide pneumatic plugs that resist internal test pressures without requiring external bracing or blocking.
e. Provide an air compressor of adequate capacity for charging the system.

3. Perform air test only on lines less than 36" diameter. Air tests for pipes larger than 36" may be air tested at each joint.
4. Check connections for leakage with a soap solution. Release the air pressure, repair the leak, and retest with soap solution until results are satisfactory, before resuming air test if leaks are found,.
5. Determine the shortest allowable time for the pressure to drop from 3.5 pounds per square inch to 2.5 pounds per square inch by the following formula:

$$T = 0.0850\ DK/Q$$

Equation Term	Represents	Measure
T	Time for the pressure to drop 1.0 pound per square inch gauge	seconds
K	Factor equal to 0.000419DL, but not less than 1.0	
D	Average inside diameter of the pipe	inches
L	Length of line of the same pipe size	feet
Q	Rate of loss. Use 0.0015 cubic feet per minute per square foot of internal surface	

E. AIR TEST FOR INDIVIDUAL JOINTS
1. Lines 36" and larger may be tested at individual joints.
2. The shortest allowable time for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge is 10 seconds for all pipe sizes.

F. DEFLECTION TESTING FOR PIPE
1. Perform deflection tests on flexible and semi-rigid pipe in accordance with ASTM 3034.
   a. The maximum allowable deflection of pipe measured as the reduction in vertical inside diameter is 5.0% unless specified otherwise.
   b. Conduct test after the final backfill has been in place a minimum of 30 days.

c. Thoroughly clear the lines before testing.

2. Perform test by pulling a properly sized mandrel through the line.
3. Excavate and repair pipe with deflections in excess of the maximum allowable deflection.

G. MANHOLE TESTING

Test manholes for leakage separately and independently of the wastewater lines by hydrostatic exfiltration testing, vacuum testing or other approved methods acceptable to TCEQ. Test manholes after installation with all connections (existing and/or proposed) in place. Plug lift holes with an approved non-shrink grout prior to testing. Install drop-connections and gas sealing connections prior to testing.

1. Hydrostatic Test - Make manhole watertight and re-test if the manhole fails the leakage test. The maximum leakage for hydrostatic testing is 0.025 gallons per foot diameter per foot of manhole depth per hour. Prepare for hydrostatic exfiltration testing by sealing all wastewater lines coming into the manhole with an internal pipe plug, then fill the manhole with water and maintain full for at least one hour. With concrete manholes a period of 24 hours prior to testing may be used in order to allow saturation of the concrete.
2. Vacuum Test – Temporarily plug lines entering the manhole with the plugs braced to prevent them from being drawn into the manhole. Install plugs in the lines beyond drop-connections, gas sealing connections, etc. Place the test head inside the frame at the top of the manhole and inflate in accordance with the manufacturer's recommendations. Draw a vacuum of 10 inches of mercury, then turn off the vacuum pump. Read the level of vacuum after the required test time with the valve closed. The manhole will pass the test if the drop in the level is less than 1 inch of mercury (final vacuum greater than 9 inches of mercury). The required test time for 48", 60", and 72" manholes with depths up to 30 feet is one minute-thirty seconds. Test times for manholes of greater size and depths will be determined by the Engineer.
3. Manhole Repairs – Manholes will be accepted in accordance with the criteria above. Repair any manhole which fails the initial test with non-shrink grout or other suitable material as determine for the material from which the manhole is constructed. Retest the manhole as described above until a successful test is achieved. Remove all temporary plugs and grout after a successful test.

H. TESTS FOR PLUMBING DRAINAGE AND VENT SYSTEMS

1. Plug openings as necessary.
2. Test drainage and venting systems by filling piping with water to the level of the highest vent stack for 30 minutes.
3. Make the examination for leakage at joints and connections.
4. Test fail if there is any drop in water level.

3.06 ELECTRICAL TESTING

A. QUALIFICATIONS

1. Perform testing using qualified personnel with a minimum of five (5) years' experience installing and testing electrical equipment and machinery, unless otherwise specified.
2. Use testing firms or individuals to perform tests that have not provided services or materials used on the Project or are otherwise related or affiliated with other Contractors or Suppliers for this project unless permitted by the Owner.

B. REPORT FORMS

Complete appropriate test report neatly and in ink for the items being tested. Note listed data that is not applicable or cannot be obtained as "N/A" or document with an explanation for the omission. Substitute forms recording similar data and test equipment as that specified may be used if approved by the Engineer.

C. TEST EQUIPMENT

1. Provide test equipment and materials necessary to perform the requested tests.
2. Test equipment and apparatus shall be appropriate for the full range and duration of the test to be performed.
3. Demonstrate that the test equipment is functioning properly, prior to the commencement of the test. Suspend the test and repair or replace the equipment if test equipment fails during any portion of a test. Repeat the test in its entirety or as otherwise required by the Engineer or Owner.
4. Provide a copy of the test equipment calibration certificate prior to the commencement of the test. Provide test equipment that has been calibrated with six (6) months of the date of the test using methods approved by the National Institute of Standards and Technology.

D. EXECUTION

1. Make appropriate repairs or replacements if the circuit, equipment or machinery being tested does not pass. Repeat test as directed by the Engineer or Owner.
2. The more rigid requirement prevail if test procedures or equipment conflicts occur between the various sections and/or Supplier’s recommendations.

E. ELECTRICAL CABLE

1. COMMUNICATION CABLE AND CONDUCTORS - Submit test forms to the Owner's for approval prior to performing the following tests:
   a. Test shielded pair, telephone, paging, signaling and computer cables for continuity, short circuits and grounds with a low voltage source, not to exceed the insulation rating of the conductors or jacket.
   b. Test fiber-optic cable between terminating ends for each circuit per the Supplier’s recommendation. Cables, splices (where permitted), and connectors shall be tested for continuity, band width (maximum), and attenuation losses.
2. 600 VOLT CABLE AND CONDUCTORS:
   a. Test power and control conductors rated at 600 volts with an insulation resistance tester at 1,000 volts, with respect to ground, and at 1,000 volts with respect to all other conductors in each circuit.
   b. Verify suitable ground connections are provided and maintained throughout the test.
   c. Perform tests and record results as required by the "600 Volt Cable Test Report" or form provided by the Engineer.
   d. Test each circuit and record the results for continuity between terminating ends with a low voltage source.
3. 5KV CABLE AND CONDUCTORS:
   a. Perform insulation resistance test on 5KV cable for insulation resistance tested at 2,500 volts with respect to ground and at 2,500 volts with respect to all other conductors in each circuit.

b. H-Pot test 5KV cables incrementally to 25 KVDC for 15 minutes per ANSI/IEE STD 400. Record leakage current in the spaces provided, at the time intervals shown, on the "Medium Voltage Cable Test Report." Do not exceed the cable Supplier's maximum test values or procedures.
c. Perform Individual conductor resistance tests and recorded results. Test each circuit for continuity between terminations ends and record the test results. Provide additional tests and checks as requested by the Supplier.

4. 15KV CABLE AND CONDUCTORS:
   a. Perform insulation resistance test on 15KV cable at 2500 volts with respect to all other conductors in each circuit.
   b. H-Pot test 15KV cable incrementally to 55KVDC for 15 minutes per ANSI/IEE STD. 400. Record leakage current at the time interval, shown, on the "Medium Voltage Cable Test Report." Do not exceed the cable Supplier's recommended maximum test values or procedures. Perform individual conductor resistance tests and record the results. Test each circuit for continuity between terminating ends and record the results. Provide additional tests and checks as required by the Supplier.

F. SWITCHGEAR
1. Test electrical switchgear and electrical devices and controls mounted on or in the switchgear in accordance with the "Switchgear Test Report" form.
2. Record the following information and attach to the test report:
   a. Resistance reading across joints of each horizontal and vertical bus.
   b. Verify proper operation of electrical, mechanical and keyed interlocking systems.
   c. Operate devices to both their open and close states. Operate stored energy devices mechanically and electrically as applicable. Operate remotely controlled devices from their remote location.
   d. Verify proper operation of draw-out circuit breakers and switches. Remove and re-install each unit. Verify proper operation of shutters and barriers.
   e. Disconnect electrical and electronic sensing and protective devices not rated to withstand insulation resistance test potentials. Reconnect the devices before energizing the switchgear.
   f. Perform insulation resistance tests at the test voltages shown below for the following equipment. Do not exceed the Supplier's recommended maximum test values or procedures.

Equipment Rating	Test Voltage
0-250 VOLTS	500 VOLTS
251-600 VOLTS	1,000 VOLTS
601-5,000 VOLTS	2,500 VOLTS
5,001-15,000 VOLTS	2,500 VOLTS
15,001-39,000 VOLTS	5,000 VOLTS

   g. Provide additional tests and checks as recommended by the Supplier before energizing.
   h. Energize switchgear. Measure and record instrument indications for no load and connected load conditions.

G. TRANSFORMERS

1. Test single and 3-phase, liquid filled and dry transformers rated 5KVA and larger in accordance with the "Transformer Test Report," form.
2. Record the following information and attach to the test report.
   a. Verify proper operation of all fans, alarms, and other auxiliary and monitoring devices.
   b. Verify "tap changer" operation, if applicable, in all positions. Set and secure "tap changer" to position recommended by the Supplier or Engineer.
   c. Obtain insulating liquid sample from all liquid filled transformers. Submit sample to testing laboratory, approved by the Owner for analysis. Perform standard insulating liquid tests as required by the Supplier or Engineer Deliver test results to the Owner within 30 days after sampling.
   d. Perform insulation resistance tests at the test values shown below for the following equipment.
   e. Perform tests from each winding to ground and winding to winding. Primary and secondary sections shall be tested separately.
   f. Do not exceed the Supplier's recommended maximum test values or procedures.

Transformer Coil Rating	Test Voltage
0-600 VOLTS	1,000 VOLTS
601-5,000 VOLTS	2,500VOLTS
5,001-15,000VOLTS	5,000 VOLTS
15,001-39,000 VOLTS	10,000 VOLTS

   g. Provide additional tests and checks as recommended by the Supplier before energizing.
   h. Energize transformer. Measure and record primary and secondary volts and amps under no load and connected load conditions.

H. MOTORS
1. Test electric motors in accordance with the "Motor Start-Up Report" form.
2. Check and record motor winding continuity phase to phase with a low voltage source.
3. Check and record motor winding insulation resistance, each phase with respect to ground, at the test values shown below for A.C. induction motors per REF. IEEE Standard 43.
4. Do not exceed the Supplier's recommended maximum test values or procedures.

Motor Voltage Rating (Volts)	Test Voltage
250V and below	500
above 250 V	1,000
2,360 Volt - 3 Phase	Per Manufacturer’s start-up instructions or as otherwise directed by the Engineer.
4,160 Volt - 3 Phase	Per Manufacturer’s start-up instructions or as otherwise directed by the Engineer.

5. Check and record motor circuit voltage before starting motor.

6. Verify operation of motor space heater if applicable.
7. Provide additional tests and checks as recommended by the Supplier before energizing.
8. Start motor and verify immediately correct shaft rotation.
9. Check and record motor running volts and amps.
10. Verify correct operation of all interlocking and protective devices.

3.07 Soil Compaction

A. Piping Systems – As specified in 31 23 33 – Trenching, Backfilling and Compacting.

B. Structural Backfill – Test each lift of compacted backfill for moisture and compaction.

END OF SECTION

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01 43 39 MOCKUPS

1.00 GENERAL

1.01 SUMMARY

A. Section includes: Mockups of specific assemblies to be installed on this Project.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 VISUAL MOCKUPS

A. Definition:
   1. Visual mockup:
      a. Separate mockup construction incorporating elements specified in various Sections, intended to illustrate materials and workmanship in an assembly, and used for technical and aesthetic evaluation. Mockup shall not be a part of the finished construction. Mockup shall be accepted by Engineer prior to beginning this work on the building.
         1) Configuration and extent of mockup: As required to illustrate the design intent for Engineer's evaluation.
         2) Place mockup on-site in a location where it will not be disturbed or damaged during construction.

B. Maintain and protect Visual Mockups from damage during construction, and dispose of mockups when no longer required, as determined by Engineer.

1.03 BENCHMARK MOCKUPS

A. Definition:
   1. Benchmark mockup:
      a. In-place portions of assemblies to be repeated throughout the Work.
      b. Accepted benchmark mockups are intended to serve as a standard by which the work will be judged.
      c. Accepted benchmark mockups may be incorporated into the final construction.

B. Construct benchmark mockups to verify selections made under sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation.

C. Acceptance of benchmark mockups incorporated in the Work does not constitute approval of deviations from the Contract Documents unless Engineer specifically approves such deviations in writing.

D. Protect benchmark mockup from damage and ensure it is not disturbed at time of Project Completion.

1.04 MOCKUP DESCRIPTION

A. General: Provide mockups as specified below:
   1. Mockup construction schedule: Indicate time required for mockup construction, Engineer's and Owner's review and acceptance, and removal/demolition work associated with mockups, in Construction Progress Schedule.

B. Building façade colored and textured concrete (visual mockup):
   1. Provide façade mock-up for all buildings.

2.00 PRODUCTS

2.01 MATERIALS

A. Products and materials as required for a complete mockup.

3.00 EXECUTION

3.01 MOCKUP MATERIALS

A. Contractor is cautioned to not purchase all materials for the project that are involved in any one mockup until after the mockup has been reviewed and accepted by the Engineer.

END OF SECTION

01 50 00 TEMPORARY FACILITIES

1.00 GENERAL

1.01 WORK INCLUDED

A. Contractor shall furnish Engineer and Owner's field office and may elect to furnish temporary facilities, including Contractor's field office, storage sheds, and temporary utilities needed to complete the work.

B. Contractor to furnish, install, and maintain temporary project identification sign as required to meet Texas Water Development Board signage requirements.

1.02 QUALITY ASSURANCE

A. DESIGN CRITERIA
   1. Furnish a total electrical heating and cooling system for the Engineer and Owner's field office capable of maintaining the following minimum design criteria:
      a. Heating: Minimum 75 degrees ID temp @ 10 ambient.
      b. Cooling: Minimum 75 degrees ID temp @ 105 ambient.
      c. Relative humidity: 48 to 54%

B. TESTING
   1. Inspect and test each service before placing temporary utilities in use. Arrange for all required inspections and tests by regulatory agencies, and obtain required certifications and permits for use.

1.03 DELIVERY AND STORAGE

A. Arrange transportation, loading, and handling of temporary buildings and sheds.

1.04 JOB CONDITIONS

A. Locate buildings and sheds at the job site as approved by the Owner.

B. Prepare the site by removing trees, brush, or debris and performing demolition or grubbing needed to clear a space adequate for the structures.

C. Pay for the utilities used by temporary facilities during construction.

D. Provide each temporary service and facility ready for use at each location when the service or facility is first needed to avoid delay in the performance of the Work. Provide Engineer and Owner's field office completely installed and ready for occupancy and use as soon as practical after receiving the Notice to Proceed. The field office shall remain on site while work is taking place.

E. Maintain, expand as required, and modify temporary services and facilities as needed throughout the progress of the Work.

F. Do not remove services and facilities until they are no longer needed.

G. Operate temporary facilities in a safe and efficient manner.
   1. Do not overload temporary services or facilities.
   2. Do not let temporary services or facilities interfere with the progress of the work.
   3. Do not allow unsanitary conditions, public nuisance, or hazardous conditions to develop or exist at the site.
   4. Do not permit freezing of pipes, flooding, or the contamination of water.
   5. Maintain site security and protection of the facilities.

1.05 OPTIONS

A. Construction offices may be prefabricated buildings on skids or mobile trailers.

B. Storage sheds may be prefabricated buildings on skids or truck trailers.

2.00 PRODUCTS

2.01 TEMPORARY PROJECT SIGN

A. Provide new sign, wood or metal with structure and framing in sound condition. Materials are to be structurally adequate and suitable for the indicated finish.

B. Minimum 4’ by 8’ sign project sign to be set on 4x4 wooden posts at a conspicuous location for the duration of the project.

C. Bolts, brackets, fasteners, and other hardware are to be galvanized or stainless steel.

D. Provide exterior quality coatings.

2.02 TEMPORARY OFFICES

A. Furnish and continuously maintain throughout the project duration a field office for the Engineer and Owner's use which meets the following requirements:
   1. Minimum size 12’ x 12’ separated by full height walls from other spaces used by the Contractor, accessible to a private or shared restroom.
      a. Engineer and Owner’s space is to have an exterior 3’-0” x 6’-8” locking, weather-tight door with keys only provided to the Owner.
      b. Engineer and Owner’s space shall be separated by spaces used by Contractor by 3’-0” x 6’-8” locking doors with keys only provided to the Owner.
      c. Engineer and Owner’s space is to have a minimum of one 4’-0” x 5’-0” window.
      d. Flooring may be plywood, vinyl, or VCT tile. Do not use carpet.
   2. Structurally sound, weather-tight, and have floor raised above the ground.
   3. Adequately braced and anchored to prevent movement.
   4. Heated and air-conditioned.
   5. Make connections to electrical power source and provide electrical service to building for duration of project.
   6. Provide desk, swivel chair with arm rests, 22” x 34” plan table, and one visitor chair.
   7. Provide internet access for the Owner’s use.

B. Other trades may provide their own offices only when space is available on the site, and both the Owner and the Contractor agree.

2.03 TEMPORARY STORAGE BUILDINGS

A. Furnish storage buildings of adequate size to store any materials or equipment delivered to the site that might be affected by weather.

2.04 TEMPORARY SANITARY FACILITIES

A. Provide sanitary facilities at the job site from the Notice to Proceed until project conclusion. Maintain these facilities in a clean and sanitary condition at all times, and comply with the requirements of the local health authority. On large sites, provide portable toilets at such locations that no point in the work-site shall be more than 600' from a toilet.

B. Use these sanitary facilities. Do not use rest rooms within existing or Owner - occupied buildings.

2.05 TEMPORARY HEAT

A. Provide heating devices needed to protect the building during construction.
   1. Provide fuel needed to service the heating devices.
   2. Attend heating devices at all times.
   3. Do not allow heaters to operate overnight without someone in attendance.

2.06 TEMPORARY UTILITIES

A. Provide all temporary utilities needed during construction, testing, and start-up of the Work, including electrical power, water, and internet access. Include costs associated with furnishing temporary utilities in the Contract Price.
   1. Provide a source of temporary electrical power of adequate size for the construction procedures.
      a. Provide electrical pole and service that complies with OSHA and other safety requirements and the requirements of the power company
      b. Make the electrical power available to the trades as needed.
      c. Provide extensions to the various parts of the buildings as needed.
      d. Provide junction boxes in such an arrangement that distribution boxes are available within 75' of any part of the structure.
   2. Provide for temporary water. Extend water to the construction site and maintain source until such time that the permanent water supply can be extended to the site. Include the cost of water, costs for construction, testing, disinfection, and start-up of the Work in the Contract Price.

B. Make arrangements with the local utility company, comply with utility company's requirements and pay for the utility costs during construction, testing, and start-up of the Work.

C. Make utilities available to the trades during construction, testing, and start-up.

3.00 EXECUTION

3.01 LOCATION OF TEMPORARY FACILITIES

A. Locate all temporary facilities in an area that will not interfere with any Work to be performed under this contract.

B. Construct and install signs at locations as required by applicable regulatory agencies or as selected by the Owner. Install informational signs at the height of optimum visibility, on ground-mounted poles or attached to temporary structural surfaces.

3.02 PROJECT IDENTIFICATION AND SIGNS

A. Provide project identification signs of the size, lettering, and construction indicated by the Owner and in accordance with specified requirements.

B. Contractor shall identify all temporary locks provided during construction.

3.03 TEMPORARY LIGHTING

A. Once a building is "shelled-in", provide temporary lighting inside the building.
   1. Lighting shall be adequate to perform work within any space.
   2. Lights shall be left in position in such a manner that every space has temporary light at all times.
   3. Temporary lights may be removed once the permanent lighting is in service.

B. Provide portable flood lights at any time that work will be performed outside the structure at night. Provide adequate lighting to provide sufficient light at any location work is being performed.

3.04 REMOVAL OF TEMPORARY FACILITIES

A. Remove temporary buildings, sheds, and utilities at the conclusion of the project and restore the site to original condition or finished in accordance with the drawings.

B. Remove informational signs upon completion of construction.

C. Remove project identification signs, framing, supports, and foundations upon completion of the project.

3.05 MAINTENANCE

A. Maintain signs and supports in a neat, clean condition. Repair damage to structures, framings, or signs.

B. Repair any damage to permanent structures or finishes caused by placement or removal of temporary signage.

3.06 JANITORIAL SERVICE AND MAINTENANCE

A. Provide janitorial service (sweeping/mopping) for the Engineer and Owner's field office on a biweekly basis or as requested.

B. Maintain signs and supports in a neat, clean condition. Repair damage to structures, framings, or signs.

C. Repair any damage to permanent structures or finishes caused by placement or removal of temporary signage.

END OF SECTION

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01 57 00 TEMPORARY CONTROLS

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and incidentals necessary to construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.

B. Construct temporary impounding works, channels, diversions, furnishing and operation of pumps, installing piping and fittings, and other construction for control of conditions at the Site. Remove temporary controls at the end of the Project.

C. Provide a Storm Water Pollution Prevention Plan in accordance with TCEQ. File required legal notices and obtain required permits prior to beginning any construction activity.

D. Provide labor, materials, equipment, and incidentals necessary to prevent storm water pollution for the duration of the Project. Provide and maintain erosion and sediment control structures as required to preventive sediment and other pollutants from the Site from entering any storm water system, including open channels. Remove pollution control structures when no longer required to prevent storm water pollution.

1.02 QUALITY ASSURANCE

A. Construct storm water pollution prevention measures prior to the beginning of construction and maintain these during construction until final stabilization has been achieved for the area protected.

B. Plan and conduct all land-disturbing activities to minimize the area to be exposed at any one time. Minimize the time of exposure, off-site erosion, sedimentation, and adverse water quality impacts.

C. Manage surface water runoff originating upgrade of an exposed area to minimize erosion and sediment loss during the period of exposure.

D. Install measures to control both the velocity and rate of release so as to minimize erosion and sedimentation of the receiving water body (i.e., ditch, channel, stream) in accordance with regulatory requirements and as directed by the Owner or Engineer.

E. Periodically clean out and dispose of all sediment and other pollutants as necessary to maintain the treatment capacity of each pollution control feature. Clean out and properly dispose of all sediment and other storm water pollutants at the time of completion of the Work.

1.03 SUBMITTALS

A. Provide copies of notices, records and reports required by Paragraph 1.05 as Record Data in accordance with Section 01 33 00, Submittals.

1.04 STANDARDS

A. Provide a storm water pollution prevention plan that complies with Local, State, and Federal requirements. Comply with all requirements of the Texas Commission on Environmental Quality for storm water discharges from construction activities under the Texas Pollutant Discharge Elimination System (TPDES) program.

B. Perform Work to comply with “Best Practice” as established by the North Central Texas Council Of Governments (NCTCOG) integrated Storm Water Management (iSWM) Design Manual for Construction or the local agency of jurisdiction.

1.05 PERMITS

A. Submit a copy of the Construction Site Notice to the Operator of any Municipal Separate Storm Sewer System (MS4) receiving construction site discharge prior to beginning construction activity.

B. Post a copy of the Construction Site Notice at the construction site in a location where it is readily available for viewing by the general public and Local, State, and Federal authorities prior to starting construction activities and maintain the posting until completion of the construction activities.

C. Maintain copies of a schedule of major construction activities, inspection reports, and revision documentation with the storm water pollution prevention plan (SWPPP) required under the TPDES for Storm Water Discharges from Construction Activities for all projects.

1.06 POLLUTION CONTROL

A. Prevent the contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations. Provide adequate measures to prevent the creation of noxious air-borne pollutants. Prevent dispersal of pollutants into the atmosphere. Do not dump or otherwise discharge noxious or harmful fluids into drains or sewers, nor allow noxious liquids to contaminate public waterways in any manner.

B. Provide equipment and personnel and perform emergency measures necessary to contain any spillage.

C. Contain chemicals in protective areas and do not dump on soil. Dispose of such materials at off-Site locations in an acceptable manner.

D. Excavate contaminated soil and dispose at an off-Site location if contamination of the soil does occur. Fill resulting excavations with suitable backfill and compact to the density of the surrounding undisturbed soil.

E. Provide documentation to the Owner which states the nature and strength of the contaminant, method of disposal, and the location of the disposal Site.

F. Comply with local, State and Federal regulations regarding the disposal of pollutants.

G. Groundwater or run-off water which has come into contact with noxious chemicals, sludge, or sludge-contaminated soil is considered contaminated. Contaminated water must not be allowed to enter streams or water courses, leave the Site in a non-contained form or enter non-contaminated areas of the Site.

H. Construct temporary earthen dikes or take other precautions and measures as required to contain the contaminated water and pump to a designated storage area.

I. Wash any equipment used for handling contaminated water or soil within contaminated areas three times with uncontaminated water prior to using such equipment in an uncontaminated area. Dispose of wash water used to wash such equipment as contaminated water.

1.07 EARTH CONTROL

A. Remove excess soil, spoil materials and other earth not required for backfill at the time of generation. Control stockpile material to eliminate interference with Contractor and Owner's operations.

B. Dispose of excess earth off the Site. Pay cost for disposal unless otherwise noted. Provide written approval by the property owner for all disposal on private property, and approval by the Owner if such disposal affects the use of Site or other easements.

1.08 MAINTENANCE OF WATER

A. Manage water resulting from rains or ground water at the site. Maintain trenches and excavations free of water at all times. Provide and maintain pumps as necessary to remove excess water. Direct water away from the site to prevent damage to surrounding property.

B. Maintain standby equipment to provide proper and continuous operation for water management Monitor the operation on a 24-hour basis to provide continuous operation.

C. Ensure that water drainage does not damage adjacent property. The Contractor shall be responsible for the discharge of water from the site.

2.00 PRODUCTS

2.01 MATERIALS

A. Provide materials meeting regulatory requirements.

3.00 EXECUTION

3.01 Constructing, maintaining and removing temporary controls

A. Construct temporary controls in accordance with regulatory requirements.

B. Maintain controls in accordance with regulatory requirements were applicable, or in accordance with the requirements of the Contract Documents.

C. Remove temporary control when no longer required, but before the Project is complete. Correct any damage or pollution that occurs as the result of removing controls before the point where they are no longer required.

END OF SECTION

01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS

1.00 GENERAL

1.01 WORK INCLUDED

A. Comply with requirements of the General Conditions and specified administrative procedures in closing out the Construction Contract.

1.02 SUBSTANTIAL COMPLETION

A. Submit written notification that the work or designated portion of the work is substantially complete to the Engineer and Owner when the work is considered to be substantially complete per the General Conditions. Include a list of the items remaining to be completed or corrected before the project will be considered to be complete.

B. Owner and Engineer shall visit the project site to observe the work within a reasonable time after notification is received to determine the status of completion.

C. Engineer shall issue notification to the Contractor that the work is either substantially complete or that additional work must be performed before the project may be considered substantially complete.
   1. Engineer shall notify the Contractor in writing of items that must be completed before the project can be considered substantially complete.
      a. Correct the noted deficiencies in the work.
      b. Issue a second written notice with a revised list of deficiencies when work has been completed.
      c. Owner and Engineer shall revisit the site and the procedure shall begin again.
   2. Engineer shall issue a tentative Certificate of Substantial Completion to the Owner when the project is considered to be substantially complete. Certificate shall include a tentative list of items to be corrected before final payment.
      a. Owner will review and revise the list of items and notify the Engineer of any objections or other items that are to be included in the list.
      b. Engineer shall prepare and send to the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be corrected or completed.
      c. Review the list and notify the Engineer in writing of any objections within 10 days of receipt of Certificate of Substantial Completion.

1.03 FINAL INSPECTION

A. Submit written request for final inspection when the project is complete and:
   1. Contract Documents have been reviewed.
   2. Work has been completed in compliance with the Contract Documents.
   3. Equipment and systems have been tested per Contract Documents and are fully operational.
   4. Final Operations and Maintenance Manuals have been provided to the Owner and all operators training has been completed.
   5. Specified spare parts and special tools have been provided.
   6. Work is complete and ready for final inspection.

B. Engineer shall make an inspection with the Owner and appropriate regulatory agencies to determine the status of completeness within a reasonable time after the receipt of the Certificate.

C. Engineer shall issue notice that the project is complete or notify the Contractor that work is not complete or is defective.
   1. Submit the request for final payment with Closeout submittals described in Paragraph 1.07 if notified that the project is complete and the work is acceptable.
   2. Upon receipt of notification from the Engineer that work is incomplete or defective, take immediate steps to remedy the stated deficiencies. Send a second certification to the Engineer when work has been completed or corrected.
   3. Owner and Engineer shall re-visit the site and the procedure will begin again.

1.04 RE-INSPECTION FEES

A. Pay fees to the Owner to compensate the Engineer for re-inspection of the work required by the failure of the work to comply with the claims of status of completion made by the Contractor.

B. Owner may withhold the amount of these fees from the Contractor's final payment.

C. Cost for additional inspections will be billed to the Owner by the Engineer for the actual hours required for the inspection and preparation of related reports in accordance with the rates in the Supplemental Conditions

1.05 CLOSEOUT SUBMITTALS TO THE ENGINEER

A. Record Drawings per Section 01 31 13, Project Coordination.

B. Keys and keying schedule.

C. Warranties and bonds.

D. Evidence of payment or release of liens as required by the General Conditions.

E. Releases from property owners of land outside the easement which were used by the Contractor.

F. Consent from Surety to Final Payment.

G. Equipment installation reports on equipment.

H. Shop drawings, record data, Operations and Maintenance Manuals, and other submittals as required by the Contract Documents.

I. Specified spare parts and special tools.

J. Certificates of Occupancy, operating certificates, or other similar releases required to allow the Owner unrestricted use of the work and access to services and utilities.

K. Evidence of final, continuing insurance, and bond coverage as required by the Contract Documents.

1.06 FINAL PAYMENT REQUEST

A. Submit a preliminary final payment request. This request is to include adjustments to the Contract Amount for:
   1. Approved Change Orders
   2. Allowances not previously adjusted by Change Order
   3. Unit prices
   4. Deductions for defective work that has been accepted by the Owner
   5. Penalties and bonuses
   6. Deductions for liquidated damages
   7. Deductions for re-inspection payments per Paragraph 1.05
   8. Other adjustments

B. Engineer shall prepare a final Change Order, reflecting the approved adjustments to the contract amount which have not been covered by previously approved Change Orders.

C. Submit the final Application for Payment per the General Conditions, including the final Change Order.

1.07 TRANSFER OF UTILITIES

A. Transfer utilities to the Owner when the Substantial Completion has been issued, final cleaning has been completed and the work has been accepted by the Owner.

B. Submit final meter readings for utilities and similar data as of the date the Owner occupied the work.

1.08 WARRANTIES, BONDS, AND SERVICES AGREEMENTS

A. Provide warranties, bonds, and service agreements required by Section 01 33 00, or by the individual sections of the specifications.

B. The date for the start of warranties, bonds, and service agreements is established per the General Conditions.

C. Compile warranties, bonds, and service agreements and review these documents for compliance with the Contract Documents.
   1. Each document is to be signed by the respective manufacturer, supplier, and subcontractor.
   2. Each document is to include:
      a. The product or work item description
      b. The firm, with the name of the principal, address, and telephone number
      c. Scope of warranty, bond or services agreement
      d. Date, duration, and expiration date for each warranty bond and service agreement
      e. Procedures to be followed in the event of a failure
      f. Specific instances that might invalidate the warranty or bond

D. Submit one digital copy and two hard copies of each document to the Engineer for review and transmittal to the Owner.
   1. Submit duplicate sets.
   2. Documents are to be submitted on 8-1/2" x 11" paper, punched for a standard three-ring binder.
   3. Submit each set in a commercial quality three-ring binder with a durable and cleanable plastic cover. The title "Warranties, Bonds, and Services Agreements", the project name and the name of the Contractor are to be typed and affixed to the cover.

E. Submit warranties, bonds and services agreements:
   1. At the time of final completion and before final payment.
   2. Within 10 days after inspection and acceptance for equipment or components placed in service during the progress of construction.

1.09 CLAIMS AND DISPUTES

A. Claims and disputes must be resolved prior to recommendations of final payment. Acceptance and final payment by the Contractor will indicate that any outstanding claims or disputed issues have been resolved to the full satisfaction of the Contractor.

END OF SECTION

01 73 29 CUTTING AND PATCHING

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:
   1. Section 02 41 19, Selective Demolition.
   2. See other sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.03 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.04 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

2.00 PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
   1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.

2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.03 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Provide materials and comply with installation requirements specified in other Sections.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
      a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

b. Restore damaged pipe covering to its original condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION

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01 75 00 STARTING AND ADJUSTING

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide step-by-step procedures for starting provided systems, including equipment, pumps and processes.

B. Provide pre-start up inspections by equipment manufacturers.

C. Provide instruction and demonstration of operation, adjustment, and maintenance of each system and the component parts.

D. Place system in service and operate the system to prove performance and to provide for initial correction of defects in workmanship, calibration, and operation.

E. Provide for initial maintenance and operation.

1.02 SUBMITTALS

A. Provide Submittals in accordance with Section 01 33 00:
   1. Provide Equipment Installation Reports per Section 01 33 00.
   2. Provide Operation and Maintenance Manuals per Section 01 78 23.

1.03 STANDARDS

A. Comply with any standards associated with the testing or start-up of equipment, as listed in the various sections of the specifications.

1.04 SPECIAL JOB CONDITIONS

A. Do not start or test any apparatus until the complete unit has been installed and thoroughly checked.

B. Furnish the services of a representative of the Supplier to witness tests and start-up procedures as required by these specifications.

2.00 PRODUCTS

2.01 TESTING INSTRUMENTATION

A. Furnish any instrumentation or other testing devices needed to conduct tests.

3.00 EXECUTION

3.01 SERVICES OF SUPPLIER'S REPRESENTATIVES

A. Provide the services of a Supplier's representative for inspection, supervision of installation, and training. Supplier’s representative must be an experienced and competent technical (not sales) representative of the Supplier.

B. Perform installation, adjustment, and testing of the equipment under the direct supervision of the Supplier's representative where specified.

C. Provide the services of the Supplier's representative to instruct the Owner or his authorized personnel on operational procedures and maintenance requirements.

D. Include the cost of the services of the Supplier's representative in the equipment price which is included in the Contract Price.

3.02 INSPECTION AND START-UP

A. Inspect equipment prior to placing any equipment or system into operation. Make adjustments as necessary for proper operation.
   1. Check for adequate and proper lubrication.
   2. Determine that parts or components are free from undue stress from structural members, piping or anchorage.
   3. Adjust equipment for proper balance and operations.
   4. Determine that vibrations are within acceptable limits.
   5. Determine that equipment operates properly under full load conditions.
   6. Determine that the equipment is in true alignment.

B. Have the Supplier's representative present when the equipment is placed in operation.
   1. The Supplier is to be on Site as often as necessary for proper and trouble free operation.
   2. Ensure that the proper procedure is employed in start-up of systems.

C. Provide Equipment Installation Reports for Equipment on the form indicated in Section 01 31 13.13.
   1. Certify that the equipment and related appurtenances have been thoroughly examined and approved for start-up and operation.
   2. Include the date when Owner's personnel were instructed in the proper operation and maintenance of the equipment in the report.

3.03 STARTING REQUIREMENTS

A. Refer to the individual sections of the specifications for specific start up procedures.

3.04 INITIAL OPERATION

A. Start, test, and place equipment and systems into operation for 30 days to allow the Owner and Engineer to observe the operation and overall performance of the equipment and to determine that controls function as intended.

B. Equipment which operates on a limited or part-time basis shall be operated in the presence of the Engineer to demonstrate that controls function as specified.

C. Perform acceptance test as specified in individual specification sections. Demonstrate that equipment and systems meet the specified performance criteria.

D. Unless specifically stated otherwise in the individual equipment specifications, equipment and systems are not Substantially Complete until the end of this initial operation period. If an exception to this requirement is specifically noted in an

individual equipment specification, the exception shall only apply to that particular piece of equipment and not to the remaining components provided under the project.

3.05 OPERATOR TRAINING

A. Provide instruction and demonstration of the care and operation of the equipment to the Owner's personnel. Instruction is to include classroom and hands-on training.

B. Provide training in adequate detail to ensure that the trainees who complete the program will be qualified and capable of operating and maintaining the equipment, products, and systems provided.

C. Operations training is to include but not be limited to:
   1. Orientation to provide an overview of system/subsystem configuration and operation
   2. Terminology, nomenclature, and display symbols.
   3. Operations theory.
   4. Equipment appearance, functions, concepts, and operation.
   5. Operating modes, practices and procedures under normal, diminished, and emergency conditions.
   6. Start-up and shutdown procedures.
   7. Safety precautions.
   8. On-the-job operating experience for monitoring functions, supervisory, or command activities Include functions and activities associated with diminished operating modes, failure recognition, and responses to system/subsystem and recovery procedures.
   9. Content and use of Operation and Maintenance manuals and related reference materials.

D. Provide training for performing on-site routine, preventive, and remedial maintenance of the equipment, product, or system. Maintenance training is to include but not be limited to:
   1. Orientation to provide an overview of system/subsystem concept, configuration, and operation.
   2. Operations theory and interfaces.
   3. Instructions necessary to ensure a basic theoretical and practical understanding of equipment appearance, layout and functions.
   4. Safety precautions.
   5. Use of standard and special tools and test equipment.
   6. Adjustment, calibration, and use of related test equipment.
   7. Detailed preventive maintenance activities.
   8. Troubleshooting, diagnostics, and testing.
   9. Equipment assembly and disassembly.
   10. Repair and parts replacement.
   11. Parts ordering practices and storage.
   12. Failure and recovery procedures.
   13. Cabling and/or interface connectors.
   14. Content and use of operation and maintenance manuals and related reference materials.
   15. Procedures for warranty repairs.
   16. Lubrication.

17. Procedures, practices, documentation, and materials required to commence system maintenance.

E. Provide a training plan that indicates the schedule and sequence of the training programs. The training plan is to include for each course:
   1. Number of hours for the course.
   2. Agenda and narrative description, including the defined objectives for each lesson.
   3. Draft copy of training handbooks.
   4. A descriptive listing of suggested reference publications.
   5. Audio-visual equipment required for training.
   6. Type and number of tools or test equipment required for each training session.

F. Provide and use training aids to complement the instruction and enhance learning.
   1. Provide training handbooks for use in both the classroom and the hands-on phases of training for each course.
   2. Provide instructional materials which include references to the Operation and Maintenance Manuals and identify and explain the use of the manual.
   3. Provide a copy of all audio/visual training materials used in the presentations.

G. Provide qualified instructors to conduct the training.
   1. Provide instructors with knowledge of the theory of operation and practical experience with the equipment, product, or system.
   2. Provide instructors that have successfully conducted similar training courses.

H. Training may be recorded by the Owner or its consultants for use in future training. Provide legal releases or pay additional fees required to allow training by the Supplier to be recorded.

I. Schedule for training is to be approved by Owner.
   1. Schedule training and start-up operations for no more than one piece of equipment or system at a time.
   2. Owner may require re-scheduling of training if operations personnel are not available for training on a scheduled date.
   3. Provide a minimum of two weeks' notice if training must be rescheduled.
   4. Coordinate with Owner's operation staff for scheduling.
   5. Time required for training is to be considered in the development of the project schedule.

J. Schedule and coordinate training for equipment, products, or systems which depend upon other equipment or systems for proper operation so that trainees can be made familiar with the operation and maintenance of the entire operating system.

K. Conduct a training course for the equipment, products and systems as specified in by the individual sections of the specifications. Training is to be adequate to meet the training objectives described above. Minimum hours of training do not include installation, startup, testing and other required manufacturer representative field work as specified in each individual equipment specification:

3.06 INITIAL MAINTENANCE

A. Maintain equipment until the project is accepted by the Owner.

1. Insure that mechanical equipment is properly greased, oiled, or otherwise cared for as recommended by the Supplier.
2. Operate air handling equipment only when filters are in place and are clean. Change filters weekly during construction.

B. Service equipment per the Supplier's instructions immediately before releasing the equipment to the Owner.
   1. Replace replaceable filters and clean permanent filters associated with air handling units or other packaged equipment.
   2. Remove and clean screens at strainers in piping systems.
   3. Clean insects from intake louver screens.

END OF SECTION

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01 78 23 OPERATION AND MAINTENANCE DATA

1.00 GENERAL

1.01 WORK INCLUDED

A. Prepare a complete and detailed Operation and Maintenance Manual for each type and model of equipment or product furnished and installed under this contract.

B. Prepare the manuals in the form of an instruction manual for the Owner. The manual is to be suitable for use in providing operation and maintenance instruction as required by Section 01 75 00.

C. Provide complete and detailed information specifically for the products or systems provided for this project. Include the information required to operate and maintain the product or system.

D. Manuals are to be in addition to any information packed with or attached to the product when delivered. This information is to be taken from the product and provided as an attachment to the manual.

1.02 SUBMITTALS

A. Submit manuals in accordance with Section 01 33 00, Submittals.

B. Draft manuals to be submitted in digital format for review.

C. Final manuals shall be provided in digital format printed directly from native software (such as Word and ACAD) to PDF in color. Digital manuals shall be searchable with key words.

D. Provide three hard copies of final manuals to City.

1.03 GUARANTEES

A. Provide copies of the Manufacturer's warranties, guarantees, or service agreements in accordance with Section 01 70 00, Execution and Closeout Requirements.

2.00 PRODUCTS

2.01 MATERIALS

A. Print manuals on heavy, first quality paper.
   1. Paper shall be 8-1/2" X 11" paper.
      a. Reduce drawings and diagrams to 8-1/2" X 11" paper size.
      b. When reduction is not practical, fold drawings and place each separately in a clear, super heavy weight, top loading polypropylene sheet protector designed for ring binder use. Provide a typed identification label on each sheet protector.
   2. Punch paper for standard three-ring binders.

B. Place manuals in Wilson Jones D-Ring Presentation Binders.
   1. Binders are to have clear front, back, and spine covers.
   2. Sheet lifters are to be provided.
   3. Minimum size is 2" capacity. Maximum size is 3" capacity.

C. Provide tab indexes for each section of the manual.
   1. Indexes are to be constructed of heavy-duty paper with a reinforced binding edge and punched with 9/32" holes to fit the binders.
   2. Index is to have clear insertable tabs for a typed insert.

D. Provide indexed PDF version of manual by means of storage as approved by the Owner.

3.00 EXECUTION

3.01 MANUAL ORGANIZATION AND CONTENTS

A. Provide a Table of Contents listing each section of the manual for each product or system.
   1. Identify each product or system using the nomenclature shown in the Contract Documents.
   2. Assign a number and letter to each section in the manual.
      a. Assign a number to each product or system. The number is to correspond to the Owner's equipment numbering system or other system designated by the Engineer.
      b. A cross reference is to be provided for the Owner's numbering system and designations for equipment indicated in the Contract Documents.
      c. The letter assigned will represent the part of the manual, consistent with the manual contents as required by Paragraphs 3.02, 3.03, and 3.04.
   3. Provide index tabs for each section in the manual.
   4. The designation on each index tab is to correspond to the number and letter assigned in the Table of Contents.

B. Include only the information that pertains to the product described. Annotate each sheet to:
   1. Clearly identify the specific product or component installed.
   2. Clearly identify the data applicable to the installation.
   3. Delete reference to inapplicable information.

C. Supplement manual information with drawings as necessary to clearly illustrate relations of component parts of equipment and systems, and control and flow diagrams.

D. Identify each manual by placing a printed cover sheet in the front cover of the binder and as the first page in the manual. The first page is to be placed in a clear polypropylene sheet protector. The information on first page and the cover page are to include:
   1. Name of Owner
   2. Project Name
   3. Volume number
   4. The Table of Contents for that volume

E. Insert the Table of Contents into the spine of each manual.

F. Manuals for several products or systems may be provided in the same binder.
   1. Sections for each product or system must be included in the same binder.
   2. Sections must be in numerical order from volume to volume.

G. Correlate the data into related groups when multiple binders are used.

H. Fill binders to only 3/4 of its indicated capacity to allow for addition of materials to each binder by the Owner.

3.02 EQUIPMENT AND SYSTEMS MANUAL CONTENT

A. Manual shall provide the following information:
   1. A description of the unit and component parts.
   2. Operating instructions for startup, normal operations, regulation, control, shutdown, emergency conditions, and limiting operating conditions.
   3. Maintenance instructions including assembly, installation, alignment, adjustment, and checking instructions.
   4. Lubrication schedule and lubrication procedures. Include a cross reference for recommended lubrication products.
   5. Troubleshooting guide.
   6. Schedule of routine maintenance requirements.
   7. Description of sequence of operation by the Control Manufacturer.
   8. Warnings for detrimental maintenance practices.
   9. Parts lists including:
      a. Outline, cross section and assembly drawings, engineering data, test data, and performance curves.
      b. Control schematics and point to point wiring diagrams prepared for field installation, including circuit directories of panel boards and terminal strips.
      c. Other information as may be required by the individual sections of the specifications.

3.03 MAINTENANCE SUMMARY

1. Compile individual Maintenance Summary for each applicable equipment item, respective unit or system, and for components or sub-units.
2. Format:
   a. Each Maintenance Summary may take as many pages as required.
   b. Use only 8-1/2-inch by 11-inch size paper.
   c. Complete using electronic printing.
3. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommend type, grade, and temperature range of lubricants and frequency of lubrication.
4. Recommended Spare Parts:
   a. Data to be consistent with manufacturer’s Bill of Materials/Parts List furnished in O&M manuals.
   b. “Unit” is the unit of measure for ordering the part.
   c. “Quantity” is the number of units recommended.
   d. “Unit Cost” is the current purchase price.

3.04 EQUIPMENT LIST

A. Provide Equipment List containing the following information for all equipment included in the Contract Documents.
   1. Description of Equipment including type, location, model number and serial number.
   2. Routine Maintenance:
      a. Lubrication Schedule.
      b. Maintenance Schedule.
   3. Warranty Period start and end dates.

3.05 LIST OF SERVICE ORGANIZATIONS

A. Provide a directory of authorized service organizations with company name, address, telephone number, and the contact person for warranty repair.

END OF SECTION

02 41 19 SELECTIVE DEMOLITION

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected portions of or entire building or structure.
   2. Demolition and removal of selected site elements and portions of process equipment
   3. Salvage of existing items to be reused or recycled.

B. Related Sections include the following:
   1. Section 01 73 29, Cutting and Patching.

1.03 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

1.04 MATERIALS OWNERSHIP

A. Owner has the right of first refusal for any items demolished.

1.05 SUBMITTALS

A. Contractor shall submit proposed demolition and removal procedures for review by the Engineer at least three weeks prior to proceeding with this item. Contractor shall verify the location and extent of items to be demolished prior to submitting this proposed demolition plan. Extents of demolition and removal, location of capped and/or disconnected utilities, and all other pertinent information shall be shown on the Project Record Documents to be delivered to the Owner's representative.

B. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

C. Pre-demolition photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations. Comply with Division 1 Section "Photographic Documentation." Submit before Work begins.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI A10.6 and NFPA 241.

1.07 PROJECT CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
   1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner.

1.08 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

2.00 PRODUCTS (Not Used)

3.00 EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.

B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Arrange to shut off indicated utilities with utility companies.

2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of the facility.
3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
   a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.03 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
   2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
   3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   4. Cover and protect furniture, furnishings, and equipment that have not been removed.
   5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 1 Section "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
   1. Strengthen or add new supports when required during progress of selective demolition.

3.04 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and

contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:
1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.05 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts. Where existing walls and/or slabs are to be sawcut or cored and portions removed, the exposed reinforcing steel shall be removed to 1 inch below the exposed face and grouted. Paint or apply protective coatings on exposed surfaces to match existing.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

D. Elevated Concrete Slabs: Temporarily support section to be demolished. Saw-cut perimeter of area to be demolished, then break up and remove. Do not allow demolished section to fall and damage areas that are to remain.

E. Structures: Unless otherwise noted, structures shall be demolished to the base of the foundation (at least one (1) feet below finished grade) and the rubble shall be removed from the project site.

F. Pipelines: Pipelines shown on the Plans to be removed shall be removed in their entirety unless otherwise indicated on the Plans or approved in writing by the OWNER. Small diameter piping associated with a demolished facility shall be cut and capped at the limit of the demolition and marked on the record drawings.

G. Electrical: Electrical wiring to demolished facilities shall be disconnected at both ends and removed prior to demolition. All associated labels shall be removed. Conduits shall be cut cleanly and capped at the limit of the excavation/demolition and marked on record drawings.

H. Equipment: Equipment to be removed by the CONTRACTOR shall have anchor bolts cut off 1-inch below the concrete surface which remains. Grout shall be placed over the cutoff bolts. Existing pipe connections which are to be reused shall have flanges cleaned and new bolts and gasket sets furnished. Piping which remains, as well as sumps, trenches, etc., shall be protected during demolition activities to prevent debris from entering them. Cut ends of pipe shall be ground smooth, cleaned, and painted per specifications.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

B. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.07 CLEANING

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

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SECTION 03 11 00

CONCRETE FORMING

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete forming. The Work also includes:
      a. Designing forming systems in accordance with requirements of ACI 347 and the Contract Documents.
      b. Providing forming to accommodate the Work under this and other Sections and building into forming items such as sleeves, anchorage devices, inserts, pipe embedments, reinforcing, and all other items to be embedded in concrete for which placement is not specifically provided under other Sections.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before concrete forming Work.
   2. Coordinate forming Specifications with requirements for finished surfaces specified in Section 03 30 00, Cast-In-Place Concrete.

C. Related Sections:
   1. Section 03 15 00, Concrete Accessories.
   2. Section 03 30 00, Cast-In-Place Concrete.

1.02 REFERENCES

A. Standards referenced in this Section are:
   1. ACI 117, Specifications for Tolerances for Concrete Construction and Materials and Commentary.
   2. ACI 301, Specifications for Structural Concrete.
   3. ACI 347, Guide to Formwork for Concrete.
   4. ASTM C805/C805M, Test Method for Rebound Number of Hardened Concrete.
   5. ASTM C1074, Practice for Estimating Concrete Strength by the Maturity Method.
   6. NIST PS 1, Structural Plywood.

1.03 QUALITY ASSURANCE

A. Qualifications:
   1. Professional Engineer:

a. CONTRACTOR or formwork Supplier shall retain a registered professional engineer legally qualified to practice in same state as the Site.
b. Responsibilities include:
    1) Reviewing formwork and falsework performance and design criteria stated in the Contract Documents.
    2) Preparing written requests for clarifications or interpretations of performance or design criteria for submittal to ENGINEER by CONTRACTOR.
    3) Preparing or supervising preparation of design calculations verifying compliance of formwork and falsework with requirements of the Contract Documents.
    4) Signing and sealing all calculations.
    5) Certifying that:
        a) Design of formwork and falsework was performed in accordance with performance and design criteria stated in the Contract Documents, and
        b) Design conforms to all Laws and Regulations, and to prevailing standards of practice.

1.04 SUBMITTALS

A. Informational Submittals: Submit the following:
1. Shop Drawings: When requested by ENGINEER, submit Shop Drawings showing and indicating general construction of individual forms, including:
    a. Jointing.
    b. Special formed joints or reveals.
    c. Location, pattern, and details of form tie placement, removal, and repair procedures.
    d. Location and details for temporary openings.
    e. Void-form layout drawings and details of installation.
    f. Other items that would visually affect the finished concrete.
2. Design of Temporary Measures: Design of formwork and falsework is CONTRACTOR's responsibility. Submit the following:
    a. Falsework layout drawings with the seal and signature of CONTRACTOR's or Supplier's professional engineer. Layout drawings shall show bracing details, waler arrangements, location of shores, joint forming details, and details at connections to previously placed concrete. ENGINEER's review will be for general conformance to the requirements of the Contract Documents and ACI 347, as indicated for delegated design in the General Conditions.
    b. Design calculations for formwork and falsework, when requested by ENGINEER.
    c. Certification letter from CONTRACTOR's or Supplier's professional engineer stating that in-place falsework was inspected and complies with the intent of the falsework design.
3. Product Data: Manufacturer's data for proprietary materials, including form coatings, manufactured form systems, ties and accessories.

4. Manufacturer's Instructions: Installation instructions for proprietary materials, including form coatings, manufactured form systems, ties and accessories.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage:
   1. Upon delivery to the Site, place materials in area protected from weather.
   2. Store materials in accordance with manufacturer's recommendations.
   3. Store materials above ground on framework or blocking. Cover wood for forms and other accessory materials with protective, waterproof covering. Provide for adequate air circulation or ventilation under cover.

B. Handle materials in accordance with the manufacturers' recommendations. Do not damage materials during handling.

PART 2 PRODUCTS

2.01 SYSTEM PERFORMANCE

A. Design Criteria:
   1. Design, erect, support, brace and maintain forming in accordance with ACI 347 so that forming safely supports vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by forming system or in-place construction that has attained adequate strength for the purpose. Construct forming so that concrete members and structures are of correct size, shape, alignment, elevation, and position.
   2. Design forms and falsework to include values of live load, dead load, weight of moving equipment operated on forming, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.
   3. Provide shores and struts with positive means of adjustment capable of taking up forming settlement during concrete placing operations, using wedges or jacks, or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.
   4. Support form facing materials by structural members spaced sufficiently close to prevent beyond tolerance deflection, in accordance with ACI 117. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances. For long-span members without intermediate supports, provide camber in forming as required for anticipated deflections resulting from weight and pressure of fresh concrete and construction loads.
   5. Design and construct forming to be readily removable without impact, shock or damage to concrete surfaces and adjacent materials.

6. Provide forming sufficiently tight to prevent leakage of cement paste during concrete placing. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

2.02 FORM MATERIALS

A. Forms for Smooth Finish Concrete:
   1. Unless otherwise shown or indicated in the Contract Documents, construct forming for smooth concrete surfaces with plywood, metal, metal-framed plywood-faced, or other panel type materials acceptable to ENGINEER, to provide continuous, straight, smooth as-cast surfaces with no wood grain or other surface texture imparted by forming. Provide in largest practical sizes to minimize number of joints and to conform to joint system shown or specified in the Contract Documents. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

B. Forms for Standard Finish Concrete:
   1. Form concrete surfaces designated to have standard formed finish with plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least two edges and one side.

C. Form Ties:
   1. Provide factory-fabricated metal form ties, designed to prevent form deflection, and to prevent spalling of concrete surfaces upon removal.
   2. Unless otherwise shown or indicated in the Contract Documents, provide ties so that portion of tie remaining within concrete after removal of exterior parts of tie is at least 1.5 inches from the outer concrete surface. Unless otherwise shown or indicated in the Contract Documents, provide form ties that will leave a hole no larger than one-inch diameter in concrete surface.
   3. Ties shall have waterstops on all exterior, below-grade walls, and walls subject to hydrostatic pressure.
   4. Ties shall leave a uniform, circular hole when forms are removed.
   5. Do not use removable ties unless accepted by ENGINEER. Removable ties are not allowed on exterior below-grade walls or walls subject to hydrostatic pressure. If removable ties are accepted, CONTRACTOR shall submit hole repair details for ENGINEER approval.
   6. Wire ties are not allowed.
   7. Do not use reinforcing bars shown by the Drawings as part of the form tie system unless approved by ENGINEER.

D. Form Coatings:
   1. Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede wetting of surfaces to be cured with water or curing compounds. For concrete surfaces that will be in contact with potable water or water that will be treated to become potable, form coating shall be a mineral oil base coating.

E. Void-Forms:
   1. Void (carton) forms shall be corrugated fiberboard used for creating a void space beneath grade beams and slabs on grade.
   2. Manufacturer: Provide void-forms by one of the following:
      a. Savway Carton Forms
      b. Sheplers
      c. SureVoid or StormVoid by Void Form Products
      d. Or equal
   3. Void-forms shall have moisture-resistant treated paper faces, be laminated with waterproof adhesive, and be biodegradeable. Void-forms shall have interior fabrication of uniform braced cellular configuration and shall be capable of sustaining minimum working load of 1,000 psf for minimum of ten days after concrete placement.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine substrate and conditions under which the Work will be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 FORM CONSTRUCTION

A. Construct forms in accordance with ACI 347; to the exact sizes, shapes, lines, and dimensions shown; as required to obtain accurate alignment, location, and grades; to tolerances specified; and to obtain level and plumb work in finish structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes. Finish shall be in accordance with approved mock-up or sample panel, when specified.

B. Allowable Tolerances:
   1. Construct forming to provide completed concrete surfaces complying with tolerances specified in ACI 117, ACI 301, and ACI 347.
      a. Architectural finish forming, and where shown or indicated on the Drawings, shall be Class A surface, 1/8-inch offset.
      b. Other surfaces exposed to view shall be Class B surface, 1/4-inch offset.
      c. Other surfaces shall be Class C surface, 1/2-inch offset.
   2. Tolerances apply to form offsets and to irregularities within the formed surface when measured with a straightedge over a five-foot distance.

C. Install forming and accessories for facilities in accordance with manufacturer's instructions, Laws and Regulations, and the Contract Documents.

D. Fabricate forms for easy removal without damaging concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope

is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.

E. Provide temporary openings where interior area of forming is inaccessible for cleanout, for inspection before concrete placement, and for placing concrete. Brace temporary closures and set tightly to forms to prevent loss of cement paste. Locate temporary openings on forms in locations as inconspicuous as possible, consistent with requirements of the Work. Form intersecting planes of openings to provide true, clean-cut corners, with edge grain of plywood not exposed as form for concrete.

F. Falsework:
   1. Erect falsework and support, brace, and maintain falsework to safely support vertical, lateral, and asymmetrical loads applied until such loads can be supported by in-place concrete structures. Construct falsework so that adjustments can be made for take-up and settlement.
   2. Provide wedges, jacks or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce finished Work of required dimensions.

G. Forms for Smooth Finish Concrete:
   1. Do not use metal cover plates for patching holes or defects in forms.
   2. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
   3. Use extra studs, walers, and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material that will produce bow.
   4. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
   5. Form molding shapes, recesses, rustication joints and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

H. Corner Treatment:
   1. Form exposed corners of beams, walls, foundations, bases and columns to produce smooth, solid, unbroken lines, except as otherwise shown or indicated in the Contract Documents. Chamfer exposed corners.
   2. Form chamfers with 3/4-inch by 3/4-inch strips, unless otherwise shown or indicated in the Contract Documents, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Use rigid PVC chamfers for architecturally formed concrete. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
   3. Reentrant or internal and unexposed corners may be formed either square or chamfered.

I. Joints:

1. For joint treatment, comply with Section 03 15 00, Concrete Accessories. Locate joints as shown and specified.

J. Openings and Built-In Work:
1. Provide openings in concrete forming shown or required under other Sections. Refer to Paragraph 1.01B of this Section for coordination requirements.
2. Accurately place and securely support items to be built into forms.

K. Sealing Forming:
1. Forming joints shall be tight-fitting or otherwise sealed to prevent loss of cement paste.
2. Provide forming resting against concrete surfaces with compressible gasket material between the concrete and edge of form, to fill irregularities and create tight seal.

L. Cleaning and Tightening:
1. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before concrete is placed. Retighten forms immediately after placing concrete, as required to eliminate cement paste leaks.

M. Tie Hole Repair:
1. Repair tie holes in accordance with Section 03 30 00, Cast-In-Place Concrete.

3.03 FORM COATINGS

A. Coat form contact surfaces with non-staining form-coating compound before installing reinforcing materials. Do not allow excess form coating material to accumulate in forms or come into contact with surfaces that will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.

B. Coat steel forms with non-staining, rust-preventative form oil, or otherwise protect against rusting. Do not use rust-stained steel forming.

3.04 INSTALLATION OF EMBEDDED ITEMS

A. Set and build into forming anchorage devices and other embedded items, shown, specified, or required under other Sections. Refer to Paragraph 1.01B of this Section for coordination requirements. Use necessary setting drawings, diagrams, instructions, and directions.

B. Edge Forms and Screeds Strips for Slabs:
1. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units to support screeds.

3.05 VOID-FORMS

A. Install void-forms where shown or indicated in the Contract Documents, to the thickness indicated, in accordance with manufacturer's recommendations.

B. Where void-form is shown or indicated in the Contract Documents, place void-form to grades and elevations shown over an even, well-compacted subgrade to form continuous void space under entire extent of slab, mat, or grade beam.

C. For structural slab applications, place 1/8-inch thick masonite or plywood sheet over void-form. Place void-forms in largest pieces practical and secure in place.

D. Properly surround and void around upper portion of drilled piers at intersection of slab, grade beam or pier cap using premanufactured, non-field cut sealed void-form with curved, radial, vertical edge adjacent to drilled pier.

E. Void-forms shall remain dry and undamaged prior to concrete placement. Replace damaged pieces prior to placing concrete. Seal all joints and exposed ends to prevent concrete leakage into void space.

3.06 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Before placing concrete, check ties, tie cones, tie waterstops, embedded items, form coatings, forming stability, alignment, and tolerances. Make corrections and adjustments to ensure forming complies with intent of the forming design, proper stability of forming systems, and accurate size and location of concrete members.
   2. During concrete placing, check forming and related supports to ensure that forms are not displaced and that completed Work will be within specified tolerances.
   3. If forms are unsatisfactory in any way, either before or during concrete placing, stop or postpone placing of concrete until defects are corrected as required by CONTRACTOR's or Supplier's professional engineer and accepted by ENGINEER.

3.07 REMOVAL OF FORMS

A. Determination of time between placing concrete and removing forms is CONTRACTOR's responsibility. Requirements specified in this Section are minimum times and requirements intended to ensure that concrete will support its own weight, and do not consider additional effects of the construction. Additional effects of the construction shall be accounted for by CONTRACTOR when determining time for removing forming. Time for removing of forms is subject to ENGINEER's acceptance.

B. Comply with requirements of ACI 301 and ACI 347, except as indicated in the Contract Documents.

C. Removal of Forms for Walls, Columns, Sides of Beams and Girders, and Slab and Foundation Edges:
   1. Comply with requirements of the table below:

Component	Average Daily Ambient Air Temperature (deg F)				Min. Concrete Compressive Strength for Form Removal
	Over 70 F	**60 F to 70 F**	**50 F to 60 F**	**Below 50 F**	
Walls	One day	Two days	Three days	See Para-graph 3.8.C.2 of this Section	750 psi
Columns	Two days	Three days	Four days		1000 psi
Side of beams and girders	One day	One day	Two days		500 psi
Slab and foundation edges	One day	One day	Two days		500 psi

   2. When average daily ambient air temperature is below 50 degrees F, do not remove forms until concrete attains minimum compressive strength indicated in the table above for form removal, and comply with Paragraph 3.07.C.3.b of this Section.
   3. Concrete Strength Requirements for Form Removal:
      a. For other than beams and elevated slabs, do not remove forms until concrete attains minimum concrete compressive strength indicated in Table 03 10 00-A for form removal.
      b. For beams and elevated slabs, do not remove supporting forms or shoring until concrete attains minimum of 90 percent of its specified compressive strength.

D. Alternative Criteria for Removing Forms for Walls, Columns, Sides of Beams and Girders, and Slab and Foundation Edges: CONTRACTOR has the option of submitting an alternative removal of forms table, together with supporting data, for ENGINEER's acceptance. Supporting data shall include representative field data for each different placement ambient temperature condition and minimum of three tests per temperature condition to ensure that accurate correlation between concrete strength and placement temperature is obtained.

E. Determination of In-place Concrete Strength:
   1. Determine compressive strength of in-place concrete by compression test specimens cured at the Site under the same conditions of temperature and moisture as the concrete member under consideration.
   2. Alternately, determine compressive strength of in-place concrete by maturity factor procedure in accordance with ASTM C1074 and approved by ENGINEER. Location of embedded thermistors or thermocouples shall be as approved by ENGINEER.

F. When high-early strength concrete is used, time for removing the forms will be developed at the Site from the age/strength relationships established for the materials and proportions used by tests in accordance with ACI 301.

G. Continue curing, including bottom surfaces of slabs and beams, after form removal in accordance with Section 03 30 00, Cast-In-Place Concrete.

3.08 PERMANENT SHORES

A. Provide permanent shores in accordance with ACI 347.

B. Reshores are not allowed.

3.09 RE-USE OF FORMS

A. Clean and repair surfaces of forms to be re-used in the construction. Do not use split, frayed, delaminated, or otherwise damaged form facing material. Apply form coating compound material to concrete contact surfaces as specified for forming.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use “patched” forms for exposed concrete surfaces. Form surfaces are subject to ENGINEER’s approval.

+ + END OF SECTION + +

SECTION 03 15 00

CONCRETE ACCESSORIES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete accessories.

B. Related Sections:
   1. Section 03 11 00, Concrete Forming.
   2. Section 03 60 00, Grouting.
   3. Section 07 92 00, Joint Sealants.

1.02 REFERENCES

A. Standards referenced in this Section are:
   1. ACI 301, Standard Specifications for Structural Concrete.
   2. ASTM D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
   3. CRD-C572, U.S. Army Corps of Engineers Specifications for Polyvinyl-Chloride Waterstop.

1.03 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Layout of construction and expansion joint locations. Submit and obtain approval prior to submitting concrete reinforcement Shop Drawings.
      b. For construction and expansion joints that require waterstops, submit layout of locations showing waterstop details. Indicate waterstop type, waterstop joint conditions, and details on how joint conditions will be handled.

B. Informational Submittals: Submit the following:
   1. Manufacturer's Instructions: Manufacturer's specifications and installation instructions for all materials required.

1.04 DELIVERY, STORAGE AND HANDLING

A. Transportation and Handling of Products:
   1. Deliver materials to Site to ensure uninterrupted progress of the Work.
   2. Comply with Section 01 65 00, Product Delivery Requirements.

B. Storage and Protection:
   1. Store concrete joint materials on platforms or in enclosures or covered to prevent contact with ground and exposure to weather and direct sunlight. Comply with manufacturer's storage and protection requirements.
   2. Comply with Section 01 66 00, Product Storage and Handling Requirements.

PART 2 PRODUCTS

2.01 WATERSTOPS

A. Polyvinyl Chloride (PVC):
   1. Material Requirements:
      a. Waterstops shall be extruded from elastomeric PVC compound containing plasticizers, resins, stabilizers, and other materials necessary to meet requirements of the Contract Documents and requirements of CRD-C572. Do not use reclaimed or scrap material.
      b. Tensile strength of finished waterstop: 1,400 psi, minimum.
      c. Ultimate elongation of finished waterstop: 280 percent, minimum.
      d. Minimum thickness shall be 3/8-inch over entire width of waterstop.
      e. Provide waterstops with minimum of seven ribs equally spaced at each end on each side. First rib shall be at the edge. Ribs shall be a minimum of 1/8-inch in height.
      f. Provide waterstops with hog rings or factory-installed grommets anchored to exterior ribs to facilitate tying waterstop in position.
   2. Split waterstops are not allowed.
   3. Construction Joints: Waterstops shall be flatstrip ribbed type, six-inch minimum width, unless otherwise shown or indicated in the Contract Documents.
   4. Expansion Joints: Waterstops shall be centerbulb ribbed type, nine-inch minimum width, unless otherwise shown or indicated in the Contract Documents. Centerbulb shall have minimum outside diameter of 7/8-inch.
   5. Retrofit Applications: Waterstops shall be T-profile, centerbulb ribbed type with six-inch minimum projection into new concrete and anchored to the existing concrete via stainless steel anchor bolts and an epoxy bed.
   6. Product and Manufacturer: Provide one of the following:
      a. W.R. Meadows, Inc.
      b. DCA Construction Products.
      c. Greenstreak Plastic Products Company.
      d. Paul Murphy Plastics Company.
      e. Vinylex Corporation.
      f. Or equal.

B. Hydrophilic Waterstop Materials:
   1. General Material Properties:

a. Bentonite-free, and expandable by minimum of 80 percent of dry volume in presence of water to form watertight joint seal without damaging concrete in which material is cast. Provide only where shown or indicated in the Contract Documents.
b. Material shall be composed of resins and polymers that absorb water and cause an increase in volume in completely reversible and repeatable process. Waterstop material shall be dimensionally stable after repeated wet-dry cycles with no deterioration of swelling potential.
c. Select materials that are recommended by manufacturer for type of liquid to be contained.

2. Hydrophilic Rubber Waterstop:
   a. Minimum cross sectional dimensions shall be 3/16-inch by 3/4-inch.
   b. Product and Manufacturer: Provide one of the following:
      1) Duroseal Gasket, by BBZ USA, Inc.
      2) Adeka Ultraseal MC-2010M, by Asahi Denka Kogyo K.K.
      3) Hydrotite, by Greenstreak Plastic Products Company.
      4) Or equal.
3. Hydrophilic Sealant:
   a. Hydrophilic sealant shall adhere firmly to concrete, metal, and PVC in dry or damp condition. When cured sealant shall be elastic indefinitely.
   b. Product and Manufacturer: Provide one of the following:
      1) Duroseal Paste, by BBZ USA, Inc.
      2) Adeka Ultraseal P-201, by Asahi Denka Kogyo K.K.
      3) Hydrotite, by Greenstreak Plastic Products Company.
      4) SikaSwell S, by Sika Corporation.
      5) Or equal.

2.02 PREFORMED EXPANSION JOINT FILLER

A. Provide preformed expansion joint filler complying with ASTM D1752, Type I (sponge rubber) or Type II (cork).

2.03 CONCRETE CONSTRUCTION JOINT ROUGHENER

A. Provide water-soluble non-flammable, surface-retardant roughener.

B. Product and Manufacturer: Provide one of the following for the types of joints specified:
   1. Rugasol-S, by Sika Corporation for horizontal joints only.
   2. Concrete Surface Retarder-Formula S, by Euclid Chemical Company, for horizontal joints only.
   3. Concrete Surface Retarder-Formula F, by Euclid Chemical Company, for vertical joints only.
   4. TK-6100 Concrete Form Surface Retarder, by TK Products.
   5. Or equal.

2.04 EPOXY BONDING AGENT

A. Provide a two-component epoxy-resin bonding agent.

B. Product and Manufacturer: Provide one of the following:
   1. Sikadur 32 Hi-Mod LPL, by Sika Corporation.
   2. Eucopoxy LPL, by the Euclid Chemical Company.
   3. Resi-Bond J-58, by Dayton Superior.
   4. Or equal.

2.05 EPOXY-CEMENT BONDING AGENT

A. Provide three component epoxy resin-cement blended formulated as bonding agent.

B. Product and Manufacturer: Provide one of the following:
   1. Sika Armatec 110 EpoCem, as manufactured by Sika Corporation.
   2. Duralprep A.C., as manufactured by the Euclid Chemical Company.
   3. Emaco P24, as manufactured by MBT/ChemRex.
   4. Or equal.

2.06 JOINT SEALANT AND ACCESSORIES

A. For joint sealants and accessories used on isolation joints, control joints, and expansion joints, refer to Section 07 92 00, Joint Sealants.

2.07 CONCRETE BOND BREAKERS

A. Provide asphalt-saturated rag felt building paper, not less in weight than commercially known as 15 pound felt building paper, which weighs 15 pounds per 100 square feet.

B. Chemical Bond Breaker:
   1. Provide medium solids resin solution chemical concrete bond breaker complying with ASTM C309, Type I, Class B.

PART 3 EXECUTION

3.01 INSPECTION

A. CONTRACTOR and installing Subcontractor, if any, shall examine substrate and conditions under which the Work is to be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 CONSTRUCTION JOINTS

A. Comply with requirements of ACI 301 and the Contract Documents.

B. Locate and install construction joints as shown or indicated on the Drawings. Where not shown or indicated, locate joints to not impair strength of the structure; position joints at points of minimum shear. Location of joints shall be approved by ENGINEER. In addition to joints shown or indicated on the Drawings, locate construction joints as follows:

1. In foundation mats, locate joints at spacing of approximately 40 feet. Joints shall be located within middle third of element span, unless otherwise shown or indicated on the Drawings. Element span shall be considered distance between piles or, as determined by ENGINEER, distance between bearing elements, such as columns, exterior walls and interior walls. Place concrete in strip pattern, unless otherwise shown or indicated on the Drawings.
2. In walls, locate joints at a maximum spacing of 40 feet. Locate joints away from wall intersections a minimum of one-quarter of the clear span distance between wall intersections measured horizontally.
3. In structural slabs and beams, joints shall be located within middle third of element span and shall be located in compliance with ACI 301, unless otherwise shown or indicated on the Drawings.
4. In slabs on grade, locate joints at spacing of approximately 40 feet. Place concrete in strip pattern, unless otherwise shown or indicated on the Drawings.

C. Horizontal Joints:
1. Roughen concrete at interface of construction joints by abrasive blasting, hydroblasting, or using surface retardants and water jets to expose aggregate and remove accumulated concrete on projecting rebar immediately subsequent to form stripping, unless otherwise approved by ENGINEER. Immediately before placing fresh concrete, thoroughly clean existing contact surface using stiff brush or other tools and stream of pressurized water. Surface shall be clean and wet, and free from pools of water at time of placing fresh concrete.
2. Remove laitance, waste mortar, and other substances that may prevent complete adhesion. Where joint roughening was performed more than seven days prior to concrete placing or where dirt or other bond reducing contaminants are on surface, perform additional light abrasive blasting or hydroblasting to remove laitance and all bond-reducing materials just prior to concrete placement.
3. Provide over contact surface of concrete a six-inch layer of Construction Joint Grout as specified in Section 03 60 00, Grouting. Place fresh concrete before grout has attained its initial set. Placement of grout may be omitted if concrete mix has slump increased to at least six inches by addition of high range water reducer.

D. Vertical Joints:
1. Apply roughener to the form in thin, even film by brush, spray, or roller in accordance with manufacturer's instructions. After roughener is dry, concrete may be placed.
2. When concrete has been placed, remove joint surface forms as early as necessary to allow for removal of surface retarded concrete. Forms covering member surfaces shall remain in place as required under Section 03 11 00, Concrete Forming. Wash loosened material off with high-pressure water spray to obtain roughened surface subject to approval by ENGINEER. Alternately, surface shall be roughened by abrasive blasting or hydroblasting to expose aggregate. Outer one-inch of each side of joint face shall be masked and protected from blasting to avoid damaging member surface.

3.03 EXPANSION JOINTS

A. Comply with requirements of ACI 301 and this Section.

B. Locate and install expansion joints as shown and indicated in the Contract Documents. Install joint filler in accordance with manufacturer's instructions. Install sealants as specified in this Section.

3.04 CONTROL JOINTS

A. Provide control joints in non-water bearing slabs on grade as shown or indicated on the Drawings. Where control joints are not shown or indicated on the Drawings, space control joints at 24 to 36 times thickness of slab in both directions. Locate control joints only at places approved by ENGINEER.

B. A groove, with depth of at least 25 percent of the member thickness, shall be tooled, formed, or saw-cut in concrete. Groove shall be filled with joint sealant material in accordance with Section 07 92 00, Joint Sealants.

C. Where control joint is formed by sawcutting, make sawcut in presence of ENGINEER immediately after concrete has set sufficiently to support the saw and be cut without damage to concrete. Keep concrete continually moist during cutting. Joints shall be approximately 1/8-inch wide.

D. Control joints may be formed with tool or by inserting joint forming strip. After concrete has achieved design strength, remove upper portion of joint forming strip and fill void with sealant.

3.05 ISOLATION JOINTS

A. Provide isolation joint where sidewalk or other slab on grade abuts a concrete structure and slab on grade is not shown doweled into that structure. Form isolation joint by 1/2-inch joint filler with upper 1/2-inch of joint filled with sealant.

3.06 WATERSTOPS

A. General:
   1. Comply with ACI 301 and this Section. Make joints in accordance with manufacturer's instructions.
   2. Provide PVC waterstops, except where otherwise shown or indicated on the Drawings.
   3. Provide waterstops in all joints where concrete construction is below grade or intended to retain liquid. Install waterstop to the higher of: at least 12 inches above grade, or 12 inches above overflow liquid level in tanks.
   4. Waterstops shall be fully continuous for extent of joint and with waterstops in intersecting joints. Maintain waterstop continuity at transitions between waterstops in joints at different levels and orientations.

5. In vertical joints in walls that are free at the top, waterstops shall extend no closer than six inches from top of wall.
6. In placing concrete around horizontal waterstops, with waterstop flat face in horizontal plane, work the concrete under waterstops by hand to avoid forming air and rock pockets.

B. Polyvinyl Chloride Waterstop:
1. Waterstops shall be positively held from displacement during concrete placing. Tie waterstops to reinforcement or other rigid supports at maximum spacing of 18 inches so that waterstop is securely and rigidly supported in proper position during concrete placing. Continuously inspect waterstops during concrete placing to ensure proper positioning.
2. Perform splicing in waterstops by heat sealing adjacent waterstop sections in accordance with manufacturer's printed recommendations. The following is required:
   a. Material shall not be damaged by heat sealing.
   b. Splices shall have tensile strength of not less than 60 percent of unspliced material's tensile strength.
   c. Maintain the continuity of waterstop ribs and of its tubular center axis.
3. Only butt-type joints of ends of two identical waterstop sections shall be made while material is in forms.
4. Prefabricated PVC Waterstop Joint:
   a. Joints with waterstops involving more than two ends to be jointed together, and joints that involve an angle cut, alignment change, or joining of two dissimilar waterstop sections, shall be prefabricated by CONTRACTOR or manufacturer prior to placing in the forms.
   b. Prefabricated joints shall have minimum of 2.0 feet of waterstop material beyond joint in each direction.
   c. Install prefabricated joint assembly in the forms and butt-weld each two-foot end to a straight-run portion of waterstop in place in the forms.
5. Where centerbulb waterstop intersects and is jointed with non-centerbulb waterstop, seal end of centerbulb using additional PVC material as required.
6. Symmetrical halves of waterstops shall be equally divided between concrete placements at joints and centered within joint width, unless shown or indicated otherwise in the Contract Documents. Place centerbulb waterstops in expansion joints so that centerbulb is centered on joint filler material.
7. When waterstop is installed in the forms or embedded in first concrete placement and waterstop remains exposed to atmosphere for more than four days, implement suitable precautions to shade and protect exposed waterstop from direct rays of sun during entire exposure, until exposed portion of waterstop is embedded in concrete.
8. Protect waterstop placed in joints intended for future concrete placement from direct rays of the sun by temporary means until permanent cover is installed, so that waterstop is not exposed to direct rays of the sun for more than four days total.

C. Hydrophilic Rubber Waterstop and Sealant:

1. Where a hydrophilic rubber waterstop or sealant is required in accordance with the Contract Documents, or where approved by ENGINEER, install waterstop or sealant in accordance with manufacturer's instructions and recommendations; except, as modified in the Contract Documents.
2. When requested by ENGINEER, provide manufacturer's technical assistance at the Site.
3. Locate waterstop or sealant as near as possible to center of joint. Waterstop or sealant shall be continuous around entire joint. Minimum distance from edge of waterstop to face of the member shall be three inches.
4. Where hydrophilic rubber waterstop is used in combination with PVC waterstop, hydrophilic rubber waterstop shall overlap PVC waterstop for minimum of six inches. Fill contact surface between hydrophilic rubber waterstop and PVC waterstop with hydrophilic sealant.
5. Where wet curing methods are used, apply hydrophilic rubber waterstop and sealant after curing water is removed and just prior to closing up of the forms for concrete placement. Protect hydrophilic rubber waterstop and sealant from direct rays of sun and from becoming wet prior to concrete placement. If material becomes wet and expands, allow material to dry until material has returned to original cross sectional dimensions before placing concrete.
6. Install hydrophilic rubber waterstop in bed of hydrophilic sealant, before skinning and curing begins, so that irregularities in concrete surface are completely filled and waterstop is bonded to sealant. After sealant has cured, install concrete nails, with washers of a diameter equal to waterstop width, to secure waterstop to concrete at maximum spacing of 1.5 feet.
7. Prior to installing hydrophilic sealant, wire brush or sandblast the concrete surface to remove laitance and other materials that may interfere with bonding. Metal and PVC surfaces to receive sealant shall be cleaned of paint and any material that may interfere with bond. When sealant alone is shown or indicated in the Contract Documents, place sealant placed in built-up bead which has a triangular cross section with each side of triangle at least 3/4-inch long, unless otherwise indicated in the Contract Documents. Do not place concrete until sealant has cured as recommended by sealant manufacturer.

3.07 BONDING AGENT

A. Use epoxy bonding agent for bonding of fresh concrete to concrete that has been in place for at least 60 days, and for bonding to existing concrete.

B. Use epoxy-cement bonding agent for the following:
   1. Bonding toppings and concrete fill to concrete that has been in place for at least 60 days, and for bonding to existing concrete.
   2. For locations where bonding agent is required and concrete cannot be placed within open time period of epoxy bonding agent.
   3. Bonding of horizontal construction joints where joints are required in accordance with the Drawings or approved by ENGINEER for foundation mats that are five feet thick or greater.

C. Use cement-water slurry as bonding agent for toppings and concrete fill to new concrete. Cement water slurry shall be worked into surface with stiff bristle broom and place the concrete before cement-water slurry dries.

D. Handle and store bonding agent in accordance with manufacturer's printed instructions and safety precautions.

E. Mix bonding agent in accordance with manufacturer's instructions.

F. Before placing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with bonding agent not less than 1/16-inch thick. Place fresh concrete while bonding agent is still tacky (within its open time), without removing in-place bonding agent coat, and as directed by manufacturer.

END OF SECTION

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SECTION 03 20 00

CONCRETE REINFORCING

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete reinforcing.
   2. Extent of concrete reinforcing is shown and indicated in the Contract Documents.
   3. Work includes fabrication and placement of reinforcing including bars, ties, and supports, and welded wire fabric for concrete, encasements, and fireproofing.

B. Related Sections:
   1. Section 03 15 00, Concrete Accessories.
   2. Section 05 05 33, Anchor Systems.

1.02 REFERENCES

A. Standards referenced in this Section are:
   1. ACI 315, Details and Detailing of Concrete Reinforcement.
   2. ACI 318, Building Code Requirements for Structural Concrete.
   3. ACI 350, Code Requirements for Environmental Engineering Concrete Structures.
   4. ANSI/AWS D1.4, Structural Welding Code - Reinforcing Steel.
   5. ASTM A82, Specification for Steel Wire, Plain, for Concrete Reinforcement.
   6. ASTM A185, Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
   7. ASTM A615, Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   8. ASTM A706, Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   9. ASTM E329, Specification for Agencies Engaged in Construction Inspection and/or Testing.
   10. Concrete Reinforcing Steel Institute (CRSI), CRSI 1MSP, Manual of Standard Practice.
   11. ICC Evaluation Service (ES) AC 308, Acceptance Criteria for Post-Installed Anchors in Concrete Elements.

1.03 QUALITY ASSURANCE

A. Qualifications:
   1. Testing Laboratory: Shall meet requirements of ASTM E329 and shall have experience in the testing welded splices of reinforcing steel and

tension testing of reinforcing bars set in adhesive in hardened concrete.

2. Installer of Adhesive Dowels: Shall be experienced and certified by manufacturer of adhesive as possessing necessary training for installing manufacturer's products. Distributors or manufacturer's representatives shall not provide product training unless qualified as certified trainers by anchor manufacturer.

B. Certifications:
   1. Weld Procedures: For types of splices and grades of reinforcing used in the Work, weld procedures for welded reinforcing steel splices shall be certified in accordance with ANSI/AWS D1.4.
   2. Welders: For types of splices and grades of reinforcing used in the Work, welders shall be certified for welding reinforcing steel splices in accordance with ANSI/AWS D1.4.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Drawings for fabricating, bending, and placing concrete reinforcing. Comply with ACI 315, Parts A and B.
      b. For walls, show elevations at minimum scale of 1/4-inch to one foot.
         1) Elevations shall show all openings and reference details that identify additional reinforcing required around each opening.
         2) Elevations shall denote each wall intersection and reference a detail that identifies additional reinforcing required at wall intersection. As an alternate to providing separate details for each wall intersection, provide overall plan detailing only the additional wall intersection reinforcing for each wall intersection.
      c. For slabs and mats, show top and bottom reinforcing on separate plan views.
         1) Plans shall show all openings and shall reference details that identify additional reinforcing around each opening.
      d. Show bar schedules, stirrup spacing, diagrams of bent bars, location of bar splices, length of lap splices, arrangements, and assemblies, as required for fabricating and placing concrete reinforcing unless otherwise noted.
      e. Provide plans and elevations detailing location, spacing, and lengths of masonry wall dowels, where masonry is required. Coordinate location of dowels with masonry openings and with standard modular spacing. Submit masonry wall dowels with reinforcing submittal for element into which masonry dowel will be embedded. Coordinate with Section 04 05 05, Unit Masonry Construction.
      f. Splices shall be kept to a minimum. Avoid, when possible, splices in regions of maximum tensile stresses.
      g. Drawings detailing location of all construction and expansion joints, as required under Section 03 15 00, Concrete Accessories,

shall be submitted and approved before Shop Drawings for reinforcing are submitted.

h. Drawings detailing location, spacing, edge distance, and embedment depth of adhesive dowels. Adhesive system shall be submitted and approved before Shop Drawings with adhesive dowels are submitted.

2. Product Data:
   a. Manufacturer's product data for adhesive, if not submitted under other Sections.
   b. Adhesive manufacturer's test data and ICC ES report to verify specified capacity of adhesive dowels.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Steel manufacturer's certificates of mill analysis, tensile, and bend tests for reinforcing steel.
      b. Certification of welders and weld procedures for splices.
      c. Adhesive manufacturer's certification verifying that installer is qualified and using proper installation procedures.
   2. Manufacturer's Instructions:
      a. Installation instructions for adhesive systems.
   3. Field Quality Control Submittals:
      a. Reports of all field quality control testing, where applicable.
      b. Results of required inspection of welded splices of reinforcing bars.
      c. Results of required tensile testing of adhesive dowels. Include size and location of bars tested.
   4. Special Procedure Submittals; Description of reinforcing weld locations and weld procedures.

1.05 DELIVERY, HANDLING, AND STORAGE

A. Deliver concrete reinforcing products to Site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings on approved Shop Drawings.

B. Store concrete reinforcing products to prevent damage and accumulation of dirt and excessive rust. Store on heavy wood blocking so that reinforcing does not come into contact with the ground.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars: Shall be deformed in accordance with ASTM A615, and as follows:
   1. Provide Grade 60 for all bars, unless indicated otherwise.

B. Mechanical Couplers: Reinforcement bars may be spliced with mechanical connection. Connection shall be full mechanical connection that shall develop in tension or compression, as required, at least 125 percent of

specified yield strength (fy) of bar in accordance with ACI 318 and ACI 350. Where splices at the face of wall are shown or approved by ENGINEER, form saver-type mechanical couplers may be used. Form-saver couplers shall have integral plates designed to positively connect coupler to formwork.

C. Steel Wire: Shall be in accordance with ASTM A82.

D. Column Spirals: Hot-rolled rods for spirals, conforming to ASTM A615.

E. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting and fastening reinforcing in place.
   1. Use wire bar type supports complying with CRSI 1 MSP recommendations, except as specified in this Section. Do not use wood, brick, or other unacceptable materials.
   2. For slabs on grade, use precast concrete blocks, four inches square in plan, with embedded tie wire as specified by CRSI 1 MSP. Precast concrete blocks shall have same or higher compressive strength as specified for concrete in which they are located.
   3. For concrete surfaces where legs of supports are in contact with forms, provide supports complying with CRSI 1 MSP as follows:
      a. At formed surfaces in contact with soil, weather, or liquid, or located above liquid, supports shall be CRSI Class 1 for maximum protection. Plastic coating on legs shall extend at least 0.5-inch upward from form surface.
      b. At interior dry surfaces (not located above liquid), supports shall be either Class 1 or Class 2 for moderate protection.
   4. Over waterproof membranes, use precast concrete chairs.

F. Adhesive Dowels:
   1. Dowels:
      a. Dowel reinforcing bars shall be deformed in accordance with ASTM A615, Grade 60.
   2. Adhesive:
      a. Requirements for adhesive are specified under requirements for concrete adhesive anchors in Section 05 05 33, Anchor Systems.

2.02 FABRICATION

A. General: Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI 1 MSP. In case of fabricating errors, do not re-bend or straighten reinforcing in manner that injures or weakens material.

B. Unacceptable Materials: Reinforcing with one or more of the following defects is not allowed:
   1. Bar lengths, bends, and other dimensions exceeding specified fabrication tolerances.
   2. Bends or kinks not shown on approved Shop Drawings.
   3. Bars that do not meet or exceed their ASTM specification requirements when hand-wire-brushed, with respect to cross section, nominal weight, or average height of deformations.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine the substrate and conditions under which concrete reinforcing is to be placed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with Work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with applicable recommendations of Laws and Regulations, applicable standards, and CRSI 1 MSP for details and methods of reinforcing placement and supports.

B. Clean reinforcing to remove loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Position, support, and secure reinforcing against displacement during formwork construction and concrete placing. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
   1. Place reinforcing to obtain minimum concrete coverages specified in ACI 318, AC I 350, and the Contract Documents. Arrange, space, and securely tie bars and bar supports together with 16-gage wire to hold reinforcing accurately in position during concrete placing. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.
   2. Prior to placing concrete, using surveyor's level or string line, demonstrate to ENGINEER that specified cover of reinforcing has been attained.
   3. Do not secure reinforcing steel to forms with wire, nails, or other ferrous metal. Metal supports subject to corrosion shall not touch formed or exposed concrete surfaces.

D. Allowable Placing Tolerances: Comply with ACI 318, Chapter 7 - Details of Reinforcement, and ACI 350, Chapter 7 - Details of Reinforcement, except as specified in this Section:
   1. Concrete surfaces in contact with liquid shall have minimum of two inches of concrete over reinforcing steel.

E. Provide sufficient number of supports of strength required to carry reinforcing. Do not place reinforcing bars more than two inches beyond last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

F. Lap Splices:
   1. Provide standard reinforcing splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements shown for minimum lap of spliced bars as shown on the Drawings.

G. Mechanical Couplers:
   1. Mechanical butt splices shall be in accordance with recommendations of mechanical splicing device manufacturer. Butt splices shall develop

125 percent of specified minimum yield tensile strength of spliced bars or of smaller bar in transition splices. Bars shall be flame-dried before butt splicing. Provide adequate jigs and clamps or other devices to support, align, and hold longitudinal centerline of bars being butt spliced in straight line.

H. Welded Splices:
   1. When field welding of reinforcing is required on the Drawings or allowed by ENGINEER in writing, welding of reinforcing bars shall conform to ANSI/AWS D1.4. Preheating and rate of cooling requirements shall be based on bar steel chemistry and ANSI/AWS D1.4. Welded splices shall be sized and constructed to transfer minimum of 125 percent of specified minimum yield tensile strength of spliced bars or of smaller bar in transition splices. Unless otherwise allowed by Engineer in writing, welding of crossing bars (tack welding) for assembly of reinforcement is prohibited.
   2. Welding of wire to wire, and of wire or welded wire fabric to reinforcing bars or structural steels, shall conform to applicable provisions of ANSI/AWS D1.4 and ENGINEER's requirements for the particular application.
   3. After completing welding on coated reinforcing bars, repair coating damage as specified in this Section. Welds and steel splice members, when used to splice bars, shall be coated with same material used for repair of coating damage.

I. Adhesive Dowels:
   1. Comply with manufacturer's written installation instructions and requirements of this Section.
   2. Drill holes to adhesive system manufacturer's recommended drill bit diameter and to specified depth. Drill holes in hammering and rotation mode with carbide-tipped drill bits complying with tolerances indicated in ANSI B212.15. Core-drilled holes shall not be permitted.
   3. Before setting adhesive dowel, hole shall be made free of dust and debris by method recommended by adhesive system manufacturer. Brush the hole with adhesive system manufacturer-approved brush and blow hole clean with clean, dry, oil-free compressed air to remove all dust and loose particles. Hole shall be dry as defined by adhesive system manufacturer.
   4. Before injecting adhesive, obtain ENGINEER's concurrence that hole is dry and free of oil and other contaminants.
   5. Prior to injecting adhesive into the drilled hole, dispense to an appropriate location for waste an initial amount of adhesive from the mixing nozzle until adhesive is a uniform color, indicating that product is properly mixed.
   6. Inject adhesive into hole through injection system-mixing nozzle and extension tubes (as required) placed to bottom of hole. Withdraw nozzle's discharge end as adhesive is placed while keeping nozzle immersed to prevent formation of air pockets. Fill hole to depth that ensures that excess material is expelled from hole during dowel placing.

7. Twist dowel during insertion into partially-filled hole to ensure full wetting of rod surface with adhesive. Insert rod slowly to avoid developing air pockets.
8. Provide adequate curing in accordance to adhesive system manufacturer's requirements prior to continuing with adjoining or adjacent Work that could impose or impart load on the dowels. Do not begin adjoining or adjacent Work until dowels are successfully tested or when approved by ENGINEER.
9. Limitations:
    a. Installation Temperature: Comply with manufacturer's instructions for installation temperature requirements. Provide temporary protection and other measures, such as heated enclosures, necessary to ensure that base material temperature complies with requirements of adhesive systems manufacturer during installation and adhesive system curing.
    b. Oversized Holes: Advise ENGINEER immediately if size of drilled hole is larger than recommended by adhesive system manufacturer. Cost of corrective measures, including but not limited to redesign of dowels due to decreased capacities, shall be paid by CONTRACTOR.

3.03 FIELD QUALITY CONTROL

A. Site Inspections and Tests:
1. General:
    a. Do not place concrete until reinforcing is inspected, and permission for placing concrete is granted by ENGINEER. Concrete placed in violation of this provision will be rejected.
    b. Do not close up formwork for walls and other vertical members until reinforcing is inspected, and permission for placing concrete is granted by ENGINEER. Concrete placed in violation of this provision will be rejected.
    c. Correct defective Work by removing and replacing or correcting, as required by ENGINEER.
    d. CONTRACTOR shall pay cost of corrections and subsequent testing required to confirm integrity of post-installed anchors.
    e. Testing laboratory shall submit test results to CONTRACTOR and ENGINEER within 24 hours of completion of test.
2. Site Tests:
    a. CONTRACTOR shall employ independent testing laboratory to perform field quality testing of adhesive dowels at the Site.
        1) Testing shall comply with ASTM E488.
        2) Test at least ten percent of each type of adhesive dowel. If one or more dowels fail the test, CONTRACTOR shall pay cost to test all dowels of same diameter and type installed on the same day as the failed dowel.
        3) Test dowels to 60 percent of specified yield strength. ENGINEER will direct which dowels are to be tested.
        4) Apply test loads with hydraulic ram.
        5) Displacement of dowels shall not exceed D/10, where D is nominal diameter of dowel.

3. Inspection of Welded Splices: OWNER will employ testing laboratory to perform field quality control testing of welded splices. All welded splices shall be visually inspected. Radiographically test minimum of five percent of butt splice welds. Repair defective welds so that welds are completely sound.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install cast-in-place concrete.
   2. The Work includes providing concrete consisting of portland cement, fine and coarse aggregate, water, and approved admixtures; combined, mixed, transported, placed, finished, and cured. The Work also includes:
      a. Providing openings in concrete to accommodate the Work under this and other Sections, and building into the concrete all items such as sleeves, frames, anchorage devices, inserts, and all other items to be embedded in concrete Work.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate installation of items to be installed in the concrete Work.

C. Classifications of Concrete:
   1. Class “A” concrete shall be steel-reinforced and includes the following:
      a. All concrete, unless otherwise shown or indicated.
   2. Class “B” concrete shall be placed without forms or with simple forms, with little or no reinforcing, and includes the following, unless otherwise shown or indicated:
      a. Concrete fill within structures.
      b. Duct banks.
      c. Unreinforced encasements.
      d. Curbs and gutters.
      e. Sidewalks.
      f. Thrust blocks.
   3. Class “D” concrete shall be unreinforced and used where required as concrete fill under foundations, filling abandoned piping, and where “lean concrete” or “mudmat” is shown or indicated in the Contract Documents.

D. Related Sections:
   1. Section 03 15 00, Concrete Accessories.
   2. Section 03 60 00, Grouting.

1.02 REFERENCES

A. Standards referenced in this Section are:
   1. AASHTO M 182, Specification for Burlap Cloth Made From Jute or Kenaf and Cotton Materials.

2. AASHTO TP23, Test Method for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying.
3. ACI 117, Specifications for Tolerances for Concrete Construction and Materials and Commentary.
4. ACI 214R, Evaluation of Strength Test Results of Concrete.
5. ACI 301, Specifications for Structural Concrete.
6. ACI 302.1R, Guide for Concrete Floor and Slab Construction.
7. ACI 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
8. ACI 305R, Specification for Hot Weather Concreting.
9. ACI 306R, Cold Weather Concreting.
10. ACI 309R, Guide for Consolidation of Concrete.
11. ACI 318, Building Code Requirements for Structural Concrete and Commentary.
12. ACI 350/350R, Code Requirements for Environmental Engineering Concrete Structures and Commentary.
13. ASTM C31/C31M, Practice for Making and Curing Concrete Test Specimens in the Field.
14. ASTM C33, Specification for Concrete Aggregates.
15. ASTM C39/C39M, Test Method for Compressive Strength of Cylindrical Con-crete Specimens.
16. ASTM C42/C42M, Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
17. ASTM C94/C94M, Specification for Ready-Mixed Concrete.
18. ASTM C109/C109M, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
19. ASTM C138/C138M, Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
20. ASTM C143/C143M, Test Method for Slump of Hydraulic- Cement Concrete.
21. ASTM C150, Specification for Portland Cement.
22. ASTM C157/C157M, Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
23. ASTM C171, Specification for Sheet Materials for Curing Concrete.
24. ASTM C172, Practice for Sampling Freshly Mixed Concrete.
25. ASTM C231, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
26. ASTM C260, Specification for Air-Entraining Admixtures for Concrete.
27. ASTM C309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
28. ASTM C330, Specification for Lightweight Aggregates for Structural Concrete.
29. ASTM C494/C494M, Specification for Chemical Admixtures for Concrete.
30. ASTM C618, Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
31. ASTM C882/C882M, Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
32. ASTM C989, Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
33. ASTM C1064/C1064M, Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.

34. ASTM C1077, Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
35. ASTM C1240, Specification for Silica Fume Used in Cementitious Mixtures.
36. ASTM D1042, Test Method for Linear Dimensional Changes of Plastics Under Accelerated Service Conditions.
37. ASTM D3574, Standard Test Methods for Flexible Cellular Materials—Slab, Bonded, and Molded Urethane Foams.
38. ASTM E96/E96M, Test Methods for Water Vapor Transmission of Materials
39. ASTM E329, Specification for Agencies Engaged in Construction Inspection and/or Testing.
40. ASTM E1643, Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
41. ASTM E1745, Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
42. NSF/ANSI 61, Drinking Water System Components - Health Effects.

1.03 QUALITY ASSURANCE

A. Qualifications:
   1. Concrete Testing Laboratory:
      a. Employ independent testing laboratory experienced in design and testing of concrete materials and mixes to perform material evaluation tests and to design concrete mixes. Employ different laboratories for design of concrete mixes and field testing.
         1) Testing agency shall be in accordance with ASTM E329 and ASTM C1077.
         2) Testing laboratory shall have been inspected and passed within previous two years by Cement and Concrete Reference Laboratory (CCRL) of NIST for: testing concrete aggregates, and for preparing and testing concrete trial batches with or without admixtures. Testing laboratory shall provide documentation indicating how deficiencies, if any, in most recent CCRL inspection report were corrected.
         3) Selection of testing laboratory is subject to OWNER's acceptance.
         4) Submit written description of proposed concrete testing laboratory giving qualifications of personnel, laboratory facilities, and equipment, and other information requested by ENGINEER.
   2. Water Reducing Admixture Manufacturer:
      a. Water-reducing admixtures shall be manufactured under strict quality control in facilities operated under a quality assurance program. Submit copy of manufacturer's quality assurance handbook to document program existence.
      b. Manufacturer shall maintain a concrete testing laboratory approved by CCRL at NIST.
      c. Manufacturer shall be capable of providing services of qualified field service representatives at the Site.

B. Laboratory Trial Batch:
   1. Each concrete mix design specified shall be verified by laboratory trial batch, unless indicated otherwise.
   2. For classes of concrete that require air-entrainment, test the trial batch at highest percentage of air allowed for that class of concrete.
   3. Perform the following testing on each trial batch:
      a. Aggregate gradation for fine and coarse aggregates.
      b. Fly ash testing to verify meeting specified properties, unless fly ash Supplier submits certification by an independent testing laboratory.
      c. Slump.
      d. Air content.
      e. Compressive strength based on three cylinders each tested at seven days and at 28 days.
      f. Shrinkage test in accordance with this Section, for Class “A” concrete.
   4. Submit for each trial batch the following information:
      a. Project identification name and number (if applicable).
      b. Date of test report.
      c. Complete identification of aggregate source of supply.
      d. Tests of aggregates for compliance with the Contract Documents.
      e. Scale weight of each aggregate.
      f. Absorbed water in each aggregate.
      g. Brand, type, and composition of cementitious materials.
      h. Brand, type, and amount of each admixture.
      i. Amounts of water used in trial mixes.
      j. Proportions of each material per cubic yard.
      k. Gross weight and yield per cubic yard of trial mixtures.
      l. Measured slump.
      m. Measured air content.
      n. Compressive strength developed at seven days and 28 days, from not less than three test cylinders cast for each seven day and 28 day test, and for each design mix.
      o. Shrinkage test results where required and as specified in this Section. Report results and averages for original length and at zero, seven, 14, 21, and 28 days of drying.

C. Certification of Concrete Mix:
   1. The requirement for trial batch will be waived upon compliance with requirements of this Paragraph. Verify compressive strength of each specified mix by data from series of at least 30 consecutive tests that have been made within previous 12 months. Test is the average strength of all specimens of the same age fabricated from sample taken from a single batch of concrete. Tests shall have been made on concrete with identical mix design to mix design proposed for the Work, including sources of aggregate and manufacturers of cementitious materials and admixtures. Tests shall average above specified strength with no individual test falling more than 500 psi below specified strength and no three consecutive tests averaging below specified strength. Standard deviation for series of tests shall not exceed 640 psi in accordance with ACI 214.

D. Shrinkage Test:
   1. Perform drying shrinkage tests for trial batch as specified in this Section.
   2. Drying shrinkage specimens shall be four-inch by four-inch by 11-inch prisms with effective gage length of ten inches; fabricated, cured, dried, and measured in accordance with ASTM C157 modified as follows: remove specimens from molds at an age of 23 hours, plus-or-minus one hour, after trial batching; shall be placed immediately in water at 70 degrees F plus-or-minus three degrees F for at least 30 minutes; and shall be measured within 30 minutes thereafter to determine original length and then submerged in saturated lime water at 73 degrees F plus-or-minus three degrees F. Measurement to determine expansion expressed as percentage of original length shall be made at age of seven days. Length at age of seven days shall be base length for drying shrinkage calculations (zero days drying age). Immediately afterward store specimens in humidity-controlled room maintained at 73 degrees F plus-or-minus three degrees F, and 50 percent (plus-or-minus four percent) relative humidity for remainder of test. Obtain measurements to determine shrinkage expressed as percentage of base length and report measurements separately for seven, 14, 21, and 28 days of drying after seven days of moist curing.
   3. Determine drying shrinkage deformation of each specimen as the difference between base length (at zero days drying age) and length after drying at each test age. Determine average drying shrinkage deformation of specimens to nearest 0.0001-inch at each test age. If drying shrinkage of a specimen departs from average of that test age by more than 0.0004-inch, results obtained from that specimen shall be disregarded. Report results of shrinkage test to nearest 0.001 percent of shrinkage. Compression test specimens shall be taken in each case from same concrete used for preparing drying shrinkage specimens. Tests shall be considered part of normal compression tests for the Work. Allowable shrinkage limitations shall be as specified in PART 2 of this Section.

E. Component Supply and Compatibility:
   1. Provide all admixture materials from a single manufacturer.

F. Designated Finish Sample Areas:
   1. ENGINEER will identify areas of concrete members, to serve as reference examples of acceptable concrete finishes, from first members constructed for each finish.
   2. At each area so designated, complete the finish as specified.
   3. Where specified concrete finish is not obtained, repair the member to provide an acceptable finish. Adjust construction techniques to produce the required finish.
   4. Clearly mark each Sample area with name of specified finish to cause no damage to finish.
   5. Protect Sample areas from damage and maintain access to view Sample areas.

G. Concrete Coordination Conference:

1. Conduct concrete coordination conference to review detailed requirements of CONTRACTOR's proposed concrete design mixes, to discuss procedures for producing proper concrete construction, and to clarify roles of the parties involved. CONTRACTOR shall organize and schedule the conference, and prepare and distribute to all parties attending conference minutes of the conference.
2. Conduct concrete coordination conference no later than 14 days after the date the Contract Times commence running. Conference shall be held at mutually agreed upon date and time; conference shall be held at the Site unless otherwise mutually agreed upon. Notify all parties to attend concrete coordination conference not less than five days prior to scheduled date of conference.
3. All parties involved in the concrete Work shall attend concrete coordination conference including, but not limited to, the following:
   a. CONTRACTOR.
   b. Field testing services representative.
   c. Concrete Subcontractor (if any).
   d. Reinforcing steel Subcontractor (if any) and reinforcing steel Supplier and detailer.
   e. Concrete Supplier.
   f. Admixture manufacturer's representative.
   g. ENGINEER.
   h. Resident Project Representative (if any).

1.04 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. List of concrete materials and proportions for the proposed concrete mix designs. Include data sheets, test results, certifications, and mill reports to qualify the materials proposed for use in the mix designs. Do not start laboratory trial batch testing until this submittal is approved by ENGINEER.
      b. Laboratory Trial Batch Reports: Submit laboratory test reports for concrete cylinders, materials, and mix design tests.
      c. Ready-mixed Concrete: Submit the following information.
         1) Physical capacity of mixing plant.
         2) Trucking facilities available.
         3) Estimated average amount of the specified concrete that can be produced and delivered to the Site during a normal, eight-hour day, excluding output to other customers.
   2. Product Data:
      a. Manufacturers' specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.
   3. Samples:
      a. Submit Samples of materials as specified and as requested by ENGINEER. Include with each Sample names of product and Supplier, and description.

B. Informational Submittals: Submit the following:
   1. Certifications:

a. Notarized certification of conformance to reference standards used in this Section, when required by ENGINEER.

2. Delivery Tickets: Copies of all delivery tickets for each load of concrete delivered to or mixed at the Site. Each delivery tickets shall contain the information in accordance with ASTM C94 along with project identification name and number (if any), date, mix type, mix time, quantity and amount of water introduced.
3. Field Quality Control Submittals:
   a. Report of testing results for testing of field concrete cylinders for each required time period. Submit within 24 hours after completion of associated test. Test report shall include results of all testing required at time of sampling.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Transportation, Delivery, and Handling:
   1. Materials used for concrete shall be clean and free from foreign matter during transportation and handling, and kept separate until measured and placed into concrete mixer.
   2. Implement suitable measures during hauling, piling, and handling to ensure that segregation of coarse and fine aggregate particles does not occur and grading is not affected.

B. Storage:
   1. For storage, provide bins or platforms with hard, clean surfaces.

PART 2 PRODUCTS

2.01 GENERAL

A. All cementitious materials, admixtures, and other industrial-produced materials used in concrete, or for curing or repairing of concrete, that can contact potable water or water that will be treated to become potable shall be listed in NSF/ANSI 61.

2.02 CEMENTITIOUS MATERIALS

A. Cement:
   1. Portland cement shall be Type II(MH) ASTM C150. Type I or Type II may be used in lieu of Type II(MH) when approved by ENGINEER.
   2. Portland cement shall be produced by one facility. Alternate cement sources may be used provided that mix design has been approved and acceptable trial batch verifying performance has been made.
   3. Do not use cement that has deteriorated because of improper storage or handling.

B. Fly Ash Mineral Admixture:
   1. Mineral admixtures, when used, shall conform to the requirements of ASTM C618 Class F, except as follows:
      a. The loss on ignition shall be a maximum of four percent.
      b. The maximum percent of sulfur trioxide (SO3) shall be 4.0.

2. Fly ash shall be considered to be a cementitious material.
3. Laboratory trial batches shall be tested to determine compliance with strength requirements, times of setting, slump, slump loss, and shrinkage characteristics.

C. Ground Granulated Blast Furnace Slag:
1. Ground granulated blast furnace slag (GGBS) mineral admixture, when used, shall conform to ASTM C989, Grade 120.
2. GGBS is considered a cementitious material.
3. Perform laboratory tests on trial batches to determine compliance with strength requirements, times of setting, slump, slump loss, and shrinkage characteristics.

D. For all classes of concrete, when Type II(MH) Cement is used, fly ash or GGBS may be used within the following percentages by weight. When Type II Cement is used, fly ash or GGBS shall be used within the following percentages by weight. When Type I Cement is used, in lieu of Type II(MH) Cement, fly ash or GGBS shall be used such that total tricalcium aluminate content (C3A) of the resulting cementitious material is not greater than eight percent.
1. When fly ash is used, material shall have minimum of 20 percent and maximum of 25 percent of total weight of cementitious material.
2. When GGBS is used, material shall have minimum of 40 percent and maximum of 50 percent of total weight of cementitious material.

2.03 AGGREGATES

A. General:
1. Aggregates shall conform to ASTM C33, Class Designation 4S, and as specified in this Section.
2. Do not use aggregates containing soluble salts or other substances, such as iron sulfides, pyrite, marcasite, ochre, or other materials, that can cause stains on exposed concrete surfaces.

B. Fine Aggregate:
1. Provide clean, sharp, natural sand free of loam, clay, lumps, and other deleterious substances.
2. Dune sand, bank run sand, and manufactured sand are unacceptable.

C. Coarse Aggregate:
1. Provide clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
a. Crushed stone, processed from natural rock or stone.
b. Washed gravel, either natural or crushed. Slag, pit gravel, and bank run gravel are unacceptable.

2.04 WATER

A. Water used in producing and curing concrete shall be clean and free of injurious quantities of oils, acids, alkalis, organic materials, and other substances that may be deleterious to concrete and steel.

2.05 CONCRETE ADMIXTURES

A. Provide admixtures in accordance with product manufacturer's published instructions. Admixtures shall be compatible with each other. Admixtures shall not contain thiocyanates, shall not contain more than 0.05 percent chloride ion, and shall be non-toxic in the concrete mix after 30 days. Do not use admixtures that have not been incorporated and tested in the accepted mixes, unless otherwise approved by ENGINEER.

B. Air Entraining Admixtures: ASTM C260.
   1. Air entraining admixture shall be vinsol resin or vinsol rosin-based.

C. Water-Reducing Admixture: ASTM C494, Type A.
   1. Proportion Class "A", Class "AF", Class "AS", and Class "B" concrete with non-air entraining, normal setting, water-reducing, aqueous solution of modified organic polymer. Admixture shall not contain lignin, nitrates, or chlorides added during manufacturing.

D. High Range Water-Reducing Admixture (HRWR): ASTM C494, Type F/G.
   1. Use high range water-reducing admixture in the concrete classifications so specified or indicated. Use of HRWR admixture is allowed at CONTRACTOR's option in all other classifications of concrete. When used, HRWR admixture shall be added to concrete in accordance with admixture manufacturer's published instructions. Specific admixture formulation shall be as recommended by admixture manufacturer for Project conditions.

E. Set Control Admixtures: In accordance with ASTM C494. Use the following as required:
   1. Type B, Retarding.
   2. Type C, Accelerating.
   3. Type D, Water reducing and Retarding.
   4. Type E, Water reducing and Accelerating.
   5. Type F, Water-reducing, high range admixtures.
   6. Type G, Water-reducing, high range, and retarding admixtures.

F. Calcium Chloride: Do not use calcium chloride.

G. Shrinkage Reducing Admixture:
   1. Shrinkage reducing admixture may be used in mix design when necessary to conform to specified shrinkage limitations, provided that specified strength requirements are complied with and there is no reduction in sulfate resistance in the concrete and no increase in concrete permeability.

2.06 PROPORTIONING AND DESIGN OF MIXES

A. Prepare concrete design mixes in accordance with the table below:

Table 03 30 00-A - CONCRETE DESIGN MIX CRITERIA

Concrete	Coarse	Minimum	Max.	Slump(2)	Air	Min. Comp

Class	Aggregate(1)			W/CM(4)		(%)	Strength(3) (psi)
	Size A	Size B	Cementitious (lbs/cu yd)				
Class “A”	No. 57	No. 8	564	0.42	4" max.	4.5 +/- 1.5	4,500
Class “B”	No. 57 or No. 67		517	0.50	4" max.	4.5 +/- 1.5	3,000
Class “D”	Any ASTM C33		⇐ No requirements ⇒				2,000

Notes Applicable to Table:

1. Coarse aggregate size numbers refer to ASTM C33. Where Size A and B are designated in Table 03 30 00-A, it is intended that the smaller Size B aggregate is to be added, replacing a portion of the coarse or fine aggregate, in the minimum amount necessary to make a workable and pumpable mix with sand content not exceeding 41 percent of total aggregate.
2. Slumps indicated are prior to addition of high range water reducer (super plasticizer).
3. Mix designs shall be made for all but Class “D”, which does not require trial batch, so that the compressive strength achieved for laboratory trial batches will not be less than 125 percent of specified design strength.
4. Quantity of water to be used in the determination of water-cementitious materials (W/CM) ratio shall include free water on aggregates in excess of SSD and water portion of admixtures.

B. Adjustment to Concrete Mixes: Mix design adjustments may be requested by CONTRACTOR when characteristics of materials, Site conditions, weather, test results, or other circumstances warrant; at no additional cost to OWNER and as approved by ENGINEER. Before using adjusted concrete mixes, laboratory test data and strength results shall be submitted to and approved by ENGINEER.

C. Admixtures:
   1. Use air-entraining admixture in concrete, unless otherwise shown or indicated. Add air-entraining admixture at admixture manufacturer’s prescribed rate to produce concrete at point of placement having air content within prescribed limits.
   2. Use water-reducing or high-range water-reducing admixtures in all Class “A” concrete.
   3. Use amounts of admixtures recommended by admixture manufacturer for climatic conditions prevailing at the Site at time of placing. Adjust quantities and types of admixtures as required to maintain quality.

D. Slump Limits with High-Range Water Reducer:
   1. Slump shall not exceed four inches prior to adding high-range water reducer and shall not exceed eight inches, measured at point of placement, after adding high-range water reducer.

E. Shrinkage Limitation:
   1. Concrete shrinkage for specimens cast in laboratory from trial batch with total water of 30.2 gallons per cubic yard or less, as measured at 21-day drying age and at 28-day drying age shall not exceed 0.039

percent and 0.045 percent, respectively. For trial batch with total water of 32.7 gallons per cubic yard or greater respective limits shall not exceed 0.035 percent and 0.040 percent. Limits in between shall be linear interpolated. Use mix design for construction that complies with trial batch shrinkage requirements. Shrinkage limitations apply to Class "A" concrete.

2. Trial Batch Does Not Comply with Shrinkage Limitation:
   a. If trial batch results do not comply with shrinkage limitation specified in the Contract Documents, redesign the mix to reduce shrinkage.
   b. After mix has been repeatedly redesigned and ENGINEER is satisfied that all reasonable means to provide concrete mix that complies with shrinkage requirement have been exercised; and mix design still fails to comply with shrinkage limitation in the Contract Documents, ENGINEER reserves the right to accept the higher-shrinkage mix, provided that the quantity of shrinkage reinforcing in structures is increased.
   c. "Reasonable means" will be construed as reducing the total water content to a maximum of 27 gallons per cubic yard, having the large aggregate blended so that eight percent to 18 percent of combined aggregate is retained on each sieve, using an alternate aggregate source, and a combination of these means.
   d. Basis for shrinkage reinforcing increase will be proportional to amount that shrinkage value is over the specified shrinkage limitation and will be determined by ENGINEER. The cost of providing additional shrinkage reinforcement will be paid by the Owner.

2.07 BONDING AGENT

A. Provide epoxy and epoxy-cement bonding agents in accordance with Section 03 15 00, Concrete Accessories.

2.08 CONCRETE CURING MATERIALS

A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 10 ounces per square yard and complying with AASHTO M 182, Class 3.

B. Curing Mats: Shall be heavy carpets or cotton mats, quilted at four inches on centers, and weighing minimum of 12 ounces per square yard when dry.

C. Moisture-Retaining Cover: Provide one of the following, complying with ASTM C171:
   1. Waterproof paper.
   2. Polyethylene film.
   3. White burlap polyethylene sheet.

2.09 FINISHING AIDS

A. Evaporation Retardant:
   1. Product and Manufacturer: Provide one of the following:

a. Confilm, by Master Builders.
b. Eucobar, by Euclid Chemical Company.
c. SikaFilm, by Sika Corporation.
d. Or equal.

2.10 CRACK INJECTION MATERIALS

A. Structural Crack Repair System:
1. Epoxy for Injection: Low-viscosity, high-modulus moisture insensitive type.
2. Products and Manufacturers: Provide one of the following:
a. Sikadur 35, Hi-Mod L.V. and Sikadur 31, Hi-Mod Gel, by Sika Corporation.
b. Eucopoxy Injection Resin, by Euclid Chemical Company.
c. Or equal.

B. Non-structural Crack Repair System:
1. Hydrophobic Polyurethane Chemical Grout:
a. Provide hydrophobic polyurethane that forms a flexible gasket.
b. Products and Manufacturers: Provide one of the following:
1) SikaFix HH LV, by Sika Chemical Company.
2) Hydro Active Flex SLV, by De Neef Construction Chemicals, Inc.
3) Or equal.
c. Shrinkage limit shall not exceed 4.0 percent in accordance with ASTM D1042.
d. Minimum elongation of 250 percent in accordance with ASTM D3574.
e. Minimum tensile strength of 150 psi in accordance with ASTM D3574.
2. Hydrophilic Acrylate-Ester Resin:
a. Hydrophilic crack repair system shall be acrylate-ester resin that forms a flexible gasket and increase in volume a minimum of 50 percent when in contact with water.
b. Products and Manufacturers: Provide one of the following:
1) Duroseal Multigel 850, manufactured by BBZ USA, Inc.
2) Or equal.

2.11 CONCRETE REPAIR MATERIALS

A. Concrete repair mortar shall be pre-packaged, polymer-modified cementitious repair mortar with the following minimum properties:
1. Compressive Strength at One Day: 2,000 psi (ASTM C109).
2. Compressive Strength at 28 Days: 6,000 psi (ASTM C109).
3. Bond Strength at 28 Days: 1,800 psi (ASTM C882 modified).

B. Products and Manufacturers: Provide one of the following:
1. Five Star Structural Concrete, by Five Star Products, Inc. Use formulation recommended by manufacturer for the specific application conditions.
2. SikaTop 122 Plus, SikaTop 123 Plus, SikaTop 111 Plus, or Sikacem 133, by Sika Corporation. Use formulation from among those listed in

this paragraph recommended by manufacturer for specific application conditions.

3. Emaco S88-CA or S66-CR, by Master Builders Inc. Use formulation from among those listed in this paragraph recommended by manufacturer for specific application conditions.
4. Verticoat, Verticoat Supreme, or Euco SR-VO, by Euclid Chemical Company. Use formulation from among those listed in this paragraph recommended by manufacturer for specific application conditions.
5. Or equal.

C. Cement Mortar: Shall consist of mix of one part cement to 1.5 parts sand with sufficient water to form trowelable consistency. Minimum compressive strength at 28 days shall be 4,000 psi. Where required to match the color of adjacent concrete surfaces, blend white portland cement with standard portland cement so that, when dry, patching mortar matches the color of surrounding concrete.

2.12 CHEMICAL HARDENER

A. Provide clear chemical hardener of fluosilicate family.

B. Product and Manufacturer: Provide one of the following:
1. Lapidolith, by Sonneborn ChemRex Inc.
2. Hornolith, by A.C. Horn, Inc.
3. Or equal.

2.13 SHAKE-ON METALLIC HARDENER

A. Provide metallic hardener formulated, processed, and packaged under stringent quality control at metallic hardener manufacturer-owned and -controlled factory. Hardener shall be a mixture of specially-processed and -graded aggregate, selected portland cement, and plasticizing agents.

B. Product and Manufacturer: Provide one of the following:
1. Euco-Plate H.D., by Euclid Chemical Company.
2. Masterplate 200, by Master Builders, Inc.
3. Or equal.

2.14 VAPOR RETARDER

A. Vapor Retarder:
1. Vapor retarder membrane shall comply with the following.
   a. Water Vapor Transmission Rate, ASTM E96: 0.04 perms or lower.
   b. Water Vapor Retarder, ASTM E1745: Meets or exceeds Class C.
   c. Thickness of Retarder (plastic), ACI 302 1R: Not less than 10 mils.
2. Products and Manufacturers: Provide one of the following:
   a. Stego Wrap 10-mil Vapor Retarder, by Stego Industries LLC.
   b. Griffolyn 10-mil, by Reef Industries.
   c. Moistop Ultra, by Fortifiber Industries.
   d. Or equal.

B. Accessories:
   1. Provide accessories by same manufacturer as vapor retarder.
   2. Seam Tape:
      a. Tape shall have water vapor transmission rate (ASTM E96) of 0.3 perms or lower.
      b. Products and Manufacturers: Provide one of the following:
         1) Stego Tape by Stego Industries LLC.
         2) Griffolyn Fab Tape by Reef Industries.
         3) Moistop Tape by Fortifiber Industries.
         4) Or equal.
   3. Vapor Proofing Mastic:
      a. Mastic shall have a water vapor transmission rate ASTM E96, 0.3 perms or lower.
   4. Pipe Boots:
      a. Construct pipe boots from vapor barrier material, pressure sensitive tape, mastic, or a combination thereof, in accordance with manufacturer's recommendations.

2.15 SOURCE QUALITY CONTROL

A. Concrete materials may require testing, as directed by ENGINEER, at any time during the Work if concrete quality is in question. Provide access to material stockpiles and facilities at all times. Tests shall be done at no expense to OWNER.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine the substrate and conditions under which the Work will be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 CONCRETE MIXING

A. General:
   1. Concrete may be produced at batch plants or by the ready-mixed process. Batch plants shall comply with recommendations of ACI 304R and have sufficient capacity to produce concrete of qualities required and in quantities required to comply with the accepted Progress Schedule. All plant facilities are subject to acceptance of ENGINEER.
   2. Mixing:
      a. Mix concrete with a rotating type batch machine, except where hand mixing of very small quantities is approved by ENGINEER.
      b. Remove hardened accumulations of cement and concrete from drum and blades to ensure proper mixing action.
      c. Replace mixer blades upon loss of ten percent of mixer blades' original height.

B. Ready-Mix Concrete:
   1. Comply with ASTM C94 and the Contract Documents.
      a. Plant Equipment and Facilities: Conform to requirements of NRMCA certification.
      b. Mix concrete in revolving-type truck mixers that are in good condition and produce thoroughly-mixed concrete conforming to the Contract Documents.
      c. Do not exceed rated capacity of mixer.
      d. Mix concrete for minimum of two minutes after arrival at the Site, or as recommended by mixer manufacturer.
      e. Do not allow drum to mix while in transit.
      f. Mix at proper speed until concrete is discharged from mixer.
      g. Maintain adequate facilities at the Site for continuous delivery of concrete at required rates.
      h. Provide access to mixing plant for ENGINEER upon request.

C. Maintain equipment in proper operating condition, with drums cleaned before charging each batch. Schedule rates of delivery to prevent delay of placing concrete after mixing, or holding dry-mixed materials too long in mixer before the adding water and admixtures.

3.03 TRANSPORTING CONCRETE

A. Transport and place concrete not more than 90 minutes after water has been added to the dry ingredients.

B. Avoid spilling and separation of concrete mixture during transportation.

C. Do not place concrete in which the ingredients have separated.

D. Do not retemper partially set concrete.

E. Use suitable equipment for transporting concrete from mixer to forms.

3.04 PREPARATION FOR CONCRETING

A. Submit to ENGINEER laboratory trial batch test results for proposed mixes at least 15 days prior to start of Work. Do not begin concrete production until associated laboratory trial batch test result submittal has been approved by ENGINEER.

B. Notify ENGINEER a minimum of 24 hours in advance of placing concrete to allow for inspection of form work, joints, waterstops, reinforcement, embedded items, and vapor retarders. The section to be placed shall be fully prepared for concrete placement at the time of notice. Confirm inspection status with ENGINEER a minimum of 4 hours prior to concrete placement. Do not begin placing concrete until Work is in conformance with the Contract Documents.

C. Subgrade surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent

sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.

D. Reinforcing steel and embedded items shall be completely cleaned of mortar, loose rust, form release compounds, dirt, or any other substance which would interfere with proper bonding with concrete. Protective coatings on embedded aluminum items shall continuously cover the surface to be in contact with concrete. Any defects in the coating shall be repaired.

E. Do not place concrete until flow of water entering space to be filled with concrete has been properly stopped or has been diverted by pipes, or other means, and carried out of the forms, clear of the Work. Do not deposit concrete underwater, and do not allow water to rise on concrete surfaces until concrete has attained its initial set. Do not allow water to flow over concrete surface in manner and or velocity that will injure concrete surface finish. Provide temporary pumping or other dewatering operations for removing water as required.

F. Prepare joint surfaces in accordance with Section 03 15 00, Concrete Accessories.

G. Installation of Vapor Retarder:
   1. Provide vapor retarder under slabs-on-grade and outside walls to receive resilient floor finishes, carpet, ceramic and slate tile, chemical resistant coatings, and where shown or indicated on the Drawings.
   2. Install in accordance with manufacturer's instructions, ASTM E1643, and the following:
      a. Unroll vapor retarder with longest dimension parallel with direction of the pour.
      b. Lap vapor retarder over footings and seal to foundation walls.
      c. Overlap vapor retarder joints by six inches and seal with vapor retarder manufacturer's tape.
      d. Seal penetrations, including pipes, in accordance with vapor retarder manufacturer's instructions.
      e. Penetration of vapor retarder is not allowed except for reinforcing steel and permanent utilities.
      f. Repair damaged areas of vapor retarder by providing, for each damaged area, patch of vapor retarder material and overlapping damaged area with the patch by six inches on each side, and securely and continuously taping all four sides of patch to undamaged vapor retarder.

3.05 CONCRETE PLACEMENT

A. General:
   1. Place concrete continuously, so that no concrete will be placed on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. If section cannot be placed continuously, provide construction joints in accordance with Section 03 15 00, Concrete Accessories.

2. Deposit concrete as nearly as practical in its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to action that may cause segregation.
3. Screed concrete that is to receive other construction to proper level to avoid excessive skimming or grouting.
4. Do not use concrete that becomes non-plastic and unworkable, or does not conform to required quality limits, or that has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the Site and dispose of it in conformance with Laws and Regulations.
5. Do not place concrete until forms, bracing, reinforcing, and embedded items are each in final position and secure.
6. Do not place footings in freezing weather unless adequate precautions are taken against frost action.
7. Do not place footings, piers or pile caps on frozen soil.
8. Unless otherwise instructed, place concrete only when ENGINEER is present.
9. Allow minimum of three days between adjoining concrete placements.

B. Bonding for Next Concrete Pour:
1. Prepare for bonding of fresh concrete to concrete that has set but is not fully cured, as follows:
   a. Thoroughly wet the surface, but allow no free-standing water.
   b. For horizontal surfaces place a six-inch layer of Construction Joint Grout, as specified in Section 03 60 00, Grouting, over the hardened concrete surface.
   c. Place fresh concrete before the grout has attained its initial set.
2. Accomplish bonding of fresh concrete to fully cured, hardened, existing concrete by using a bonding agent as specified in Section 03 15 00, Concrete Accessories.

C. Concrete Conveying:
1. Handle concrete from point of delivery at the Site, transfer to concrete conveying equipment, and transfer to locations of final deposit as rapidly as practical by methods that prevent segregation and loss of concrete mix materials.
2. Provide mechanical equipment for conveying concrete to ensure continuous flow of concrete at delivery end of conveyor. Provide runways for wheeled concrete conveying equipment from concrete delivery point to locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice, and other deleterious materials.
3. Do not use chutes for distributing concrete, unless accepted by ENGINEER.
4. Pumping concrete is allowed, however do not use aluminum pipe for conveying concrete.

D. Placing Concrete into Forms:
1. Deposit concrete in forms in horizontal layers not deeper than 18 inches each and in manner that avoids inclined construction joints. Where placement consists of several layers, place concrete at such rate that concrete being integrated with fresh concrete while still plastic.

2. Do not allow concrete to free-fall within the form from height exceeding four feet. Where high-range water reducer is used to extend slump to at least six inches, maximum allowable free-fall of concrete is six feet. Use “elephant trunks” to prevent free-fall and excessive splashing of concrete on forms and reinforcing. Discontinue free-falls in excess of four feet if there is evidence of segregation.
3. Remove temporary spreaders in forms when concrete placing has reached elevation of such spreaders.
4. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidating concrete in accordance with applicable recommended practices in ACI 309. Vibration of forms and reinforcing is not allowed unless otherwise accepted by ENGINEER.
5. Where height of concrete placement in walls exceeds 14 feet, provide temporary windows in formwork to facilitate vibration. Properly close temporary windows when height of concrete approaches windows. Determine location, size, and spacing of temporary windows to suit equipment used.
6. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly-spaced locations not farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate the layer of concrete and at least six inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcing and other embedded items without causing segregation of concrete mix.
7. Do not place concrete in beam and slab forms until concrete previously placed in columns and walls is no longer plastic.
8. Prevent voids in the concrete. Force concrete under pipes, sleeves, openings, and inserts from one side until visible from the other side.

E. Placing Concrete Slabs:
1. Deposit and consolidate concrete slabs in continuous operation, within limits of construction joints, until placing of a slab panel or section is completed.
2. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcing and other embedded items and into corners.
3. Consolidate concrete placed in beams and girders of supported slabs, and against bulkheads of slabs on ground, as specified in this Article for formed concrete structures.
4. Bring slab surfaces to correct elevation and level. Smooth the surface, leaving surface free of humps or hollows. Do not sprinkle water on surface while concrete is plastic. Do not disturb slab surfaces prior to commencing concrete finishing.
5. Where slabs are placed in conditions of high temperature or wind that could lead to formation of plastic shrinkage cracks, provide evaporation retardant applied in accordance with retardant manufacturer’s recommendations, when required by ENGINEER.

F. Quality of Concrete Work:
   1. Concrete shall be solid, compact, and smooth, and free of laitance, cracks, and cold joints.
   2. Concrete for liquid-retaining structures, and concrete in contact with earth, water, or exposed directly to the elements shall be watertight.
   3. Cut out and properly replace to extent directed by ENGINEER, or repair to satisfaction of ENGINEER, surfaces with cracks or voids, that are unduly rough, or are defective in any other way. Thin patches or plastering are unacceptable.
   4. Leaks through concrete that exhibit flowing water, and cracks, holes, or other defective concrete in areas of potential leakage, shall be repaired and made watertight.
   5. Repair, removal, and replacement of defective concrete as directed by ENGINEER shall be at no additional cost to OWNER.

G. Cold Weather Placing:
   1. Protect concrete Work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures, in compliance with ACI 306 and the Contract Documents.
   2. When air temperature has fallen to or may be expected to fall below 40 degrees F, provide adequate means to maintain temperature in area where concrete is being placed between 50 degrees F and 70 degrees F for at least seven days after placing. Provide temporary housings or coverings including tarpaulins or plastic film. Maintain temporary heating and protection as necessary so that ambient temperature does not fall more than 30 degrees F in the 24 hours following the seven-day period. Avoid rapid dry-out of concrete due to overheating, and avoid thermal shock due to sudden cooling or heating.
   3. When air temperature has fallen to or is expected to fall below 40 degrees F, uniformly heat water and aggregates before mixing for concrete as required to obtain concrete mixture temperature not less than 55 degrees F and not more than 85 degrees F at point of placement.
   4. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Before placing concrete, verify that forms, reinforcing, and adjacent concrete surfaces are entirely free of frost, snow, and ice.
   ~~5.~~ Do not use salt or other materials containing antifreeze agents. Do not use chemical accelerators or set-control admixtures unless approved by ENGINEER and tested in mix design proposed for use.

H. Hot Weather Placing:
   1. When hot weather conditions exist that would impair the quality and strength of concrete, place concrete in compliance with ACI 305 and the Contract Documents.
   2. When ambient air temperature is at or above 90 degrees F and rising, cool ingredients before mixing concrete to maintain concrete temperature at time of placement below 80 degrees F. When ambient air temperature is at or above 90 degrees F and falling, cool the ingredients before mixing concrete to maintain concrete temperature at

time of placement below 85 degrees F. In no case shall the concrete temperature at time of placement exceed 90 degrees F.

3. Mixing water may be chilled, or chopped ice may be used to control concrete temperature provided the water equivalent of ice is calculated in total amount of mixing water. If required, reduce the time from addition of mix water to placement, or use set-retarding admixture.
4. Cover reinforcing materials with water-soaked burlap if ambient air temperature becomes too hot, so that reinforcing material temperature does not exceed ambient air temperature immediately before embedment of reinforcing in concrete.
5. Wet forms thoroughly before placing concrete.
6. Do not place concrete at temperature that causes difficulty from loss of slump, flash set, or cold joints.
7. Do not use set-control admixtures unless approved by ENGINEER in mix design.
8. Obtain ENGINEER's approval of substitute methods and materials proposed for use.

3.06 FINISHING OF FORMED SURFACES

A. Standard Form Finish:
   1. Standard form finish shall be basically smooth and even, but is allowed to have texture imparted by the form material used. Repair defects in accordance with the Contract Documents.
   2. Use standard form finish for the following:
      a. Exterior vertical surfaces from foundation up to one foot below grade.
      b. Vertical surfaces not exposed to view.
      c. Other areas shown or indicated.

B. Smooth Form Finish:
   1. Produce smooth form finish by selecting form materials that will impart smooth, hard, uniform texture. Arrange panels in orderly and symmetrical manner with minimum of seams. Repair and patch defective areas in accordance with the Contract Documents.
   2. Use smooth form finish for the following:
      a. Exterior surfaces exposed to view.
      b. Surfaces to be covered with coating material. Coating material may be applied directly to concrete or may be a covering bonded to concrete such as waterproofing, dampproofing, painting, or other similar system.
      c. Interior vertical surfaces of liquid-containers.
      d. Interior and exterior exposed beams and undersides of slabs.
      e. Surfaces to receive abrasive blasted finish.
      f. Surfaces to receive smooth rubbed or grout cleaned finish.
      g. Other areas shown or indicated.

C. Smooth Rubbed Finish:
   1. Provide smooth rubbed finish to concrete surfaces that have received smooth form finish and where defects have been repaired, as follows:
      a. Rubbing of concrete surfaces not later than the day after form removal.

b. Moistening of concrete surfaces and rubbing with carborundum brick or other abrasive until uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

2. Use smooth rubbed finish for the following:
   a. Interior exposed walls and other vertical surfaces.
   b. Exterior exposed walls and other vertical surfaces down to one foot below grade.
   c. Interior and exterior horizontal surfaces, except exterior exposed slabs and steps.
   d. Interior exposed vertical surfaces of liquid-containing structures down to one foot below normal operating liquid level.
   e. Other areas shown or indicated.

D. Grout Cleaned Finish:
1. Provide grout cleaned finish to concrete surfaces that have received smooth form finish and where defects have been repaired, as follows:
   a. Combine one part portland cement to 1.5 parts fine sand by volume, and mix with water to consistency of thick paint. Blend standard portland cement and white portland cement, in proportions determined by trial patches, so that final color of dry grout will closely match adjacent concrete surfaces.
   b. Thoroughly wet concrete surface and apply grout uniformly by brushing or spraying immediately to wetted surfaces. Scrub surface with cork float or stone to coat surface and fill surface holes. Remove excess grout by scraping, followed by rubbing with clean burlap to remove visible grout film. Keep grout damp during setting period by using fog spray on surface for at least 36 hours after final rubbing. Complete each area the same day the area is started, with limits of each area being natural breaks in the finished surface.
2. Use grout cleaned finish for the following:
   a. Interior exposed walls and other vertical surfaces.
   b. Exterior exposed walls and other vertical surfaces down to one foot below grade.
   c. Interior and exterior horizontal surfaces, except exterior exposed slabs and steps.
   d. Interior exposed vertical surfaces of liquid-containing structures down to one foot below normal operating liquid level.
   e. Other areas shown.

E. Related Unformed Surfaces:
1. At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise shown or indicated.

3.07 SLAB FINISHES

A. Float Finish:

1. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently. Check and level the surface plane to tolerance not exceeding 1/4-inch in ten feet when tested with a ten-foot straightedge placed on surface at not less than two different angles. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to uniform, smooth, granular texture.
2. Use float finish for the following:
    a. Interior exposed horizontal surfaces of liquid-containing structures, except those to receive grout topping.
    b. Exterior below-grade horizontal surfaces.
    c. Surfaces to receive additional finishes, except as shown or indicated.

B. Trowel Finish:
1. After floating, begin first trowel finish operation using power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over the surface.
2. Consolidate concrete surface by the final hand troweling operation. Finish shall be free of trowel marks, uniform in texture and appearance, and with surface plane tolerance not exceeding 1/8-inch in ten feet when tested with a ten foot straight edge. Grind smooth surface defects that would otherwise project through applied floor covering system.
3. Use trowel finish for the following:
    a. Interior exposed slabs, unless otherwise shown or indicated.
    b. Slabs that receive one of the following: resilient flooring, carpeting, or ceramic tile.

C. Non-Slip Broom Finish:
1. Immediately after float finishing, slightly roughen concrete surface by brooming in direction perpendicular to main traffic route. Use fine fiber-bristle broom, unless otherwise directed by ENGINEER. Coordinate required final finish with ENGINEER before applying finish.
2. Use non-slip broom finish for the following:
    a. Exterior exposed horizontal surfaces subject to lightweight foot traffic.
    b. Interior and exterior concrete steps and ramps.

D. Shake-On Metallic Finish:
1. For each slab shown or indicated to receive shake-on metallic finish, provide application of shake-on metallic hardener at rate of two pounds per square foot. First shake shall comprise two-thirds of specified quantity of hardener. Provide first application after initial floating operation, unless climatic conditions dictate earlier application. Shake-on metallic hardener shall be floated in the second application. Surface shall be floated again after second application to properly bond hardener to base concrete slab. Surface shall then be troweled at least twice to smooth, dense finish.
2. Furnish field service upon five days notice by the hardener manufacturer to assist CONTRACTOR in obtaining maximum benefits

of product under prevailing conditions at the Site. Hardener manufacturer's representative shall attend concrete coordination conference required in Article 1.03 of this Section.

3. Use shake-on metallic hardener finish with Class "C" concrete for slabs shown or indicated on the Drawings as receiving this finish.
4. Protect slabs against oil and greases. Remove from slab surface dripping, flaking, or loose substances and other bonded foreign particles that might prevent adhesion of finish.
5. Patch and repair other floor imperfections in accordance with hardener manufacturer's recommendations.

E. Scratched Finish:
1. After providing float finish, roughen concrete surface with rake before concrete's final set. Amplitude of surface shall be minimum of 1/4-inch.
2. Provide scratched finish for the following:
   a. Horizontal surfaces that will receive grout topping or concrete equipment pad.
   b. Surfaces so indicated on the Drawings or elsewhere in the Contract Documents.

3.08 CONCRETE CURING AND PROTECTION

A. General:
1. Protect freshly placed concrete from premature drying, excessive cold or hot temperatures, and maintain without drying at relatively constant temperature for period necessary for hydration of cement and proper hardening of concrete.
2. Start curing after placing and finishing concrete, as soon as free moisture has disappeared from concrete surface. Keep surface continuously moist during entire curing period. Cure for a minimum of 10 days and in accordance with ACI 301 procedures. For concrete sections over 30-inches thick, the curing period shall be for a minimum of 14 days. Avoid rapid drying at end of final curing period.
3. For curing, use water that is free of impurities that could etch or discolor exposed concrete surfaces.
4. Confine water for curing to area being cured.

B. Curing Methods: Curing methods are specified below. Curing methods to be used on each type of concrete surface are specified elsewhere in this Article.
1. Water Curing. Cure by one of the following methods:
   a. Keep concrete surface continuously wet.
   b. Ponding or immersion.
   c. Continuous water-fog spray.
   d. Covering concrete surface with curing mats, thoroughly saturating mats with water, and keeping mats continuously wet with sprinklers or porous hoses. Place curing mats to cover concrete surfaces and edges with four-inch horizontal lap over adjacent mats; provide eight-inch lap over adjacent mats at vertical surfaces. If necessary, weigh down curing cover to maintain contact with concrete surface.
2. Form Curing. Cure by one of the following methods:

a. Forms shall be maintained and loosened during curing period.
b. Immediately after forms are loosened or removed, continue with the required curing method as applicable, for remainder of curing period.
c. Where wood forms are kept in place, apply water to keep forms wet.

3. Moisture Retaining Cover Curing. Cure as follows:
   a. Cover concrete surfaces with the required moisture retaining cover for curing concrete, placed in widest practical width with sides and ends lapped at least three inches and sealed using waterproof tape or adhesive. Immediately repair holes or tears during curing period using cover material and waterproof tape.

C. Formed Surfaces: Use the following curing methods:
   1. Walls That Will Retain Liquid or That are Under Ground Surface:
      a. If forms are wood, form curing is allowed for entire curing period. If forms are steel, form curing is allowed for maximum of three days after which forms shall be removed so that concrete is free of the forms for remainder of the curing process.
      b. Immediately after the forms are loosened or removed, continue with water curing for remainder of curing period.
   2. Formed Slab Underside and Beam Surfaces Where Will Retain Liquid:
      a. Form curing is allowed for the full curing period.
      b. Immediately after forms are loosened or removed, continue with water curing for remainder of curing period.
   3. Vertical Joint Surfaces and Surfaces to Receive Surface Treatment:
      a. Form curing is allowed for entire curing period.
      b. Immediately after forms are loosened or removed, continue with water curing for remainder of curing period.
   4. Cure other formed surfaces using an appropriate curing method specified in the Contract Documents.

D. Unformed Surfaces: Treat with one of the following curing methods:
   1. Slabs and Mats That Will Retain Liquid or are Below Ground Surface:
      a. Water curing.
      b. Moisture-retaining cover curing when allowed by ENGINEER.
   2. Construction Joint Surfaces and Slab and Mat Surfaces to Receive Surface Treatment.
      a. Water curing.
      b. Moisture-retaining cover curing.
   3. Cure other formed surfaces using an appropriate curing method specified in the Contract Documents.

E. Temperature of Concrete During Curing:
   1. When ambient temperature is 40 degrees F or less, continuously maintain concrete temperature between 50 degrees F and 70 degrees F throughout curing period. When necessary, before concrete placing provide for temporary heating, covering, insulation, or housing as required to continuously maintain specified temperatures and moisture conditions throughout concrete curing period. Provide cold weather protection in accordance with ACI 306.

2. When the ambient temperature is 80 degrees F and above, or during other climatic conditions that would cause too-rapid drying of concrete, before starting concrete placing, provide wind breaks and shading as required, and fog spraying, wet sprinkling, or moisture retaining coverings as required. Continuously protect concrete throughout concrete curing period. Provide hot weather protection in accordance with ACI 305, unless otherwise specified.
3. Maintain concrete temperature as uniformly as possible, and protect from rapid ambient temperature changes. Avoid concrete temperature changes that exceed five degrees F in one hour and 50 degrees F in 24-hour period.

F. Protection:
1. During curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and damage by rain and flowing water. Protect finished concrete surfaces from damage by subsequent construction operations.

3.09 CONCRETE INSTALLATION TOLERANCES

A. Installation Tolerances:
1. Concrete placement tolerances, unless otherwise specified in the Contract Documents, shall be in accordance with ACI 117.
2. Notify ENGINEER in writing when concrete placement does not conform with required tolerances, as soon as the condition is known to CONTRACTOR.
3. When concrete installation does not conform to required tolerances, do not repair or correct by grinding unless specified in the Contract Documents or approved by ENGINEER in writing.
4. Verification Measurements:
   a. If surfaces where tolerances are in question, obtain measurements to verify conformance with tolerances in manner acceptable to ENGINEER.
   b. If surfaces tolerances are in question, cost of obtaining measurements shall be at no additional cost to the OWNER.
   c. Before obtaining measurements, obtain ENGINEER's acceptance of method proposed for obtaining measurements.
   d. After obtaining measurements, submit measurements to ENGINEER.
5. Submit with verification measurements submittal proposed method to rectify out-of-tolerance concrete. Do not start repair Work without obtaining ENGINEER's approval.

3.10 FIELD QUALITY CONTROL

A. Field Testing Services:
1. CONTRACTOR shall employ an independent testing laboratory to perform field quality control testing for concrete. ENGINEER will direct where samples are to be obtained.
2. Testing laboratory shall make standard compression test cylinders and entrained air tests as specified in this Article, under direct observation by ENGINEER or Resident Project Representative.

3. Testing laboratory will provide all labor, material, and equipment required for sampling and testing concrete, including: scale, glass tray, cones, rods, molds, air tester, thermometer, and other incidentals required.
4. Provide all curing and necessary cylinder storage as specified in Section 01 45 28, On-Site Facilities for Testing Laboratory.
5. Refer to Article 1.03 of this Section for required testing laboratory qualifications.

B. Quality Control Testing During Construction:
1. Perform sampling and testing for field quality control during placement of concrete, as follows:
   a. Sampling Fresh Concrete: ASTM C172.
   b. Slump: ASTM C143; one test for each concrete load at point of discharge.
   c. Concrete Temperature: ASTM C1064; one for every two concrete loads at point of discharge, and when a change in the concrete is observed. Test each load when time from batching to placement exceeds 75 minutes.
   d. Air Content: ASTM C231; one for every two concrete load at point of discharge, and when a change in the concrete is observed.
   e. Unit Weight: ASTM C138; one for every two concrete loads at point of discharge, and when a change in the concrete is observed.
   f. Compression Test Specimens:
      1) In accordance with ASTM C31; make one set of compression cylinders for each 50 cubic yards of concrete, or fraction thereof, of each mix design placed each day. Each set shall be four standard cylinders, unless otherwise directed by ENGINEER.
      2) Cast, store, and cure specimens in accordance with ASTM C31.
      3) Test and record the following when cylinders are cast: slump, concrete temperature, air content, and unit weight.
   g. Compressive Strength Tests:
      1) In accordance with ASTM C39; one specimen tested at seven days, and three specimens tested at 28 days.
      2) Adjust mix design if test results are unsatisfactory and resubmit for approval.
      3) Concrete that does not comply with strength requirements will be considered as defective Work.
   h. Water/Cementitious Materials Ratio: Perform test when required by ENGINEER in accordance with AASHTO TP23.
   i. Submit test results, certified by testing laboratory, to ENGINEER within 24 hours of completion of test.

C. Evaluation of Field Quality Control Tests:
1. Do not use concrete delivered to final point of placement having slump, concrete temperature, total air content or unit weight outside specified values.
2. Water/Cementitious Materials Ratio:

a. When water content testing indicates water/cementitious materials ratio to exceed specified requirements by greater than 0.02, remaining batches required to complete concrete placement shall have water content decreased in the mix and water reducing admixture dosage increased as required to bring subsequently-batched concrete within specified water/cementitious materials ratio.
b. Perform additional testing to verify compliance with specified water/cementitious materials ratio.
c. Do not resume concrete production for further concrete placement until CONTRACTOR has identified cause of excess water in the mix and revised batching procedures, or adjusted the mix design (and obtained ENGINEER's associated approval) to bring water/cementitious materials ratio into conformance with the Contract Documents.

3. Compressive Strength:
   a. Compressive strength tests for laboratory-cured cylinders will be acceptable if the averages of all sets of three consecutive compressive strength tests results equal or exceed specified 28-day design compressive strength of the associated type or class of concrete, and no individual strength test falls below required compressive strength by more than 500 psi.
   b. Questionable Field Conditions During Concrete Placement:
      1) Where questionable field conditions exist during concrete placement or immediately thereafter, strength tests of specimens cured under field conditions will be required by ENGINEER to check adequacy of curing and protecting of concrete placed. Specimens shall be molded at the same time and from the same samples as laboratory-cured specimens.
      2) Provide improved means and procedures for protecting concrete when 28-day compressive strength of field-cured cylinders is less than 85 percent of companion laboratory cured cylinders.
      3) When laboratory-cured cylinder strengths are appreciably higher than minimum required compressive strength, field-cured cylinder strengths need not exceed minimum required compressive strength by greater than 500 psi even though the 85 percent criterion may not be met.
      4) If individual tests of laboratory-cured specimens produce strengths more than 500 psi below the required minimum compressive strength, or if tests of field-cured cylinders indicate deficiencies in protection and curing, provide additional measures to ensure that load-bearing capacity of the structure is not jeopardized or impaired. If likelihood of low-strength concrete is confirmed and evaluations indicate load-bearing capacity may have been reduced, perform tests of cores from the concrete in question at CONTRACTOR's expense.
   c. If compressive strength tests fail to indicate compliance with minimum requirements of the Contract Documents, concrete represented by such tests will be considered defective.

D. Testing Concrete Structure for Strength:
   1. When there is evidence that strength of in-place concrete does not comply with the Contract Documents, CONTRACTOR shall employ the services of concrete testing laboratory to obtain cores from hardened concrete for compressive strength determination. Cores and tests shall comply with ASTM C42 and the following:
      a. Obtain at least three representative cores from each concrete member or suspect area of concrete at locations directed by ENGINEER.
      b. Strength of concrete for each series of cores will be acceptable if average compressive strength is at least 85 percent of specified compressive strength and no single core is less than 75 percent of required 28-day required concrete compressive strength.
      c. Testing laboratory shall submit test results to ENGINEER on same day that tests are completed. Include in test reports Project name and number (if any), date of sampling and testing, CONTRACTOR name, name of concrete testing laboratory, exact location of test core in the Work, type or class of concrete represented by core sample, nominal maximum size aggregate, design compressive strength, compression breaking strength, and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plane of concrete as placed, and moisture condition of the core at time of testing.
   2. Fill core holes solid with non-shrink grout in accordance with Section 03 60 00, Grouting, and finish to match adjacent concrete surfaces.
   3. If results of core tests are unacceptable or if it is impractical to obtain cores, perform static load test and evaluations complying with ACI 318 and ACI 350, as directed by ENGINEER.

E. Concrete Tolerance Verification Measurements: Refer to Article 3.09 of this Section.

F. Supplier's Services:
   1. Water-Reducing Admixture Manufacturer: Furnish services of qualified concrete technician employed by admixture manufacturer to assist in proportioning concrete for optimum use of admixture. Concrete technician shall advise on proper addition of admixture to concrete and on adjustment of concrete mix proportions to meet changing conditions at the Site.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Temporary Openings:
   1. Openings in concrete walls and slabs required for passage of Work are allowed only upon approval of ENGINEER.
   2. Temporary openings made in concrete shall be provided with waterstop in below-ground or liquid-retaining members and structures. Reinforcement going through and around the opening shall be made continuous to provide continuity and shall be approved by the ENGINEER.
   3. Temporary openings that remain in concrete structures shall be filled with the same class of concrete as the adjoining construction, after the

Work causing need for temporary opening is complete, unless otherwise shown or directed by ENGINEER. Mix, place, and cure concrete as specified in this Section to blend with in-place construction. Provide miscellaneous concrete filling shown or required to complete the Work.

B. Bases or Pads for Piping, Panels, and Equipment:
   1. Unless specifically shown or indicated otherwise, provide concrete bases or pads for equipment, floor-mounted panels, and floor-mounted supports for piping and similar construction. Provide all concrete pad and base Work not specifically included under other Sections.
   2. Dimensions and Elevations:
      a. Coordinate and construct bases and pads to dimensions shown or indicated, or as required to comply with equipment, panel, or piping manufacturer's requirements and elevations indicated on the Drawing.
      b. Unless otherwise shown or indicated, place concrete bases for equipment up to one-inch below the equipment manufacturer's base or mounting plate.
      c. Where specific dimensions or elevations are not shown or indicated, bases and pads shall be six inches thick and extend three inches outside dimensions of the equipment, panel, or supports.
   3. Finish: Bases and pads outside of areas to receive non-shrink grout shall have smooth trowel finish, unless special finish such as terrazzo, ceramic tile, quarry tile, or heavy-duty concrete topping is required. In such cases, provide appropriate concrete finish. Surfaces of bases and pads to receive non-shrink grout shall have broom finish.

C. Curbs:
   1. Provide monolithic finish to interior curbs by stripping forms while concrete is still green followed by steel-troweling surfaces to hard, dense finish with corners, intersections, and terminations slightly rounded.
   2. Exterior curbs shall have rubbed finish for vertical surfaces and broomed finish for top surfaces.

3.12 REPAIR OF CONCRETE PLACED UNDER THIS CONTRACT

A. Repair of Formed Surfaces:
   1. Repair the following defects in all formed finishes:
      a. Spalls, air bubbles, rock pockets, form depressions, and other defects that are more than 1/4-inch in depth.
      b. Holes from tie rods and other form tie systems.
      c. Fins, offsets, and other projections that extend more than 1/4-inch beyond designated concrete member surface.
      d. Structural cracks, as defined by ENGINEER.
      e. Non-structural cracks greater than 0.010-inch wide as defined by ENGINEER. In liquid-retaining structures, elevated slabs subject to the elements or washdowns, below-grade members, and cracks that evidence leakage. Where it is not possible to verify whether a crack is leaking, repair the crack.

2. Repair the following defects in smooth-finish surfaces, in addition to those listed above in this Section:
    a. Spalls, air bubbles, rock pockets, form depressions, and other defects that extend to more than 1/2-inch in width in any direction, no matter how deep.
    b. Spalls, air bubbles, rock pockets, form depressions, and other defects of any size that exceed three in number in a 12-inch by 12-inch area, or 12 in number in a three-foot by three-foot area.
    c. Fins, offsets, and other projections shall be completely removed and smoothed.
    d. Scratches and gouges in concrete surface.
    e. Texture and color irregularities. In liquid-retaining surfaces, texture and color irregularities need not be repaired when greater than 12 inches below minimum normal operating liquid surface elevation, except where such defects are indicative of reduced durability.
3. Where smooth rubbed or grout cleaned finish is specified, minor surface defects repairable by the finishing process need not be repaired prior to finish application, when approved by ENGINEER.

B. Method of Repair of Formed Surfaces:
1. Immediately after removing forms, repair and patch defective areas with cement mortar or concrete repair mortar as directed by ENGINEER. Make repairs made to liquid-retaining structures and below-grade surfaces with repair mortar only. Repair form tie holes in liquid-retaining or below-grade surfaces with non-shrink grout in accordance with Section 03 60 00, Grouting.
2. Honeycombs, Rock Pockets, and Holes Left by Tie Rods and Bolts:
    a. Cut out honeycomb, rock pockets, voids, and holes left by tie rods and bolts, down to solid concrete but, in no case, to depth less than one-inch for cement mortar and 1/2-inch for repair mortar. Make edges of cuts perpendicular to concrete surface.
    b. Before placing cement mortar, thoroughly clean and brush-coat area to be patched with specified bonding agent.
    c. When using concrete repair mortar, use of bonding agent is optional; prepare the surface and place mortar in accordance with mortar manufacturer's recommendations.
    d. Repairs at exposed-to-view surfaces shall match the color of surrounding concrete, except color matching is not required for interior surfaces of liquid-retaining surfaces up to one foot below typical minimum liquid level. Impart texture to repaired surfaces to match texture of existing adjacent surfaces. Provide test areas at inconspicuous locations to verify mixture, texture, and color match before proceeding with patching.
    e. Compact mortar in place and strike off slightly higher than the surrounding surface.
3. Structural Cracks: Pressure-grout structural cracks using injectable epoxy installed using pressurized system. Apply in accordance with epoxy manufacturer's directions and recommendations.
4. Non-structural Cracks: Shall be pressure-grouted using hydrophobic or hydrophilic resin. Install in accordance with resin manufacturer's directions and recommendations.

5. Determination of the crack type shall be made by the ENGINEER.
6. Holes Through Concrete:
   a. Using plunger-type gun or other suitable device, fill holes extending through concrete from least-exposed face, using flush stop held at exposed face; completely fill the hole with specified repair material.
   b. At below-grade and liquid-containing members, fill holes with concrete repair mortar and use color-matched cement mortar for outer two inches at exposed-to-view surfaces.
7. Where powerwashing or scrubbing is not adequate, abrasive blast exposed- to-view surfaces that require removal of stains, grout accumulations, sealing compounds, and other substances marring the surfaces. Use sand finer than No. 30 and air pressure from 15 to 25 psi.

C. Repair of Unformed Surfaces:
1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to specified tolerances for each surface and finish. Correct low and high areas in accordance with this Section.
2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using template having the required slope. Correct high and low areas in accordance with this Section.
3. Repair finish of unformed surfaces containing defects that adversely affect concrete durability. Surface defects include crazing, cracks in excess of 0.01-inch wide, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
4. Repair structural cracks in all structures and non-structural cracks in liquid-retaining structures. In liquid-retaining structures, where dry face of concrete member can be observed, repair all cracks evidencing any rate of water flow through crack. Where dry face of member cannot be observed, repair all cracks.

D. Methods of Repair of Unformed Surfaces:
1. Correct high areas in unformed surfaces by grinding, after concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.
2. Correct low areas in unformed surfaces, during or immediately after completion of surface finishing, by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Where repairs are required and concrete has already set, sawcut around perimeter of area to be repaired to depth of 1/2-inch and remove concrete so that minimum thickness of repair is 1/2-inch. Apply specified concrete repair mortar in accordance with repair mortar manufacturer's directions and recommendations.
3. Repair defective areas, except random cracks and single holes not exceeding one-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least 3/4-inch clearance all around. Minimum thickness of repair shall be 1.5 inches. Dampen concrete surfaces in contact with patching concrete and brush with specified bonding agent. Place patching concrete while bonding agent is tacky. Mix patching concrete of same materials and

proportions to provide concrete of same classification as original, adjacent concrete. Place, compact, and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

4. Repair isolated, random, non-structural cracks (in members that are not below grade or liquid-retaining), and single holes not greater than one-inch diameter, by dry-pack method. Groove top of cracks, and cut out holes to sound concrete, and clean repair area of dust, dirt, and loose particles. Dampen all cleaned concrete surfaces and brush with the specified bonding agent. Place dry-pack before cement grout takes its initial set. Mix dry-pack, consisting of one part portland cement to 2.5 parts fine aggregate passing No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for at least 72 hours.
5. Structural cracks shall be pressure-grouted using injectable epoxy. Apply in accordance with epoxy manufacturer's directions and recommendations.
6. Non-structural cracks in below-grade and liquid-retaining structures shall be pressure-grouted using hydrophilic resin. Apply in accordance with resin manufacturer's directions and recommendations.
7. Determination of crack type will be by ENGINEER.
8. Ensure that surface is acceptable for flooring material to be installed in accordance with flooring manufacturer's recommendations.

E. Other Methods of Repair:
   1. Repair methods not specified in this Section may be used when approved by ENGINEER.

END OF SECTION

SECTION 03 60 00

GROUTING

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install grout and perform grouting Work.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before grouting Work.

C. Related Sections:
   1. Section 03 15 00, Concrete Accessories.
   2. Section 03 30 00, Cast-In-Place Concrete.

D. Application and Grout Material:
   1. The following is a listing of grouting applications and the corresponding type of grout material to be provided for the associated application. Unless shown or indicated otherwise in the Contract Documents, provide grout in accordance with the following:

Table 03 60 00-A - GROUT APPLICATIONS AND MATERIAL TYPES

Application	Required Grout Material Type
Beam and column (one- or two-story height) base plates and precast concrete bearing less than 16 inches in the least dimension	Class II Non-Shrink
Column base plates and precast concrete bearing (greater than two-story height or larger than 16 inches in the least dimension)	Class I Non-Shrink
Base plates for storage tanks and other non-motorized equipment, and motorized equipment or machinery less than 50 horsepower	Class I Non-Shrink (unless otherwise recommended by equipment manufacturer)
Motorized equipment or machinery equal to and greater than 50 horsepower, and motorized equipment or machinery equipment less than 50 horsepower subject to severe shock loads or high vibration	Class III Non-Shrink Epoxy (unless otherwise recommended by equipment manufacturer)
Filling blockout spaces for embedded items such as railing posts, guide frames for hydraulic gates, and similar applications	Class II Non-Shrink (Class I where placement time exceeds 15 minutes)

Grout fill or grout toppings less than four inches thick	Grout Fill
Grout fill greater than four inches thick	Class "B" Concrete in accordance with Section 03 30 00, Cast-In-Place Concrete
Applications not listed above, where grout is indicated on the Drawings	Class I Non-Shrink, unless shown or indicated otherwise

1.02 REFERENCES

A. Standards referenced in this Section are:
   1. ACI 211.1, Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
   2. ACI 301, Structural Concrete for Buildings.
   3. ASTM C33/C33M, Specification for Concrete Aggregates.
   4. ASTM C109/C109M, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
   5. ASTM C230/C230M, Specification for Flow Table for Use in Tests of Hydraulic Cement.
   6. ASTM C531, Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
   7. ASTM C579, Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
   8. ASTM C827, Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
   9. ASTM C882/C882M, Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
   10. ASTM C939, Text Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
   11. ASTM C1107/C1107M, Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
   12. ASTM C1181, Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts.
   13. NSF/ANSI 61, Drinking Water System Components - Health Effects.

1.03 QUALITY ASSURANCE

A. Qualifications:
   1. Grout Testing Laboratory:
      a. Independent testing laboratory employed for design and testing of grout materials and mixes shall comply with testing laboratory requirements in Section 03 30 00, Cast-in-Place Concrete and other applicable requirements in the Contract Documents.
   2. Manufacturer: Shall have a minimum of five years experience of producing products substantially similar to that required and shall be able to submit documentation of at least five satisfactory installations that have been in successful operation for at least five years each.
   3. Manufacturer's Field Service Technician: When required, provide services of manufacturer's full-time employee, factory-trained in

handling, use, and installing the products required, with at least five years of experience in field applications of the products required.

B. Trial Batch:
   1. Each grout fill and construction joint grout mix proportion and design shall be verified by laboratory trial batch or field experience methods. Comply with ACI 211.1 and submit to ENGINEER a report with the following data:
      a. Complete identification of aggregate source of supply.
      b. Tests of aggregates for compliance with specified requirements.
      c. Scale weight of each aggregate.
      d. Absorbed water in each aggregate.
      e. Brand, type, and composition of cement.
      f. Brand, type, and amount of each admixture.
      g. Amounts of water used in trial mixes.
      h. Proportions of each material per cubic yard.
      i. Unit weight and yield per cubic yard of trial mixtures.
      j. Measured slump.
      k. Measured air content.
      l. Compressive strength developed at seven days and 28 days, from not less than three test specimens cast for each seven-day and 28-day test, and for each design mix.
   2. Laboratory Trial Batches: When laboratory trial batches are used to select grout proportions, prepare test specimens and conduct strength tests as specified in ACI 301.
   3. Field Experience Method: When field experience methods are used to select grout proportions, establish proportions as specified in ACI 301.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Schedule of Project-specific grout applications, installation locations, and the grout type proposed for each.
      b. List of grout materials and proportions for the proposed mix designs. Include data sheets, test results, certifications, and mill reports to qualify the materials proposed for use in the mix designs. Do not start laboratory trial batch testing until submittal is approved by ENGINEER.
      c. Trial Batch Reports: Submit laboratory test reports for grout materials and mix design tests.
   2. Product Data:
      a. Data sheets, certifications, and manufacturer's specifications for all materials proposed for use.

B. Informational Submittals: Submit the following:
   1. Manufacturer’s Instructions:
      a. Special instructions for shipping, storing, protecting, and handling.
      b. Installation instructions for the materials.
   2. Field Quality Control Submittals:
      a. Report field testing results for each required time period. (e.g., seven-day tests, 28-day tests). Submit within 24 hours after

completion of associated test. Each test report shall include results of all testing required at time of sampling.

3. Supplier Reports:
   a. Submit written report of results of each visit to Site by Supplier's field service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.
4. Qualifications Statements:
   a. Testing laboratory, when not submitted under other Sections.
   b. Manufacturer, when submittal of qualifications is required by ENGINEER.
   c. Manufacturer's field service technician, when submittal of qualifications is required by ENGINEER.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Storage of Materials: Store grout materials in a dry location, protected from weather and protected from moisture.

PART 2 PRODUCTS

2.01 NON-SHRINK GROUT MATERIALS

A. General: Non-shrink grout shall be a prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or container in which the materials are packaged. Specific formulation for each type or class of non-shrink grout specified in this Section shall be that recommended by the grout manufacturer for the particular application.

B. Class I Non-Shrink Grout:
   1. Class I non-shrink grouts shall have a minimum 28-day compressive strength of 7,000 psi. Use grout for precision grouting and where water-tightness and non-shrink reliability in both plastic and hardened states is critical, in accordance with Table 03 60 00-A in this Section.
   2. Products and Manufacturer: Provide one of the following:
      a. MasterFlow 928, by Master Builders, Inc.
      b. Five Star Grout, by Five Star Products, Inc.
      c. Hi-Flow Grout, by Euclid Chemical Company.
      d. Or equal.
   3. Comply with ASTM C1107/C1107M, Grade C and B (as modified below) when tested using amount of water required to achieve the following properties:
      a. Fluid consistency (20 to 30 seconds) shall be in accordance with ASTM C939.
      b. At temperatures of 45, 73.4, and 95 degrees F.
   4. Length change from placing to time of final set shall not have shrinkage greater than the expansion measured at three or fourteen days. Expansion at three or fourteen days shall not exceed the 28-day expansion.

5. Non-shrink property shall not be based on chemically-generated gas or gypsum expansion.
6. Fluid grout shall pass through the flow cone, with continuous flow, one hour after mixing.

C. Class II Non-Shrink Grout:
1. Class II non-shrink grouts shall have minimum 28-day compressive strength of 7,000 psi. Use grout for general-purpose grouting applications in accordance with Table 03 60 00-A in this Section.
2. Products and Manufacturer: Provide one of the following:
   a. MasterFlow 100, by Master Builders, Inc.
   b. FSP Construction Grout, by Five Star Products, Inc.
   c. NS Grout, by Euclid Chemical Company.
   d. Or equal.
3. Comply with ASTM C1107/C1107M and the following when tested using the quantity of water required to achieve the following properties:
   a. Flowable consistency (140 percent flow in accordance with ASTM C230/C230M, five drops in 30 seconds).
   b. Fluid working time of at least 15 minutes.
   c. Flowable for at least 30 minutes.
4. When tested, grout shall not bleed at maximum allowed water.
5. Non-shrink property shall not be based on chemically-generated gas or gypsum expansion.

D. Class III Non-Shrink Epoxy Grout:
1. Epoxy grout shall be a pourable, non-shrink, 100-percent solids system.

2. Products and Manufacturer: Provide one of the following:
   a. E3G, by Euclid Chemical Company.
   b. Sikadur 42 Grout Pak LE, by Sika Corporation.
   c. HP Epoxy Grout, by Five Star Products, Inc.
   d. Or equal.
3. Epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all pre-measured and prepackaged. Resin component shall not contain non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are unacceptable. Variation of component ratios is not allowed without specific recommendation by manufacturer. Manufacturer's instructions shall be printed on each container in which products are packaged.
4. The following properties shall be attained with the minimum quantity of aggregate allowed by epoxy grout manufacturer.
   a. Vertical volume change at all times before hardening shall be between zero percent shrinkage and 4.0 percent expansion when measured in accordance with ASTM C827 (modified for epoxy grouts by using an indicator ball with specific gravity between 0.9 and 1.1).
   b. Length change after hardening shall be less than 0.0006-inch per inch and coefficient of thermal expansion shall be less than 0.00003-inch per inch per degree F when tested in accordance with ASTM C531.

c. Compressive creep at one year shall be less than 0.001-inch per inch when tested under a 400-psi constant load at 140 degrees F in accordance with ASTM C1181.
d. Minimum seven-day compressive strength shall be 14,000 psi when tested in accordance with ASTM C579
e. Grout shall be capable of maintaining at least a flowable consistency for minimum of 30 minutes at 70 degrees F.
f. Shear bond strength to portland cement concrete shall be greater than shear strength of concrete when tested in accordance with ASTM C882/C882M.
g. Minimum effective bearing area shall be 95 percent.

2.02 GROUT MATERIALS OTHER THAN NON-SHRINK GROUT

A. General: Materials for grouts (other than non-shrink grouts) shall be in accordance with Section 03 30 00, Cast-In-Place Concrete, except as otherwise specified in this Section.

B. Grout Fill:
1. Grout fill shall be comprised of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed in accordance with this Section.
a. Minimum Compressive Strength: 4,000 psi at 28 days.
b. Maximum Water-Cement Ratio: 0.45 by weight.
c. Coarse Aggregate: ASTM C33/C33M, No. 8 size.
d. Fine Aggregate: ASTM C33/C33M, approximately 60 percent by weight of total aggregate.
e. Air Content: Seven percent (plus or minus one percent).
f. Minimum Cement Content: 564 pounds per cubic yard.
g. Slump for grout fill shall be adjusted to match placing and finishing conditions, and shall not exceed four inches.

C. Construction Joint Grout:
1. Construction joint grout shall be comprised of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned with similar cementitious characteristics as Class “A” concrete specified in Section 03 30 00, Cast-In-Place Concrete. Mix design shall result in grout that is flowable with high mortar content. Mix requirements are:
a. Minimum Compressive Strength: 4,500 psi at 28 days.
b. Maximum Water-Cement Ratio: 0.42 by weight.
c. Coarse Aggregate: ASTM C33/C33M, No. 8 size.
d. Fine Aggregate: ASTM C33/C33M, approximately 60 percent by weight of total aggregate.
e. Air Content: Seven percent (plus or minus one percent).
f. Minimum Cement Content: 752 pounds per cubic yard.
g. Slump for Construction Joint Grout: Seven inches (plus or minute one inch).

2.03 CURING MATERIALS

A. Curing materials shall comply with Section 03 30 00, Cast-in-Place Concrete, and shall be as recommended by the manufacturer of prepackaged grouts.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine substrate and conditions under which grouting will be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. General:
   1. Place grout as shown and indicated, and in accordance with Laws and Regulations and grout manufacturer's instructions. If manufacturer's instructions conflict with the Contract Documents, obtain clarification or interpretation from ENGINEER before proceeding.
   2. Consistency of non-shrink grouts shall be as required to completely fill the space to be grouted for the particular application. Do not install grout for dry-packing without approval of ENGINEER. When dry-packing is approved by ENGINEER, dry-pack consistency shall be such that grout has sufficient water to ensure hydration and grout strength development, and remains plastic, moldable, and that does not flow.
   3. Grouting shall comply with temperature and weather limitations in Section 03 30 00, Cast-In-Place Concrete.
   4. Cure grout in accordance with grout manufacturer’s instructions for prepackaged grout and Section 03 30 00, Cast-In-Place Concrete, for grout fill.

B. Columns and Beams:
   1. After shimming columns and beams to proper elevation, securely tighten anchors. Properly form around base plates allowing sufficient room around edges for placing grout. Provide adequate depth between bottom of base plate and top of concrete base to assure that void is completely filled with non-shrink grout.

C. Equipment Bases:
   1. Install equipment in accordance to manufacturer’s recommendations, Laws, and Regulations, and the Contract Documents. After shimming equipment to proper elevation, securely tighten anchors. Properly form around base plates, allowing sufficient room around edges for placing grout. Provide adequate depth between bottom of equipment base and top of concrete base to ensure that voids are completely filled with non-shrink grout.

D. Construction Joints:

1. Place a six-inch minimum thick layer of construction joint grout over contact surface of concrete at interface of horizontal construction joints in accordance with Section 03 15 00, Concrete Accessories, and Section 03 30 00, Cast-In-Place Concrete.

E. Grout Fill:
1. All mechanical, electrical, and finish work shall be completed prior to placing grout fill. Base slab shall be provided with a scratched finish in accordance with Section 03 30 00, Cast-In-Place Concrete. Roughen existing slabs shall by abrasive blasting or hydroblasting exposing aggregates to ensure bonding to base slab.
2. Minimum thickness of grout fill shall be one-inch. Where finished surface of grout fill is to form an intersecting angle of less than 45 degrees with concrete surface against which grout will be placed, form a key in the concrete surface at the intersection point. Key shall be minimum of 3.5 inches wide by 1.5 inches deep.
3. Thoroughly clean and wet base slab prior to placing grout fill. Do not place grout fill until slab is completely free of standing water. A thin coat of neat Type II cement slurry shall be broomed into surface of slab. Place grout fill while slurry is wet. Grout fill shall be compacted by rolling or tamping, brought to elevation, and floated. In tanks and basins where scraping-type equipment will be installed, grout fill shall be screeded by blades attached to revolving mechanism of equipment in accordance with procedures recommended by equipment manufacturer after grout is brought to elevation.
4. Grout fill placed on sloping slabs shall be installed uniformly from bottom of slab to top, for full width of placement.
5. Test grout fill surface with a straight edge to detect high and low spots; immediately correct high and low spots in grout fill. When grout fill has hardened sufficiently, grout fill shall be steel troweled to provide a smooth surface free of bug holes and other imperfections. While an acceptable type of mechanical trowel may be used in this operation, the last pass over the grout fill surface shall be by hand-troweling. During finishing, do not apply the following to the grout fill surface: water, dry cement, or mixture of dry cement and sand.
6. Cure and protect grout fill in accordance with Section 03 30 00, Cast-In-Place Concrete.

3.03 FIELD QUALITY CONTROL

A. Field Testing Services:
1. CONTRACTOR shall employ an independent testing laboratory to perform field quality control testing for grout. ENGINEER will direct where samples are to be obtained.
2. CONTRACTOR shall provide all curing and necessary cube storage as specified in Section 01 45 28, On-Site Facilities for Testing Laboratory.
3. Comply with testing laboratory requirements in Section 03 30 00, Cast-In-Place Concrete for required testing laboratory qualifications.

B. Quality Control Testing During Construction:
1. Grout Fill: Perform sampling and testing for field quality control during grout fill placing as follows:

a. Sampling Fresh Grout Fill: ASTM C172.
b. Slump: ASTM C143; one test for each load of grout at point of discharge.
c. Air Content: ASTM C231; one sample for every two grout loads at point of discharge, and when a change in the grout is observed.
d. Compression Test Specimens:
1) In accordance with ASTM C109/C109M; make one set of compression cubes for each 50 cubic yards of grout, or fraction thereof, of each mix design placed each day. Each set shall be four standard cubes, unless otherwise directed by ENGINEER.

2. Non-shrink Grout: Perform sampling and testing for field quality control during non-shrink grout placing as follows:
a. Perform compression testing of non-shrink grout in accordance to ASTM C109/C109M at intervals during construction as selected by ENGINEER. Make a set of four specimens for testing compressive strength at a period of time selected by the ENGINEER.
b. Perform compression tests on epoxy grout and fabricate specimens for epoxy grout testing in accordance with ASTM C579, Method B, at intervals during construction as selected by the ENGINEER. Make a set of four specimens for testing compressive strength at a period of time selected by ENGINEER.

C. Evaluation of Field Quality Control Tests:
1. Do not use grout, delivered to final point of placement, having slump or total air content that does not comply with the Contract Documents.
2. Compressive strength tests for laboratory-cured cubes will be acceptable if averages of all sets of three consecutive compressive strength test results equal or exceed the required 28-day design compressive strength of the associated type of grout.
3. If the compressive strength tests do not comply with the requirements in the Contract Documents, the grout represented by such tests will be considered defective and shall be removed and replaced, or subject to other action required by ENGINEER, at CONTRACTOR's expense.

D. Manufacturer's Services:
1. Manufacturers of proprietary materials shall make available upon 72 hours notification the services of qualified, full time employee, experienced in serving as a field service technician for the products required, to aid in assuring proper use of products under the actual conditions at the Site.

END OF SECTION

SECTION 05 05 33

ANCHOR SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install anchor systems.
   2. This Section includes all anchor systems required for the Work, but not specified under other Sections.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before anchor systems Work.

1.02 REFERENCES

A. Standards referenced in this Section are:
   1. ACI 318, Building Code Requirements for Structural Concrete.
   2. ACI 350, Code Requirements for Environmental Engineering Concrete Structures.
   3. ACI 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete.
   4. ASTM A194/A194M, Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
   5. ASTM A276, Specification for Stainless Steel Bars and Shapes.
   6. ASTM A493, Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging.
   7. ASTM A563, Specification for Carbon and Alloy Steel Nuts.
   8. ASTM A1011/A1011M, Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
   9. ASTM B633, Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
   10. ASTM C307, Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings.
   11. ASTM C579, Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
   12. ASTM C881/C881M, Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
   13. ASTM D695, Test Method for Compressive Properties of Rigid Plastics.
   14. ASTM D790, Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

15. ASTM E329, Specification for Agencies Engaged in Construction Inspection and/or Testing.
16. ASTM E488, Test Methods for Strength of Anchors in Concrete and Masonry Elements.
17. ASTM F593, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
18. ASTM F594, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
19. ASTM F1554, Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength.
20. FS A-A-1922A, Shield, Expansion (Caulking Anchors, Single Lead).
21. FS A-A-1923A, Concrete Expansion Anchors.
22. FS A-A-1925A, Shield, Expansion (Nail Anchors).
23. FS A-A-55614, Shield, Expansion (non-drilling expansion anchors).
24. ICC-ES AC01, Acceptance Criteria for Expansion Anchors in Masonry Elements.
25. ICC-ES AC58, Acceptance Criteria for Adhesive Anchors in Masonry Elements.
26. ICC-ES AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
27. ICC-ES AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
28. ISO 3506-1, Mechanical Properties of Corrosion-Resistant Stainless Steel Fasteners -- Part 1: Bolts, Screws and Studs.
29. ANSI/MSS SP-58, Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.
30. NSF/ANSI 61, Drinking Water System Components – Health Effects.

1.03 QUALITY ASSURANCE

A. Qualifications:
   1. Testing Laboratory: Shall comply with ASTM E329 and shall be experienced in tension testing of post-installed anchoring systems.
   2. Post-installed Anchor Installer: Shall be experienced and trained by post-installed anchor system manufacturer in proper installation of manufacturer's products. Product installation training by distributors or manufacturer's representatives is unacceptable unless the person furnishing the training is qualified as a trainer by the anchor manufacturer.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Listing of all anchor systems products intended for use in the Work including product type, intended location in the Project, and embedded lengths.
   2. Product Data:
      a. Manufacturer's specifications, load tables, dimension diagrams, acceptable base material conditions, acceptable drilling methods, and acceptable bored hole conditions.

b. When required by ENGINEER, copies of valid ICC ES reports that presents load-carrying capacities and installation requirements for anchor systems.

B. Informational Submittals: Submit the following:
1. Certificates:
a. For each type of anchor bolt or threaded rod, submit copies of laboratory test reports and other data required to demonstrate compliance with the Contract Documents.
b. Post-installed anchor system manufacturer's certification that installer received training in the proper installation of manufacturer's products required for the Work.
2. Manufacturer's Instructions:
a. Installation instructions for each anchor system product proposed for use, including bore hole cleaning procedures and adhesive injection, cure and gel time tables, and temperature ranges (storage, installation and in-service).
3. Field Quality Control Submittals:
a. Submit results of field quality control testing and inspections performed by testing laboratory.

1.05 DELIVERY, STORAGE AND HANDLING

A. Storage and Protection:
1. Keep materials dry during delivery and storage.
2. Store adhesive materials within manufacturer's recommended storage temperature range.
3. Protect anchor systems from damage at the Site. Protect products from corrosion and deterioration.

PART 2 PRODUCTS

2.01 SYSTEM PERFORMANCE

A. General:
1. At locations where conditions dictate that Work specified in other Sections is to be of corrosion resistant materials, provide associated anchor systems of stainless steel materials, unless other corrosion-resistant anchor system material is specified. Provide anchor systems of stainless steel materials where stainless steel materials are required in the Contract Documents.
2. Stainless Steel Nuts:
a. For anchor bolts and adhesive anchors, provide ASTM A194/A194M, Grade 8S (Nitronic 60) stainless steel nuts for stainless steel anchors used for anchoring equipment, gates, and weirs, and other locations, if any, where the attachment will require future removal for operation or maintenance. Provide lock washer or double nuts on each anchorage device provided for equipment, as required by equipment manufacturer.
b. For other locations, provide for each anchorage device a nut as specified or as required by anchor manufacturer. When ASTM

A194/A194M, Grade 8S (Nitronic 60) nuts are not required for anchor bolts and adhesive anchors as specified in this Section, provide anti-seizing compound where stainless steel rods are used with stainless steel nuts of the same type.

3. Materials that can contact potable water or water that will be treated to become potable shall be listed in NSF/ANSI 61.

B. Design Criteria

1. Size, Length, and Load-carrying Capacity: Comply with the Contract Documents. When size, length or load-carrying capacity of anchor system is not otherwise shown or indicated, provide the following:
   a. Anchor Bolts: Provide size, length, and capacity required to carry design load based on values and requirements of Paragraph 3.02A of this Section. For conditions outside limits of critical edge distance and spacing in Paragraph 3.02A of this Section, minimum anchor bolt embedment as shown or indicated in Paragraph 3.02A of this Section apply and capacity shall be based on requirements of Laws and Regulations, including applicable building codes.
   b. Adhesive Anchors, Expansion Anchors, or Concrete Inserts: Provide size, length, type, and capacity required to carry design load. Anchor capacity shall be based on the procedures required by the building code in effect at the Site. Where Evaluation Service Reports issued by the ICC Evaluation Service are required in this Section, anchor capacities shall be based on design procedure required in the applicable ICC Evaluation Service Report.
      1) General: Determine capacity considering reductions due to installation and inspection procedures, embedment length, strength of base fastening materials, spacing, and edge distance, as indicated in the manufacturer's design guidelines. For capacity determination, concrete shall be assumed to be in the cracked condition, unless calculations demonstrate that the anchor system will be installed in an area that is not expected to crack under any and all conditions of design loading.
      2) Concrete Adhesive Anchors: Unless otherwise shown or indicated in the Contract Documents or approved by ENGINEER, provide minimum embedment depth of the greater of the following: required to develop tensile strength of anchor, or a minimum embedment of 10 anchor diameters; and minimum anchor spacing and edge distance of 12 anchor diameters.
      3) Concrete Masonry Adhesive Anchors: Unless otherwise shown or indicated in the Contract Documents or approved by ENGINEER, provide minimum anchor spacing and edge distance as indicated in anchor manufacturer's instructions.
      4) Concrete Expansion Anchors: Unless otherwise shown or indicated in the Contract Documents or approved by ENGINEER, provide minimum embedment depth of six anchor diameters, and minimum anchor spacing and edge distance of seven anchor diameters.

5) Concrete Masonry Expansion Anchors: Unless otherwise shown or indicated in the Contract Documents or approved by ENGINEER, provide minimum anchor spacing and edge distance as indicated in anchor manufacturer's instructions.
6) Concrete Undercut Anchors: Unless otherwise shown or indicated in the Contract Documents, or approved by ENGINEER, provide minimum anchor spacing and edge distance as tabulated in anchor manufacturer's instructions.

2. Design Loads. Comply with the Contract Documents. When design load of supported material, equipment, or system is not otherwise shown or indicated, provide the following:
   a. Equipment Anchors: Use design load recommended by equipment manufacturer. When equipment can be filled with fluid, use loads that incorporate equipment load and load imposed by fluid.
   b. Pipe Hangers and Supports: Use full weight of pipe, and fluid contained in pipe that are tributary to the support plus the full weight of valves and accessories located between the hanger or support being anchored and the next hanger or support.
   c. Hangers and Supports for Electrical Systems, and HVAC, Plumbing, and Fire Suppression Systems and Piping: Use the full weight of supported system that is tributary to the support plus the full weight of accessories located between the hanger or support being anchored and the next hanger or support. When piping or equipment is to be filled with fluid, anchor systems shall be sized to support such loads in addition to the weight of the equipment, piping, or system, as applicable.
   d. Delegated Design: When anchor systems are used for supporting materials, equipment, or systems delegated to a design professional retained by CONTRACTOR, Subcontractor, or Supplier, provide anchor system suitable for loads indicated in delegated design documents and consistent with the design intent expressed in the Contract Documents.

C. Application:
   1. Anchor Bolts:
      a. Where anchor bolt is shown or indicated, use cast-in-place anchor bolt unless another anchor type is approved by ENGINEER.
      b. Provide anchor bolts as shown or indicated, or as required to secure structural element to appropriate anchor surface.
   2. Concrete Adhesive Anchors:
      a. Use where adhesive anchors are shown or indicated for installation in concrete.
      b. Suitable for use where subject to vibration.
      c. Suitable for use in exterior locations or locations subject to freezing.
      d. Suitable for use in submerged, intermittently submerged, or buried locations.
      e. Do not use in overhead applications, unless otherwise shown or approved by ENGINEER.
      f. Do not use for pipe hangers, unless otherwise shown or approved by ENGINEER.
   3. Grout-filled Concrete Masonry Adhesive Anchors:

a. Use where adhesive anchors are shown or indicated for installation in grout-filled concrete masonry units.
b. Suitable for use where subject to vibration.
c. Suitable for use in exterior locations or locations subject to freezing.
d. Do not use for pipe hangers, unless otherwise shown or approved by ENGINEER.

4. Hollow Concrete Masonry Adhesive Anchors:
   a. Use where adhesive anchors are shown or indicated for installation in hollow concrete unit masonry.
   b. Suitable for use where subject to vibration.
   c. Suitable for use in exterior locations or locations subject to freezing.
   d. Do not use for pipe hangers, unless otherwise shown or approved by ENGINEER.
5. Concrete Wedge Expansion Anchors:
   a. Use where expansion anchors are shown or indicated for installation in concrete.
   b. Do not use where subject to vibration.
   c. Do not use in exterior locations or locations subject to freezing.
   d. Do not use in submerged, intermittently submerged, or buried locations.
   e. Suitable for use in overhead applications.
6. Grout-filled Concrete Masonry Wedge Expansion Anchors:
   a. Use where expansion anchors are shown or indicated for installation on the interior face of grout-filled unit masonry.
   b. Do not use where subject to vibration.
   c. Do not use in exterior locations or locations subject to freezing.
7. Hollow Concrete Masonry Sleeve Expansion Anchors:
   a. Use where expansion anchors are shown or indicated for installation in hollow concrete unit masonry or solid brick.
   b. Do not use for attaching safety-related systems, such as piping conveying hazardous or potentially hazardous materials, or fire suppression systems.
   c. Do not use where subject to vibration.
   d. Do not use in exterior locations or locations subject to freezing.
8. Drop-in Expansion Anchors:
   a. Use drop-in expansion anchors installed in concrete where light-duty anchors are required to support piping or conduit two-inch diameter or smaller.
   b. Do not use for attaching safety-related systems, such as piping conveying hazardous or potentially hazardous materials, or fire suppression systems.
   c. Do not use where subject to vibration.
   d. Do not use at submerged, intermittently submerged, or buried locations.
   e. Do not use in exterior locations or locations subject to freezing.
   f. Suitable for use in overhead applications.
9. Concrete Undercut Anchors:
   a. Use where undercut anchors are shown or indicated for installation in concrete.

b. Suitable for use where subject to vibration.
c. Do not use in submerged, intermittently submerged, or buried locations.
d. Do not use in exterior locations or locations subject to freezing.
e. Suitable for use in overhead applications.

10. Concrete Inserts:
    a. Use only where shown or indicated in the Contract Documents.
    b. Allowed for use to support pipe hangers and pipe supports for pipe size and loading recommended by the concrete insert manufacturer.
11. Drive-In Expansion Anchors:
    a. Use drive-in expansion anchors installed in concrete, precast concrete, grouted masonry units, or brick, where light-duty anchors are required to support piping or conduit one-inch diameter and smaller.
    b. Do not use for attaching safety-related systems, such as piping conveying hazardous or potentially hazardous materials, or fire suppression systems.
    c. Do not use in overhead applications.

2.02 MATERIALS

A. Anchor Bolts:
1. Interior Dry Non-corrosive Locations: Provide straight threaded carbon steel rods complying with ASTM F1554, Grade 36, with heavy hex nuts complying with ASTM A563 Grade “A”, unless otherwise shown or indicated on the Drawings. Hooked anchor bolts are unacceptable.
2. Exterior, Buried, Submerged Locations, or When Exposed to Wastewater: Provide stainless steel straight threaded rods complying with ASTM F593, AISI Type 316, Condition A, with ASTM F594, AISI Type 316, stainless steel nuts. Provide ASTM A194/A194M, Grade 8S (Nitronic 60) stainless steel nuts where required. Other AISI types may be used when approved by ENGINEER. Hooked bolts are unacceptable.
3. Equipment: Provide anchor bolts complying with material requirements of this Section and equipment manufacturer’s requirements relative to size, embedment length, and anchor bolt projection. Anchor bolts shall be straight threaded rods with washers and nuts as specified in this Section. Hooked bolts are unacceptable.
4. Anchoring of Structural Elements: Provide anchor bolts of size, material, and strength shown or indicated in the Contract Documents.

B. Concrete Adhesive Anchors:
1. General:
    a. Adhesive anchors shall consist of threaded rods anchored into hardened concrete using an adhesive system.
2. Products and Manufacturers: Provide one of the following:
    a. HIT-RE 500-SD Injection Epoxy Adhesive Anchoring System, by Hilti Fastening Systems, Inc.
    b. SET-3G High-Strength Epoxy Adhesive, by Simpson Strong-Tie Company, Inc.
    c. Or equal.

3. Adhesive:
   a. Adhesive system shall use two-component adhesive mix.
   b. Epoxy adhesives shall comply with physical requirements of ASTM C881/C881M, Type IV, Grade 2 and 3, Class A, B, and C, except gel times.
   c. Adhesives shall have a current evaluation report by ICC Evaluation Service for use in both cracked and uncracked concrete with seismic recognition for SDC A through F as tested and assessed in accordance with ICC-ES AC308.
   d. Adhesives shall have minimum bond strength and minimum design bond strength (bond strength multiplied by strength reduction factor) in accordance with Table 05 05 33-A:

TABLE 05 05 33-A:-ADHESIVE BOND STRENGTH [1,2]

Anchor	**Uncracked Concrete**		**Cracked Concrete**	
Rod Diameter / Dowel Size	**Bond Strength (psi)**	**Design Bond Strength (psi)**	**Bond Strength (psi)**	**Design Bond Strength (psi)**
3/8-inch / #3	2040	1300	1090	700
1/2-inch / #4	1920	1200	920	560
5/8-inch / #5	1830	1150	710	390
3/4-inch / #6	1760	1050	710	460
7/8inch / #7	1670	900	610	340
1-inch / #8	1650	1050	850	460
- / #9	1900	1000	800	400
1.25-inch/ #10	1580	1000	730	400

Table Notes:
1. Bond strengths listed for hammer-drilled, dry hole.
2. Bond strengths listed for maximum short term concrete temperature of 110 degrees F and maximum long term concrete temperature of 75 degrees F.

4. Anchor:
   a. Provide continuously-threaded, AISI Type 316 stainless steel adhesive anchor rod. Threaded rods shall comply with the concrete adhesive anchor manufacturer's specifications as included in the ICC Service Evaluation Report for the anchor submitted. Nuts shall have specified proof load stresses equal to or greater than the minimum tensile strength of the stainless steel threaded rod used. Provide ASTM A194/A194M, Grade 8S (Nitronic 60) stainless steel nuts where required.

C. Grout-filled Concrete Masonry Adhesive Anchors:
   1. General:
      a. Adhesive anchors shall consist of threaded rods anchored into grout-filled concrete block masonry using an adhesive system.
   2. Products and Manufacturers: Provide one of the following:
      a. HIT-HY 150 Max Adhesive Anchoring System, by Hilti Fastening Systems, Inc.
      b. Acrylic-Tie Adhesive, by Simpson Strong-Tie Company, Inc.
      c. Or equal.

3. Adhesive:
    a. Adhesive system shall use two-component adhesive mix.
    b. Acrylate hybrid adhesives shall comply with the following:
        1) ASTM C579 compressive strength greater than 7,252 psi, or ASTM D695 compressive yield strength greater than or equal to 10,210 psi.
        2) ASTM C307 modulus of elasticity greater than 507,000 psi or ASTM D695 compressive modulus of elasticity greater than 660,800 psi.
    c. Adhesives shall have current ICC Evaluation Service Report for use in grout-filled concrete masonry, tested and assessed in accordance with ICC-ES 58.
4. Anchor:
    a. Provide stainless steel adhesive anchor rod complying with ASTM F593, AISI Type 316, Condition CW, with ASTM F594, AISI Type 316 stainless steel nuts. Provide ASTM A194/A194M, Grade 8S (Nitronic 60) stainless steel nuts where required.

D. Hollow Concrete Masonry Adhesive Anchors:
1. General:
    a. Adhesive anchors shall consist of threaded rods with a cylindrical mesh steel or plastic screen tube anchored into hollow concrete block masonry using an adhesive system.
2. Products and Manufacturers: Provide one of the following:
    a. HIT-HY 20 for Masonry Anchoring System, by Hilti Fastening Systems, Inc.
    b. Acrylic-Tie Anchoring Adhesive, by Simpson Strong-Tie Company, Inc.
    c. Or equal.
3. Adhesive:
    a. Adhesive system shall use two-component adhesive mix.
    b. Hybrid adhesives shall comply with the following:
        1) ASTM D695 compressive strength, greater than 7,410 psi.
        2) ASTM D790 modulus of elasticity: 0.33×10^6 psi or ASTM D695 compressive modulus of elasticity greater than 0.668×10^6 psi.
    c. Adhesives shall have a current ICC Evaluation Service Report for use in hollow concrete masonry as tested and assessed in accordance with ICC-ES AC58.
4. Anchor:
    a. Provide stainless steel adhesive anchor rod complying with ASTM F593, AISI Type 316, Condition CW, with ASTM F594, AISI Type 316, stainless steel nuts. Provide ASTM A194/A194M, Grade 8S (Nitronic 60) stainless steel nuts where required.
5. Mesh Screen Tube:
    a. Provide with mesh size, length, and diameter as specified by adhesive anchor manufacturer.
    b. Mesh shall be AISI 304 stainless steel.

E. Concrete Wedge Expansion Anchors:
1. General:

a. Concrete wedge expansion anchors shall consist of stud, wedge, nut, and washer.

2. Products and Manufacturers: Provide one of the following:
   a. Kwik Bolt TZ Wedge Anchor, by Hilti Fastening Systems, Inc.
   b. Or equal.
3. Anchors shall comply with physical requirements of FS A-A-1923A, Type 4. Provide concrete wedge expansion anchors suitable for use in cracked and uncracked concrete in accordance with ACI 318 and ACI 350, Appendix D. Demonstrate suitability of cracked concrete wedge anchors in accordance with ACI 355.2 prequalification tests.
4. Interior Dry Non-corrosive Locations: Provide carbon steel anchors complete with nuts and washers, zinc plated, in accordance with ASTM B633.
5. Other Locations: Provide expansion anchors complete with nuts and washers, AISI Type 304 stainless steel anchor body, in accordance with ASTM A276 or ASTM A493.
6. Concrete wedge expansion anchors shall have a current ICC Evaluation Service Report for use in both cracked and uncracked concrete with seismic recognition in seismic design Categories A through F when tested and assessed in accordance with ICC-ES AC193.

F. Grout-filled Masonry Wedge Expansion Anchors:
   1. General:
      a. Grout-filled masonry wedge expansion anchors shall each consist of stud, wedge, nut, and washer.
   2. Product and Manufacturers: Provide one of the following:
      a. Kwik-Bolt 3 Expansion Anchors, by Hilti Fastening Systems, Inc.
      b. Wedge-All Wedge Anchors, by Simpson Strong-Tie Company, Inc.
      c. Or equal.
   3. Anchors shall comply with physical requirements of FS A-A-1923A, Type 4. Anchors shall be non-bottom bearing type with single-piece steel expansion clip providing 360-degree contact with base material and shall not require oversized holes for installation.
   4. Interior Dry Non-corrosive Locations: Provide carbon steel anchors complete with nuts and washers, zinc plated, in accordance with ASTM B633.
   5. Other Locations: Provide AISI Type 316 stainless steel anchor, complete with nut and washer, in accordance with ASTM A276 or ASTM A493.
   6. Grout-filled masonry wedge expansion anchors shall have a current ICC Evaluation Service report for use in fully-grouted concrete masonry construction when tested and assessed in accordance with ICC-ES AC01.

G. Hollow Concrete Masonry Sleeve Expansion Anchors:
   1. General:
      a. Sleeve expansion anchors shall each consist of an externally threaded stud with full length expanding sleeve.
   2. Products and Manufacturers: Provide one of the following:
      a. HLC Sleeve Anchors, by Hilti Fastening Systems, Inc.
      b. Dynabolt Sleeve Anchors, by ITW Red Head.

c. Or equal.

3. Anchors shall comply with physical requirements of FS A-A-1922A. Anchors shall be non-bottom bearing type with single-piece steel expansion sleeve providing 360-degree contact with base material, and shall not require oversized holes for installation.
4. Interior Dry Non-corrosive Locations: Provide carbon steel anchors complete with nuts and washers, zinc plated, in accordance with ASTM B633.
5. Other Locations: Provide expansion anchors complete with nuts and washers, Type 304 stainless steel, in accordance with ASTM A276 or ASTM A493.

H. Drop-in Expansion Anchors:
1. General:
   a. Drop-in expansion anchors shall each consist of an internally threaded, deformation-controlled expansion anchor with pre-assembled expander plug.
2. Products and Manufacturers: Provide one of the following:
   a. HDI Drop-In Anchors, by Hilti Fastening Systems, Inc.
   b. Drop-In Anchor, by Simpson Strong-Tie Company, Inc.
   c. Or equal.
3. Provide carbon steel anchors complete with nuts and washers, zinc plated, in accordance with ASTM B633, complying with physical requirements of FS A-A-55614, Type I. Anchors shall be flush or shell type. Provide low-profile anchors for use in precast concrete planks.

I. Concrete Undercut Anchors:
1. General:
   a. Each concrete undercut anchor shall consist of threaded stud, thick-walled expansion sleeve, expander coupler, and nut and washer. Anchors shall be pre-set type or through-set type, as shown on the Drawings.
2. Products and Manufacturers: Provide one of the following:
   a. HDA Undercut Anchor, by Hilti Fastening Systems, Inc.
   b. DUC Ductile Undercut Anchor, by USP Structural Connectors.
   c. Or equal
3. Provide concrete undercut expansion anchors in accordance with ACI 318 and ACI 350, Appendix D. Demonstrate suitability of cracked concrete undercut anchors in accordance with ACI 355.2 prequalification tests.
4. Installed anchor shall exhibit form fit between bearing elements and the undercut in the concrete.
5. Interior Dry Non-Corrosive Locations: Provide carbon steel anchors, complete with nuts and washers, zinc plated, in accordance with ASTM B633.
6. Other Locations: Provide stainless steel anchors, complete with nuts and washers, manufactured of AISI Type 316 stainless steel or materials complying with ISO 3506-1 and having corrosion resistance equivalent to AISI Type 316 stainless steel.
7. Concrete undercut anchors shall have a current ICC Evaluation Service Report for use in both cracked and uncracked concrete for

seismic recognition for seismic design Categories A through F when tested and assessed in accordance with ICC-ES AC193.

J. Concrete Inserts:
   1. Manufacturers: Provide products of one of the following:
      a. Unistrut Corporation.
      b. Cooper B-Line, Inc.
      c. Anvil International, Inc.
      d. Or equal.
   2. Spot Concrete Inserts:
      a. Provide inserts recommended by insert manufacturer for required loading. Inserts shall comply with ANSI/MSS SP-58, malleable iron, Type 18. Spot inserts shall allow for lateral adjustment and have means for attachment to forms. Provide nuts compatible with insert and to suit threaded hanger rod sizes.
   3. Continuous Concrete Inserts:
      a. Provide inserts recommended by insert manufacturer for required loading. Inserts shall be continuous type and shall be manufactured from minimum 12-gage cold-formed channel sections, complying with ASTM A1011/A1011M, stainless steel, Grade 33, complete with styrofoam inserts, end caps, and means for attaching to forms. Provide channel nuts compatible with insert suitable for threaded hanger rod sizes.
   4. Provide inserts with plain finish.

K. Drive-In Expansion Anchors:
   1. General:
      a. Drive-In expansion anchors shall each consist of stainless steel drive pin and expanding alloy body.
   2. Products and Manufacturers: Provide one of the following:
      a. Metal HIT Anchor, by Hilti Fastening Systems, Inc.
      b. Zinc Nailon Anchor, by Simpson Strong-Tie Company, Inc.
      c. Or equal.
   3. Provide Type 304 stainless steel drive pin with zinc alloy body. Anchor shall comply with physical requirements of FS A-A-1925A, Type 1.

L. Unless approved by ENGINEER, do not use power-actuated fasteners or other types of bolts and fasteners not specified in this Section.

M. Anti-Seizing Compound:
   1. Products and Manufacturers: Provide one of the following:
      a. Pure Nickel Never-Seez, by Bostik.
      b. Nickel-Graf, by Anti-Seize Technology.
      c. Or equal.
   2. Provide pure nickel anti-seizing compound.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions under which materials will be installed and advise ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Anchor Bolts:
   1. Provide anchor bolts as shown or indicated in the Contract Documents, or as required to secure structural element to the appropriate anchor surface.
   2. Locate and accurately set anchor bolts using templates or other devices as required, prior to placing concrete. Wet setting of anchor bolts is unacceptable.
   3. Protect threads and shank from damage during installation and subsequent construction operations.
   4. Unless otherwise shown or approved by ENGINEER anchor bolts shall comply with Table 05 05 33-B:

TABLE 05 05 33-B:
SINGLE ANCHOR ALLOWABLE LOADS ON ANCHOR BOLTS [1]

Bolt Diameter (inch)	F1554 Grade 36				F1554			
	F593 Type 316, Condition A				Grade 55			
	Minimum Embedment (inch)	Minimum Edge Distance and Spacing[2] (inch)	Shear[3,4] (lb)	Tension[3] (lb)	Minimum Embedment (inch)	Minimum Edge Distance and Spacing[2] (inch)	Shear[3] (lb)	Tension[3] (lb)
1/2	6	9	1,262	2,420	8.5	12.75	1,660	3,190
5/8	7.5	11.25	2,010	3,860	10.5	15.75	2,640	5,080
3/4	9	13.5	2,974	5,720	13	19.5	3,910	7,520
7/8	10.5	15.75	4,106	7,890	15	22.5	5,400	10,390
1	12	18	5,386	10,360	17	25.5	7,090	13,450
1 1/8	13.5	20.25	6,787	13,052	19	28.5	8,930	16,580
1 1/4	15	22.5	8,617	16,572	21	31.5	11,340	20,040

Table Notes:
1. Table is based on ACI 318 and ACI 350, Appendix D, f'_c = 4000 psi. Table 05 05 33-B is not applicable to anchor bolts embedded in grouted masonry.

2. Critical edge distance and spacing are indicated in the table. Capacity of anchor bolts for other combination of edge distances and spacing shall be evaluated in accordance with ACI 318 and ACI 350, Appendix D.
3. Values for shear and tension listed are not considered to act concurrently. Interaction of tension and shear will be evaluated by ENGINEER in accordance with ACI 318 and ACI 350, Appendix D.

B. Adhesive Anchors, Undercut Anchors, and Expansion Anchors – General:
   1. Prior to drilling, locate existing reinforcing steel in vicinity of proposed holes. If reinforcing conflicts with proposed hole location, obtain ENGINEER's approval of alternate hole locations to avoid drilling through or damaging existing reinforcing bars.

C. Adhesive Anchors:
   1. Comply with manufacturer's written installation instructions and the following.
   2. Drill holes to adhesive system manufacturer's recommended drill bit diameter to the specified depth. Drill holes in hammering and rotation mode with carbide-tipped drill bits that comply with the tolerances of ANSI B212.15. Core-drilled holes are unacceptable.
   3. Before setting adhesive anchor, hole shall be made free of dust and debris by method recommended by adhesive anchor system manufacturer. Hole shall be brushed with adhesive system manufacturer-approved brush and blown clean with clean, dry, oil-free compressed air to remove all dust and loose particles. Hole shall be dry as defined by adhesive system manufacturer.
   4. Before injecting adhesive, obtain ENGINEER's concurrence that hole is dry and free of oil and other contaminants.
   5. Prior to injecting adhesive into the drilled hole, dispense, to a location appropriate for such waste, an initial amount of adhesive from the mixing nozzle, until adhesive is uniform color.
   6. Inject adhesive into hole through injection system-mixing nozzle and necessary extension tubes, placed to bottom of hole. Discharge end shall be withdrawn as adhesive is placed but kept immersed to prevent formation of air pockets. Fill hole to depth that ensures that excess material is expelled from hole during anchor placement.
   7. Twist anchors during insertion into partially-filled hole to guarantee full wetting of rod surface with adhesive. Insert rod slowly to avoid developing air pockets.
   8. Provide adequate curing in accordance to adhesive system manufacturer's requirements prior to continuing with adjoining Work that could place load on installed adhesive anchors. Do not begin adjoining Work until adhesive anchors are successfully tested or when allowed by ENGINEER.
   9. Limitations:
      a. Installation Temperature: Comply with manufacturer's instructions for installation temperature requirements. Provide temporary protection and other measures, such as heated enclosures, necessary to ensure that base material temperature complies with anchor systems manufacturer's requirements during installation and curing of adhesive anchor system.

b. Oversized Holes: Advise ENGINEER immediately if size of drilled hole is larger than recommended by anchor system manufacturer. Cost of corrective measures, including but not limited to redesign of anchors due to decreased anchor capacities, shall be paid by CONTRACTOR.
c. Embedment depths shall be based on installation in normal-weight concrete with compressive strength of 2,500 psi when embedded in existing concrete, and 4,000 psi when embedded in new concrete.

D. Expansion Anchors:
1. Comply with expansion anchor manufacturer's written installation instructions and the following:
2. Drill holes using anchor system manufacturer's recommended drill bit diameter and to the specified depth. Drill holes in hammering and rotation mode with carbide-tipped drill bits complying with tolerances of ANSI B212.15. Core drilled holes are unacceptable.
3. Before installing anchor, hole shall be made free of dust and debris by method recommended by anchor system manufacturer. Hole shall be brushed with anchor system manufacturer-approved brush and blown clean with clean, dry, oil-free compressed air to remove all dust and loose particles.
4. Before installing anchor, obtain ENGINEER's concurrence that hole is dry and free of oil and other contaminants.
5. Protect threads from damage during anchor installation. Drive anchors not less than four threads below surface of the attachment. Set anchors to anchor manufacturer's recommended torque using a torque wrench.

E. Concrete Undercut Anchors:
1. Comply with undercut anchor manufacturer's written installation instructions and the following.
2. Protect threads from damage during anchor installation.
3. Drill hole to anchor manufacturer's specified depth and diameter using a drill bit matched to the specific anchor.
4. Before setting the undercut anchor, hole shall be free of dust and debris using method recommended by undercut anchor system manufacturer. Hole shall be blown clean with clean, dry, oil-free compressed air to remove all dust and loose particles.
5. Insert the anchor by hand until anchor reaches bottom of hole.
6. Set anchor in accordance with manufacturer's instructions using anchor manufacturer's specified setting tool.
7. Verify that the setting mark is visible on the threaded rod above the sleeve.
8. Anchor shall be set to manufacturer's recommended torque, using a torque wrench.

F. Concrete Inserts:
1. Comply with concrete insert manufacturer's installation instructions.
2. Inserts shall be flush with slab bottom surface.
3. Protect embedded items from damage during concrete placing. Ensure that embedded items are securely fastened to prevent

movement during concrete placing, and ensure that embedded items do fill with concrete during concrete placing.

4. Inserts intended for piping greater than four-inch diameter shall be provided with hooked rods attached to concrete reinforcing.

G. Anti-Seizing Compound:

1. Provide anti-seizing compound in accordance with anti-seizing compound manufacturer's installation instructions, at locations indicated in Paragraph 2.01B of this Section.
2. Do not use anti-seizing compound at locations where anchor bolt or adhesive anchor will contact potable water or water that will be treated to become potable.

3.03 CLEANING

A. After embedding concrete is placed, remove protection and clean bolts and inserts.

3.04 FIELD QUALITY CONTROL

A. Site Tests:

1. Furnish services of independent testing laboratory to perform field quality tensile testing of post-installed anchors at the Site.
   a. Testing shall comply with ASTM E488.
   b. Test at least ten percent of all types of post-installed anchors. If one or more post-installed anchors fail the test, CONTRACTOR shall pay cost of testing, or at ENGINEER's option CONTRACTOR may arrange for testing paid by CONTRACTOR, for all post-installed anchors of same diameter and type installed on the same day as the failed anchor. If anchors installed on the same day as the failed anchor also fail the test, ENGINEER may require retesting of all anchors of the same diameter and type installed in the Work. CONTRACTOR shall be responsible for retesting costs.
   c. Test post-installed anchors to 50 percent of ultimate tensile capacity of post-installed anchor. ENGINEER will direct which anchors are to be tested.
   d. Apply test loads with hydraulic ram.
   e. Displacement of post-installed anchors shall not exceed D/10, where D is nominal diameter of anchor being tested.
2. Correct defective Work by removing and replacing or correcting, as directed by ENGINEER.
3. CONTRACTOR shall pay for all corrections and subsequent testing required to confirm integrity of post-installed anchors.
4. Testing agency shall submit test results to CONTRACTOR and ENGINEER within 24 hours of completion of test.

B. Manufacturer's Services:

1. Provide at the Site services of qualified adhesive manufacturer's representative during initial installation of adhesive anchor systems to train CONTRACTOR's personnel in proper installation procedures. Manufacturer's representative shall observe to confirm that installer

demonstrates proper installation procedures for adhesive anchors and adhesive material.

END OF SECTION

SECTION 05 50 00

MISCELLANEOUS METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish miscellaneous metal fabrications, including surface preparation and shop priming.

B. The extent of miscellaneous metal fabrications Work is shown on the Drawings and includes items fabricated from iron, steel and aluminum shapes, plates, bars, castings and extrusions, which are not a part of the structural steel or other metal systems covered by other Sections of these Specifications.

C. The types of miscellaneous metal items include, but are not limited to the following:
   1. Aluminum ladders.
   2. Ships ladders.
   3. Extruded aluminum stair nosings.
   4. Bollards.
   5. Access hatches.
   6. Miscellaneous framing and supports.
   7. Miscellaneous accessories and fasteners.
   8. Seat Angles, supports and brackets.

D. Related Sections:
   1. Section 05 05 33, Anchor Systems.
   2. Section 05 52 15, Aluminum Handrails and Railings.

1.02 QUALITY ASSURANCE

A. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown and specified:
   1. ASTM A 36, Specification for Carbon Structural Steel.
   2. ASTM A 153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   3. ASTM A 240, Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
   4. ASTM A 276, Stainless and Heat-Resisting Steel Bars and Shapes.
   5. ASTM A 320, Specification for Alloy Steel Bolting Material for Low Temperature Service.
   6. ASTM B 209, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   7. ASTM B 211, Specification for Aluminum and Aluminum-Alloy Bars, Rods and Wire.

8. ASTM B 221, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
9. ANSI A14.3, Safety Requirements for Fixed Ladders.
10. AWS D1.1, Structural Welding Code.
11. NAAMM, Metal Finishes Manual.
12. OSHA.

B. Field Measurements:
1. Take field measurements where required prior to preparation of Shop Drawings and fabrication to ensure proper fitting of the Work.

C. Shop Assembly:
1. Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.03 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
1. Fabrication and erection details of all assemblies of miscellaneous metal Work. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Include setting drawings and templates for location and installation of miscellaneous metal items and anchorage devices.
2. Copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions for products to be used in miscellaneous metal Work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Plates, Shapes and Bars: ASTM A 36.

B. Aluminum:
1. Alloy and Temper: Provide alloy and temper as shown on the Drawings or specified, or as otherwise recommended by the aluminum producer or finisher.
2. Extruded Shapes and Tubes: ASTM B 241.
3. Plate and Sheet: ASTM B 209.
4. Bars, Rods and Wire: ASTM B 211.

C. Stainless Steel Plates, Sheets and Bars: ASTM A 276, Type 316 stainless steel.
1. Use Type 316 stainless steel unless shown otherwise in the Drawings.

D. Stainless Steel Fasteners and Fittings: ASTM A 320.

E. Surface Preparation and Shop Priming: All steel shall be primed in the shop.

F. Galvanizing: All galvanizing of fabricated steel items shall comply with the requirements of ASTM A 123.

G. Aluminum Finish: Provide an Architectural Class I anodized finish for all aluminum work unless specifically shown or specified to be mill or other finish.

2.02 MISCELLANEOUS METAL ITEMS

A. Aluminum Ladders:
   1. Fabricate ladders for the locations shown on the Drawings, with dimensions, spacings, details and anchorages as shown on the Drawings, and specified. Comply with the requirements of ANSI A14.3, except as otherwise shown on the Drawings or specified.
      a. Unless otherwise shown on the Drawings, provide 1 1/2-inch diameter Schedule 40 side rails, spaced 18-inches apart, minimum.
      b. Provide extruded square rungs, spaced 12-inches on centers, maximum with non-slip surface on the top of each rung. Adhesive strips for non-slip surfaces will not be allowed.
   2. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
   3. Support each ladder at top and bottom and at intermediate points spaced not more than five feet on centers. Use welded or bolted brackets, designed for adequate support and anchorage, and to hold the ladder clear of the wall surface with a minimum of 7-inches clearance from wall to centerline of rungs. Unless otherwise shown on the Drawings, or approved by the ENGINEER, extend rails 42-inches above top rung, and return rails to wall or structure, unless other secure handholes are provided. If the adjacent structure does not extend above the top rung, goose neck the extended rails back to the structure to provide secure ladder access.
   4. Use extruded aluminum conforming to alloy and temper of the 5000 series alloys.

B. Ships Ladders:
   1. Ladders shall be fabricated to dimensions shown on the Drawings.
   2. Ladders shall have 75 degree rake.
   3. Ladders shall have a minimum 24-inch clear width.
   4. Ladders shall be fabricated from aluminum. All hardware and anchorages shall be Type 304 stainless steel.
   5. Product and Manufacturer: Provide one of the following:
      a. Alaco.
      b. Surespan.
      c. Or approved equal.

C. Fall Prevention System: All ladders greater than 12-feet-0-inches in height shall be provided with a fall prevention system. The system shall meet OSHA standards.
   1. The system shall consist of a rail permanently attached to the ladder to which a harness belt is attached. The rail shall be notched and constructed of aluminum. Ladder attachments shall be provided as required by the manufacturer. A removable extension section shall be provided at the top of the ladder.
   2. Product and Manufacturer: Provide one of the following:

a. Saf-T-Climb by Norton Company.
b. Vi-Go Ladder Climbing Safety System by Miller Fall Protection

D. Aluminum Stairs:
1. Stringers: 6061-T6 aluminum alloy.
2. Stair Treads:
a. Aluminum of same type specified under Aluminum Grating.
b. Of sizes indicated on the Drawings and 1-3/4 inch minimum depth with cast abrasive type safety nosings.
3. Handrails and Guardrails: Aluminum pipe specified under Aluminum Handrails and Guardrails (Nonwelded Pipe).
4. Fasteners: Type 316 stainless steel.

E. Extruded Aluminum Stair Nosings:
1. Fabricate of sizes and configurations required for the Work.
a. Unless otherwise shown on the Drawings, provide ribbed abrasive filled type, using black abrasive filler.
2. Provide anchors for embedding in concrete, either integral or applied to treads, as standard with the manufacturer.
3. Product and Manufacturer: Provide stair nosings by one of the following:
a. American Abrasive Metals Company.
b. Wooster Products Incorporated.

F. Bollards: Unless shown otherwise in the Drawings, provide 8-inch diameter, Schedule 40 galvanized steel pipe, 4-feet-0-inches above grade, 4-feet-0-inches below grade. Fill with concrete and mound top. Bollards shall be primed in the shop. Surface preparation and painting shall conform to the requirements of Section 09 91 00.

G. Access Hatches:
1. Hatches shall be fabricated to dimensions shown on the Drawings.
2. Hatches shall be fabricated from 316 stainless steel. All hardware and anchorages shall be Type 304 stainless steel.
3. Provide lockable hasp at all hatches.
4. All hatches shall be watertight.
5. Product and Manufacturer:
a. Bilco.
b. Or approved equal.

H. Miscellaneous Framing and Supports:
1. Provide miscellaneous metal framing and supports, which are not a part of the structural steel framework and are required to complete the Work.
2. Fabricate miscellaneous units to the sizes, shapes and profiles shown on the Drawings or, if not shown on the Drawings, of the required dimensions to receive adjacent grating, plates, tanks, doors, or other work to be retained by the framing. Except as otherwise shown on the Drawings, fabricate from structural shapes, plates, and bars, of all welded construction using mitered corners, welded brackets and splice plates and a minimum number of joints for field connection. Cut, drill and tap units to receive hardware and similar items to be anchored to the Work.

3. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
   a. Except as otherwise shown on the Drawings, space anchors, 24-inches on centers, and provide units the equivalent of 1-1/4 by 1/4 by 8-inch strips.
   b. All material shall be Type 316 stainless steel unless noted otherwise in the Drawings.

I. Fasteners and Fittings: Provide Type 316 stainless steel, for all aluminum fabrications, and zinc coated hardware for all galvanized fabrications, unless otherwise shown on the Drawings or specified.

J. Surface Preparation and Shop Priming: All miscellaneous metal fabrications shall be primed in the shop.

K. Aluminum Finish: Provide an Architectural Class 1 anodized finish, AA M32C22 A41, clear, as specified in NAAMM Manual.

PART 3 EXECUTION

3.01 INSTALLATION

A. Set miscellaneous metal fabrications accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Brace temporarily or anchor temporarily in formwork where fabrications are to be built into concrete, masonry or similar construction.

B. Anchor securely as shown on the Drawings or as required for the intended use, using concealed anchors wherever possible.

C. Fit exposed connections accurately together to form tight hairline joints. Weld steel connections, which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind steel joints smooth and touch up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units, which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

D. Protection of Aluminum from Dissimilar Materials:
   1. Coat all surfaces of aluminum in contact with dissimilar materials, such as concrete, grout, masonry and steel or other dissimilar metals with the following:
      a. Cast Aluminum: Heavy coat of bituminous paint.
      b. Extruded Aluminum: Two coats of clear lacquer.
   2. Do not extend coating beyond contact surfaces. Remove coating where exposed-to-view in the finished Work.

E. E. All welds to be coated shall be grinded smooth according to NACE “Surface Preparation of Welds Prior to Coating”.

END OF SECTION

SECTION 05 52 15

ALUMINUM HANDRAILS AND RAILINGS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and install aluminum handrail and railing systems. The Work also includes:
      a. Providing openings in, and attachments to, aluminum handrail and railing systems to accommodate the Work under this and other Specification Sections. Provide all items for aluminum handrails and railings, including anchorages, fasteners, studs, and other items required for which provision for is not specifically included under other Sections.
   2. Aluminum handrails and railings Work shall include components and features shown and specified, and all components and features available from specified manufacturers required for providing complete aluminum handrail and railing system in accordance with the Contract Documents.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before aluminum handrails and railings Work.
   2. Aluminum handrail and railing locations shall comply with Laws and Regulations.

C. Related Sections:
   1. Section 03 60 00, Grouting.
   2. Section 05 05 33, Anchor Systems.
   3. Section 09 91 00, Painting.

1.02 REFERENCES

A. Standards referenced in this Section are:
   1. AA, Aluminum Design Manual.
   2. ASTM B26/B26M, Specification for Aluminum-Alloy Sand Castings.
   3. ASTM B117, Standard Practice for Operating Salt Spray (Fog) Apparatus.
   4. ASTM B136, Standard Method for Measurement of Stain Resistance of Anodic Coatings on Aluminum.
   5. ASTM B137, Standard Test Method for Measurement of Coating Mass per Unit Area on Anodically Coated Aluminum.
   6. ASTM B221, Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.

7. ASTM B241/B241M, Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
8. ASTM B244, Standard Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments.
9. ASTM B247, Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and rolled Ring Forgings.
10. ASTM B429, Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
11. ASTM E 935, Standard Test Methods for Permanent Metal Railing Systems and Rails for Buildings.
12. NAAMM/Architectural Metal Products Division (AMP), Pipe Railing Manual.
13. NAAMM/AMP AMP 501 Finishes for Aluminum.

1.03 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer:
      a. Upon request manufacturer shall submit document at least five years successful experience in fabricating aluminum handrail and railing systems of scope and type similar to that required.
   2. Professional Engineer:
      a. CONTRACTOR or handrail and railing manufacturer shall retain a registered professional engineer legally qualified to practice in same state as the Site. Professional engineer shall have at least five years experience designing aluminum handrails and railings.
      b. Responsibilities include:
         1) Reviewing aluminum handrail and railing system performance and design criteria stated in the Contract Documents.
         2) Preparing written requests for clarifications or interpretations of performance or design criteria for submittal to ENGINEER by CONTRACTOR.
         3) Preparing or supervising preparation of design calculations verifying compliance of aluminum handrail and railing system with requirements of the Contract Documents.
         4) Signing and sealing all calculations.
         5) Certifying that:
            a) Design of aluminum handrail and railing system was performed in accordance with performance and design criteria stated in the Contract Documents, and
            b) Design conforms to all applicable local, state, and federal Laws and Regulations, and to prevailing standards of practice.
   3. Installer:
      a. Retain a single installer trained and with record of successful experience in installing aluminum handrail and railing systems.
      b. Installer shall have record of successfully installing aluminum handrail and railing systems in accordance with recommendations and requirements of manufacturer, or shall provide evidence of being acceptable to the manufacturer.

c. Installer shall employ only tradesmen with specific skill and successful experience in the type of Work required.
d. When requested by ENGINEER, submit name and qualifications of installer with the following information for at least three successful, completed projects:
1) Names and telephone numbers of owner and architect or engineer responsible for each project.
2) Approximate contract cost of the aluminum handrail and railing systems for which installer was responsible.
3) Amount (linear feet) of aluminum handrail and railing installed.

B. Component Supply and Compatibility:
1. Obtain all materials furnished under this Section regardless of component manufacturer, from a single aluminum handrail and railing system manufacturer.
2. Aluminum handrail and railing system manufacturer shall review and approve or prepare all Shop Drawings and other submittals (except for delegated design submittals, when professional engineer is retained by other than handrail and railing manufacturer) for all components furnished under this Section.
3. Components shall be specifically constructed for specified service conditions and shall be integrated into overall assembly by aluminum handrails and railings manufacturer.

C. Regulatory Requirements: Comply with Laws and Regulations including:
1. OSHA Part 1910.23, Guarding Floor and Wall Openings and Holes.

D. Certifications:
1. Submit certification, signed by authorized officer of manufacturer and notarized, stating that handrail and railing systems comply with the design prepared by the professional engineer.
2. Submit certification, signed by authorized officer of CONTRACTOR and notarized, stating that all components and fittings are furnished by the same manufacturer.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:
1. Shop Drawings:
a. Drawings for fabrication and installation of aluminum handrail and railing systems with sizes of members, pipe wall thickness, information on components, and anchorage devices. Show all anchorages. Provide details drawn at scale of 1.5-inch equal to one foot.
b. Indicate required location of posts.
c. Indicate locations and details of all expansion joints, if any.
d. Indicate locations and details of gaps across seismic joints, if any.
e. Profile drawings of aluminum handrail and railing system components.

f. Custom detail drawings. Details of forming, jointing, sections, connections, internal supports, trim and accessories. Provide details drawn at scale of 1.5-inch equal to one foot.

2. Product Data:
   a. Manufacturer's specifications, standard detail drawings, and installation instructions for aluminum handrail and railing systems.
   b. Manufacturer's catalogs showing complete selection of standard and custom components and miscellaneous accessories for selection by ENGINEER.
3. Delegated Design Submittals:
   a. Design Data:
      1) Design computations or complete structural analysis of handrail and railing systems, signed and sealed by professional engineer. Professional engineer's seal shall be clearly legible, including state of registration, registration number, and name on seal.
      2) Certification by professional engineer that professional engineer has performed design of aluminum handrail and railing systems in accordance with performance and design criteria stated in the Contract Documents, and that design conforms to all local, state, and federal Laws and Regulations, and to prevailing standards of practice.
   b. Color Samples: Maximum range of clear anodized aluminum that shall appear in finished Work. Prepare range Samples, to show highest level of color control feasible for actual handrail and railing systems, as determined by licensor of finishing process specified, on actual extrusions and castings of the Work.
   c. ENGINEER will review Samples for finish, color, joint tolerances, workmanship, and general component assembly only. Compliance with other requirements is the responsibility of the CONTRACTOR.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Certification on source of supply, as specified in Article 1.03 of this Section.
      b. Manufacturer certification specified in Article 1.03 of this Section.
   2. Qualifications Statements: Submit qualifications for the following:
      a. Manufacturer, when requested by ENGINEER.
      b. Professional engineer.
      c. Installer, when requested by ENGINEER. Qualifications statement shall include record of experience with references specified.

C. Closeout Submittals: Submit the following:
   1. Maintenance Manuals: Furnish detailed maintenance manuals that include the following:
      a. Product name and number.
      b. Detailed procedures for routine maintenance and cleaning, including cleaning materials, application methods and precautions in use of products that may be detrimental to finish when improperly applied.

c. Handrail and railings systems manufacturer's current catalog including individual parts.
d. Maintenance manuals shall be in accordance with Section 01 78 23, Operations and Maintenance Data.

2. Guarantee: Provide in maintenance manual the guarantee specified.

1.05 DELIVERY, STORAGE AND HANDLING

A. Storage and Protection:
1. Keep products off ground using pallets, platforms, or other supports. Protect products from corrosion and deterioration.

B. Handling of Products:
1. Do not subject handrail and railing products to bending or stress.
2. Do not damage edges or handle products in a manner that will cause scratches, warping, or dents.
3. Protect handrails and railings by paper or coating as acceptable to handrail and railing manufacturer, against scratching, splashes of mortar, paint, and other marring during transportation, handling, and erection. Protect until completion of adjacent work.

1.06 GUARANTEE

A. Guarantee: Manufacturer shall provide written guarantee of availability of replacement parts and components for period of at least five years after completion of the Project.

PART 2 PRODUCTS

2.01 SYSTEM PERFORMANCE

A. System Description: Aluminum handrail and railing system shall consist of equally spaced horizontal rails with totally concealed mechanical fasteners, internally threaded tubular rivets and components fastened to posts spaced no more than five feet on centers and system of handrails supported from adjacent construction by mounting brackets spaced at no more than five feet on centers.

B. Design Criteria and Performance Criteria:
1. Design, fabricate, and install aluminum handrail and railing systems to withstand the most critical effects resulting from the following loads (loads listed below do not act concurrently):
a. Uniform Load: 50 pounds per foot, applied at top in any direction.
b. Concentrated Load: 200 pounds single load, applied at any point along the top in any direction.
c. Components: Intermediate rails (all rails except the handrail), balusters, and panel fillers, if any, shall withstand horizontally-applied normal load of 50 pounds on an area equal to one square foot, including openings and space between rails. Reactions due to this loading are not required to be superimposed to loading specified for main supporting members of handrails and railings.

d. Comply with AA Aluminum Design Manual for determining allowable stresses and safety factors for aluminum structural components.
e. Limit deflection in each single span of railing and handrail to 1.5-inch maximum, and to 1/4-inch maximum on railing posts. Applied loads shall not produce permanent deflection in the completed Work when loads are removed.

2. Thermal Control: Provide adequate expansion within fabricated systems that allows for thermal expansion and contraction caused by material temperature change of 140 degrees F to -20 degrees F without warp or bow of system components. Distance between expansion joints shall be based on providing 1/4-inch wide joint at 70 degrees F, which accommodates movement of 150 percent of calculated amount of movement for specified temperature range.
3. Where handrail and railing systems cross expansion joints in the building or structure, provide expansion joints in handrail and railings systems.
4. For posts located at or near end of runs as shown, uniformly space intermediate posts as required to conform to loading and deflection criteria specified, at intervals no greater than maximum post spacing specified. Where posts are shown for handrails along both sides of walkways and other similar locations, locate posts opposite each other; do not stagger post locations.

2.02 MANUFACTURERS

A. Products and Manufacturers: Provide one of the following:
1. Wesrail, by Moultrie Manufacturing Company.
2. Alumaguard, by Alumaguard – A division of Bettinger West, Inc.
3. Or equal.

2.03 MATERIALS

A. Extruded Aluminum Architectural and Ornamental Shapes: ASTM B221, Alloy 6063-T52.

B. Aluminum Forgings: ASTM B247.

C. Extruded or Drawn Aluminum Pipe and Tube:
1. ASTM B429 or ASTM B241/B241M, Alloy 6063-T5, 6063-T52, or 6063-T832 as required by loadings, deflections, and post spacing specified.
2. Provide Schedule 40 pipe, minimum, unless conditions of detail and fabrication require extra-heavy pipe to comply with Specifications. Rails and posts shall have minimum outside diameter of 1.90 inches.

D. Reinforcing Bars: Urethane foam-filled, Schedule 80, 23 inches long 6061-T6 aluminum reinforcing bars or tubes with outside diameter same as inside diameter of post.

E. Anchors and Fastenings:
1. For anchors and fasteners, use Type 316 stainless steel; minimum 3/8-inch diameter.

2. Provide minimum of four bolt fasteners per post where surface-mounted posts are shown. Components shall be in accordance with manufacturer's recommendations and as approved or accepted (as applicable) by ENGINEER on submittals.
3. Anchors: In accordance with Section 05 05 33, Anchor Systems.

F. Castings:
1. Provide high-strength aluminum alloy brackets, flanges, and fittings suitable for anodizing as specified.
2. Aluminum alloy sand castings: ASTM B26/B26M.

G. Connector Sleeves: Schedule 40, five-inch long by 1.610-inch diameter.

H. Sockets: Provide six-inch deep by 2.5-inch outside diameter aluminum sockets with 3.5-inch wide socket cover on bottom of each socket and on top and bottom of removable post sockets.

I. Gates: For each gate in handrail or railing system, provide the following:
1. Hinges: Two-self closing aluminum hinges.
2. Latches and Stops: One latch and stop with rubber bumper and one-inch diameter plastic knobs.

J. Custom Cover Flanges: 1/4-inch high by four-inch diameter, aluminum.

K. Non-shrink Grout: Comply with Section 03 60 00, Grouting.

L. Toeboards:
1. Provide extruded Alloy 6063-T5 or T52 aluminum alloy toeboards, unless railing is mounted on curbs or other construction of sufficient height and type to comply with OSHA 1910.23. Bars or plates are not acceptable.
2. Unless otherwise specified, toeboards shall comply with OSHA 1910.23, Section (e).

M. System Components and Miscellaneous Accessories: Provide complete selection of manufacturer's standard and custom aluminum handrail and railing systems components and miscellaneous accessories required. Show type and location of all such items on Shop Drawings and other submittals as applicable.

2.04 FABRICATION

A. General: Unless otherwise shown or specified, provide typical non-welded construction details and fabrication techniques recommended in NAAMM/AMP Pipe Railing Manual and NAAMM/AMP AMP 501.

B. Fabricate handrail and railing systems true to line and level, with accurate angles surfaces and straight edges. Fabricate corners without using fittings. Provide bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work. Form elbow bends and wall returns to uniform radius, free from buckles and twists, with smooth

finished surfaces, or use prefabricated bends. Provide not less than four-inch outside radius.

C. Remove burrs from exposed edges.

D. Close aluminum pipe ends by using prefabricated fittings.

E. Weep Holes:
   1. Fabricate joints that will be exposed to weather to exclude water.
   2. Provide 15/64-inch diameter weep holes at lowest possible point on each post in handrail and railing systems.
   3. Provide pressure relief holes at closed ends of handrail and railing systems.

F. Toeboards:
   1. Provide manufacturer's standard toeboard, that accommodates movement caused by thermal change specified without warping or bowing toeboards.
   2. Provide manufacturer's standard toeboard, which accommodates storage for removable socket covers.
   3. Coordinate and cope toeboard as required to accommodate cover flanges at posts.
   4. Toeboards shall follow curvature of railing. Where railing is shown to have curved contours at corners, or other locations, toeboard shall likewise be curved to follow line of railing system.

G. Reinforcing Bars: Provide reinforcing bar friction-fitted at each post in railing system. Extend reinforcing bars of tubes six inches into cast-in-place sleeves or other types of supporting brackets.

H. Mechanically Fitted Component Pipe Handrail and Railing System:
   1. Use non-welded pipe handrail and railing system with posts, top and intermediate rail(s), and flush joints.
   2. Provide top and two intermediate horizontal rail(s), equally spaced.
   3. Use Type 304/305 stainless steel blind rivets and Type 304/305 stainless steel self-tapping screws in assembling components of the Work.

2.05 FINISHES

A. General:
   1. Prepare surfaces for finishing in accordance with recommendation of aluminum producer and the aluminum finisher or processor.
   2. Adjust and control direction of mechanical finishes specified to achieve best overall visual effect in the Work.
   3. Color and Texture Tolerance: Provide uniform color and continuous mechanical texture for aluminum components. ENGINEER reserves the right to reject aluminum materials because of color or texture variations that are visually objectionable, but only where variation exceed range of variations established by manufacturer prior to fabrication, by means of range of Samples approved by ENGINEER.
   4. Anodize aluminum components.

B. Finish:
   1. Mechanically finish aluminum by wheel or belt polishing with aluminum oxide grit of 180 to 220 size, using peripheral wheel speed of 6,000 feet per minute; AA Designation - M32 Medium Satin Directional Texture.
   2. Hand-Rubbed Finish: Where required to complete the Work and provide uniform, continuous texture, provide hand-rubbed finish to match medium satin directional texture specified to even out and blend satin finishes produced by other means.

C. Cleaning:
   1. Provide non-etching chemical cleaning by immersing aluminum in inhibited chemical solution, as recommended by coating applicator, to remove lard oil, fats, mineral grease, and other contamination detrimental to providing specified finishes.
   2. Clean and rinse with water between steps as recommended by aluminum manufacturer.

D. Exposed Aluminum Anodic Coating: Provide anodic coatings as specified that do not depend on dyes, organic or inorganic pigments, or impregnation processes to obtain color. Apply coatings using only the alloy, temperature, current density, and acid electrolytes to obtain specified colors in compliance with designation system and requirements of NAAMM/AMP Pipe Railing Manual and NAAMM/AMP AMP 501. Comply with the following:
   1. Provide Architectural Class I high density anodic treatment by immersing the components in tank containing solution of 15 percent sulfuric acid at 70 degrees F with 12 amperes per square foot of direct current for minimum of sixty minutes; AA Designation A41 Clear.
   2. Physical Properties:
      a. Anodic Coating Thickness, ASTM B244: Minimum of 0.7-mils thick.
      b. Anodic Coating Weight, ASTM B137: Minimum of 32 mg/sq. in.
      c. Resistance to Staining, ASTM B136: No stain after five minutes dye solution exposure.
      d. Salt Spray, ASTM B117: 30,000 hours exposure with no corrosion or shade change.
   3. Seal finished anodized coatings using deionized boiling water to seal pores and prevent further absorption.
   4. Products and Manufacturers: Provide one of the following:
      a. Alumilite 215 Clear by Aluminum Company of America, Inc.
      b. Or equal.

2.06 SOURCE QUALITY CONTROL

A. Allowable Tolerances:
   1. Limit variation of cast-in-place inserts, sleeves and field-drilled anchor and fastener holes to the following:
      a. Spacing: Plus-or-minus 3/8-inch.
      b. Alignment: Plus-or-minus 1/4-inch.
      c. Plumbness: Plus-or-minus 1/8-inch.
   2. Minimum Handrails and Railings Systems Plumb Criteria:

a. Limit variation of completed handrail and railing system alignment to 1/4-inch in 12 feet with posts set plumb to within 1/16-inch in 3.0 feet.
b. Align rails so variations from level for horizontal members and from parallel with rake of stairs and ramps for sloping members do not exceed 1/4-inch in 12.0 feet.

3. Provide “pencil-line” thin butt joints.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions under which Work will be performed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Verify to ENGINEER the gage of aluminum pipe railing posts and rails brought to the Site by actual measurement of on-Site material in presence of ENGINEER.

3.02 INSTALLATION

A. General:
1. Do not erect components that are scarred, dented, chipped, discolored, otherwise damaged, or defaced. Remove from Site railing and handrail system components that have holes, cuts, gouges, deep scratches, or dents of any kind. Repairs to correct such Work will not be accepted. Remove and replace with new material.
2. Comply with installation and anchorage recommendations of NAAMM/AMP Pipe Railing Manual and NAAMM/AMP AMP 501 in addition to requirements specified and approved or accepted (as applicable) submittals.

B. Fastening to In-Place Construction:
1. Remove protective plastic immediately before installing.
2. Adjust handrails and railings prior to securing in place, to ensure proper matching at butting joints and correct alignment throughout their length. Plumb posts in each direction. Secure posts and rail ends to building or structure as follows:
a. Anchor posts to stair stringers with stringer or support flanges, angle type or floor type as required by conditions, shop-connected to posts and bolted to steel supporting members. Flanges shall be as recommended by manufacturer. Verify that reinforcing bars are inserted into posts before installation. Do not install posts without reinforcing bar.
b. Side-mount posts by fastening them securely in brackets attached to steel or concrete fascia as shown and in accordance with approved or accepted (as applicable) submittals.
c. Provide removable railing sections where shown. Provide removable railing system posts with friction-fitted reinforcing bar in

each post. Provide sockets with socket covers stored in extruded toeboard. Provide aluminum pipe collars for all removable posts. Accurately locate sleeves to match post spacing.

d. Provide posts set in concrete with an aluminum floor cover flange.

3. Use devices and fasteners recommended by handrail and railing systems manufacturer and as shown on approved or accepted (as applicable) submittals.

C. Cutting, Fitting, and Placement:

1. Perform cutting, drilling and fitting required for installation. Set the Work accurately in location, alignment, and elevation, plumb, level, true, and free of rack, measured from established lines and levels.
2. Fit exposed connections accurately together to form tight hairline joints. Do not cut or abrade surfaces of units that have been finished after fabrication, and are intended for field connections.
3. Make permanent field splice connections using stainless steel blind rivets and five-inch minimum length connector sleeves. Tight press-fit field splice connectors and install in accordance with manufacturer's written instruction. Install two blind rivets per joint on 180-degree centers.
4. Make splices as near as possible to posts, but not exceeding 12 inches from nearest post.
5. Field welding is not allowed. Make splices using pipe splice lock employing a single allen screw to lock joint.
6. Provide hinged gates as shown.
7. Securely fasten toeboards in place with not more than 1/4-inch clearance above floor level.
8. Drill one 15/64-inch diameter weep hole not more than 1/4-inch above top of location of solid reinforcing bar or tube in each post.

D. Fastening to Existing Construction:

1. Provide heavy-duty floor flange and anchorage devices and fasteners where necessary for securing handrail and railing systems components to existing construction; including stainless steel threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts and other connectors as required. Refer to Section 05 05 33, Anchor Systems.
2. Use devices and fasteners recommended by handrail and railing systems manufacturer and as shown on approved or accepted (as applicable) submittals.

E. Expansion Joints:

1. Provide slip joint with internal sleeve extending not less than two inches beyond joint on each side.
2. Construct expansion joints as for field splices, except fasten internal sleeve securely to one side of rail only.
3. Locate joints within six inches of posts.

F. Protection from Dissimilar Materials:

1. Coat aluminum surfaces in contact with dissimilar materials such as concrete, masonry, and steel, in accordance with Section 09 91 00, Painting.

2. Do not extend coating beyond contact surfaces. Remove coating where exposed-to-view in the finished Work.

3.03 CLEANING AND REPAIRING

A. Cleaning:
   1. Clean exposed surfaces of handrail and railing systems after completion of installation. Comply with recommendations of both handrail and railing system manufacturer and finish manufacturer. Do not use abrasives or unacceptable solvent cleaners. Test cleaning techniques on an unused section of railing before employing cleaning technique.
   2. Remove stains, dirt, grease, and other substances by washing handrails and railings systems thoroughly using clean water and soap; rinse with clean water.
   3. Do not use acid solution, steel wool, or other harsh abrasives.
   4. If stain remains after washing, remove defective sections and replace with new material complying with this Section.

B. Handrails and railings shall be free of dents, burrs, scratches, holes, and other blemishes. Replace damaged or otherwise defective Work with new material that complies with this Section at no additional cost to OWNER.

C. Prior to Substantial Completion, replace adjacent work marred by the Work of this Section.

END OF SECTION

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SECTION 05 53 16

ALUMINUM GRATING

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install aluminum grating and frames.
   2. The Work includes:
      a. Providing grating, frames, and appurtenances.
      b. Providing openings in aluminum grating to accommodate the Work under this and other Sections, and attaching to aluminum grating all items such as sleeves, bands, studs, fasteners, and items required for which provision is not specifically included under other Sections.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before aluminum grating Work.

C. Related Sections:
   1. Section 09 91 00, Painting.

1.02 REFERENCES

A. Standards referenced in this Section are:
   1. AA Aluminum Design Manual.
   2. ASTM B210, Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
   3. ASTM B221, Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   4. NAAMM MBG 531, Metal Bar Grating Manual.
   5. NAAMM MBG 533, Welding Specifications for Fabrication of Steel, Aluminum and Stainless Steel Bar Grating.

1.03 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Shall have at least five years experience manufacturing products substantially similar to those required and shall be able to submit documentation of at least five installations in satisfactory operation for at least five years each.

B. Component Supply and Compatibility:

1. Obtain all products and materials included in this Section regardless of component manufacturer from a single aluminum-grating manufacturer.
2. Aluminum grating manufacturer shall review and approve or prepare all Shop Drawings and other submittals for all products and materials furnished under this Section.
3. Components shall be suitable for the specified service conditions and be integrated into overall assembly by aluminum grating manufacturer.
4. Provide only one type of aluminum grating exclusively throughout the Project.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Fabrication and erection of all Work. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items.
      b. Setting drawings and templates for location and installation of anchorage devices.
   2. Product Data:
      a. Manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Shipping, Handling and Unloading:
   1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices to be embedded in cast-in-place concrete in ample time to prevent delaying the Work.
   2. Comply with Section 01 65 00, Product Delivery Requirements.

B. Storage and Protection:
   1. Protect materials from corrosion and deterioration.
   2. Do not store materials in contact with concrete or other materials that might cause corrosion, staining, scratching, or damage materials or finish.
   3. Comply with Section 01 66 00, Product Storage and Handling Requirements.

PART 2 PRODUCTS

2.01 SYSTEM PERFORMANCE

A. Aluminum Grating: Provide aluminum grating complying with the following:
   1. Grating Design Loads: Uniform live load shall be as shown or indicated in the Contract Documents. Where live load is not shown or indicated, uniform live and concentrated loads shall be as indicated below, whichever results in the greater design stresses.
      a. Live Load: 150 psf; Concentrated Load: 750 lbs per foot of grating width at center span.

2. Maximum Clear Span Deflection for Uniform Live Loads: 1/120 of span, but not more than 1/4-inch.
3. Maximum Fiber Stress: 12,000 psi.
4. Do not install aluminum grating in areas subject to vehicular traffic.
5. Minimum Size of Members:
   a. Minimum size of bearing bars shall be within standard mill tolerance as indicated in load tables in NAAMM MBG 531 for applicable loading and deflection requirements.
   b. Minimum dimensions of cross bars shall be as indicated in tables of Minimum Standard Cross Bars and Connecting Bars in NAAMM MBG 531.
6. Banding bar shall be 1/4-inch thick minimum. Top of banding bar shall be flush with top of grating, unless otherwise shown or indicated. Banding bar shall be 1/4-inch shorter than the bearing bar height.
7. Comply with requirements of AA Aluminum Design Manual.

B. Stair Treads: Provide stair treads complying with the following:
1. Stair Tread Design Loads: Concentrated live load shall be:
   a. 300 pounds on front-most five inches of tread at center of tread of span up to 5.5 feet.
   b. 300 pounds on front-most five inches of tread at the one-third points of tread of span greater than 5.5 feet.
2. Maximum Clear Span Deflection for Concentrated Live Loads: 1/240 of span, but not more than 1/4-inch.
3. Maximum Fiber Stress: 12,000 psi.
4. Minimum Size of Members:
   a. Minimum size of bearing bars shall be within standard mill tolerance as indicated in load tables in NAAMM MBG 531 for applicable loading and deflection requirements.
   b. Minimum dimensions of cross bars shall be as indicated in tables of Minimum Standard Cross Bars and Connecting Bars in NAAMM MBG 531.
5. Carrier plate shall be 1/4-inch thick minimum. Top of carrier plate shall be flush with top of tread, unless otherwise shown or indicated. Provide carrier plate with hole and slot for attachment to stringer.
6. Comply with requirements of AA Aluminum Design Manual.

2.02 MANUFACTURERS

A. Grating, Products and Manufacturers: Provide one of the following:
1. Swage-Locked I-Bar Grating, by IKG Industries.
2. Swage-Locked I-Bar Grating, by AMICO.
3. Or equal.

B. Stair Treads, Products and Manufacturers: Provide one of the following:
1. I-Bar Treads, by IKG Industries.
2. I-Bar Treads, by AMICO.
3. Or equal.

2.03 MATERIALS

A. Bearing Bars: Aluminum alloy 6061-T6 or alloy 6063-T6, complying with ASTM B221.

B. Cross Bars or Bent Connecting Bars: Aluminum alloy 6061-T6 or alloy 6063-T6, complying with either ASTM B221 or ASTM B210.

C. Frames: Aluminum alloy 6061-T6 or alloy 6063-T6, complying with ASTM B221.

D. Stud anchors welded to steel supports and other fasteners shall be Type 316 stainless steel.

2.04 FABRICATION

A. Use materials of minimum depth and thickness specified and required to comply with performance criteria in the Contract Documents.

B. Provide grating as follows:
   1. Grating Type: Aluminum I-bar with swage-locked cross bars at right angles to bearing bars.
   2. Depth: One-inch minimum.
   3. Bearing Bars: Aluminum I-bar minimum of one-inch spaced at 1-3/16-inch on centers.
   4. Cross-Bars: Swage-locked to bearing bars at maximum spacing of four inches on centers.
   5. Surface: Unpunched.
   6. Finish: Mill.

C. Provide stair treads as follows:
   1. Tread Type: Aluminum I-bar with swage-locked cross bars at right angles to bearing bars.
   2. Depth: One-inch minimum.
   3. Bearing Bars: Aluminum I-bar minimum one-inch spaced at 1-3/16-inch on centers.
   4. Cross Bars: Swage-locked to bearing bars at maximum spacing of four inches on centers.
   5. Surface: Grooved.
   6. Nosing: Cast aluminum abrasive nosing.
   7. Finish: Mill.

D. Provide cutouts in grating for passage of piping, electrical conduit, valve stems, columns, ducts, and similar work. Where more than two bearings bars are included in a cut out, provide banding bars of same dimensions as bearing bars around opening welded to grating component parts.

E. Gratings shall be accurately fabricated, free from warps, twists, and other defects that would affect grating appearance and grating serviceability.

F. Welding shall conform to requirements of NAAMM MBG 533. Welds shall be ground smooth at top surfaces and bearing surfaces.

G. Openings in and edges of gratings sections shall be banded with banding bars. Weld bands to intersecting members.

H. Size each section of grating to weigh not more than 100 pounds, unless otherwise indicated in the Contract Documents.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine conditions under which Work is to be performed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Check all dimensions at the Site after piping and equipment are in place and determine exact locations of openings and cutouts.

3.02 INSTALLATION

A. Fastening to In-Place Construction:
   1. Use anchorage devices and fasteners to secure aluminum grating to supporting members or prepared openings, as recommended by manufacturer.
   2. Weld Type 316 stainless steel stud bolts to receive saddle clip or flange block anchors to supporting steel members. Drill for machine bolts when supports are aluminum.

B. Cutting, Fitting, and Placing:
   1. Perform cutting, drilling and fitting required for installation. Set the Work accurately in location, alignment and elevation, plumb, level, true, and free of rack. Do not use wedges or shimming devices.
   2. Where gratings are penetrated by piping, electrical conduit, ducts, structural members, or similar protrusions, cut openings neatly and accurately to size and attach banding bar as specified.
   3. Divide panels into sections only to extent required for installation where aluminum grating is to be installed around previously installed piping, electrical conduit, ducts, structural members, or similar protrusions.

C. Aluminum gratings in concrete floors shall be removable and arranged in sizes to be readily lifted. Provide aluminum gratings in concrete with aluminum angle frames with mitered corners and welded joints. Grind exposed joints smooth. Frames shall have welded anchors set into concrete. Angle size shall match grating depth selected for flush fit.

D. Clearance at ends or between sections of grating shall be a maximum of 1/4-inch.

E. Tops of aluminum gratings shall be set flush with surrounding construction.

F. Aluminum gratings shall be set with full and uniform end bearing on frames to preclude rocking movement; do not use wedges or similar shimming devices.

G. Protection of Aluminum from Dissimilar Materials: Coat aluminum surfaces in contact with dissimilar materials such as concrete, masonry, steel, or other metals, in accordance with Section 09 91 00, Painting.

END OF SECTION

SECTION 05 53 18

STAINLESS STEEL GRATING

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install stainless steel grating and frames.
   2. The Work includes:
      a. Providing grating, frames, and appurtenances.
      b. Providing openings in stainless steel grating to accommodate the Work under this and other Sections and attaching to stainless steel grating all items such as sleeves, bands, studs, fasteners, and items required for which provision is not specifically included under other Sections.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before stainless steel grating Work.

1.02 REFERENCES

A. Standards referenced in this Section are:
   1. ASTM A276, Specification for Stainless Steel Bars and Shapes.
   2. ASTM A666, Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   3. NAAMM MBG 531, Metal Bar Grating Manual.
   4. NAAMM MBG 533, Welding Specifications for Fabrication of Steel, Aluminum and Stainless Bar Grating.

1.03 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Shall have at least five years experience manufacturing products substantially similar to those required and shall be able to submit documentation of at least five installations in satisfactory operation for at least five years each.

B. Component Supply and Compatibility:
   1. Obtain all products included in this Section regardless of component manufacturer from a single stainless steel grating manufacturer.
   2. Stainless steel grating manufacturer shall review and approve or prepare all Shop Drawings and other submittals for all components furnished under this Section.

3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the stainless steel grating manufacturer.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Fabrication and erection of all stainless steel gratings Work. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items.
      b. Setting drawings and templates for location and installation of anchorage devices.
   2. Product Data:
      a. Manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Deliver products to the Site to ensure uninterrupted progress of the Work. Deliver anchorage materials to be embedded in concrete in ample time to prevent delaying the Work.
   2. Comply with Section 01 65 00, Product Delivery Requirements

B. Storage and Protection:
   1. Protect materials from corrosion and deterioration.
   2. Comply with Section 01 66 00, Product Storage and Handling Requirements.

PART 2 PRODUCTS

2.01 SYSTEM PERFORMANCE

A. Stainless Steel Grating: Provide stainless steel grating complying with the following:
   1. Grating Design Loads: Uniform live load shall be as shown or indicated in the Contract Documents. Where live load is not shown or indicated, uniform live and concentrated loads shall be as indicated below, whichever results in the greater design stresses:
      a. Live Load: 150 psf; Concentrated Load: 750 lbs per foot of grating width at center span.
   2. Maximum Clear Span Deflection for Uniform Live Loads: 1/120 of span, but not more than 1/4-inch.
   3. Maximum Fiber Stress: 20,000 psi.
   4. Minimum Size of Members:
      a. Minimum size of bearing bars shall be within standard mill tolerance as indicated in load tables in NAAMM MBG 531 for applicable loading and deflection requirements.

b. Minimum dimensions of cross bars shall be as indicated in the tables of Minimum Standard Cross Bars and Connecting Bars in NAAMM MBG 531.

5. Banding bar shall be 1/4-inch thick minimum. Top of banding bar shall be flush with top of grating, unless otherwise shown or indicated. Banding bar shall be 1/4-inch shorter than bearing bar height.

2.02 MANUFACTURERS

A. Grating, Products and Manufacturers: Provide one of the following:
   1. Weldforged Stainless Grating, manufactured by IKG Industries.
   2. Electroforged Stainless Grating, manufactured by McNichols Company.
   3. Or equal.

2.03 MATERIALS

A. Stainless steel used in bearing bars and cross bars shall be Type 316 alloy complying with ASTM A666.

B. Frames: Stainless steel complying with ASTM A276, Type 316.

2.04 FABRICATION

A. Use materials of minimum depth and thickness as specified and required to comply with performance criteria in the Contract Documents.

B. Provide grating as follows:
   1. Grating Type: Welded rectangular bearing bars with cross bars resistance-welded at right angles to bearing bars.
   2. Depth: One-inch, minimum.
   3. Bearing Bars: Minimum one-inch by 3/16-inch spaced at 1-3/16-inch on centers.
   4. Cross Bars: Welded to bearing bars at maximum spacing of four inches on centers.
   5. Surface: Unpunched.
   6. Finish: Mill.

C. Provide cutouts in grating for passage of piping, electrical conduits, valve stems, columns, ducts, and similar work. Where more than two bearings bars are included in a cut out, provide banding bars of same dimensions as bearing bars around opening welded to grating component parts.

D. Gratings shall be accurately fabricated, free from warps, twists or other defects that would affect grating appearance and grating serviceability of the grating.

E. Tops of grating bearing bars and cross bars shall be in the same plane.

F. Welding shall comply with NAAMM MBG 533. Welds shall be ground smooth at top and bearing surfaces.

G. Openings in and edges of grating sections shall be banded with flat banding bars as specified in this Section, welded along the line of cutout or to end of grating panel.

H. Size each section of grating to weigh maximum of 150 pounds, unless otherwise indicated in the Contract Documents.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions under which Work is to be performed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Check all dimensions at the Site after piping and equipment are in place and determine exact locations of openings and cutouts.

3.02 INSTALLATION

A. Fastening to In-Place Construction:
   1. Use anchorage devices and fasteners to secure stainless steel grating to supporting members or prepared openings, as recommended by manufacturer.
   2. For grating having bearing bars at 1-3/16-inch centers or greater, provide four saddle clip stainless steel anchors designed to fit over two bearing bars, and four stainless stud bolts with stainless washers and nuts for each grating panel, unless otherwise shown or indicated. For bearing bars spacing less than 1-3/16-inch centers, provide anchors in accordance with manufacturer's recommendations.

B. Cutting, Fitting, and Placing:
   1. Perform cutting, drilling and fitting required for installation. Set the Work accurately in location, alignment and elevation, plumb, level, true, and free of rack. Do not use wedges or shimming devices.
   2. Where gratings are penetrated by piping, electrical conduits, ducts, structural members, or similar protrusions, cut openings neatly and accurately to size and attach banding bar as specified.
   3. Divide panels into sections only to extent required for installation where stainless steel grating is to be installed around previously installed piping, electrical conduits, ducts, structural members, or similar protrusions.

C. Stainless steel gratings in concrete floors shall be removable and shall be arranged in sizes to be readily lifted. Provide stainless steel gratings in concrete with stainless steel angle frames having mitered corners and welded joints. Grind exposed joints smooth. Frames shall have welded anchors set into concrete. Angle size shall match grating depth selected for flush fit.

D. Clearance at ends or between sections of stainless steel grating shall be not greater than of 1/4-inch.

E. Tops of stainless steel gratings shall be set flush with surrounding construction.

F. Stainless steel gratings shall be set with full and uniform end bearing on frames to preclude rocking movement; do not use wedges or similar shimming devices.

G. Remove stains, cement droppings, oils, dirt, grease, paint, and other foreign matter.

END OF SECTION

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06 80 17 FIBERGLASS REINFORCED PLASTIC FABRICATIONS

1.00 GENERAL

1.01 SUMMARY

A. Section includes: Fiberglass reinforced plastic fabrications including:
   1. Effluent V-notch weir plates, and scum baffles for the two Secondary Clarifiers.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

C. Contractor shall verify installation meets specified weir elevations tolerances at time of installation and from three to five months after continuous operation prior to project completion. Relevel as needed to meet specified tolerances.

1.02 REFERENCES

A. American Water Works Association (AWWA):
   1. F 102 – Matched-Die-Molded, Fiberglass-Reinforced Plastic Weir Plates, Scum Baffles, and Mounting Brackets.

B. ASTM International (ASTM):
   1. C 582 – Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment.
   2. D 635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
   3. D 638 – Standard Test Method for Tensile Properties of Plastics.
   4. D 790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
   5. D 883 – Standard Terminology Relating to Plastics.
   6. D 2563 – Standard Practice for Classifying Visual Defects in Glass-Reinforced Plastic Laminate Parts.
   7. D 2583 – Standard Test Method for Indentation of Hardness of Rigid Plastics by Means of a Barcol Impressor.
   8. D 2584 – Standard Test Method for Ignition Loss of Cured Reinforced Resins.

C. United States, Department of the Interior:
   1. Bureau of Reclamation (USBR):
      a. ISO 9826 – Water Measurement Manual, Measurement of Liquid Flow in Open Channel.

1.03 SUBMITTALS

A. Shop drawings and calculations:
   1. Dimensions.
   2. Job specific layout.

3. Sectional assembly.
4. Location and identification mark.
5. Weir locations and attachment.
6. Scum baffle locations and attachment.
7. Accessories, attachments, transition pieces.
8. Connection details including bolt and anchor locations.
9. Method of attachment including number, locations and size of fasteners.

B. Manufacturer's catalog data showing:
1. Dimensions, spacing, and construction details
2. Materials of construction including resins and glass fiber content and layout for FRP constructions.
3. Descriptive literature.

C. Certificates
1. Submit Manufacturer's certification that all materials furnished comply with the applicable requirements of this specification.

D. Manufacturer's Instructions
1. Submit complete information and instructions relating to the storage, handling, installation, and inspection of all equipment related to this Section.

E. Operation and Maintenance Data.

F. Warranty.

1.04 QUALITY ASSURANCE

A. Manufacturer qualifications: Fiberglass reinforced plastic manufacturer with experienced personnel, physical facilities, and management capacity sufficient to produce custom-made glass fiber and resin products of quality and size specified for minimum five years with satisfactory performance record.

1.05 COORDINATION

A. Manufacturer shall coordinate the weir and scum baffle design and installation requirements with the clarifier mechanism configuration.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The parts and assemblies that are shipped unassembled shall be packaged and tagged in a manner that will protect the equipment from damage and facilitate the final assembly in the field.

B. All FRP materials shall be stored before, during, and after shipment in a manner to prevent cracking, twisting, bending, breaking, chipping or damage of any kind to the materials.

C. Provide temporary bracing for Parshall flume liner to assure maintenance of dimensions during shipment. Maintain bracing in place for installation.

1.07 WARRANTY

A. The equipment manufacturer shall warranty each unit being supplied to the Owner against defects in workmanship and material for a period of,
   1. Two years from the date the equipment in the final or third clarifier is placed into service.
   2. Two years from the date the Parshall flume is placed into service.

B. In the event a component fails to perform as specified or is proven defective in service during the warranty period, the manufacturer shall provide a replacement part without cost to the Owner. The Contractor shall provide, without cost, such labor as may be required to replace, repair or modify all materials and equipment provided pursuant to this specification.

2.00 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. All weir plates and baffles provided as part of this project shall be supplied by the same manufacturer under one submittal. Acceptable manufacturers include:
   1. MFG Water Treatment Products.
   2. NEFCO, Inc
   3. Warminster Fiberglass
   4. Fiberglass Fabricators

2.02 WEIR PLATES AND SCUM BAFFLES

A. General:
   1. In accordance with AWWA F 102, and as specified in this Section.

B. Materials:
   1. Laminate construction: Glass fiber-reinforced, chemical-resistant polyester resin.
      a. Glass content of laminate: Minimum 20 percent by weight.
      b. Resin fillers: Minimum 40 percent.
   2. Physical properties of laminate: Equal to or exceeding the tensile, flexural, impact, hardness, and water absorption properties specified in AWWA F 102.
   3. Performance criteria:
      a. Chemical resistance: Classification: AWWA F 102 Type II (chemical-resistant resin, filler and fabrications)
   4. Each plate and baffle shall have the following minimum physical properties:

Property	Test	Minimum Value
Tensile Strength	ASTM D-638	14,000 psi
Flexural Strength	ASTM D-790	25,000 psi
Flexural Modulus	ASTM D-790	1.0×10^6 psi
Barcol Hardness	ASTM D-2853	40
Water Absorption	ASTM D-570	0.2%

C. Fabrications:

1. Fabricated to the shapes, dimensions, and details indicated on the Drawings and specified**,** and using processes as specified in this Section.
2. Dimensions:
   a. Conform to tolerances in accordance with AWWA F 102, unless otherwise indicated.
   b. Final laminate thickness: Plus or minus 10 percent of nominal thickness.
3. Fabricate weir plates with oversize holes to allow vertical adjustment.
4. Seal cut edges of non-standard lengths, and edges of drilled and countersunk holes in fiberglass reinforced plastic fabrications with resin.
5. Furnish fiberglass reinforced plastic lapped plate splices at joints.

D. V-notch weir plates:
1. Shall be 1/4” thick plastic laminate and not exceed 12’ in length unless otherwise noted.
2. Oversized mounting holes in the weir plates shall be provided for vertical and horizontal alignment of at least 2” with 5” diameter FRP weir washers to cover the holes.
3. The weirs shall be mounted with 1/2” x 4-1/4” stainless steel expansion anchors 2’ on center.

E. Scum baffles:
1. Shall be 1/4” thick plastic laminate, 12” high and not exceed 12’ in length unless otherwise noted.
2. Splice plates shall be 6” x 12”.
3. The scum baffle brackets shall be 6” x 6” x 3/8” FRP Angle with slotted holes to provide horizontal, vertical and radial adjustment of the baffle. The brackets shall be installed on 4’ centers. Fastening holes in the scum baffle panel shall be countersunk to accommodate flat head fasteners.

F. Expansion anchors, nuts, bolts, washers and other hardware shall be Type 316 stainless steel.

3.00 EXECUTION

3.01 ERECTION AND INSTALLATION, GENERAL

A. Install products where indicated on the Drawings in accordance with manufacturer's printed instructions.

3.02 WEIRS AND SCUM BAFFLES

A. Carefully install weirs and scum baffles, aligning and leveling to the elevations indicated on the Drawings.

B. Installation tolerances:
1. V-notch weirs. In the completed installation:
   a. The variation in elevation between any 2 notches of the weir plate in a tank shall not exceed 1/8 inch.
   b. In a round tank, the variation from elevation between any one quadrant of the weir and that of any other quadrant shall not exceed 1/16 inch.

C. Contractor shall verify installation meets specified weir elevations tolerances at time of installation and from three to five months after continuous operation prior to project completion. Relevel as needed to meet specified tolerances.

END OF SECTION

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SECTION 09 80 00

CONCRETE PROTECTIVE COATINGS - COMPOSITES

PART 1 GENERAL

1.01 SUMMARY

A. The CONTRACTOR shall furnish all labor, materials, equipment and incidentals necessary to apply protective coatings as shown on the Plans or as specified herein.

B. Protective coatings shall be applied at the locations shown on the drawings.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Certified in compliance with ISO 9001 Quality Standards for formulation (research and development), manufacture, and technical support.
2. Manufacturer must have a local authorized NACE certified coating inspector on site during critical phases of installation process.
3. Manufacturer shall have a minimum of ten (10) years successful applications of the protective coatings specified herein on similar applications.
4. Manufacturer must supply a list of references outlining structures and equipment coated and proof of successful application.

B. Applicator's Qualifications:

1. Must be qualified in this line of work and have at least ten (10) years documented experience in concrete repair/restoration.
2. Must have a minimum of ten (10) years documented experience in the application of the protective coatings specified herein.
3. Must have a minimum of ten (10) years of documented successful installations of the specified products, on structures and/or equipment similar to this project.
4. Submit a list of (5) recent projects of the same structures and names and contact information of references.
5. Applicator must be Manufacturer certified for 5 years prior to bid submission.

C. Protective Coating Application Coordination Conference:

1. Conduct coating application coordination conference to review detailed requirements of CONTRACTOR's proposed coating installation methods and procedures for the successful installation of the coating system. CONTRACTOR shall organize and schedule the conference and prepare and distribute to all parties attending conference minutes of the conference.
2. Conference shall be held at mutually agreed upon location, date and time; Notify all parties to attend coordination conference not less than two weeks prior to scheduled date of conference.
3. All parties involved in the installation and inspection of the coating work shall attend the coordination conference including, but not limited to, the following:
   a. CONTRACTOR.
   b. Coating manufacturer representative
   c. Certified coating installer

d. Concrete repair installation subcontractor

e. Field testing services representative.

f. Repair mortar manufacturer representative

g. ENGINEER.

h. OWNER Representative.

D. Testing: Protective coatings shall be applied under quality control procedures that include inspection of surface preparation before each coat. Do not proceed with the next step until the OWNER and COATING MANUFACTURER has approved the previous step. The CONTRACTOR shall be solely responsible for testing for this section, at no further cost to the OWNER. The ENGINEER shall also make such tests if it is considered necessary. Cooperate with the OWNER, providing equipment, scaffolds, and other equipment as requested by the OWNER.

Protective coatings shall be applied under quality control procedures that include the following test procedures.

1. Pre-installation

a. Surface profile test equal to ANSI/NACE/ICRI standards for specified substrate.

b. pH testing for acidification of concrete

c. Chloride testing for soluble salts

d. Ultraviolet light testing for hydrocarbon residues

e. Hydration testing for moisture content

2. In-process testing (daily)

a. Surface temperature

b. Relative humidity

c. Ambient temperature

d. Dew point

All testing shall be documented daily and submitted to inspector prior to commencing work.

3. Post-installation

a. High voltage spark testing for pinhole/holiday free verification

b. Dolly adhesion pull-off for surface preparation/application/cure verification

c. Visual surface for irregularities

All post installation testing shall be documented and submitted to inspector after completion of work.

1.03 SURFACE PREPARATION

A. All surfaces to receive coating shall be dry abrasive blasted to profile equal to ICRI CSP #3 or 60 grit sand paper. All existing liner or coatings systems at areas to receive new coatings must be removed. Surface preparation shall be inspected and

approved by the coating manufacturer representative prior to the application of the coatings.

B. All terminations (walls, floors, gates, pipe, and doors etc.) shall be keyed back terminations to prohibit corrosion at seams.

C. All leaking cracks, spalls and surfaces where repair mortar installation is shown on the drawings, shall repaired per Section 03 30 00. The repaired surfaces shall be inspected and approved by the coating manufacturer representative prior to the application of the coatings.

1.04 SUBMITTALS

Submittals shall be made in accordance with Section 01 33 00 and shall include:

A. Manufacturer's product data sheet for each coating type, including surface preparation requirements, recommended spreading rates, application procedures, recommended primers, environmental limits (temperature, humidity, and dew point) and other instructions.

B. Material Safety Data Sheets (MSDS) for all coatings, solvents, etc.

C. Applicator's qualifications.

D. Manufacturer's statement regarding applicator instruction on product use and application.

E. Manufacturer's written warranty.

F. Manufacturer's ISO 9001 certification.

1.05 REFERENCE STANDARDS

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by designation only.

A. AMERICAN SOCIETY OF TESTING MATERIALS (ASTM)

ASTM C307	Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings
ASTM C531	Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
ASTM C579	Standard Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
ASTM C580	Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
ASTM C868	Standard Test Method for Chemical Resistance of Protective Linings
ASTM C884	Standard Test Method for Thermal Compatibility Between Concrete and an Epoxy-Resin Overlay
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

ASTM D1002	Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)
ASTM D4060	Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D4272	Standard Test Method for Total Energy Impact of Plastic Films by Dart Drop
ASTM D4541	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM G8	Standard Test Methods for Cathodic Disbonding of Pipeline Coatings

1.06 JOB CONDITIONS

A. Store coating materials at temperatures of between 50° and 90°F or in accordance with manufacturer recommendations.

B. The OWNER shall approve surfaces for application of coating at each stage. Any material that is coated prior to the OWNER's approval shall be stripped back and recoated.

C. Environmental Conditions

1. Do not apply under conditions that are unsuitable for the production of good results. Do not begin application of coatings in areas where other trades are working, or where construction activities result in airborne dust or other debris. Do not apply coatings in conditions which do not conform to the recommendations of coating manufacturer.

2. Coatings shall only be applied when conditions fall within the parameters listed in manufacturer's printed data.

3. New concrete shall be cured for 30 days minimum before coating is applied. At surfaces where repair mortars are installed provide minimum curing as required by the mortar manufacturer. The coatings manufacturer shall determine and approve the suitability of the surface for coating application prior to installation.

D. Working Conditions

1. Provide adequate lighting at any location that coatings are being applied or testing is performed. Illumination shall be of sufficient intensity to achieve good results. Provide explosion-proof lighting when required.

2. Temporary ladders and scaffolds shall conform to applicable safety requirements. Erect temporary scaffolds where needed to cover large areas. Provide ladders or scaffolding during testing procedures.

1.07 GUARANTEES

A. Protective coating lining shall be warrantied for a period of Ten (10) years from the date of the OWNER's acceptance of the project. The warranty shall specify failure modes and substandard product performance, defined as "chemical attack or coating induced mechanical failure or improper installation leading to loss of adhesion from substrate". A manufacturer's warranty against defects and physical properties warranty is unacceptable.

B. A warranty inspection shall be conducted annually for the entire warranty period with the manufacturer present. Any defective work discovered shall be corrected by the

CONTRACTOR in accordance with specifications at no additional cost to the OWNER. Other corrective measures may be required during the warranty period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products shall be one of the following named manufacturers/suppliers.

1. A.W. Chesterton, ARC 791 system.
2. Belzona 4111, Magma Quartz system.

No Alternate Manufacturers/Suppliers are included in these specifications. Substitute Manufacturers/Suppliers will not be considered.

2.02 MATERIALS

A. Primer:

1. Two component primer.
2. Primer must be chemically unique from the top coat matrix.
3. Primer must provide a recoat window of not less than 2 hours at 77°F.
4. Primer shall be hydrophobic, moisture insensitive, have a low viscosity and be able to bond to wet concrete.

B. Top Coat:

1. Matrix shall be a compounded epoxy resin reacted with modified aliphatic amine curing agent.
2. Composite shall utilize quartz reinforcements that have been pre-treated with a polymeric coupling agent.

C. Concrete Repair Mortars: Concrete repair mortars shall be manufactured and/or approved by coatings manufacturer and/or supplied by same. All repair materials/mortar shall be installed by Coatings Manufacturer Certified applicator.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare surfaces in accordance with manufacturer’s written recommendations.

B. New Concrete shall be cured for 30 days minimum before coating is applied. At surfaces where repair mortars are installed provide a minimum curing as required by the mortar manufacturer. The coatings manufacturer shall determine the suitability of the surface for coating application prior to installation.

C. Remove all grease, oils, and grime by washing with an emulsifying alkaline water-base cleaner. Follow with a thorough rinsing.

D. Remove all surface contaminants including old coatings, chemical salts, dust, loose concrete, and the laitance layer by hydro-blasting, steel shot-blasting, scabbling, scarifying, or dry abrasive blasting. Abrasives used for cleaning shall be used one time without recycling.

E. Resulting surface must be structurally sound and free of contaminants prior to coating application.

F. Surface to be coated can be damp. There shall be no standing water.

G. Pre-fill cracks in horizontal surfaces with mixed primer and cover with fiberglass or nylon mesh. For cracks in vertical surfaces, or in the upper 90 degree section of the pipe, pressure inject with a suitable injection system per spec section 03 30 00 and per manufacturer's recommendations.

H. For coatings to be applied to slab on grade, if no vapor barrier is present, check slab for vapor permeation.

3.02 APPLICATION

A. Primer

1. Properly mixed primer should be clear, not cloudy.
2. Apply primer with brush, roller, and squeegee or with spray equipment to the freshly prepared concrete surfaces.
3. Primer coat shall be a uniform wet coat with a wet thickness of 7 to 10 mils.
4. Do not prime more surface area than can be top coated within 4 hours.
5. Double prime vertical surfaces and areas where the concrete is porous.
6. To reduce the chance for vapor blistering or disbondment, do not install overlayment when the temperature of the concrete is rising. This may require installation in the evening or at night.
7. Primer is to be applied around the entire interior circumference of the proposed 60-inch PCCP effluent piping and appurtenances of PC 6 and PC 8. See civil drawings for limits of coatings.

B. Top Coat

1. Mixing: Material temperatures shall be between 70° and 90°F to facilitate mixing and application or as per manufacturer recommendations.
2. Apply top coat shortly after application of primer while primer is still wet or tacky. This is normally within approximately 4 hours of primer application.
3. If the area to be coated is not wet or tacky, re-prime the area.
4. Minimum application temperature is 50°F, recommended application temperature is 77°F.
5. Apply single coat at 250 mils dry film thickness (DFT).
6. Horizontal surfaces:
   a. Distribute over floor surface using screed guides and rigid bar, or screed box, not exceeding 4 feet in width.
   b. Rough screed a minimum of 0.25 inches and finish the surface using steel trowels.
   c. Large areas may be power troweled to achieve the required flatness and finish.
7. Vertical surfaces and pipelines (includes bottom of upper slab):
   a. Apply to vertical surfaces using a hawk and trowel, pressing the top coat firmly onto the surface to promote contact with the primer.
   b. Finish the surface to the desired texture with a trowel.
   c. For pipelines, Certified installer shall grout the interior joints prior to coating. Once coating has been applied, installer shall break out the grout in joints and install a flexible polysulfide sealant. This material

shall be selected by the supplier and installer such that the warranty for the composite is not affected and submitted to owner for approval.

8. Remove all trowel marks and unevenness before the end of the “Working Time” (see curing schedule below).

9. Top Coat is to be applied around the entire interior circumference of the proposed 60-inch PCCP effluent piping and appurtenances of PC 6 and PC 8. See civil drawings for limits of coatings.

3.03 FIELD QUALITY CONTROL

A. Certified manufacturer’s representative shall be present to observe application of coating and after completion to inspect and certify that product was properly applied.

B. Sound random areas where coating has been applied in accordance with manufacturer recommendations.

C. The OWNER may, at his option, elect to have the surface preparation and application witnessed by his representative. The CONTRACTOR and coating manufacturer certified installer shall notify the OWNER sufficiently in advance of the dates that surface preparation and application will occur, so that the OWNER can make arrangements for his representative to be present.

3.04 CLEAN AND ADJUST

A. Promptly remove trash and debris resulting from coating operation from the site.

END OF SECTION

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09 91 00 PAINTING AND COATINGS

1.00 **GENERAL**

1.01 Summary

A. Furnish and install paint and protective coatings to all surfaces unless specifically excluded in this section or on the drawings.

B. Paint and coatings shall be furnished and installed on all proposed surfaces, modified surfaces, and surfaces damaged during construction.

C. Paint and coatings are not required on existing items unless shown otherwise on the drawings or unless existing items are modified or damaged during construction.

1.02 WORK INCLUDED

A. Surface preparation

B. Surface finish schedule

1.03 REFERENCES

A. References:

1. ASTM International (ASTM)

a. D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.

b. D2016 - Test Method for Moisture Content of Wood.

c. D4417 – Standard Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel.

2. Texas Commission on Environmental Quality (TCEQ)

a. Chapter 217 Design Criteria for Domestic Wastewater Systems

3. The Society for Protective Coatings (SSPC)

a. SSPC Painting Manual, “Good Painting Practice”

b. SSPC Painting Manual, “Systems and Specifications”

c. SP1 Surface Preparation Specification No. 1 - Solvent Cleaning

d. SP3 Surface Preparation Specification No. 3 - Power Tool Cleaning

e. SP5 Surface Preparation Specification No. 5 - White Metal Blasting

f. SP6 Surface Preparation Specification No. 6 - Commercial Blast Cleaning

g. SP7 Surface Preparation Specification No. 7 - Brush-Off Blast Cleaning

h. SP10 Surface Preparation Specification No. 10 - Near-White Blast Cleaning

i. SP12 Surface Preparation Specification No. 12 - Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating

j. SP13 Surface Preparation Specification No. 13 - Surface Preparation of Concrete

k. SP14 Surface Preparation Specification No. 140 - Industrial Blast Cleaning

l. VIS 1 89 - Visual Standard for Abrasive Blast Cleaned Steel

4. NACE International (National Association of Corrosion Engineers International)

a. SP0287-2016-SG "Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape"

b. RP0188-99 "Discontinuity (Holiday) Testing of Protective Coatings"

c. RP0178-95 "Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service"

d. RPO 892-92 "Linings Over Concrete for Immersion Service"

e. RPO 591-96 "Coatings for Concrete Surfaces in Non-Immersion"

f. 6G186 "Surface Preparation of Contaminated Steel Surfaces"

g. 6G191 "Surface Preparation of Contaminated Concrete."

h. RPO 178 "Weld preparation Visual Comparator."

5. National Science Foundation (NSF)

1.04 DEFINITIONS

A. Conform to ANSI/ASTM D16 for interpretation of terms used in this Section.

B. Where the terms "exposed" surfaces are used to define painting locations and requirements it shall include all visible outside surfaces, top of walls and inside surfaces to 1'-0" below the ground level or to floor level, whichever applies.

1.05 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with 10 years' experience.

B. Applicator: Company specializing in industrial painting and finishing with 5 years documented experience, approved by product manufacturer.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame/fuel/smoke rating requirements for finishes.

B. Materials and coatings in contact with potable water must conform to NSF Standard 61.

1.07 SUBMITTALS

A. Submit product data under provisions of Section 01 33 00.

B. Provide product data on all coatings.

C. Submit samples or color charts illustrating range of colors and textures available for each surface-finishing product scheduled, for selection.

D. Submit manufacturer's application instructions under provisions of Section 01 33 00.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and protect products in accordance with coating manufacturer's instructions.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.

C. Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.

D. Unless otherwise required by the manufacturer, store paint materials at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in well ventilated area, unless required otherwise by manufacturer's instructions.

E. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F (7 degrees C) for 24 hours before, during and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.

B. No exterior coatings shall be applied during rain or snow, when the air temperature is below 50ºF (10ºC) or above 120ºF (49ºC) or when the temperature of the surface to be coated is below 50ºF (10ºF) except as allowed by the coating manufacturer. No coating shall be applied if a predicted temperature of 35ºF (1.67ºC) or lower is forecast within 24 hours of application unless the coating is enclosed and heated. No painting is to be done when the relative humidity meets or exceeds 50% or when the substrate temperature is within 5ºF (2.78ºC) of the dew point, as allowed by the manufacturer.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior, unless required otherwise by manufacturer's instructions.

D. Minimum Application Temperature for Varnish and Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80-foot candles measured mid-height at substrate surface.

2.00 **PRODUCTS**

2.01 ACCEPTABLE MANUFACTURERS – ALL COATINGS

A. PPG Protective & Marine Coatings (Ameron)

B. Carboline

C. Tnemec

D. Valspar

2.02 MATERIALS

A. Coatings: Ready mixed, except field-catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.

B. Accessory Materials: Thinning of paint and all accessory type materials used shall be strictly in accordance with the manufacturer's recommendations covering material types, solvents, mix ratios, and methods.

C. Contractor shall have complete responsibility for ensuring that each coating applied is compatible with its substrate and/or its intended finish coat, and that the complete coating system is suitable for its intended service.

2.03 FINISHES

A. Colors shall be selected by Owner from manufacturer's standard color charts.

3.00 EXECUTION

3.01 INSPECTION

A. Verify that surfaces are ready to receive work, including specified surface preparation and profile, as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums, unless more stringent limitations are recommended by the coating manufacturer:

1. Plaster and Gypsum Wallboard: 12 percent
2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent

3.02 PREPARATION

A. Surface preparation shall be as indicated in Part 3.8 or as otherwise indicated in an individual specialized equipment specification.

3.03 PROTECTION

A. Protect elements surrounding the work of this Section from damage or disfiguration.

B. Repair damage to other surfaces caused by work of this Section.

C. Furnish drop cloths, shields and protective methods to prevent spray or droppings from disfiguring other surfaces.

D. Remove empty paint containers from site, and dispose of all excess materials and empty containers in full accordance with all applicable state, federal and local laws.

3.04 APPLICATION

A. Apply products in accordance with manufacturer's instruction.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish.

D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

E. Sand lightly between coats to achieve required finish.

F. Allow applied coat to cure adequately per manufacturer's instructions before next coat is applied.

G. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

H. Prime back surfaces of interior and exterior woodwork with primer paint.

I. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

J. Paint all exterior and interior wood, concrete, and metal items throughout the project except for surfaces listed below:
   1. Indoor concrete surfaces, unless specifically noted on the Plans.
   2. Concrete walkways, pavement, sidewalks and stair treads.
   3. Inside of walls and columns one foot below the average water surface level of tanks and wet wells.
   4. Fiberglass items unless specified otherwise.
   5. Metal surfaces of anodized aluminum, stainless steel, or chromium plate.
   6. Operating parts, unless otherwise specified.
   7. Existing structures, piping or equipment, unless otherwise specified.
   8. Exposed roof decking that is factory primed and finished.

K. Repair any damage to paint on existing structures caused by construction work. Match existing colors with touch-up paint.

L. New concrete shall age a minimum of 30 days before application of coatings.

3.05 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Colors for equipment shall be selected by Owner during submittal process.

B. Paint shop primed equipment.

C. Remove unfinished louvers, grilles, covers and access panels on mechanical and electrical components and paint separately.

D. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports.

E. Replace identification markings on mechanical or electrical equipment when painted accidentally.

F. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to limit of sight line. Paint dampers exposed behind louvers, grilles and convector and baseboard cabinets to match face panels.

G. Paint exposed conduit and electrical equipment occurring in finished areas.

H. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

I. All exposed piping, indoor and outdoor, insulated and un-insulated, except RCCP and stainless steel pipe, shall be painted.

J. Color code equipment, piping, conduit, and exposed ductwork as directed by the OWNER.

K. Replace electrical plates, hardware, light fixture trim and fittings removed prior to finishing.

3.06 CLEANING

A. As Work proceeds, promptly remove paint where spilled, splashed or spattered.

B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials and debris.

C. Collect cotton waste, cloths and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

D. Where existing paint is removed, collect and dispose of removed coatings in full accordance with all applicable laws and regulations.

3.07 TESTING

A. Wet Film Testing – Make wet-film tests during painting operations to assure proper thicknesses of coating are being applied. After each coat has been applied, test the paint film thickness with a non-destructive, magnetic type thickness gauge.

B. Dry Film Thickness Testing – Make dry film tests after coating operations to assure proper thickness of coating has been applied. The total thickness after the final coat has been applied shall be 100 percent of the thickness specified, minimum. Apply additional coats until the specified thickness is reached or exceeded.

C. Holiday Testing
   1. Test the entire surface of coated metal structures with a holiday detector.
   2. For thickness between 10 and 20 mils (250 to 500 microns), a nonsudsing type wetting agent, as recommended by the holiday detector Manufacturer shall be added to the water prior to wetting the detector sponge.
   3. Mark and repair pinholes in accordance with the Manufacturer's printed instructions then retest pinholes.
   4. No pinholes or other irregularities shall be permitted in the final coats.
   5. Areas containing holidays shall receive additional coats until test indicate no holidays.

3.08 SCHEDULE

A. Cast-in Place Concrete Walls and Ceilings, Precast Concrete Surfaces, Equipment Bases, Pipe Supports, and Similar Surfaces, all with "smooth rubbed finish," interior non-submerged, where painting is specifically called for on the Plans:
   1. Surface preparation: Brush-blast or acid-etch.
   2. Product and Manufacturer: Provide one of the following:
      a. Tnemec
         1) Primer: 66 Hi-Build Epoxoline-1 coat, 5.0 dry mils per coat.
         2) Finish: 66 Hi-Build Epoxoline-1 coat, 4.0 dry mils per coat, 160 square feet per gallon.
      b. Carboline:

1) Primer: Carboline 890-1 coat, 5.0 mils dft.
2) Finish: Carboline 890 – 1 coat, 4.0 mils dft.

c. Ameron:
1) Primer: Amercoat 385-1 coat, 45.0 mils per coat.
2) Finish: Amercoat 385 – 1 coat, 4.0 dry mils per coat, 211 square feet per gallon theoretical.

d. Valspar:
1) 89 Series – 1 coat – 5.0 dry mils per coat.
2) 89 Series – 1 coat – 4.0 dry mils per coat.

B. Submerged or intermittently submerged Concrete, Interior and Exterior, except for potable water service, where painting is specifically called for on the Plans:
1. Surface Preparation: Brush-off blast.
2. Product and manufacturer: Provide one of the following:
a. Tnemec:
1) Finish: 46-H-413 Teneme-Tar-2 coats, 8.0 dry mils per coat.

b. Carboline:
1) Finish: Carbomastic 14-2 coats, 8-10 dry mils dft per coat.

c. Ameron:
1) Finish: Amercoat 78HB Coat Tar Epoxy applied in 1 or 2 coats cross hatched to achieve 16 total dry mils for the system.

d. Valspar:
1) 64-J-5 Coal Tar Epoxy – 2 coats, 8.0-10.0 dry mils per coat.

C. Ferrous Steels including Structural Metal Bar Joists, Miscellaneous Metals and exposed metal Piping, including piping to be insulated, Interior:
1. Surface Preparation: SSPC-SP6 commercial blast.
2. Product and Manufacturer: Provide one of the following:
a. Tnemec:
1) Shop Primer: Series 1 Omnithane-1 coat, 3.0 dry mils.
2) Shop Primer for Bar Joists: Series 1 Omnithane 1-coat, 3.0 dry mils.
3) Field primer or field touch-up: Series 37H Chem-Prime-1 coat, 2.0 dry mils.
4) Finish: Series 66 Epoxoline – 1 coat, 4.0 dry mils.

b. Carboline:
1) Shop primer, shop primer for bar joists, field primer or touch-up: Rustbond 8 HBC 2 mils dft – 1 coat.
2) Finish: Carboline 890 – 1 coat, 4.0 mils dft.

c. Ameron:
1) Shop Primer: Amercoat 185-1 coat, 2.0 dry mils.
2) Shop Primer for Bar Joists, Field primer, or Field touch-up is the same as the shop primer.
3) Finish: Amercoat 385 Polyamide Epoxy – 1 coat, 4.0 dry mils.

d. Valspar:
1) 13-R-28 Phenolic-Alkyd Primer – 1 coat, 2.0 dry mils.
2) 89 Series – 1 coat at 4.0 dry mils.

D. Ferrous Metals, Exterior:
1. Shop Surface Preparation: SSPC-SPC6 commercial blast.
2. Field Surface Preparation: Sandblasting of field welds and other imperfections. ENGINEER may require all areas to be blasted at their discretion, in accordance with SSPC-SP6, commercial blast.

3. Products and Manufacturer: Provide one of the following:
   a. Tnemec:
      1) Shop Primer: Series 66 Epoxoline – 1 coat, 2.0 dry mils.
      2) Field Primer: Series 66 Epoxoline – 1 coat, 2.0 dry mils.
      3) Finish: Series 1074 Endura-Shield II-1 coat, 3.0 dry mils per coat.
   b. Carboline:
      1) Shop Primer: Carboline 893-1 coat, 3.0 mils dft.
      2) Field Primer: Carboline 893 –1 coat, 3.0 mils dft.
      3) Finish: Carboline 133 HB-2 coats, 1.5 mils dft per coat.
   c. Ameron:
      1) Shop/Field primer: Amercoat 385 Polyamide Epoxy – 1 coat, 4.0 dry mils to be applied in the shop or in the field.
      2) Finish: Amercoat 450HS High Solids Aliphatic Polyurethane-2 coats, 1.5 dry mils per coat.
   d. Valspar:
      1) Primer: 89 Series – 1 coat, 3.0 dry mils.
      2) Finish: V40 Series Urethane-2 coats, 1.5-2.0 dry mils per coat

E. Ferrous Metals at or Below Water Surfaces
1. Surface Preparation Prior to Abrasive Blast Cleaning: Remove any existing coatings, rust, and weld splatter. Weld flux and splatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard SP0178, Designation D.
2. Surface Preparation: SSPC-SP10 Near-White Metal Blast Cleaning followed by SSPC-SP1 Solvent Cleaning. Anchor profile shall be 3.0 mils as per ASTM D 4417, Method C or NACE Standard RP0287.
3. Product and Manufacturer: Provide one of the following:
   a. TNEMEC
      1) First Coat: TNEMEC Series 1 Omnithane applied at 2.5 to 3.5 dry mils.
      2) Second Coat: TNEMEC Series 446 Perma-Shield MCU applied at 6.0 to 8.0 dry mils.
      3) Third Coat: TNEMEC Series 446 Perma-Shield MCU applied at 6.0 to 8.0 dry mils.
      4) Total minimum dry film thickness shall be 15.0 mils.
   b. Chesterton
      1) First Coat: ARC S1 applied at 8.0 to 12.0 mils.
      2) Second Coat: ARC S1 applied at 8.0 to 12.0 mils.
      3) Total minimum dry film thickness shall be 16.0 mils.
4. The coating environment is humid and corrosive. Coatings shall be applied on the same day as the abrasive cleaning. Any rust, evidence of corrosion, or discoloration appearing after abrasive blast and before application of the coating shall be removed by abrasive blasting or power tool cleaning. The CONTRACTOR shall have the OWNER's Representative inspect the surface after preparation and prior to application of the first coat.
5. Coatings on new equipment shall have the first coat applied at the manufacturer's facility.

F. Galvanized Metal and Non-Ferrous Metal, Interior where painting is required:
1. Surface Preparation: Solvent Cleaning, SPPC-SP1 and Commercial Blast Cleaning per SSPC-SP6.

2. Product and Manufacturer: Provide one of the following:
    a. Tnemec:
        1) Primer/Finish: 66 Epoxoline-1 coat, 5 dry mils per coat
    b. Carboline:
        1) Primer/Finish: Carboline 890-1 coat, 5 dry mils per coat.
    c. Ameron:
        1) Primer/Finish: Amercoat 385 Polyamide Epoxy – 1 coat, 5 dry mils per coat.
    d. Valspar:
        1) Primer/Finish: 89 Series – 1 coat, 5.0 dry mils per coat

G. All Aluminum in Contact with Dissimilar Materials:
1. Surface Preparation: Remove all foreign matter.
2. Product and Manufacturer: Provide one of the following:
    a. Tnemec:
        1) Series 66 Hi-Build Epoxoline-2 coats, 4.0 dry mils per coat.
    b. Carboline:
        1) Carboline 893 – 2 cots, 4.0 mils dft per coat.
    c. Ameron:
        1) Amercoat 385 Polyamide Epoxy – 2 coats, 4.0 dry mils per coat
    d. Valspar:
        1) 89 Series – 2 coats, 4.0 dry mils per coat.

H. Mill-Coated Steel Pipe:
1. Surface Preparation: SSPC-sp10 Near-White blast.
2. Product and Manufacturer: Provide one of the following:
    a. Tnemec:
        1) Primer: 66-1211 Epoxoline Primer-1 coat, 4.0 dry mils per coat.
        2) Finish: Series 66-Hi-Build Epoxoline-1 coat, 4.0 dry mils per coat.
    b. Carboline:
        1) Primer: Carboline 893-1 coat, 4.0 mils dft.
        2) Finish: Carboline 890 – 1 coat, 4.0 mils dft.
    c. Ameron:
        1) Primer: Amercoat 385 Polyamide Epoxy – 1 coat, 4. dry mils.
        2) Finish: Amercoat 385 Polyamide Epoxy, 1 coat, 4.0 dry mils
    d. Valspar:
        1) Primer: 89 Series – 1 coat, 4.0 dry mils.
        2) Finish: 89 Series – 1 coat, 4.0 dry mils.

I. Insulated Ferrous Metal Pipe, Interior, Temperatures below 200 degrees F:
1. Surface Preparation: Remove foreign matter.
2. Products and Manufacturer: Provide one of the following:
    a. Tnemec:
        1) Primer: Series 1 Omnithane – 1 coat, 3.0 dry mils.
        2) Finish: Series 66 Epoxoline – 2 coats, 2.0 dry mils per coat.
    b. Carboline:
        1) Primer: Rustland 8HB-1 coat, 2.0 mils dft.
        2) Finish: Carboline 890-1 coat, 4.0 mils dft.
    c. Ameron:
        1) Primer: Amercoat 185 Universal – 1 coat, 2.0 dry mils
        2) Finish: Amercoat 385 Polyamide Epoxy – 1 coat, 4.0 dry mils per coat.

d. Valspar:
    1) Primer: 12-F-28 – 1 coat, 2.0 dry mils.
    2) Finish: 89 Series – 1 coat, 4.0 dry mils per coat

J. Above grade, Insulated, Uninsulated PVC and CPVC Piping, Interior and Exterior:
1. Surface Preparation: As recommended by coating manufacturer.
2. Product and Manufacturer: Provide one of the following:
    a. Tnemec:
        1) Finish: Series 66 Hi-Build Epoxoline-1 coat, 4.0 dry mils.
    b. Carboline:
        1) Finish: Carboline 890 – 1 coat, 4.0 mils dft.
    c. Ameron:
        1) Finish: Amercoat 385 Polyamide Epoxy – 1 coat, 4.0 dry mils.
    d. Valspar:
        1) Finish: 89 Series – 1 coat, 4.0 dry mils.

K. Interior concrete masonry unit surfaces:
1. Surface preparation: Allow mortar to cure for 28 days. Level protrusions and mortar spatter. All surfaces must be clean and free of excessive moisture, grease, oil, dirt or other foreign contaminants.
2. Product and Manufacturer: Provide one of the following:
    a. Tnemec:
        1) Primer: Series 1254 Epoxoblock -1 coat, 75-150 s.f. /per gallon for concrete masonry units.
        2) Finish: Series Hi-Build Epololine – 2 coats to 8.0 mils dft
    b. Carboline:
        1) Primer: Storglaze #2011 Concrete/Masonry Surface-1 coat, 100 s.f. /gallon for lightweight and haydite block.
        2) Finish: Carboline 890 – 2 coats to 8.0 mils dft
    c. Ameron:
        1) Primer: Amerlock 400BF, Epoxy Block Filler-1 coat, 100 s.f. /gallon for lightweight haydite block.
        2) Finish: Amercoat 385 Polyamide Epoxy – 2 coats 8.0 mils dft.
    d. Valspar:
        1) Primer: 46 x 29 – 1 coat, 100 s.f. /gallon for lightweight haydite block.
        2) Finish: 89 Series-2 coats to 8.0 mils dft.

L. All Metal Surfaces Exposed to Temperatures Over 250°F
1. Surface Preparation: SSPC-SP10 Near-White Blast.
2. Product and Manufacturer: Provide one of the following:
    a. Tnemec:
        1) Finish: 90E-92 Tneme-Zinc - 1 coats, 3.0 dry mils per coat, 360 square feet per gallon.
    b. Carboline:
        1) Finish: Carboline 4700 Aluminum - 2 coats, 1.0 mils dft per coat.
    c. Ameron:
        1) Finish: Amercoat 878 Silicone Aluminum - 2 coats, 1.0 dry mils per coat, 494 square feet per gallon theoretical.
    d. Valspar:
        1) Finish: 37-A-10 Heat Resisting Aluminum - 2 coats, 1.0 dry mils per coat.

M. All fiberglass items, including FRP duct, FRP odor control vessels, FRP fans, and unpigmented FRP chemical tanks, shall be coated as follows:
   1. Surface Preparation:
      a. Brush off cleaning, SSPC-SP7
      b. Solvent Clenaing, SSPC SP-1
   2. Products and Manufacturer:
      a. Tenemec
         1) Primer: Series 66 Hibuild Epoxoline, 3.0-4.0 mils dft. Broom surface after coating has dried.
         2) Intermediate coat: Series 66 Highbuild Epoxoline, 3.0-4.0 mils dft.
         3) Finish: Series 1075 Endura Shield II, 3.0-5.0 mils dft.
      b. Or equal by Carboline, Valspar, or Ameron.
   3. The intent of this specification is to obtain a polyurethane top coat for UV protection and cosmetic purposes. Primer and intermediate coats, as well as initial surface preparation shall be as recommended by the coating manufacturer for proper adhesion and serviceability on the fiberglass items to be painted.

END OF SECTION

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10 14 00 SIGNAGE

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide and install signs as described below and as directed by Owner:

1. Warning signs at all electrical equipment.
2. Interior room identification signs.
3. Other signs as shown on the plans or specified herein.

B. All supplementary or miscellaneous items, such as bolts, mounting brackets, concrete bases, or any other devices necessary for a secure installation are to be furnished and installed as a part of this work.

C. Contractor shall furnish and install all required and specified signage. All signs shall be in compliance with ADA and TAS. This compliance shall include, but not be limited to, locations, height, color, size of text, and width of text.

1.02 QUALITY ASSURANCE

A. All signs and appurtenances described in this section shall be furnished by a single manufacturer.

B. All signs shall have a minimum service life of 10 years exposed to sunlight and weathering.

1.03 SUBMITTALS

A. Submittal of a sign schedule shall be prepared and submitted in accordance with Section 01 33 00.

B. Submit manufacturer's catalog data showing colors dimensions, and materials of construction for each sign, as well as method of installation.

2.00 PRODUCTS

2.01 INTERIOR ROOM SIGNS

A. For bidding purposes, include signs in the contract as follows:

1. Material: Engraved 1/8-inch thick micarta plastic plate, single face 2 inches high by 10 inches long with radiussed corners and color as selected by the Engineer. Signs shall be as manufactured by the Southwell Co. or approved equal.
2. Lettering: Lettering will be Helvetica Medium Style.
3. Text/Location: Furnish signs in the quantities indicated in 2.02 B, below. Coordinate location of signs with Owner.
4. ADA Signage

2.02 OTHER SIGNS

A. Signs specified herein shall be of one of the following materials, at the Contractor’s option:

1. Fiberglass equal to Brady Corporation, "Fibershield."

2. LXSIGN as manufactured by Stonehouse Sign, Inc.

B. Specific Products: Provide products of dimensions and colors equal to the following:
   1. No-Smoking Sign: Stonehouse Signs, Inc., Stock No. 110.
   2. High Voltage Warning Signs: Stonehouse Signs, Inc., Stock No. 119.
   3. Sign Posts to Outdoor Signs: Coated Steel U-Post.
   4. Automatic Start Signs at certain equipment: Storehouse No. 184-9.
   5. Non-Potable Water Warning Sign: Storehouse Signs, Inc. Stock No. 89-20
   6. Miscellaneous other signs to be indicated by the Owner.

3.00 EXECUTION

3.01 INSTALLATION

A. Provide all necessary 316 stainless steel bolts and mounting hardware for signs. Each sign shall utilize 4 screws or 2 brackets.

END OF SECTION

CITY OF AUBREY, TEXAS

SPECIFICATIONS AND CONTRACT DOCUMENTS
WASTEWATER TREATMENT PLANT EXPANSION TO 2.25 MGD

VOLUME 2
DIVISION 26 to SECTION 40 42 13

May 2024

BID SET for **INTERNAL REVIEW**

Mead&Hunt
TBPELS FIRM NO. F-9593

In Association with:

MBROH ENGINEERING
TBPE FIRM NO. 9439

JQ Infrastructure
TBPELS Firm F-7986

rawls·culver
ARCHITECTS, LP

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SECTION 26 05 00 ELECTRICAL - GENERAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials and equipment required to install, test and provide an operational, electrical system as specified and as shown on the Drawings.

B. The work shall include furnishing, installing and testing the equipment and materials detailed in the following Sections:

26 05 00 - Electrical - General Provisions

26 05 05 - Electrical Demolition

26 05 10 - Excavation, Trenching, Backfilling and Compaction for Electrical Applications

26 05 19 - Wires and Cables (600 Volt Maximum)

26 05 26 - Grounding System

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26 05 90 - Cast-In-Place Concrete for Electrical Applications

26 09 13 - Power Metering and Protective Relays

26 22 13 - Distribution Dry-Type Transformers

26 24 14 - Low Voltage Distribution Switchboards (Compartmented)

26 24 16- Panelboards

26 24 19 - Low Voltage Motor Control Centers

26 27 26 - Light Switches and Receptacles

26 28 16- Low Voltage Enclosed Circuit Breakers and Disconnect Switches

26 29 13 - Low Voltage Motor Controllers

26 29 23 - Low Voltage Adjustable Frequency Drives (AFD's)

26 29 86 - Mechanical Manufacturer's Provided Control Panels (MEM's)

26 29 87- Electrical Manufacturer's Provided Control Panels (OEM's)

26 32 13 - Standby Generator Set

25 34 13 - NEMA Frame Induction Motors, 600 Volts and Below

26 41 00 - Lightning Protection Systems

26 50 00 - Lighting System

C. The work shall include furnishing and installing the following:

1. Texas New Mexico Power 277/ 480 VAC 3 Phase 4 Wire service
2. Conduit, wire and field connections for all motors, motor controllers, control devices, control panels and electrical equipment furnished under other Divisions. The CONTRACTOR shall coordinate with the supplier of electrical equipment specified under other Divisions.
3. Conduit, wiring and terminations for all field-mounted instruments furnished and mounted under other Divisions, including process instrumentation primary elements, transmitters, local indicators and control panels. Lightning and surge protection equipment wiring at process instrumentation transmitters. Install vendor furnished cables specified under other Divisions.
4. A complete raceway system for the Data Highway Cables and specialty cable systems. Install the Data Highway Cables and other specialty cable systems furnished under Division 40 in accordance with the system manufacturers' installation instructions. Review the raceway layout, prior to installation, with the computer system supplier and the cable manufacturer to ensure raceway compatibility with the systems and materials being furnished. Where redundant cables are furnished, install cables in separate raceways.
5. Conduit, wiring and terminations for variable frequency drives, harmonic filters, transformers and power factor correction capacitors furnished and mounted under other related Divisions.
6. Power wiring for all heating, ventilating, and air conditioning equipment furnished under other related Divisions, including power wiring for 120 Volt unit heater motors and thermostats. Refer to HVAC Drawings for the locations of 120 Volt unit heater thermostats and provide a 3/4-in C, 2 No. 12 and 1 No. 12 GRD between each heater and its respective control thermostat.
7. Furnish and install precast electrical and instrumentation manholes, handholes and light pole bases.
8. Furnish and install electrical and instrumentation manhole and handhole frames and covers.

9. Certain pieces of laboratory equipment (e.g., still, water-baths, fume hood, etc) will be furnished unassembled. Do all work necessary to make this equipment operative.

10. Modifications to existing control systems including installation of auxiliary motor starter contacts, relays, switches, etc, as required to provide the control functions or inputs as shown on the Drawings. Obtain the existing equipment shop drawings from the OWNER before attempting to make any modifications to the existing equipment wiring. Verify all existing wiring and connections for correctness. If record drawings are not available, trace all circuits in the field and develop the wiring diagrams necessary for completion of the work. Document all changes made to the wiring diagrams and return a marked-up set of Record Drawings to the OWNER after the work is complete.

11. Coordinate the sequence of demolition with the sequence of construction to maintain plant operation in each area. Remove and demolish equipment and materials in such a sequence that the existing and proposed plant will function properly with no disruption of treatment.

12. Modifications to existing motor control centers, switchboards, panelboards and motor controllers including installation of circuit breakers, etc, or disconnection of circuits as required providing the power supplies to new and existing equipment to maintain the plant in operation.

13. All bidders shall visit the site of the project, prior to submitting a bid, and satisfy themselves as to any question that they might have, relating to existing equipment, condition or construction.

D. Provide all electrical relocation work associated with the relocation of equipment for the existing and new facilities, including disconnecting all existing wiring and conduits and providing new wiring and conduit to the relocated equipment.

1.02 RELATED WORK

A. Except for directly controlled, single phase, unit heater thermostat wiring and all interlocking and termination wiring within the motor starter/motor control centers, all automatic temperature control wiring for heating, ventilating and air conditioning equipment (thermostats, duct switches, P-E switches, dampers, automatic temperature control panels, etc) will be furnished and installed under Division 26 unless otherwise indicated on the Drawings.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00 - Submittals for equipment, materials and other items furnished and as indicated in the individual specification sections.

B. The CONTRACTOR shall check shop drawings for accuracy and contract requirements prior to submittal. Shop drawings shall be stamped with the date checked and a statement indicating that the shop drawings conform to Specifications and Drawings. Shop Drawings shall be organized by specification section, with one specification section per transmittal. Each submittal shall be complete, contain all of the items listed

in the specification section, and shall be clearly marked to indicate which items are applicable on each cut sheet page. This statement shall also list all exceptions to the Specifications and Drawings. Shop drawings, not so checked and noted, will be returned unreviewed.

C. If however, in the opinion of the CONTRACTOR, a hardship of equipment delay or delivery of a specific item would delay the project through no fault of the CONTRACTOR, the CONTRACTOR may request an early review of that equipment or material, clearly stating the reason for separate approval. The approval of such material or equipment must not be dependent upon the approval of other equipment or materials to be submitted later, such as the Power System Study, etc.

D. It shall be the CONTRACTOR's responsibility to check for conformance with the Specifications and Drawings, all as contained within the Contract Documents. Errors and omissions on approved shop drawings shall not relieve the CONTRACTOR from the responsibility of providing materials and workmanship required by the Specifications and Drawings.

E. All dimensions shall be field verified at the job site and coordinated with the work of all other trades.

F. Material shall not be ordered or shipped until the shop drawings have been approved. No material shall be ordered or shop work started if shop drawings are marked "APPROVED AS NOTED CONFIRM", "APPROVED AS NOTED RESUBMIT" or "NOT APPROVED".

G. Shop Drawings, O&M Manuals, and other documentation, shall be submitted as listed in each of the Electrical Specification Sections.

1. Submit installation, operations and maintenance data for equipment furnished under this Division in accordance with Section 01 33 00 - Submittals. The manuals shall be prepared specifically for this installation and shall include catalog data sheets, drawings, equipment lists, descriptions, parts lists, etc, to instruct operating and maintenance personnel unfamiliar with such equipment.

2. Manuals shall include the following as a minimum:

   a. A comprehensive index.

   b. A complete "As-Built" set of approved shop drawings.

   c. A complete list of the equipment supplied, including serial numbers, ranges and pertinent data.

   d. A table listing of the "as left" settings for all timing relays and alarm and trip set points.

   e. System schematic drawings "As-Built", illustrating all components, piping and electric connections of the systems supplied under this Section.

   f. Detailed service, maintenance and operation instructions for each item supplied.

   g. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.

h. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.

i. Complete parts list with stock numbers, including spare parts.

H. Record Drawings shall be promptly furnished when the equipment installation is complete. Payment will be withheld until Record Drawings have been furnished and approved.

I. At the time of delivery of the equipment, the CONTRACTOR shall have an approved shop drawing in his possession for the OWNER's Inspector, and OWNER's Engineer, for verification.

1.04 REFERENCE STANDARDS

A. Electric equipment, materials and installation shall comply with the National Electrical Code (NEC) and with the latest edition of the following codes and standards:

1. National Electrical Safety Code (NESC)
2. Occupational Safety and Health Administration (OSHA)
3. National Fire Protection Association (NFPA)
4. National Electrical Manufacturers Association (NEMA)
5. American National Standards Institute (ANSI)
6. Insulated Cable Engineers Association (ICEA)
7. Instrument Society of America (ISA)
8. Underwriters Laboratories (UL)
9. Factory Mutual (FM)

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

C. All material and equipment, for which a UL standard exists, shall bear a UL label. No such material or equipment shall be brought onsite without the UL label affixed.

D. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents will take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization, authority having jurisdiction or association, or between Laws and Regulations, the higher performance requirement shall be binding on the CONTRACTOR, unless otherwise directed by the OWNER/ENGINEER.

E. In accordance with the intent of the Contract Documents, the CONTRACTOR accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time nor limit in any way, the CONTRACTOR's responsibility to comply with all Laws and Regulations at all times

1.05 AREA CLASSIFICATION AND ENCLOSURE TYPES

A. Unless otherwise specified herein or shown on the Drawings, electrical enclosures and associated installations shall have the following ratings:

1. NEMA 1 for dry, non-process indoor above grade locations (i.e. administration areas, laboratories, control rooms, storage rooms).
2. NEMA 7 (and listed for use in the area classifications shown) for “Class I Div. 1 Group D” and “Class I Div. 2 Group D” hazardous locations shown on the Drawings.
3. NEMA 4X 316 Stainless Steel enclosures, suitable for corrosive areas, shall be provided for all other locations on the project. PVC enclosures shall be used for Chlorine and Caustic Rooms.

1.06 SERVICE AND METERING

A. The power company serving this project is Texas New Mexico Power. Service shall be obtained at 480/277 Volts, 3 Phase, 4 Wire, 60 Hz from a pad mounted transformer furnished and installed by Texas New Mexico Power.

B. The power company shall be responsible for the following work:

1. Furnishing and installing the primary overhead conductors and pole line.
2. Furnishing and installing the riser pole, primary cutouts, lightning arresters and grounding.
3. Furnishing and installing primary conduits and cables.
4. Furnishing and installation of transformer and dedicated grounding.
5. Termination of underground primary cables at riser pole.
6. Termination of underground primary cables at the transformer.
7. Furnishing and installation of metering current transformers (CT's), meter and meter wiring.
8. Furnishing power company metering base and enclosure.

C. The CONTRACTOR shall be responsible for the following work:

1. Obtain an estimate from the power company for the work described in this SERVICE AND METERING paragraph and include the cost of the power company work in the Bid Price.
2. Furnishing secondary conduits and cables.
3. Furnishing and installing an empty conduit with pull line from the metering C.T. enclosure to the meter enclosure. Conduit size and type shall be approved by the power company.
4. Coordinate the electrical service installation with the Power Company.
5. Furnishing and installation of electrical service equipment and automatic transfer switch.

6. Furnishing and installation of lightning arresters and grounding.
7. Furnishing and installation of receptacles and lighting.
8. Furnishing and installation of motor control center.
9. Furnishing and installation of pump motor feeders.
10. Furnishing and installation of conduits and conductors as shown on plans.
11. Furnishing and installation of all other miscellaneous electrical systems, as shown on plans.

D. Submit shop drawings for the following items to the power company for approval:

1.07 HAZARDOUS AREAS

A. Equipment, materials and installation in areas designated as hazardous on the Drawings shall comply with NEC Articles 500, 501, 502 and 503.

B. Equipment and materials installed in hazardous areas shall be UL listed for the appropriate hazardous area classification.

1.08 CODES, INSPECTION AND FEES

A. Equipment, materials and installation shall comply with the requirements of the local authority having jurisdiction.

B. Obtain all necessary permits and pay all fees required for permits and inspections.

C. The OWNER will negotiate with the electric utility for the costs of new or revised services and make payment to the electric utility for such costs, but the CONTRACTOR shall be responsible for the coordination with the electric utility during the installation of such services.

1.09 TESTS AND SETTINGS

A. Test systems and equipment furnished under Division 26 and repair or replace all defective work. Make adjustments to the systems and instruct the OWNER's personnel in the proper operation of the systems.

B. Make the following minimum tests and checks prior to energizing electrical equipment:

1. Mechanical inspection, testing and setting of circuit breakers, disconnect switches, motor starters, control equipment, etc for proper operation.
2. Test grounding system as specified in Section 26 05 26 - Grounding.
3. Test motor control centers as specified in Section 26 24 19 - Low Voltage Motor Control Centers.
4. Test 600 volt wires and cables as specified in Section 26 05 19 - Wires and Cables (600V Maximum).
5. Check wire and cable terminations for tightness.

6. Check motor nameplates for correct phase and voltage. Check bearings for proper lubrication.
7. Check the ampere rating of thermal overloads for motors and submit a typed record to the OWNER/ENGINEER of same, including MCC cubicle location and load designation, motor service factor, horsepower, full load current and starting code letter. If inconsistencies are found, new thermal elements shall be supplied and installed.
8. Check rotation of motors prior to energization. Disconnect driven equipment if damage could occur due to wrong rotation. If it rotates in the wrong direction, correct it.
9. Check interlocking, control and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by schematic and wiring diagrams.
10. Verify all terminations at transformers, equipment, capacitor connections, panels, and enclosures by producing a 1 2 3 rotation on a phase sequenced motor when connected to "A", "B" and "C" phases.
11. Verify motor power factor capacitor ratings.

C. Testing shall be scheduled and coordinated with the OWNER/ENGINEER at least two weeks in advance. Provide qualified test personnel, instruments and test equipment.

D. Refer to the individual equipment sections for additional specific testing requirements.

E. Make adjustments to the systems and instruct the OWNER's personnel in the proper operation of the systems.

1.10 INTERPRETATION OF DRAWINGS

A. The Drawings are not intended to show exact locations of conduit runs. Coordinate the conduit installation with other trades and the actual supplied equipment.

B. Install each 3 phase circuit in a separate conduit unless otherwise shown on the Drawings.

C. Unless otherwise approved by the OWNER/ENGINEER, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.

D. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.

E. Verify the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

F. Except where dimensions are shown, the locations of equipment, fixtures, outlets and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by the CONTRACTOR and approved by the OWNER/ENGINEER during construction. Obtain information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the OWNER/ENGINEER and furnish all labor and materials necessary to complete the work in an approved manner.

G. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting and other electrical systems shown.

H. Redesign of electrical or mechanical work, which is required due to the CONTRACTOR's use of an alternate item, arrangement of equipment and/or layout other than specified herein, shall be done by the CONTRACTOR at his/her own expense. Redesign and detailed plans shall be submitted to the OWNER/ENGINEER for approval. No additional compensation will be provided for changes in the work, either his/her own or others, caused by such redesign.

I. Raceways and conductors for lighting, switches, receptacles and other miscellaneous low voltage power and signal systems as specified are not shown on the Drawings. Raceways and conductors shall be provided as required for a complete and operating system. Refer to riser diagrams for signal system wiring. Homeruns, as shown on the . drawings, are to assist the CONTRACTOR in identifying raceways to be run exposed and raceways to be run concealed. Raceways installed exposed shall be near the ceiling or along walls of the areas through which they pass and shall be routed to avoid conflicts with HVAC ducts, cranes hoists, monorails, equipment hatches, doors, windows, etc. Raceways installed concealed shall be run in the center of concrete floor slabs, above suspended ceilings, or in partitions as required.

J. The CONTRACTOR shall run all conduit and wire to PLC termination cabinets, where designated on the drawings. The conduit and wire as shown on the interface drawings may not necessarily be shown on the floor plan.

K. Install conductors carrying low voltage signals (typically twisted shielded pair cables) in raceways totally separate from all other raceways containing power or 120 volt control conductors.

L. Raceways and conductors for low voltage (120 Volts) thermostats controlling HVAC unit heaters, exhaust fans and similar equipment are not shown on the Drawings. Provide raceways and conductors between the thermostats, the HVAC equipment and the motor starters for a complete and operating system. Raceways shall be installed concealed in all finished space and may be installed concealed or exposed in process spaces. Refer to the HVAC drawings for the locations of the thermostats.

M. Raceways and conductors for the fire alarm, sound and page party systems are not shown on the Drawings. Provide raceways and conductors as required by the system manufacturer for a complete and operating system. Raceways shall be installed concealed in all finished spaces and may be installed exposed or concealed in process spaces.

1.11 PHASE BALANCING

A. The Drawings do not attempt to balance the electrical loads across the phases. Circuits on motor control centers and panelboards shall be field connected to result in evenly balanced loads across all phases.

B. Field balancing of circuits shall not alter the conductor color coding requirements as specified in Section 26 05 19 - Wires and Cables.

1.12 SIZE OF EQUIPMENT

A. Investigate each space in the structure through which equipment must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.

B. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to ensure that the tilting does not impair the functional integrity of the equipment.

1.13 RECORD DRAWINGS

A. As the work progresses, legibly record all field changes on a set of Project Contract Drawings, hereinafter called the "Record Drawings". The Record Drawings and Specifications shall be kept up to date throughout the project.

B. Record Drawings shall accurately show the installed condition of the following items:

1. One-line Diagram(s).
2. Raceways and pullboxes.
3. Conductor sizes and conduit fills.
4. Panel Schedule(s).
5. Control Wiring Diagram(s).
6. Lighting Fixture Schedule(s).
7. Lighting fixture, receptacle and switch outlet locations.
8. Underground raceway and duct bank routing.
9. Plan view, sizes and locations of switchgear, distribution transformers, substations, motor control centers and panelboards.

C. Submit a typical example of a schedule of control wiring raceways and wire numbers, including the following information:

1. Circuit origin, destination and wire numbers.
2. Field wiring terminal strip names and numbers.

D. As an alternative, submit a typical example of point-to-point connection diagrams showing the same information, may be submitted in place of the schedule of control wiring raceways and wire numbers.

E. Submit the record drawings and the schedule of control wiring raceways and wire numbers (or the point-to-point connection diagram) to the OWNER/ENGINEER.

1.14 EQUIPMENT INTERCONNECTIONS

A. Review shop drawings of equipment furnished under other related Divisions and prepare coordinated wiring interconnection diagrams or wiring tables. Submit copies of wiring diagrams or tables with Record Drawings.

B. Furnish and install all equipment interconnections.

1.15 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new, except where specifically identified on the Drawings to be re-used.

B. Material and equipment of the same type shall be the product of one manufacturer and shall be UL listed.

C. All hardware for mounting boxes and equipment, such as racks, brackets, washers, springs, nuts, etc, shall be of 316 stainless steel.

D. The CONTRACTOR shall be responsible for all material, product, equipment and workmanship being furnished by him for the duration of the project. He shall replace the equipment if it does not meet the Contract Documents.

E. Warrant all equipment furnished under Division 26 in accordance with Section 01 70 00 - Execution and Closeout Requirements. Refer to individual equipment sections for additional warranty items.

1.16 EQUIPMENT IDENTIFICATION

A. Identify equipment (disconnect switches, separately mounted motor starters, control stations, etc.) furnished under Division 26 with the name of the equipment it serves. Motor control centers, control panels, panelboards, switchboards, switchgear, junction or terminal boxes, transfer switches, etc, shall have nameplate designations as shown on the Drawings.

B. Nameplates shall be engraved, laminated plastic, not less than 1/16-in thick by 3/4-in by 2-1/2-in with 3/16-in high white letters on a black background.

C. Nameplates shall be 316 SS screw mounted to all enclosures. Screws on NEMA 4 enclosures shall be epoxy sealant coated. Epoxy adhesive or foam tape is not acceptable.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SLEEVES AND FORMS FOR OPENINGS

A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical work and form before concrete is poured.

B. Exact locations are required for stubbing-up and terminating concealed conduit. Obtain shop drawings and templates from equipment vendors or other sub CONTRACTORs and locate the concealed conduit before the floor slab is poured.

C. Where setting drawings are not available in time to avoid delay in scheduled floor slab pours, the OWNER/ENGINEER may allow the installations of such conduit to be

exposed. Requests for this deviation must be submitted in writing. No additional compensation for such change will be allowed.

D. Seal all openings, sleeves, penetration and slots as specified in Section 26 05 33 - Raceways, Boxes, Fittings and Supports.

3.02 CUTTING AND PATCHING

A. Cutting and patching shall be done in a thoroughly workmanlike manner and be in compliance with modifications and repair to concrete as specified in Section 26 05 90 - Cast-In Place Concrete for Electrical Applications. Saw cut all concrete and masonry prior to breaking out sections.

B. Core drill holes in concrete floors and walls as required.

C. Install work at such time as to require the minimum amount of cutting and patching.

D. Do not cut joists, beams, girders, columns or any other structural members.

E. Cut opening only large enough to allow easy installation of the conduit.

F. Patching to be of the same kind and quality of material as was removed.

G. The completed patching work shall restore the surface to its original appearance or better.

H. Patching of waterproofed surfaces shall render the area of the patching completely waterproofed.

I. Remove rubble and excess patching materials from the premises.

J. When existing conduits are cut at the floor line of wall line, they shall be filled with grout of suitable patching material.

3.03 INSTALLATION

A. Any work not installed according to the Drawings and this Section shall be subject to change as directed by the OWNER/ENGINEER. No extra compensation will be allowed for making these changes.

B. Electrical equipment shall be protected at all times against mechanical injury or damage by water. Electrical equipment shall not be stored outdoors. Electrical equipment shall be stored in dry permanent shelters. Do not install electrical equipment in its permanent location until structures are weather-tight. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and tested as directed by the OWNER/ENGINEER, or shall be replaced at no additional cost at the OWNER/ENGINEER's discretion.

C. Equipment that has been damaged shall be replaced or repaired by the equipment manufacturer, at the OWNER/ENGINEER's discretion.

D. Repaint any damage to the factory applied paint finish using touch-up paint furnished by the equipment manufacturer. If the metallic portion of the panel or section is damaged, the entire panel or section shall be replaced, at no additional cost to the OWNER.

3.04 MANUFACTURER'S SERVICE

A. Provide manufacturer's services for testing and start-up of the equipment as listed in each individual Specification Section.

B. Testing and startup shall not be combined with training. Testing and start-up time shall not be used for manufacturers' warranty repairs.

3.05 TESTING

A. Test systems and equipment furnished under Division 26 and repair or replace all defective work. Make adjustments to the systems and instruct the OWNER's personnel in the proper operation of the systems.

B. Make the tests and checks prior to energizing electrical equipment in accordance with the paragraph on Test and Settings, and the individual Specification sections.

C. Testing shall be scheduled and coordinated with the OWNER/ENGINEER at least two weeks in advance. Provide qualified test personnel, instruments and test equipment, including manufacturer's services, as specified in the individual Specification sections.

D. Where test reports show unsatisfactory results, the OWNER/ENGINEER may require the removal of all defective or suspected materials, equipment and/or apparatus, and their replacement with new items, all at no cost to the OWNER. The CONTRACTOR shall bear all cost for any retesting.

3.06 TRAINING

A. The CONTRACTOR shall provide manufacturer's training as specified in each individual section of the Specifications.

END OF SECTION

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SECTION 26 05 05 ELECTRICAL DEMOLITION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish, install and test all equipment, wiring and appurtenances as may be required to perform the electrical demolition shown on the Drawings and as specified herein.

1.02 SCHEDULES

A. Schedule with the OWNER/ENGINEER for required shutdowns to accommodate system demolition and installation of temporary facilities.

1.03 STANDARDS

A. Temporary wiring of systems to maintain operation of facilities while undergoing modifications and demolition shall be provided in accordance with:

1. American National Standards Institute / National Fire Protection Association (ANSI/NFPA), No. 70 – National Electrical Code (NEC), Article No. 590 – Temporary Installations.

1.04 QUALITY ASSURANCE

A. Verify field measurements and circuiting arrangements are as shown on the Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents. Discrepancies shall be reported to the OWNER/ENGINEER before disturbing the existing installation.

D. By beginning demolition, the CONTRACTOR accepts the existing conditions and warrants that he will maintain service to equipment and items not scheduled or indicated for removal.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual Sections.

2.02 DESIGN AND CONSTRUCTION

A. If temporary electrical wiring and facilities are required, the CONTRACTOR shall provide such wiring and facilities to comply with NEC - Article No. 590.

PART 3 EXECUTION

3.01 PREPARATION

A. Disconnect electrical systems in walls, floors and ceilings scheduled for removal.

B. Coordinate utility service outages with the Utility Company to provide continuous service to operating equipment.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from the OWNER/ENGINEER at least one week in advance, before partially or completely disabling system.

3.02 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit serving them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

E. Disconnect and remove abandoned panelboards and distribution equipment.

F. Disconnect and remove electrical devices and equipment that has been removed.

G. Repair adjacent construction and finishes damaged during demolition and extension work.

H. Maintain access to existing installations which remain active. Modify installation or provide access to panels as appropriate.

I. Extend existing installations using materials and methods as specified for new work.

J. Carry out the work in an orderly and careful manner. Hold noise, dust, and vibration to a minimum and conduct the Work so as to avoid any damage to the surroundings. Remove all items and parts as shown and noted on the Drawings and as otherwise may be required to be removed to carry out the Work.

K. Salvaged Equipment and Materials

1. Equipment and material designated as remaining the property of the OWNER shall be removed from the structure and hauled to a designated location on the

site and stored for the OWNER's use. Store on wood runners raised above the surrounding grade and cover with weather resistant covering and tie securely or store inside OWNER furnished storage as directed by the OWNER/ENGINEER.

2. Following is a list of the equipment and materials to remain the property of the OWNER and salvaged as specified above:

3. Take necessary precautions in removing OWNER designated property to prevent damage during the demolition process. Remove steel structural members by unbolting, cutting welds, or cutting rivet heads and punching shanks through holes. Do not use a cutting torch to separate the OWNER's equipment or material unless approved by the ENGINEER.

4. Generally, items shall be removed in one piece or in a manner that does not impact their reuse. Loose components may be removed separately. Controls and electrical equipment may be removed from the equipment and handled separately. Large units may be handled separately. Salvaged piping shall be taken apart at flanges or fittings and removed in sections.

L. Material removed from the construction site during demolition, and any equipment not otherwise designated to remain the property of the OWNER in accordance with the pre-demolition identification process shall become the property of the CONTRACTOR, and shall be promptly removed from the construction site.

M. The CONTRACTOR shall refurbish and replace any existing facility to be left in place which is damaged by the demolition operations at no additional expense to the OWNER. The repair of such damage shall leave the parts in a condition at least equal to that found at the start of the Work.

3.03 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION

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SECTION 26 05 10 EXCAVATION, TRENCHING, BACKFILLING AND COMPACTION FOR ELECTRICAL APPLICATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to perform all excavation, trenching for electrical duct work and appurtenances, including drainage, bedding, filling, backfilling, disposal of surplus material, and restoration of trench surfaces and easements.

1.02 RELATED WORK

A. Section 26 05 00 - Electrical – General Provisions.

B. Section 26 05 19 - Wire and Cables (600 Volt Maximum).

C. Section 26 05 33 - Raceways, Boxes, Fittings and Supports.

D. Section 26 05 43 - Underground System.

E. Section 26 05 90 - Cast-in-Place Concrete for Electrical Applications.

1.03 REFERENCE CODES AND STANDARDS

A. All excavation, trenching, and related sheeting, bracing, etc., as shown on the Drawings and listed in these Specifications, shall comply with the following standards (unless otherwise noted):

1. Occupational Safety and Health Administration (OSHA)
   a. Excavation safety standards (29 CFR Part 1926.650 Subpart P) - Excavation.
2. American Society for Testing and Materials (ASTM)
   a. ASTM D 698a – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600kN-m/m3)).

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 TRENCH EXCAVATION

A. The excavation shall extend to the width and depth as shown on the Drawings, or as specified, and shall provide suitable room for installing manholes, handholes, ducts and appurtenances.

B. Furnish and place all sheeting, bracing and supports.

C. Excavation shall include material of every description and of whatever substance encountered, regardless of the methods or equipment required to remove the material.

Pavement shall be cut with a saw, wheel or pneumatic chisel along straight lines before excavating.

D. The CONTRACTOR shall strip and stockpile topsoil from grassed areas crossed by trenches. At the CONTRACTOR's option, topsoil may be otherwise disposed of and replaced, when required, with approved topsoil of equal quality.

E. While excavating and backfilling is in progress, traffic shall be maintained, and all utilities and other property protected, as provided for in the Contract Documents.

F. Materials shall be excavated to the depth indicated on the Drawings and in widths sufficient for installing manholes and laying the ducts. Coordinate the trench width the Details shown on the Drawings. The bottom of the excavations shall be firm and dry in all respects acceptable to the OWNER/ENGINEER. Trench width shall be a practical minimum, but not less than 6 inches greater than the total duct section arrangement, including reinforcing steel.

G. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. The trench may be excavated by machinery to, or just below, the designated subgrade, provided that material remaining in the bottom of the trench is no more than slightly disturbed. Subgrade soils which become soft, loose or otherwise unsatisfactory as a result of inadequate excavation, dewatering or other construction methods, shall be removed and replaced by gravel fill, of aggregate as specified in Section 26 05 90 - Cast-In Place Concrete for Electrical Applications, as required by the OWNER/ENGINEER at the CONTRACTOR's expense.

3.02 EXCAVATION BELOW GRADE AND REFILL

A. Regardless of the nature of unstable material encountered, or the groundwater conditions, trench and excavation drainage shall be complete and effective.

B. If deemed necessary by the OWNER/ENGINEER, or as shown on the Drawings, the CONTRACTOR shall be required to deposit pea gravel for duct bedding or gravel refill for excavation below grade, directly on the bottom of the trench immediately after excavation has reached the proper depth and before the bottom of the trench has become softened or disturbed by any cause whatsoever. All excavation shall be made in open trenches. Gravel used for this purpose, shall be aggregate as specified in Section 26 05 90 - Cast-In Place Concrete for Electrical Applications, with a maximum coarse aggregate size of ¾ inches.

3.03 BACKFILLING

A. Remove from the excavation all materials which the OWNER/ENGINEER may deem unsuitable for backfilling.

B. Backfilling shall not commence until, not less than 48 hrs after placing of any concrete embedment, have lapsed.

C. Where the ductbanks are laid in the yard, the remainder of the trench, after concrete encasement, shall be filled with common fill material, void of rock or other non-porous material, in layers not to exceed 8-in in loose measure and compacted to 90% standard

Proctor density at optimum moisture content of +/- 4%. The backfill shall be mounded 6-in above the existing grade or as directed by the OWNER/ENGINEER. Where a grass, loam or gravel surface exists prior to excavations in the yard, it shall be removed, conserved and replaced to the full original depth as part of the work under the duct items. In some areas it may be necessary to remove excess material during the cleanup process, so that the ground may be restored to its original level and condition.

D. Where the ductbanks are laid in paved areas or designated future paved areas, existing or designated future structures, or other existing or future utilities, the remainder of the trench above the encasement, shall be backfilled with select common fill or select fill material in layers not to exceed 8-inches loose measure and compacted at optimum moisture content (+/- 3%) to 95 percent standard Proctor density. The top 18-inches below subgrade level shall be compacted at optimum moisture content (+/- 3%) to 100 percent of standard Proctor density.

E. Compaction shall be by use of hand or pneumatic tamping with tools weighing at least 20 lbs. The material being spread and compacted shall be placed in layers not over 8-in thick. If necessary, sprinkling shall be employed in conjunction with rolling or ramming.

F. Bituminous paving shall not be placed in backfill.

G. Water jetting will not be accepted as a means of consolidating or compacting backfill.

H. All road surfaces shall be broomed and hose-cleaned immediately after backfilling. Dust control measures shall be employed at all times.

3.04 RESTORING TRENCH AND ADJACENT SURFACES

A. In paved areas, the edge of the existing pavement to be removed shall be cut along straight lines, and the pavement replaced with the same type and quality of the existing paving.

B. In sections where the ductbank passes through grassed areas, the CONTRACTOR shall, at his own expense, remove and replace the sod, or shall loam and reseed the surface to match the surrounding area.

END OF SECTION

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SECTION 26 05 19 WIRES AND CABLES (600 VOLT MAXIMUM)

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish, install and test all wire, cable and appurtenances as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Provide and install all 4-20mA signal circuits, process control wiring, signal wiring to field instruments, LPU input and output wiring and other field wiring and cables.

B. Section 26 05 33 - Raceways, Boxes, Fittings and Supports

C. Section 26 05 43 - Underground System

1.03 SUBMITTALS

A. Shop Drawings

1. Submit catalog data of all wire and cable and accessories specified under this Section with all selections, options and exceptions clearly indicated.

B. Certified Tests

1. Submit a test report of all installed wire insulation tests.

C. Operation and Maintenance Manuals

1. Submit Operation and Maintenance Manuals containing installation and maintenance instructions for splice and termination kits.

1.04 REFERENCE CODES AND STANDARDS

A. The equipment in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NEMA WC-5 – Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

1.05 QUALITY ASSURANCE

A. The general construction of the wire, cables and the insulation material used shall be similar to that used for cable of the same size and rating in continuous production for at least 15 years and successfully operating in the field in substantial quantities.

B. Cable with a manufacture date of greater than twelve (12) months previous will not be acceptable.

C. The manufacturer of these materials shall have produced similar electrical materials for a minimum period of five (5) years. When requested by the Owner/Engineer, an

acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.06 DELIVERY, STORAGE AND HANDLING

A. Equipment shall not be stored onsite without written approval of the Owner/Engineer. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the Contractor's choice and at the Contractor's expense, until such time that the site is ready for permanent installation of the equipment.

B. Check for reels not completely restrained, reels with interlocking flanges or broken flanges, damaged reel covering or any other indication of damage. Do not drop reels from any height.

C. Unload reels using a sling and spreader bar. Roll reels in the direction of the arrows shown on the reel and on surfaces free of obstructions that could damage the cable.

D. Store cable on a solid, well drained location. Cover cable reels with plastic sheeting or tarpaulin. Do not lay reels flat.

E. Seal cable ends with heat shrinkable end caps. Do not remove end caps until cables are ready to be terminated.

1.07 WARRANTY

A. The Manufacturer shall warrant the wiring and installation to be free from defects in material and workmanship for 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the installation to new operating condition.

PART 2 PRODUCTS

2.01 GENERAL

A. Wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper.

B. All conductors shall be stranded.

C. Except for control, signal and instrumentation circuits, wire smaller than No. 12 AWG shall not be used.

2.02 BUILDING WIRE

A. Wire for lighting, receptacles and other circuits not exceeding 150 volts to ground shall be NEC type THHN/THWN as manufactured by Southwire, Rome or equal.

B. Wire for circuits over 150 volts to ground shall be NEC type THHN/THWN for sizes #6 AWG and smaller and shall be NEC type XHHW for sizes #4 and larger as manufactured by Southwire, Rome or equal.

C. Type THHN/THWN wire shall not be used underground.

2.03 GROUND WIRE

A. Ground wire shall be uninsulated copper, sized as shown on the Drawings, in all cases where a single ground wire is indicated to be installed in a conduit with no other conductors in the conduit, or where the ground wire is directly buried in earth or concrete. In all other cases, insulate the ground wire with insulation as specified for low voltage wire.

B. Ground wire shall be Rome, Southwire or equal.

2.04 CONTROL, STATUS AND ALARM WIRE

A. Wire shall be No.14 AWG NEC type THHN/THWN, stranded as manufactured by the Carol Cable Co. Inc., Southwire, Rhome or equal.

B. Multi-conductor control cable, where shown on the Drawings, shall be stranded, No.14 AWG 600V, polyvinyl chloride insulated, nylon jacket over insulation, polyvinyl chloride jacket overall, Type TC as manufactured by Southwire, Okonite or equal.

2.05 INSTRUMENTATION WIRE

A. Wire for 4-20 ma, R.T.D., potentiometer and similar signals shall be PLTC rated and shall be:

1. Single pair cable:
   a. Conductors: 2 #16 stranded, tinned and twisted on 2-in lay
   b. Insulation: PVC with 300 volt, 105 degrees C rating
   c. Shield: 100 percent mylar tape with drain wire
   d. Jacket: PVC with UL and manufacturers identification
   e. Max overall diameter: 0.262-in
   f. Misc: UL listed for underground wet location use
   g. Manufacturers: Belden or equal
2. Three conductor (triad) cable:
   a. Conductors: 3 #16 stranded, tinned and twisted on 2-in lay
   b. Insulation: PVC with 300 volt, 105 degrees C rating
   c. Shield: 100 percent mylar tape with drain wire
   d. Jacket: PVC with UL and manufacturers identification
   e. Max overall diameter: 0.276-in
   f. Misc: UL listed for underground wet location use
   g. Manufacturers: Belden or equal
3. Multiple pair cables (where shown on the Drawings):

a. Conductor: Multiple pairs, stranded, tinned, size as shown on the Drawings, and twisted on a 2-in lay

b. Insulation: PVC with 300 volt, 105 degrees C rating

c. Shield:..... Individual pairs shielded with 100 percent mylar tape and drain wire

d. Jacket: PVC with UL manufacturer's identification

e. Misc: UL listed for underground wet location use

f. Manufacturers: Belden or equal

2.06 TERMINATION AND SPLICE CONNECTORS

A. Power Conductors: Terminations shall be die type compression connectors. Splices shall be die type compression connectors and waterproof with heat shrink boot.

B. Control and Instrumentation Conductors (including graphic panel, alarm, low and high level signals): Termination connectors shall be of the set screw/w tongue type, as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.

C. Motor Conductors: Motor connections shall be ring type mechanical compression terminations installed on the branch circuit wires and the motor leads and secured with bolt, nut and spring washer or die type compression connector splice. Connections shall be insulated with a heat shrink boot or Raychem Type RVC roll on stub insulator, or equal.

2.07 WALL AND FLOOR SLAB OPENING SEALS

A. Wall and floor slab openings shall be sealed with "FLAME-SAFE" as manufactured by the Thomas & Betts Corp. or equal.

2.08 CONDUCTOR AND CABLE TAGS

A. Tags relying on adhesives or taped-on markers are not acceptable.

B. Wire tags shall be heat shrink type Raychem TMS-SCE, or approved equal with the tag numbers typed with an indelible marking process. Character size shall be a minimum of 1/8" in height. Hand written tags shall not be acceptable. Where ends are not available, attach cable tags with nylon tie cord.

C. Cable tags shall be engraved plastic (phenolic) with an approved color coded background (see below) and white characters of a minimum character size 3/16" in height. Cable tags (background color) shall be color coded as follows. Attach these tags to cables with nylon tie cord.

	Cable Type	Tag Color
1.	600 V and less Power & Control	Orange
2.	Instrumentation Cable	Black
3.	Data Communications Cable	Blue

D. Tagging shall be done in accordance with the execution portion of these Specifications.

2.09 WIRE COLOR CODE

A. All wire shall be color coded or coded using electrical tape in sizes #8 or greater, where colored insulation is not available. Where tape is used as the identification system, it shall be applied in all junction boxes, manholes and other accessible intermediate locations as well as at each termination.

B. The following coding shall be used:

	System	Wire	Color
1.	208Y/120, Volts	Neutral	White
2.	1-Phase, 3 Wire	Phases	Black
3.	3-Phase, 4-Wire	Phase A Phase B Phase C	Black Red Blue
4.	480Y/277 Volts	Neutral	Gray/White with one or more colored stripes
5.	3-Phase, 4-Wire	Phase A Phase B Phase C	Brown Orange Yellow

PART 3 EXECUTION

3.01 GENERAL

A. Installed unapproved wire shall be removed and replaced at no additional cost to the Owner.

B. Completely swab raceway system before installing conductors. Do not use cleaning agents and lubricants which have a deleterious effect on the conductors or their insulation.

C. Pull all conductors into a raceway at one time, using wire pulling lubricant on #4 AWG and larger. Do not install pull wires and conductors until the raceway system is in place.

D. Except for hand-pulled conductors into raceways, all wire and cable installation shall be installed with tension-monitoring equipment. Where conductors are found to have been installed without tension–monitoring, the conductors and cables shall be

immediately removed from the raceways, permanently identified as rejected material, and removed from the jobsite. New conductors and cables shall be reinstalled, tagged and raceways resealed, all at no expense to the Owner.

E. Do not exceed cable manufacturer's recommendations for maximum pulling tensions and minimum bending radii. Where pulling compound issued, use only UL listed compound compatible with the cable outer jacket and with the raceway involved.

F. Tighten all screws and terminal bolts using torque type wrenches and/or drivers to tighten to the inch-pound requirements of the NEC and UL.

G. Where single conductors and cables in manholes, handholes, vaults, cable trays, and other indicated locations are not wrapped together by some other means such as arc and fireproofing tapes, bundle throughout their exposed length all conductors entering from each conduit with nylon, self-locking,, releasable, cable ties placed at intervals not exceeding 4 inches on centers.

3.02 CONDUCTORS 600 VOLTS AND BELOW

A. Provide conductor sizes indicated on Drawings.

B. Use crimp connectors of all stranded conductors.

C. Soldered mechanical joints insulated with tape will not be acceptable.

D. Arrange wiring in cabinets and panels neatly cut to proper length, remove surplus wire, and bridle and secure in an acceptable manner. Identify all circuits entering motor control centers or other control cabinets in accordance with the conductor identification system specified herein.

E. Terminate control and instrumentation wiring with methods consistent with terminals provided, and in accordance with terminal manufacturer's instructions.

F. Attach compression lugs with a tool specifically designed for that purpose which provides a complete, controlled crimp where the tool will not release until the crimp is complete. Use of plier type crimpers is not acceptable.

G. Cap spare conductors and conductors not terminated with the UL listed end caps.

H. Where conductors pass through holes or over edges in sheet metal, remove all burrs, chamfer all edges, and install bushings and protective strips of insulating material to protect the conductors.

I. For conductors that will be connected by others, provide at least 6 feet spare conductors in freestanding panels and at least 2 feet spare in other assemblies. Provide additional spare conductor in any particular assembly where it is obvious that more conductor will be needed to reach the termination point.

3.03 GROUNDING

A. Conduits and other raceways shall contain an equipment grounding conductor whether the raceway is metallic or not. Conduits, motors, cabinets, outlets and other equipment

shall be properly grounded in accordance with NEC requirements. Where ground wire is exposed to mechanical damage, install wire in rigid aluminum conduit. Make connections to equipment with solder less connections. Wire connected to the ground rods of the ground mat shall be of the fused type equal to the Cadweld process.

3.04 TERMINATIONS AND SPLICES

A. Power conductors: Terminations shall be made with connectors as specified. Splices shall be allowed in junction box only. No splicing of conductors shall be made in condulets or underground.

B. Control Conductors: Terminations shall be made with connectors as specified. Splices shall be allowed in junction boxes only.

C. Instrumentation Signal Conductors (including graphic panel, alarm, low and high level signals): Terminations shall be made with connectors as specified. Splices shall be allowed at Instrumentation Terminal Boxes only.

D. Each termination of paired shielded or triad shielded shall be coated with silicone jelly after termination. The shield of pair shielded and triad shielded terminated on terminal strips.

E. Except where specifically permitted by the Owner/Engineer, no splices will be allowed in manholes, handholes or other below grade located boxes.

3.05 INSTRUMENTATION CABLES

A. Instrumentation cables shall be installed in aluminum raceways as specified. All circuits shall be installed as twisted pairs or triads. In no case shall a circuit be made up using conductors from different pairs or triads. Triads shall be used wherever three wire circuits are required.

B. Terminal blocks shall be provided at all instrument cable junctions, and all circuits shall be identified at such junctions.

C. Shielded instrumentation wire, coaxial, data highway, I/O and fiber optic cables shall be run without splices between instruments, terminal boxes, or panels. The shield shall be continuous for the entire run.

D. Shields shall be grounded as recommended by the instrument manufacturer and isolated at all other locations. Terminal blocks shall be provided for inter-connecting shield drain wires at all junction boxes. Where individual circuit shielding is required, each shield circuit shall be provided with its own block.

E. Seal openings in slabs and walls through which wires and cables pass.

3.06 WIRE TAGGING

A. All wiring shall be tagged at all termination points and at all major access points in the electrical raceways. A termination point in defined as any point or junction where a wire or cable is physically connected. This includes terminal blocks and device terminals. A major access point to a raceway is defined as any enclosure; box or

space designed for wire or cable pulling or inspection and includes pull boxes, manholes, and junction boxes.

B. Wire tags shall show both origination and destination information to allow for a wire or cable to be traced from point in the field. Information regarding its origination shall be shown in parenthesis.

C. For multiconductor cables, both the individual conductors and the overall cable shall be tagged. Conductors that are part of a multiconductor cable shall reference the cable identification number that they are a part of, as well as a unique conductor number within the cable. The tag format will be different for single conductor wires versus single conductors in a multiple conductor cable. See the appropriate section for each type.

3.07 CABLE TAGGING

A. All cables shall be tagged at all termination points and at all major access points in the electrical raceways as defined in the wire tag section.

B. The cable tag shall be installed where the cable enters and leaves each access point (e.g., junction box, manhole, etc.). In cases of limited access space, a single tag may be used that shows both equipment tag origination and destination. In the case where the jacket is stripped for terminations, the tag shall be installed at the end of the jacket.

3.08 RACEWAY SEALING

A. After a raceway seal has been removed for installation of conductors and cables, and the conductors and cables have been installed in that particular raceway, all entrances and exits to that raceway shall be immediately resealed with Duxseal.

B. This requirement shall be strictly adhered to for all raceways in the conduit system.

3.09 FIELD TESTS

A. Conductors under 600 Volts

1. Perform insulation resistance testing of all power circuits below 600 volts with a 1000-volt megger, in accordance with the recommendations of the wire manufacturer.
2. Prepare a written test report of the results and submit to the Owner/Engineer prior to final inspection.
3. Minimum acceptable value for insulation resistance is 50 megohms for cable lengths 40 feet or less. Lower values shall be acceptable only by the Owner/Engineer's specific written approval. For lengths longer than 40 feet, the minimum megohm value shall be 2000 megohms per foot.
4. Disconnect equipment that might be damaged by this test. Perform tests with all other equipment connected to the circuit.

B. Tests: After instrumentation cable installation and conductor termination by the instrumentation and control supplier, perform tests witnessed by the Owner/Engineer

to ensure that instrumentation cable shields are isolated from ground, except at the grounding point. Remove all improper grounds.

END OF SECTION

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SECTION 26 05 26 GROUNDING SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code (NEC), as shown on the Drawings and as specified herein.

B. All raceways, conduits and ducts shall contain equipment grounding conductors sized in accordance with the NEC. Minimum sizes shall be No. 12 AWG.

1.02 RELATED WORK

A. Section 26 05 00 - Electrical – General Provisions.

B. Section 26 05 19 - Wire and Cables (600 Volt Maximum).

C. Section 26 05 33 - Raceways, Boxes, Fittings and Supports.

1.03 SUBMITTALS

A. Submit to the ENGINEER, in accordance with Section 01 33 00 - Submittals and Section 26 05 00 - Electrical – General Provisions, shop drawings and product data, for the following:

1. Manholes, handholes and associated hardware.
2. Plastic duct spacers

1.04 REFERENCE CODES AND STANDARDS

A. All products and components shown on the Drawings and listed in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NFPA 70 – National Electrical Code (NEC)
2. NFPA 70E – Standard for Electrical Safety in the Workplace

B. All equipment specified in this section of the Specifications shall bear the appropriate label of Underwriters Laboratories.

1.05 QUALITY ASSURANCE

A. The manufacturer of these materials shall have produced similar electrical materials and equipment for a minimum period of five (5) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.06 DELIVERY STORAGE AND HANDLING

A. Protect equipment during shipment, handling, and storage by suitable complete enclosures. Protect equipment from exposure to the elements and keep thoroughly dry.

B. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Repaint damaged painted surfaces to the satisfaction of the OWNER/ENGINEER.

C. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR's choice and at the CONTRACTOR's expense, until such time that the site is ready for permanent installation of the equipment.

D. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.

E. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the CONTRACTOR at no expense to the OWNER.

PART 2 PRODUCTS

2.01 MATERIALS

A. Conduit shall be as specified under Section 26 05 33 - Raceways, Boxes, Fittings and Supports.

B. Wire shall be as specified under Section 26 05 19 - Wires and Cables (600 Volt Maximum).

C. Ground wire shall be uninsulated copper sized as shown on the Drawings, in all cases where a single ground wire is indicated to be installed in a conduit with no other conductors in the conduit, or where the ground wire is directly buried in earth or concrete. In all other cases, insulate the ground wire with insulation as specified for low voltage wire.

D. Ground rods shall be 3/4 in by 10 ft copper clad steel and constructed in accordance with UL 467. The minimum copper thickness shall be 0.25 mm. Ground rods shall be Copperweld or equal.

E. Grounding conduit hubs shall be malleable iron type, manufactured by Thomas & Betts Co.; Catalog No. 3940 (3/4 in conduit size), similar to Burndy; O.Z. Gedney Co. or equal, and of the correct size for the conduit.

F. Water pipe ground clamps shall be cast bronze saddle type, manufactured by Thomas & Betts Co. Cat. No. 2 (1/2 in, 3/4 in, or 1 in size), similar by Burndy; O.Z. Gedney Co. or equal, and of the correct size for the pipe.

G. Buried grounding connections shall be by Cadweld process, or equal exothermic welding system.

PART 3 EXECUTION

3.01 INSTALLATION

A. Run grounding electrode conductors in rigid steel conduits. Bond the protecting conduits to the grounding electrode conductors at both ends. Do not allow water pipe connections to be painted. If the connections are painted, disassemble them and re make them with new fittings.

B. Install equipment grounding conductors with all feeders and branch circuits.

C. Conduits and other raceways shall contain an equipment grounding conductor whether the raceway is metallic or not. Conduits, motors, cabinets, outlets and other equipment shall be properly grounded in accordance with NEC requirements. Where ground wire is exposed to mechanical damage, install wire in rigid aluminum conduit. Make connections to equipment with solder less connections. Wire connected to the ground rods of the ground mat shall be of the fused type equal to the Cadweld process.

D. Bond all steel building columns in new structures together with ground wire in rigid conduit and connect to the distribution equipment ground bus, as shown on the Drawings.

E. Ground wire connections to structural steel columns shall be made with long barrel type one hole heavy duty copper compression lugs, bolted through 1/2 in maximum diameter holes drilled in the column web, with stainless steel hex head cap screws and nuts.

F. Metal conduits stubbed into a motor control center shall be terminated with insulated grounding bushings and connect to the motor control center ground bus. Bond boxes mounted below motor control centers to the motor control center ground bus. Size the grounding wire in accordance with NEC Table 250 95, except that a minimum No. 12 AWG shall be used.

G. Liquid tight flexible metal conduit in sizes 1 1/2 in and larger shall have bonding jumpers. Bonding jumpers shall be external, run parallel (not spiraled) and fastened with plastic tie wraps.

H. Ground transformer neutrals to the nearest available grounding electrode with a conductor sized in accordance with NEC Article 250 94.

I. Drive grounding electrodes as shown on the Drawings.

J. All equipment enclosures, motor and transformer frames, conduits systems, cable armor, exposed structural steel and all other equipment and materials required by the NEC to be grounded, shall be grounded and bonded in accordance with the NEC.

K. Seal exposed connections between different metals with No Oxide Paint Grade A or equal.

L. Lay all underground grounding conductors slack and, where exposed to mechanical injury, protect by pipes or other substantial guards. If guards are iron pipe, or other magnetic material, electrically connect conductors to both ends of the guard. Make connections as specified herein.

M. Care shall be taken to ensure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

N. All grounding type receptacles shall be grounded to the outlet boxes with a No. 12 THWN green conductor connected to the ground terminal of the receptacle and fastened to the outlet box by means of a grounding screw.

3.02 INSPECTION AND TESTING

A. Inspect the grounding and bonding system conductors and connections for tightness and proper installation.

B. Use Biddle Direct Reading Earth Resistance Tester or equivalent test instrument to measure resistance to ground of the system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

C. All test equipment shall be provided under this Section and approved by the OWNER/ENGINEER.

D. Resistance to ground testing shall be performed during dry season. Submit test results in the form of a graph showing the number of points measured (12 minimum) and the numerical resistance to ground.

E. Testing shall be performed before energizing the distribution system.

F. A separate test shall be conducted for each building or system.

G. Notify the ENGINEER immediately if the resistance to ground for any building or system is greater than five ohms.

END OF SECTION

SECTION 26 05 33 RACEWAYS, BOXES, FITTINGS AND SUPPORTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install complete raceway systems as shown on the Drawings and as specified herein.

B. Raceways and conductors that are listed on the raceway and conductor schedules are generally not shown on the Drawings, except where they are required to pass through a restricted or designated space. Conduits indicated to be run "exposed" on the schedules shall be run near the ceilings or along the walls of the areas through which they pass and shall be routed to avoid conflicts with HVAC ducts, cranes and hoists, lighting fixtures, doors and hatches, etc. Conduits indicated to be run concealed shall be run in the center of concrete floor slabs, in partitions, or above hung ceilings, as required.

1.02 RELATED WORK

A. Section 26 05 00 Electrical – General Provisions

B. Section 26 05 19 Wires and Cables (600 Volt Maximum)

1.03 SUBMITTALS

A. Submit to the OWNER/ENGINEER, in accordance with Section 01 33 00 - Submittals, the manufacturers' names and product designation or catalog numbers of all materials specified.

1.04 REFERENCE STANDARDS

A. Wiring devices shall comply with the requirements of the National Electrical Code (NEC) and shall be Underwriters Laboratories (UL) labeled.

1.05 QUALITY ASSURANCE

A. The manufacturer of these materials shall have produced similar electrical materials and equipment for a minimum period of five (5) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly. All assemblies shall be of the same manufacturer.

1.06 DELIVERY STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. Two (2) copies of these instructions shall be included with the equipment at time of shipment, and shall be made available to the CONTRACTOR and OWNER.

B. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR's choice and at the CONTRACTOR's expense, until such time that the site is ready for permanent installation of the equipment.

C. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during jobsite storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition.

PART 2 PRODUCTS

2.01 CONDUIT

A. PVC Coated Rigid Aluminum Conduit

1. PVC coated rigid aluminum conduit shall have a minimum 0.040-in thick, polyvinyl chloride coating permanently bonded to rigid aluminum conduit and an internal chemically cured urethane or enamel coating. Rigid aluminum conduit shall be as manufactured by the Allied Tube and Conduit Corp.; Wheatland Tube Co.; Triangle PWC Inc. or equal. The ends of all couplings, fittings, etc. shall have a minimum of one pipe diameter in length of PVC overlap. PVC coated conduit and fittings shall be as manufactured by Robroy Industries Plasti-Bond, NEC Inc. BlackGuard, or ABB Ocal-Blue.

2. Elbows and couplings shall be PVC coated by the same manufacturer supplying the conduit PVC coating system. Elbows and couplings used with PVC coated conduit shall be furnished with a PVC coating bonded to the aluminum, the same thickness as used on the coated aluminum conduit.

B. Rigid Nonmetallic Conduit

1. PVC conduit shall be rigid polyvinyl chloride schedule 40 as manufactured by Carlon; An Indian Head Co.; Kraloy Products Co., Inc.; Highland Plastics Inc. or equal. Thin wall conduit designated for encased burial as (Type EB) is not acceptable for any application.

C. Liquidtight Aluminum Flexible Metal Conduit

1. Liquidtight aluminum flexible metal conduit shall have an interlocked aluminum core, PVC jacket rated for 80 degrees C., meets NEC Article 351 and UL 360. Liquidtight aluminum flexible metal conduit shall be as manufactured by Southwire Titan type AEF; the Anaconda Metal Hose Div.; Anaconda American Brass Co.; American Flexible Conduit Co., Inc.; Universal Metal Hose Co. or equal.

2. Fittings used with liquidtight flexible aluminum conduit shall be extruded from 6063 alloy in temper designation T-1 with maximum 0.1% copper content and shall conform to FEDSPEC WW-C-540C, ANSI C80.5, and UL-6.

D. Aluminum Flexible Metal Conduit

1. Aluminum flexible metal conduit shall have an interlocked aluminum core, meeting NEC Article 348, UL 1 and Federal Specification WW-C-566C. Aluminum flexible metal conduit shall be as manufactured by Southwire Alflex type SWA, the Anaconda Metal Hose Div.; Anaconda American Brass Co.; American Flexible Conduit Co., Inc.; Universal Metal Hose Co. or equal.

2. Fittings used with aluminum flexible metal conduit shall be extruded from AA 6063 alloy in temper designation T-1 and shall conform to FEDSPEC WW-C-540C, ANSI C80.5, and UL-6.

E. Rigid Aluminum Conduit

1. Rigid Aluminum conduit shall be extruded from AA 6063 alloy in temper designation T-1 and shall conform to FED Spec WW-C-581, ANSI C80-5 and UL-6A. Rigid aluminum conduit shall be as manufactured by Wheatland Tube Company, Allied, Patriot Industries, or approved equal.

F. Rigid PVC Schedule 40 Conduit

1. Schedule 40 PVC Rigid Nonmetallic Conduit (RNC) shall be designed for use above ground and underground as described in the NEC, resistant to sunlight. The conduits and fittings shall be manufactured to NEMA TC-2, Federal Specification WC1094A and UL 651 specifications. Fittings shall be manufactured to NEMA TC-3, Federal Specification WC1094A and UL 514B. Conduit shall have a UL Label. Conduit shall be Prime Conduit, Kraloy, or approved equal.

G. Rigid PVC Schedule 80 Conduit

1. Schedule 80 PVC Rigid Nonmetallic Conduit (RNC) shall be designed for use above ground and underground as described in the NEC, resistant to sunlight. The conduits and fittings shall be manufactured to NEMA TC-2, Federal Specification WC1094A and UL 651 specifications. Fittings shall be manufactured to NEMA TC-3, Federal Specification WC1094A and UL 514B. Conduit shall have a UL Label. Conduit shall be Prime Conduit, Kraloy, or approved equal.

2.02 BOXES

A. Boxes specified herein are for use with raceway systems only. Boxes used for housing electrical and instrumentation equipment shall be as described elsewhere in these specifications.

B. NEMA 1 Areas: NEMA 1 terminal boxes, junction boxes, pull boxes, etc, shall be of sheet or cast aluminum for wall mounting, or have mounting feet where self-standing. Boxes shall have continuously welded seams. Welds shall be ground smooth. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14-gauge metal and covers shall not be less than 12-gauge metal. All boxes shall have hinged gasketed doors with quarter-turn latches or a 3-point latch (single operator) system

on enclosures larger than 36 inches wide or 32 inches tall. Terminal boxes shall be furnished with terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20A, 600V. Boxes shall be furnished with hinged doors, terminal mounting straps and brackets. Boxes shall be Concept Series as manufactured by Hoffman Engineering Co., Premier Series as manufactured by Eaton B-Line, or approved equal.

C. NEMA 4X Areas: NEMA 4X terminal boxes, junction boxes, pull boxes etc, shall be Type 316 stainless steel for wall mounting, or have mounting feet where self-standing. Boxes shall have continuously welded seams. Welds shall be ground smooth. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14-gauge metal and covers shall not be less than 12-gauge metal. All boxes shall have hinged gasketed doors with quarter-turn latches or a 3-point latch (single operator) system on enclosures larger than 36 inches wide or 32 inches tall. Terminal boxes shall be furnished with terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20A, 600V. Boxes shall be furnished with hinged doors, terminal mounting straps and brackets. Boxes shall be Concept Series as manufactured by Hoffman Engineering Co., Premier Series as manufactured by Eaton B-Line, or equal.

D. NEMA 7 Areas: Explosion-proof boxes shall be designed for Class 1, Group D, Division 1 hazardous locations, and shall also have O-ring seals to meet NEMA 4 requirements. Boxes shall be aluminum, with stainless steel hinged covers and stainless-steel bolts; Type EJB-N4 as manufactured by the Crouse-Hinds Co.; Appleton Electric Co.; Adalet-PLM or equal.

E. Boxes for use in Chlorine and Caustic areas shall be of rigid PVC. Construction shall be the same as specified for NEMA 4X terminal boxes, junction boxes, pull boxes etc. as specified above.

F. Malleable iron boxes shall not be used.

2.03 CONDUIT HUBS

A. Conduit hubs for use on raceway system pull and junction boxes shall be watertight aluminum, insulated throat, gasketed, with grounding screw, as manufactured by O.Z./Gedney, Red-Dot, or equal.

B. Conduit hubs for use on outlet boxes or boxes containing electrical or instrumentation equipment shall be watertight, threaded aluminum, grounding screw type, insulated throat, hub of female-female type, with locking nipple of male construction. Hubs shall be T&B HTGZ, or approved equal. Hubs with female locking nipples, where the hub projects into the box, will not be acceptable.

2.04 CONDUIT SEALS

A. Conduit wall seals for new concrete walls below grade shall be O.Z./Gedney Co. type WSK, or equal.

B. Conduit wall seals for cored holes shall be type CSML-XXXA as manufactured by the O.Z./Gedney Co., or equal.

C. Conduit wall and floor seals for sleeved openings shall be type CSMI-XXXA as manufactured by the O.Z./Gedney Co., or equal.

D. Conduit sealing bushings shall be aluminum O.Z./Gedney Type CSBA Series, or equal.

2.05 EXPANSION-DEFLECTION FITTINGS

A. Combination expansion-deflection fittings embedded in concrete, or exposed, with internal grounding, 4” movement, shall be stainless steel/cast iron, type XJGD as manufactured by the Crouse-Hinds Co., or approved equal.

2.06 EXPANSION FITTINGS

A. Expansion fittings shall be aluminum, 8” movement, type XJGSA as manufactured by Crouse-Hinds Co., or equal, with internal grounding.

2.07 EXPLOSION-PROOF FITTINGS

A. Explosion proof fittings shall be type EYS as manufactured by the Crouse-Hinds Co.; Appleton Electric Co.; O.Z./Gedney Co., or equal.

2.08 KELLUMS GRIPS

A. Kellems grips to support cables shall be of 316 stainless steel.

2.09 CONDUIT MOUNTING EQUIPMENT

A. All pull and junction box supports, spacers, conduit support rods, clamps, hangers, channel, nut, bolts, washers, etc. and shall be of 316 stainless steel.

2.10 CONDUIT IDENTIFICATION PLATES

A. Conduit identification plates shall be embossed stainless steel with stainless steel band, permanently secured to the conduit without screws.

B. Identification plates shall be as manufactured by the Panduit Corp. or equal.

2.11 WALL AND FLOOR SLAB OPENING SEALS

A. Wall and floor slab openings shall be sealed with “Fire Seal” Poke Thru PTFS by OZ/Gedney, or equal.

2.12 WIREWAYS

A. All wireways shall be constructed of NEMA 4X 316 stainless steel with gasketed hinged covers and stainless-steel screws. Wireway shall be as manufactured by Hoffman, Eaton B-Line, or approved equal.

PART 3 EXECUTION

3.01 RACEWAY APPLICATIONS

A. Unless exact locations are shown on the Drawings, the CONTRACTOR shall coordinate the placement of conduit and related components with other trades and existing installations.

B. Unless shown on the drawings or specified otherwise, the conduit type installed with respect to the location shall be as follows:

	Conduit Type	Location
1.	Rigid Galvanized Conduit	Not acceptable for use.
2.	PVC Coated Aluminum Conduit	All embedded conduit bends (except underground duct banks) and all conduit stub-ups to a minimum of 6” above finished floor or grade.
3.	Liquidtight Flexible Aluminum Conduit	Raceway connection to vibrating equipment only in all areas.
4.	Rigid Non-metallic, Schedule 40 PVC Conduit	Underground encased in red dyed reinforced concrete.
5.	Rigid Non-metallic, Schedule 80 PVC Conduit	For use only in Chlorine and Caustic Rooms.
6.	Flexible Aluminum Conduit	Fixtures whip connection to lighting fixtures in NEMA 1 areas (maximum 3-ft). BX or AC type prefabricated cables are not permitted.
7.	Aluminum Rigid Metal Conduit	All above areas, except for concrete embedded and those areas described in Locations 2 through 6 above.

C. All conduit of a given type shall be the product of one manufacturer.

3.02 BOX APPLICATIONS

A. Boxes installed in dry areas may be of NEMA 1 aluminum construction. All other boxes shall be of Type 316 stainless steel.

B. Boxes for use only on concealed, above ground, interior electrical wiring, in air-conditioned administrative buildings remote to the process area, may be NEMA 1 galvanized boxes as specified for such areas. All boxes used in such areas, for exposed wiring, shall be of NEMA 1 aluminum or 316 stainless steel.

C. Exposed switch, receptacle and lighting outlet boxes and conduit fittings shall be cast aluminum.

D. Junction boxes and pull boxes shall have NEMA ratings suitable for the location in which they are installed, as specified in Section 26 05 00 - Electrical – General Provisions.

E. Where the raceway system connects to junction and pull boxes in a NEMA 1 area, double locknut (one outer and one inner) plus insulated bushing.

F. All boxes shall be provided with factory mounting lugs. Drilling through the back of any box or enclosure is prohibited, and if so installed shall be removed and replaced, with no increase in the Contract Price or Construction Schedule.

3.03 FITTINGS APPLICATIONS

A. Combination expansion-deflection fittings shall be installed where conduits cross structure expansion joints, on conduit transitions from underground to above ground, and where installed in exposed conduit runs such that the distance between expansion-deflection fittings does not exceed one hundred fifty (150) feet of conduit run.

B. On exposed conduit transitions from underground to above ground, where the earth has been disturbed to a depth of more than ten (10) feet, an expansion fitting, with a minimum of 6” available movement, shall be installed on the exposed side of the transition, in lieu of a combination expansion-deflection fitting.

3.04 CONDUIT SEALS APPLICATIONS

A. Conduit wall seals shall be used where underground conduits penetrate walls or at other locations shown on the Drawings.

B. Conduit sealing bushings shall be used to seal conduit ends exposed to the weather and at other locations shown on the Drawings.

3.05 INSTALLATION

A. No conduit smaller than 3/4-in electrical trade size, shall be used, nor shall any have more than the equivalent of three 90-degree bends in any one run. Pull boxes shall be provided as required or as directed.

B. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.

C. The ends of all conduits shall be tightly plugged to exclude dust and moisture during construction. Duxseal, or 3M seal spray shall be used in all applications. Plugging with tape is prohibited, even for a temporary time.

D. Where raceways enter or leave the raceway system where the raceway origin or termination, could be subjected to the entry of moisture, rain or liquid of any type, particularly where the termination of such raceways terminate in any equipment, new or existing at a lower elevation, such raceways shall be tightly sealed at the higher elevation, both before and after the installation of cables, such that there shall be no entry of water or moisture to the Raceway System at any time. Any damage to new or existing equipment shall be corrected by complete replacement of such equipment, at no cost to the OWNER. Cleaning or drying of such equipment will not be acceptable.

E. Conduit supports, other than for underground raceways, shall be spaced at intervals of 8-ft or less, as required to obtain rigid construction.

F. Single conduits shall be supported by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Multiple runs of conduits shall be supported on trapeze type hangers with horizontal members and threaded hanger rods. The rods shall be not less than 3/8-in diameter. Surface mounted panel boxes, junction boxes, conduit, etc shall be supported by spacers to provide a minimum of 1/2-in clearance between wall and equipment.

G. Conduit hangers shall be attached to structural steel by means of beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot type shall be provided.

H. All conduits on exposed work shall be run at right angles to and parallel with the surrounding wall and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduits shall be run perfectly straight and true.

I. Conduit terminating in boxes and enclosures, other than NEMA 1 type, shall be terminated with conduit hubs.

J. Conduits terminated into enclosures shall be perpendicular to the walls where flexible liquidtight or rigid conduits are required. The use of short sealtight elbow fittings for such terminations will not be permitted.

K. Conduits containing equipment grounding conductors and terminating in boxes shall have insulated throat grounding bushings. The wire shall be grounded to the box.

L. Conduits shall be installed using threaded fittings. Running threads will not be permitted.

M. All conduit fittings on PVC conduit shall be of the glued type.

N. Liquidtight flexible aluminum conduit shall be used for the primary and secondary of transformers, generator terminations and other equipment where vibration is present. Use in other locations is not permitted. Liquidtight flexible aluminum conduit shall have a maximum length not greater than that of a factory manufactured long radius elbow of the conduit size being used. The maximum bending radius shall not be less than that shown in the NEC Chapter 9, Table 2, “Other Bends”. BX or AC type prefabricated cables will not be permitted.

O. Where conduits pass through openings in walls or floor slabs, the remaining openings shall be sealed against the passage of flame and smoke.

P. Conduit ends exposed to the weather or corrosive gases shall be sealed with conduit sealing bushings.

Q. Raceways terminating in Control Panels, or boxes containing electrical equipment, shall not enter from the top of the panel or box, and the raceway shall be sealed with a removable silicone sealant.

R. All conduits from external sources entering or leaving a multiple compartment enclosure shall be stubbed up into the bottom horizontal wireway or other manufacturer designated

area, directly below the vertical section in which the conductors are to be terminated. Conduits entering from cable tray shall be stubbed into the upper section.

S. Conduit sealing and drain fittings shall be installed in areas designated as NEMA 4X or 7.

T. A conduit identification plate shall be installed on all power, instrumentation, alarm and control conduits at each end of the run and at intermediate junction boxes, manholes, etc. Conduit plates shall be installed before conductors are pulled into conduits. Exact identification plate location shall be coordinated with the OWNER/ENGINEER at the time of installation to provide uniformity of placement and ease of reading. Conduit numbers shall be exactly as shown on the Drawings.

U. Conduits noted as spare shall be capped or plugged at both ends with easily removable fittings.

V. Mandrels shall be pulled through all existing conduits that will be reused and through all new conduits 2-in in diameter and larger prior to installing conductors.

W. 3/16-in polypropylene pull lines shall be installed in all new conduits noted as spares or designated for future equipment.

X. All conduit that may under any circumstance contain liquids such as water, condensation, liquid chemicals, etc, shall be arranged to drain away from the equipment served. If conduit drainage is not possible, conduit seals shall be used to plug the conduits at the point of attachment to the equipment.

Y. Where no type or size is indicated for junction boxes, pull boxes or terminal cabinets, they shall be sized in accordance with the requirements of the NEC.

Z. Conduits shall not cross pipe shafts, access hatches or vent duct openings. They shall be routed to avoid such present or future openings in floor or ceiling construction.

AA. The use of running threads is prohibited. Where such threads are necessary, a 3-piece union shall be used.

BB. Conduits passing from heated to unheated spaces, exterior spaces, refrigerated spaces, cold air plenums, etc, shall be sealed with "Duxseal," as manufactured by Mansville or 3M, or seal fitting to prevent the accumulation of condensation.

CC. Conduits shall be located a minimum of 3-in from steam or hot water piping. Where crossings are unavoidable, the conduit shall be kept at least 1-in from the covering of the pipe crossed.

DD. Conduits terminating at a cable tray shall be supported independently from the cable tray. Provide a conduit support within 1-ft of the cable tray. The weight of the conduit shall not bear on the cable tray.

EE. Penetrations by conduit, raceways, cables, sleeves, etc., through rated walls, shafts, floors, ceilings, etc., shall be sealed by closure foam, Dow Corning 3-6548 Silicone RTV, GE RTV 35D Silicone Foam, or equal.

FF. For installations on concealed, above ground, interior electrical wiring, in administrative buildings remote to the process area, the following rules shall be observed:

1. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual situations.
2. Electrical box locations shown on the Drawings are approximate unless dimensioned. Verify location of outlets prior to rough-in.
3. Locate and install boxes to allow access.
4. Do not install boxes back-to-back in walls. Provide minimum 6 inch separation.
5. Secure boxes rigidly to the substrate upon which they are being mounted, or solidly imbed boxes in concrete or masonry. Boxes shall not be permitted to move laterally. Boxes shall be secured between two studs. Boxes connected to one stud are not permitted.
6. Provide knockout plugs for unused openings.
7. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
8. Install boxes in walls without damaging wall insulation.
9. Outlet boxes in plaster partitions shall be "shallow-type" set flush in wall so there is at least 5/8" plaster covering back of box.
10. Switch boxes shall not be used as junction boxes.
11. Outlet boxes supporting fixtures shall be securely anchored in place in an approved manner. Support outlet boxes and fixtures in acoustic ceiling areas from building structures, not from acoustic ceilings. Lighting fixture outlets shall be coordinated with mechanical and architectural equipment and elements to eliminate conflicts and provide a workable neat installation.
12. Set floor boxes level and flush with finish flooring material.
13. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.
14. Support pull and junction boxes independent of conduit.

END OF SECTION

SECTION 26 05 36 CABLE TRAY

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install complete cable tray systems, with all accessories, fittings, supports, as shown on the Drawings and as specified herein.

B. Cable tray runs outline the general routing of raceways. Select actual routing in the field to follow Drawings as closely as possible and to avoid interfering with pipes, ducts, structural members, or other equipment. Deviations in routing from that shown on the Drawings must be approved by the ENGINEER, at no additional cost to the OWNER.

1.02 RELATED WORK

A. Section 26 05 00 Electrical – General Provisions

B. Section 26 05 19 Wires and Cables (600 Volt Maximum)

1.03 SUBMITTALS

A. Shop Drawings

1. Submit to the ENGINEER, in accordance with Section 01 33 00 - Submittals, a complete tray layout and routing in AutoCAD format, fittings and hangers, with tray type, sizes, dimensions and support points.

   a. Submittal shall show tray routing, with elevations.

   b. Drawings shall show locations of tray hangers and/or concrete inserts where concrete inserts are to be used.

   c. CONTRACTOR shall not use the ENGINEER's Drawings as a base plan for the layout. Calculations shall be provided for loading and deflections. Calculations shall be submitted in a format which will permit hand calculation verification by the OWNER/ENGINEER.

B. Product Data: Provide data for fittings and accessories.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation and installation of product.

D. Operation and Maintenance Manuals

1. Submit Operation and Maintenance Manuals containing installation and maintenance instructions for the cable tray and its components.

1.04 REFERENCE STANDARDS

A. National Fire Protection Association (NFPA)

1. NFPA 70 - National Electrical Code, Article 392 Cable Trays.

B. National Electrical Manufacturers Association (NEMA)

1. NEMA VE-1 – 2002 Metal Cable Tray Systems
2. NEMA VE-2 – 2001 Cable Tray Installation Guidelines

C. Underwriters Laboratories (UL)

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 REGULATORY REQUIREMENTS

A. Conform to the requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for the purpose specified herein and as shown on the Drawings.

1.06 DELIVERY STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. Two (2) copies of these instructions shall be included with the equipment at time of shipment, and shall be made available to the CONTRACTOR and OWNER.

B. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR’s choice and at the CONTRACTOR’s expense, until such time that the site is ready for permanent installation of the equipment.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. T.J. Cope Allied.

2. B-Line

3. Acceptable Equal

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.02 LADDER-TYPE CABLE TRAY

A. Description: NEMA VE 1, Class 20C (minimum 100 lb. /ft. load rating) ladder type tray.

B. Material: Aluminum

C. Finish: N/A.

D. Inside Width: As indicated on the Drawings.

E. Inside Depth: Minimum 6-in., unless otherwise shown on the Drawings.

F. Straight Section Rung Spacing: 6-in on center.

G. Inside Radius of Fittings: Minimum 24–in, unless otherwise shown on the Drawings.

H. Provide clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, nuts, bolts, washers, lock washers, all thread and grounding straps, all of 316 stainless steel.

I. Dividers: Dividers shall be supplied to isolate cables of different voltage ratings that occupy the same cable tray.

J. Covers: None.

K. WARNING SIGNS

L. Permanent warning label shall appear on all straight sections and fittings and shall have the following wording: WARNING! DO NOT USE CABLE TRAY AS A WALKWAY, LADDER OR SUPPORT. USE ONLY AS A MECHANICAL SUPPORT FOR CABLES.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install metallic cable tray in accordance with NEMA VE 2 Cable Tray Installation Guidelines.

C. Provide supports at each connection point, at the end of each run, and at other points to maintain spacing between supports of 10-ft maximum.

D. Use expansion connectors where required.

E. Ground and bond cable tray under provisions of NEC Article 392.

1. Provide continuity between tray components.
2. Install a bare 1 AWG copper cable through entire length of each tray (both medium voltage power and low voltage power and control) and bond to each section and ground connect to the electrical system ground grid at both ends.

F. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.

G. Provide cable tray angle brackets and supports to keep cable tray from swaying or moving horizontally. Mount on each side every 10-ft.

END OF SECTION

SECTION 26 05 43 UNDERGROUND SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install a complete underground system of raceways, manholes and handholes as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Section 26 05 00 - Electrical – General Provisions

B. Section 26 05 19 - Wire and Cables (600 Volt Maximum).

C. Section 26 05 33 - Raceways, Boxes, Fittings and Supports

D. Section 26 05 90 - Cast-in-Place Concrete for Electrical Applications.

1.03 SUBMITTALS

A. Submit to the ENGINEER, in accordance with Section 01 33 00 - Submittals and Section 26 05 00 - Electrical – General Provisions, shop drawings and product data, for the following:

1. Manholes, handholes and associated hardware.
2. Plastic duct spacers

B. Submittals shall also contain information on related equipment to be furnished under this Specification but described in the related sections listed in the Related Work paragraph above. Incomplete submittals not containing the required information on the related equipment will be returned unreviewed.

1.04 REFERENCE CODES AND STANDARDS

A. All products and components shown on the Drawings and listed in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NFPA 70 – National Electrical Code (NEC)
2. NFPA 70E – Standard for Electrical Safety in the Workplace
3. ASTM A615/A615M-06a – Standard Specification for Deformed and Plain Carbon-Steel Bars for concrete Reinforcement
4. ASTM A48 – Standard Specification for Gray Iron Castings
5. ASTM A536 - Standard Specification for Ductile Iron Castings
6. AASHTO M306-04/ ASTM A48 – Drainage Structure Castings, Section 7.0 Proof Load Testing
7. ASTM C-850- Specifications for underground precast concrete utility structures

B. All excavation, trenching, and related sheeting, bracing, etc., as shown on the Drawings and listed in these Specifications, shall comply with the following standards (unless otherwise noted):

1. Occupational Safety and Health Administration (OSHA)

   a. Excavation safety standards (29 CFR Part 1926.650 Subpart P) - Excavation.

2. American Society for Testing and Materials (ASTM)

   a. ASTM D 698a – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600kN-m/m3)).

C. All equipment specified in this section of the Specifications shall bear the appropriate label of Underwriters Laboratories.

1.05 QUALITY ASSURANCE

A. The manufacturer of these materials shall have produced similar electrical materials and equipment for a minimum period of five (5) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The precast manholes shall be manufactured in a NPCA (National Precast Concrete Association) Certified Plant.

1.06 DELIVERY STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions.

B. Protect equipment and materials from exposure to the elements and keep thoroughly clean and dry until installation.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the CONTRACTOR at no expense to the OWNER.

PART 2 PRODUCTS

2.01 MATERIALS

A. Raceways

1. Raceways shall be rigid polyvinyl chloride conduit Schedule 40, encased in concrete, as manufactured by Carlon; An Indian Head Co.; Kraloy Products Co., Inc.; Highland Plastics Inc. or equal. Thin wall conduit designated for encased burial as (Type EB) is not acceptable for any application.

2. All underground raceways of the underground system, terminating in manholes or handholes shall use bell end fittings of the same size and type as the raceway. Bell ends and duct spacers shall be as manufactured by Carlon or equal.

3. Concrete encasement for raceways and duct banks shall be normal weight concrete weighing not more than 145 pcf with compressive strength a minimum of 3000 psi at 28 days, as specified in Section 26 05 90, and of dimensions as shown on the Drawings.

4. Reinforcing steel shall comply with ASTM A615 Grade 60 as specified in Section 26 05 90, and of a size and installation as shown on the Drawings.

5. Where raceways terminate into existing and new manholes, handholes or structures, the duct bank steel shall be anchored into the manhole, handhole or structure with a Hilti HIT-HY 200 epoxy anchoring system. The termination of the duct bank steel shall utilize a minimum 24 inch length of reinforcing bar anchored not less than 4 inches into the manhole, handhole or structure wall, and lapped onto each reinforcing bar in the duct bank.

B. Manholes and Handholes

1. General

   a. Manholes and handholes shall be of the precast concrete type, designed for a Class H20 load with sizes as shown on the Drawings, and as manufactured by Oldcastle Precast, Mansfield, TX.

2. Construction

   a. Concrete for manholes and handholes shall have a 28-day compressive strength of 5000 PSI. Cement shall be Type 1 or III. Reinforcing steel shall be Grade 60 with yield strength of 60,000 P.S.I. Design loadings shall be H-20-44 w/impact.

   b. Ductbank entries into the manhole or handhole shall be centered on the entering wall, unless shown otherwise on the Drawings.

   c. Where present or future duct banks are shown to terminate at a manhole or handhole, the terminating area of the manhole wall within the confines of the duct bank steel reinforcing shall be recessed approximately 1-1/2” for shear support, all as shown on the Drawings.

   d. Each manhole and handhole shall have a 12” x 12” x 18” deep concrete sump in one corner of the manhole or handhole, unless shown otherwise on the Drawings.

3. Manhole Covers

   a. Unless otherwise shown on the Drawings, manhole and handhole covers shall be heavy duty 38 in. machined gray iron, and AASHTO M306-04/ ASTM A48 CL35B Min., 40,000-pound proof load value (Class H20 X 2.5) “True Traffic” load covers, complete with frame, and “Electric” or “Communication” raised lettering recessed flush, as required, on the cover. Covers shall be R-1739-B as manufactured by Neenah Enterprises, Inc., Neenah, WI.

   b. All castings shall be made In the USA, cast with the foundry’s name, part number, “Made in USA”, and production date (example: mm/dd/yy). Castings

without proper markings will be rejected. Manufacturer shall certify that all castings conform to the ASTM and AASHTO Designations as specified herein. All casting shall be true to pattern in form and dimension, free from pouring faults, sponginess, cracks, blow holes and other defects in positions affecting strength and value for the service intended. Angles shall be filleted, and arises shall be sharp and true.

4. Access Hatch

   a. Where access hatches are shown on the Drawings, hatches shall be heavy duty aluminum, for H-20 load rating, sized as shown on the Drawings. Hatches shall be CHS1 Series as manufactured by East Jordan Iron Works, Ardmore, OK.

   b. Material shall be 6061-T6 aluminum for bars, angle and extrusions. ¼" diamond plate shall be 5086 aluminum.

   c. Unit shall have a heavy duty pneumatic-spring, for ease of operation when opening cover. Cover shall be counter-balanced so that one person can easily open the hatch door.

   d. Frame shall be of extruded aluminum with a continuous 1¼" anchor flange. A dovetail groove shall be extruded into the seat of the frame with a 1/8" silicone gasket.

   e. Hinges shall be of heavy-duty design. Material shall be grade 316 stainless steel with a 3/8" grade 316 stainless steel pin. Hinge shall be bolted to the channel frame and diamond plate with grade 316 stainless steel bolts and Ny-lock nuts. Aluminum shall be supplied with mill finish. Exterior of frame which comes in contact with concrete shall have one coat black primer.

   f. Each hatch shall be supplied with a stainless steel slam lock, with the keyway protected by a threaded aluminum plug. The plug shall be flush with the top of the ¼" diamond plate. The slam lock shall be fastened with grade 316 stainless steel bolts and washers.

   g. Each hatch shall be equipped with a stainless steel lift handle. Lift handles shall be flush with top of ¼" diamond plate.

   h. Each hatch shall be supplied with a 1 ½" threaded drain coupler on underside of channel frame for pipe connection.

5. Hardware

   a. Cable racks shall be of the heavy duty non-metallic type with arm lengths of 8", 14" and 20", each supporting a load of not less than 250 lbs. at the outer end. Racks shall be molded in one piece of U.L. listed glass reinforced polymer, Catalog CR36-B with RA08, RA14 and RA20 arms as manufactured by Underground Devices Inc. Northbrook, IL. Cable racks shall be secured to the manhole and walls by drilled, Hilti HIT-HY 200 epoxy anchoring system, with Hilti 316 stainless steel bolts. Arms for racks shall be vertically spaced not greater than 24" on centers.

   b. Pulling irons shall be of copolymer polypropylene coated ½" dia. cable, tensile strength rated at 270,000 psi, with polyethylene pulling iron pocket, all recessed in the manhole wall opposite each duct entry. Pulling irons for handholes shall have the pulling iron located in the floor of the handhole near the center of the

handhole opposite the duct entry. Pulling irons shall be as manufactured by M.A. Industries, Inc. Peachtree, GA. or Bowco Industries, Portland OR.

c. Manhole and handhole ladders shall be constructed of fiberglass reinforced plastic, safety yellow, 18” rung width with 12” rung spacings, Safrail as manufactured by Strongwell Corp., Bristol, VA. Furnish a total of two ladders, each of a length 4’ greater than the deepest manhole in the underground system.

C. Polyethylene Warning Tape

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

   a. Brady Detectable Identoline

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

3. Warning tape shall be red polyethylene film, 2 in minimum width, with embedded metallic wire for location tracing.

PART 3 EXECUTION

3.01 GENERAL

A. The CONTRACTOR shall field verify the routing of all underground duct banks before placement. He shall modify the routing as necessary to avoid underground utilities or above ground objects. Modification or rerouting for the convenience of the CONTRACTOR, or to reduce the length of duct run as designed, will not be permitted. The CONTRACTOR shall provide any alternate routing of the duct banks to the OWNER/ENGINEER and, after approval, shall proceed with the installation.

B. The CONTRACTOR shall saw cut and repair existing pavements above new and modified existing duct banks. The CONTRACTOR shall provide the alternate routing of the duct banks to the OWNER/ENGINEER and after approval shall proceed with the installation.

C. Install raceways to drain away from buildings. Raceways between manholes or handholes shall drain toward the manholes or handholes. Raceway slopes shall not be less than 3 in per 100 ft.

D. Reinforce raceway banks as shown on the Drawings.

E. A #4/0 stranded bare copper ground conductor shall be threaded through the upper tier of duct spacers, as shown on the Drawings, for the full length of each duct run between manholes and handholes, entering the duct bank opening at each manhole or handhole, and bonded to the ground conductors of the other entering ductbanks of each manhole and handhole.

F. Lay raceway lines in trenches on compacted earth as specified in Section 26 05 10.

G. Use plastic spacers located not more than 4 ft apart to hold raceways in place. Spacers shall provide not less than 2 in clearance between raceways.

H. The minimum cover for raceway banks shall be 24 in unless otherwise permitted by the OWNER/ENGINEER.

I. Raceway terminations at all manholes, existing and new, shall be with end bells for PVC conduit.

J. Where bends in raceways greater than 15 degrees are required, use long radius elbows, sweeps and offsets of PVC coated rigid galvanized steel conduit.

K. The ends of all ducts shall be tightly plugged to exclude dust and moisture during construction. Duxseal shall be used in all applications. Plugging with tape is prohibited, even for a temporary time.

L. Where raceways enter or exit the Underground System, and the raceways rise to a higher elevation upon entering or leaving the System, such raceways shall be tightly sealed at the higher elevation, both before and after the installation of cables, such that there shall be no entry of water or moisture to the Underground System at any time.

M. No wire shall be pulled until the duct system has been completed in every detail.

N. Swab all raceways clean before installing cable.

O. Train cables in manholes and handholes and support and restrain them on cable racks. All cables passing manhole duct entrances in the manhole or handhole shall pass above all duct entrances. No cable shall pass in front of or below duct bank entrances.

3.02 TRENCH EXCAVATION

A. The excavation shall extend to the width and depth as shown on the Drawings, or as specified, and shall provide suitable room for installing manholes, handholes, ducts and appurtenances.

B. Furnish and place all sheeting, bracing and supports.

C. Excavation shall include material of every description and of whatever substance encountered, regardless of the methods or equipment required to remove the material. Pavement shall be cut with a saw, wheel or pneumatic chisel along straight lines before excavating.

D. The CONTRACTOR shall strip and stockpile topsoil from grassed areas crossed by trenches. At the CONTRACTOR's option, topsoil may be otherwise disposed of and replaced, when required, with approved topsoil of equal quality.

E. While excavating and backfilling is in progress, traffic shall be maintained, and all utilities and other property protected, as provided for in the Contract Documents.

F. Materials shall be excavated to the depth indicated on the Drawings and in widths sufficient for installing manholes and laying the ducts. Coordinate the trench width the Details shown on the Drawings. The bottom of the excavations shall be firm and dry in all respects acceptable to the OWNER/ENGINEER. Trench width shall be a practical minimum, but not less than 6 inches greater than the total duct section arrangement, including reinforcing steel.

G. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. The trench may be excavated by machinery to, or just below, the designated subgrade, provided that material remaining in the bottom of the trench is no more than slightly disturbed. Subgrade soils which become soft, loose or otherwise unsatisfactory as a result of inadequate excavation, dewatering or other construction methods, shall be removed and replaced by gravel fill, of aggregate as specified in Section 31 23 33, as required by the OWNER/ENGINEER at the CONTRACTOR's expense.

H. Refer to Item 43 - Disposal of Material in the Special Conditions.

3.03 EXCAVATION BELOW GRADE AND REFILL

A. Regardless of the nature of unstable material encountered, or the groundwater conditions, trench and excavation drainage shall be complete and effective.

B. If deemed necessary by the OWNER/ENGINEER, or as shown on the Drawings, the CONTRACTOR shall be required to deposit pea gravel for duct bedding or gravel refill for excavation below grade, directly on the bottom of the trench immediately after excavation has reached the proper depth and before the bottom of the trench has become softened or disturbed by any cause whatsoever. All excavation shall be made in open trenches. Gravel used for this purpose, shall be aggregate as specified in Section 26 05 10, with a maximum coarse aggregate size of ¾ inches.

3.04 BACKFILLING

A. Remove from the excavation all materials which the OWNER/ENGINEER may deem unsuitable for backfilling.

B. Backfilling shall not commence until, not less than 48 hrs after placing of any concrete embedment, have lapsed.

C. Where the ductbanks are laid in the yard, the remainder of the trench, after concrete encasement, shall be filled with common fill material, void of rock or other non-porous material, in layers not to exceed 8-in in loose measure and compacted to 90% standard Proctor density at optimum moisture content of +/- 4%. The backfill shall be mounded 6-in above the existing grade or as directed by the OWNER/ENGINEER. Where a grass, loam or gravel surface exists prior to excavations in the yard, it shall be removed, conserved and replaced to the full original depth as part of the work under the duct items. In some areas it may be necessary to remove excess material during the cleanup process, so that the ground may be restored to its original level and condition.

D. Where the ductbanks are laid in paved areas or designated future paved areas, existing or designated future structures, or other existing or future utilities, the remainder of the trench above the encasement, shall be backfilled with select common fill or select fill material in layers not to exceed 8-inches loose measure and compacted at optimum moisture content (+/- 3%) to 95 percent standard Proctor density. The top 18-inches below subgrade level shall be compacted at optimum moisture content (+/- 3%) to 100 percent of standard Proctor density.

E. Compaction shall be by use of hand or pneumatic tamping with tools weighing at least 20 lbs. The material being spread and compacted shall be placed in layers not over 8-in loose thick. If necessary, sprinkling shall be employed in conjunction with rolling or ramming.

F. Bituminous paving shall not be placed in backfill.

G. Water jetting will not be accepted as a means of consolidating or compacting backfill.

H. All road surfaces shall be broomed and hose-cleaned immediately after backfilling. Dust control measures shall be employed at all times.

3.05 RESTORING TRENCH AND ADJACENT SURFACES

A. In paved areas, the edge of the existing pavement to be removed shall be cut along straight lines, and the pavement replaced with the same type and quality of the existing paving.

B. In sections where the ductbank passes through grassed areas, the CONTRACTOR shall, at his own expense, remove and replace the sod, or shall loam and reseed the surface to the satisfaction of the OWNER/ENGINEER.

3.06 CLEANING

A. Remove all rubbish and debris from inside and around the underground system. Remove dirt, dust, or concrete spatter from the interior and exterior of manholes, handholes and structures, using brushes, vacuum cleaner, or clean, lint free rags. Do not use compressed air.

END OF SECTION

SECTION 26 05 73 POWER SYSTEM STUDY

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The CONTRACTOR shall provide a short circuit and coordination study for the electrical power system, including additional studies as listed below. The electrical power system shall be deemed to include the utility company's transformers, the OWNER's power distribution system, including the 480V power distribution system. The short circuit and coordination study reports shall provide an evaluation of the electrical power systems and the model numbers and settings of the protective relays or devices and metering or motor monitoring devices for setting by the CONTRACTOR. The Study shall include settings for all motor protective relays and electric system monitoring devices.

B. Additional Studies

1. Arc Flash Hazard Analyzes
2. Power factor correction capacitor sizing
3. Back-to-back capacitor switching study

1.02 RELATED WORK

A. The related work, associated with this Section, shall include all Sections of the Specifications, and the Contract Drawings.

1.03 SUBMITTALS

A. The CONTRACTOR shall, not later than three (3) weeks after Contract Award, provide a submittal of the name and qualifications of the Study Engineer, for approval.

B. The CONTRACTOR shall, not later than three (3) weeks after approval of the Study Engineer, provide a copy of the List of Required Information, prepared by the Study Engineer and submitted to the CONTRACTOR, with a copy to the OWNER/ENGINEER. The CONTRACTOR shall diligently prosecute the work of providing the information required, to the Study Engineer, particularly that information required from the CONTRACTOR's electrical equipment suppliers. Any delay in the schedule specified above will not be sufficient cause to permit shipping of any equipment without the Study's selections and settings being factory installed and certified.

C. The CONTRACTOR shall include the use of his own forces to obtain all pertinent data necessary for the successful completion of the Power System Studies, including information on all existing and new equipment and wiring pertinent to the Study. This shall be interpreted to include all cable and raceway data, data for new and existing motors, data from all existing and/or new switchgear, motor control centers, panelboards, and separately mounted fuses, starters and circuit breakers. Obtain all existing or new protective device information to include all present settings The

CONTRACTOR shall obtain any needed data or information from Contract Documents, various suppliers, the Electric Utility and from conducting his own field investigations. If, in his field investigations, the CONTRACTOR encounters conflicts between the Contract Documents and the field conditions, the CONTRACTOR shall immediately notify the OWNER/ENGINEER for a resolution to the conflict. Copies of the data obtained, shall be organized and submitted to the OWNER/ENGINEER at the same time of transmittal to the Study Engineer, to show that all the requested data gathering work has been completed.

D. The CONTRACTOR shall, upon completion of the studies, submit the studies for approval to the OWNER/ENGINEER. The CONTRACTOR is reminded that equipment provided by the CONTRACTOR, and requiring selections and settings provided by the Study Engineer for such equipment, shall not be shipped from the factory until such selections and settings have been received by the equipment manufacturer and been factory installed. Prior to shipping, each equipment manufacturer shall certify that they have made such selections and settings, and that the corresponding work has been completed. The CONTRACTOR shall allow not less than three (3) calendar weeks for review of the studies by the OWNER/ENGINEER. The submittal shall not contain unresolved questions, conflicts or selective device coordination conflicts. A submittal containing such questions or conflicts will be returned unreviewed and shall not be resubmitted until such questions or conflicts have been resolved.

E. Selective device coordination is required between protective devices in equipment specified in each Section of the Electrical Specifications, and between each piece of electrical equipment, including existing equipment, supplied for this project.

F. If the Study Engineer, in the course of his work, determines that selective coordination cannot be obtained in or between pieces of existing and new equipment as specified, he shall immediately notify the CONTRACTOR, provide his supporting information to the CONTRACTOR, who shall transmit the information to the OWNER/ENGINEER for resolution of the problem.

G. The completed studies, with all known issues resolved, shall be submitted to the OWNER/ENGINEER for approval, not less than thirty (30) days prior to shipment of any equipment containing protective devices requiring selections and settings for certification by the manufacturer, as specified. Final copies shall be in electronic form,

1.04 REFERENCE CODES AND STANDARDS

A. The specified studies shall be in accordance with the following codes and standards.

1. IEEE Standard 1584-2004 – IEEE Guide for Performing Arc-Flash Hazard Calculations, Including Amendment 1584a-2004.
2. NFPA-70E–2004 - Standard for Electrical Safety Requirements for Employee Workplaces.
3. ANSI/NFPA 70 – National Electrical Code

1.05 QUALITY ASSURANCE

A. The studies shall be performed by an electrical engineer who is regularly engaged in power system studies. A Licensed Professional Engineer with proficiency in electrical power systems engineering shall conduct the study and shall seal and sign the power system studies. The Study Engineer shall be licensed to practice engineering in the state where the electric equipment is to be installed.

B. The Study Engineer shall have successfully performed studies of similar size and complexity for a period of not less than the five (5) immediate previous years.

C. The Arc Flash Hazard Analyzes Engineer shall have successfully performed studies of similar size for a period of not less than the two (2) immediate previous years. The Engineer responsible for Arc Flash Hazard Analyzes shall demonstrate experience by submitting names of at least five actual Arc Flash Hazard Analyzes that has been performed in the past years. The Arc Flash Hazard Analyzes Engineer shall demonstrate experience in providing equipment labels in compliance with NEC 2005 Section 110, and ANSI Z535.4 to identify AFIE and appropriate Personal Protective Equipment.

D. An engineer experienced in providing services and training to reduce Arc Flash exposure and train workers in accordance with NFPA 70E and other applicable standards shall be provided.

1.06 SCHEDULE OF WORK

A. The selection of the Study Engineer shall be performed in a timely manner, in accordance with the time specified, and the Study performed and submitted as specified above.

B. The completed studies, with all known issues resolved, shall be submitted to the OWNER/ENGINEER for approval, as specified above.

PART 2 STUDIES

2.01 SHORT CIRCUIT AND COORDINATION STUDY

A. Provide a complete short circuit study. Include three phase and phase-to-ground calculations. Provide an equipment interrupting or withstand evaluation based on the actual equipment and model numbers provided on this project. Generic devices are not acceptable. Normal system operating method, alternate operation, and operations that could result in maximum fault conditions, shall be thoroughly addressed in the study. The study shall assume all motors are operating at rated voltage with the exception that motors, identified as "standby," shall not be included. Electrical equipment bus impedances shall be assumed as zero. Short circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at the switchgear busses, switchboard busses, motor control centers and panelboards. The study shall be performed using actual available short circuit currents available as obtained from the Electric Utility. An assumption of infinite bus for the purposes of the study is not acceptable.

B. A protective device coordination study shall be performed to determine appropriate relay settings. The study shall include all electrical equipment provided under this contract and any up-stream or downstream equipment that has an impact on the coordination study. The study shall show transformer damage curves, cable short circuit-withstand curves and motor curves. Include all medium voltage switchgear, distribution switchboards, motor control centers, and 480 Volt panelboard main circuit breakers. Complete the short circuit study down to the main breaker or largest feeder on all 480 Volt panelboards. Panel board branch circuit devices need not be considered. The phase overcurrent and ground-fault protection shall be included as well as settings for all other adjustable protective devices. All motor monitoring relays and protective or monitoring devices that are a part of a supplier's equipment, such as soft starters or adjustable frequency drives, shall be included. Include the last protective device in the Electric Utilities system feeding each facility being considered.

C. An equipment evaluation study shall be performed to determine the adequacy of the fault bracing of all bus from the panel board level up to the main switchgear or protective device. Include circuit breakers, controllers, surge arresters, busway, switches, and fuses by tabulating and comparing the short circuit ratings of these devices with the available fault currents.

D. The study software shall be SKM System Analysis, or approved equal, using the Fault Module for short circuit calculations.

E. As a minimum, each short circuit study shall include the following:

1. One-Line Diagram:

   a. Location and function of each protective device in the system, such as relays, direct-acting trips, fuses, etc.

   b. Type designation, current rating, range or adjustment, manufacturer's style and catalog number for all protective devices.

   c. Power and voltage ratings, impedance, primary and secondary connections of all transformers. Use the ratings of the actual transformers being provided where available.

   d. Type, manufacturer, and ratio of all instrument transformers energizing each relay.

   e. Nameplate ratings of all motors and generators with their sub transient reactance.

   f. Sources of short circuit currents such as utility ties, generators, synchronous motors, and induction motors. Provide short circuit studies using each source of power separately. The study shall determine if there is sufficient short circuit current to adequately cause interruption of a protective device using the weaker power source (typically local generation),and shall determine if the equipment can safely interrupt the fault if the greater power source is connected. Additional short circuit calculations shall include emergency as well as normal switching conditions as well as normal and emergency power sources described here in.

g. All significant circuit elements such as transformers, cables, breakers, fuses, reactors, etc shall be included.

h. The time-current setting of existing adjustable relays and direct-acting trips, if applicable.

2. Impedance Diagram:

a. Available MVA or impedance from the utility company.

b. Local generated capacity impedance.

c. Transformer and/or reactor impedances.

d. Cable impedances.

e. System voltages.

f. Grounding scheme (resistance grounding, solid grounding, or no grounding).

3. Calculations:

a. Determine the paths and situations where short circuit currents are the greatest. Assume bolted faults and calculate the 3-phase and line-to-ground short circuits of each case.

b. Calculate the maximum and minimum fault currents.

F. Provide Time-Current Curves on 81/2 X 11 log-log paper. Do not put more than one branch of protective devices on any one coordination curve. Include a one-line diagram and the names of each protective device in the branch. Use the names designated in the Contract Documents. Include motor and transformer damage curves, and cable short circuit withstand curves.

G. The study shall include the selection and sizing of the type of low resistance ground (LRG) system and all associated components, including the selection of the appropriate relay to detect a single line to ground fault. The study shall also recommend the minimum size of cables to attach the electrical service to the LRG system.

2.02 ARC FLASH HAZARD ANALYZES STUDY

A. The Power System Study shall include an Arc Flash Hazard Analyzes Study that shall present the level of arc flash hazard for each item of electrical equipment, and the appropriate level of protection required per OSHA and NFPA70E standards.

B. The analysis shall be performed with the aid of computer software intended for the purpose, in order to calculate Arc Flash Incident Energy (AFIE) levels and arc flash protection boundary distances.

C. The analysis shall be performed under worst case Arc Flash conditions, and the final report shall describe, when applicable, how these conditions differ from worst case bolted fault conditions.

D. The calculations shall be performed in accordance with IEEE 1584-2004 and safe approach requirements determined in accordance with NFPA-70E-2009.

E. Results of the Analysis shall be submitted in tabular form, and shall include, device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment and AFIE levels.

F. The Study Engineer shall provide the required warning labels, with type of location designated for each and type of protection required. The type of location shall be in such detail that the recommendation includes labels on front, side, back, inside, outside, etc. The warning labels shall be installed by the CONTRACTOR.

2.03 POWER FACTOR CORRECTION CAPACITOR SIZING STUDY

A. The study shall include the appropriate sizing of the power factor correction capacitors for both existing and new motors. The CONTRACTOR shall obtain all pertinent data from the existing motor name plates and their respective manufacturers to size the capacitors to deliver a power factor of 95 percent or as close to 95 percent as possible without over-excitation of the motor. The CONTRACTOR shall obtain the maximum capacitor size from the new and existing motor manufacturers and present the data in the study. The settings, for the protective motor relays, shall take into account the correction in both starting and running current and power factor where the capacitors are located near the motors and downstream from the protective relay.

2.04 BACK-TO-BACK CAPACITOR SWITCHING STUDY

A. The study shall include a back-to-back capacitor switching study to determine the inductance required, to be installed in series the power factor correction capacitors, to decrease the level of capacitor charging inrush current and lowering the frequency of those currents. The study shall be done to include the inductance of the motor feeder cables. Examine the cases that are representative of the various combinations of motors running and starting (assuming that no two motors will ever start at once). Unless the study clearly shows that the inductance provided by the motor cables or other items of electrical equipment is sufficient to prevent capacitor damage or nuisance blowing of the capacitor fuses, inductors shall be provided in the remotely mounted PFCC enclosures.

PART 3 EXECUTION

3.01 FIELD SERVICES

A. Warning Labels Installation Certification

1. When the labels installation is complete, the CONTRACTOR and the OWNER/ENGINEER shall jointly inspect the locations and to provide to the OWNER/ENGINEER's satisfaction that labels are installed in all of the recommended locations indicated in the study.

B. Training

1. The CONTRACTOR shall provide the services of the Arc Flash Training Engineer, for a period of not less than one eight (8) hour working day, to conduct a training program for the OWNER's personnel, in the care, application and use of protective personal equipment, described by the warnings installed on the project.

The training program shall be conducted at a location onsite determined by the OWNER and shall include specific equipment locations as may be required for instruction. Applicable information from the Study shall be provided to the attendees.

C. The cost of Field Services shall be included in the Contract Price.

END OF SECTION

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SECTION 26 05 84 ELECTRICAL HEAT TRACING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install electrical heat trace system on the piping as shown on the Drawings and as specified herein.

B. The manufacturer shall design and supply the entire heating system, including the schematic arrangements, heating cable, junction boxes, thermostats and other equipment necessary to complete the system as shown on the Drawings and as specified herein.

C. The ENGINEER's piping drawings, piping line list, equipment list, instrument list and insulation schedule, constitute in conjunction with this Section, the design parameters of the heat tracing system. The Drawings are intended only to give a general layout of the heat tracing system. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation a complete electric heat tracing system based on the actual piping installation and the manufactures installation drawings and recommendations.

D. Obtain and pay for the manufacturer’s services described in this Section.

1.02 RELATED WORK

A. Section 26 05 00 – Electrical–General Provisions

B. Section 26 05 33 – Raceways, Boxes, Fittings and Supports

C. Section 26 05 19 – Wires and Cables (600 Volt Maximum).

D. Piping and installation is included in Division 22.

E. Pipe hangers and supports are included in Division 22.

1.03 SUBMITTALS

A. Submit to the ENGINEER, in accordance with Section 01 30 00 - Submittals and 26 05 00 - Electrical – General Provisions, the following calculations and information:

1. Heat loss and operating power calculations.
2. Heat tracing circuit design and loading schedule (if different from that which is shown on the Drawings).
3. Bill of materials.
4. Catalog data sheets for all components.
5. Typical installation details.

B. Submit the heat tracing system's power requirements for the design condition (extreme minimum ambient at required maintain temperature) and for the normal operating temperature (normally expected minimum ambient).

1.04 REFERENCE CODES AND STANDARDS

A. All products and components shown on the Drawings and listed in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NFPA 70 – National Electrical Code (NEC)
2. NFPA 70E – Standard for Electrical Safety in the Workplace
3. American National Standards Institute (ANSI)
4. Institute of Electrical and Electronics Engineers (IEEE)
5. American Society for Testing and Materials (ASTM)
6. National Fire Protection Association (NFPA)
7. National Electric Code (NEC)
8. Factory Mutual (FM)
9. Underwriters Laboratories (UL)
10. National Electrical Manufacturers Association (NEMA)
11. Occupational Safety and Health Administration (OSHA)

B. Furnish copies of the necessary approvals for the heat tracing system and shall verify that the approvals are current.

C. All equipment specified in this section of the Specifications shall bear the appropriate label of Underwriters Laboratories.

1.05 QUALITY ASSURANCE

A. The heat tracing system manufacturer shall be required to demonstrate a minimum of 5 years experience in the design and manufacture of industrial heat tracing systems similar to those described in this Section and shown on the Drawings.

B. The system manufacturer shall employ capable personnel to provide detail engineering, coordination, drafting and start up services and shall provide warranty compliance for the period specified.

C. All heat tracing equipment furnished under this section shall be supplied by a single manufacturer and shall have a minimum of 3 years of proven successful operation in the field under environmental conditions similar to those which will be encountered under the scope of this work.

1.06 DELIVERY STORAGE AND HANDLING

A. Protect equipment during shipment, handling, and storage by suitable complete enclosures. Protect equipment from exposure to the elements and keep thoroughly dry.

B. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Repaint damaged painted surfaces to the satisfaction of the OWNER/ENGINEER.

C. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR's choice and at the CONTRACTOR's expense, until such time that the site is ready for permanent installation of the equipment.

D. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.

E. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the CONTRACTOR at no expense to the OWNER.

1.08 AREA CLASSIFICATION

A. Supply a heating system that is suitable for the specified industrial and electrical classification and shall be designed and installed in accordance with the latest local and/or NEC regulations.

1.09 DESIGN REQUIREMENTS

A. Provide a heating system capable of maintaining the specified temperature during the extreme of ambient temperature.

B. Design Parameters

1. Low Ambient Temperature 0 degrees F
2. Maintain Temperature 32 degrees F
3. Piping and equipment lists and insulation types and thickness are found in Division 15 and on the Drawings.

C. Heat losses shall be calculated using the manufacturer's standard procedure in conjunction with the insulation requirements and equipment schedules. The design heat output of the tracing shall include a 10 percent factor of safety. CONTRACTOR is encouraged to suggest changes in insulation thickness to optimize total system economy.

D. Heating cables shall be run parallel to the pipe only. Spiral wrapping of the heat cables around the pipes shall not be permitted.

PART 2 PRODUCTS

2.01 MATERIALS

A. Parallel Resistance Self Regulating Cable

1. The heater design shall be such that it can vary its output in response to temperature variations along a pipe due to heat sinks such as fittings or pipe supports, or changes in ambient conditions such as those occurring on pipes passing into or out of buildings or process areas. This variable output feature shall apply to each increment of the heater independent of each other increment.
2. Heat tracing shall be of a type which can be field cut to length without any cold spots and can be overlapped at all power outputs without burning out.
3. The heat tracing shall be capable of continuous reliable operation when hanging loose in free air during equipment removal or replacement.
4. The cable shall not require the use of heat transfer cement or compounds.
5. The cable shall operate on standard voltages without the use of special transformers. Line voltage fluctuations shall not appreciably affect the cable wattage output.
6. Heat tracing shall be a type which can be field designed to accommodate changes in field piping without compromising its FM or UL approvals.

B. Control Thermostats

1. Control thermostats shall be UL listed, heavy duty, industrial ambient type housed in a watertight, NEMA 4 cast aluminum enclosure. The thermostat shall be provided with independently adjustable dual switches for control and low temperature alarm. Contact rating shall be 22 Amps, 480 Volts, resistive.

C. Power connection kits and junction boxes shall be watertight cast aluminum.

PART 3 EXECUTION

3.01 INSTALLATION

A. Heat tracing system shall be installed where shown on the Drawings and in accordance with manufacturer's approved shop drawings and recommendations.

B. Heating cables shall be run parallel to the pipe only. Spiral wrapping of the heat cables around the pipes shall not be permitted.

C. Power cables for heat tracing circuits running from the supply panel to circuit junction boxes located on each pipe shall be run in conduit. The heat tracing cable shall connect to the power cable in a junction box and be routed onto the pipe through a cable feeder connector with gland nut. The connector shall be two piece construction with a tapered neoprene bushing and recessed flame resistant interior gland. The connector shall be attached to the pipe with aluminum J.B. support and pipe strap.

D. At each point where the junction box is attached to the piping for heating cable entry to the pipe or device being protected and after the heating cable has been installed, the junction box stand off shall be filled with clear Dow Corning TRV 732 compound or equal rated 500

degrees F, to provide a waterproof connection. The sealant compound shall also be forced into the voids in the insulation which were created during installation of the conduit hub. The sealant compound shall be placed to position all cables away from standoff sides and to separate cables away from one another. The sealant compound shall be applied in a clean, neat manner and in strict accordance with the manufacturer's instructions for the sealant. When the installation is complete, check that none of the compound has been left on other than the prescribed areas.

E. Install "electrically traced line" warning signs every 25-ft along the outer pipe insulation jacket, Chemelex catalog number "ETL".

3.02 TESTING

A. Measure the resistance of heating cable system before and after pipe insulation.

B. Adjust and seal control thermostats to OWNER's and ENGINEER's satisfaction after installation is complete.

END OF SECTION

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SECTION 26 05 85 MISCELLANEOUS EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install miscellaneous equipment as specified herein, together with appurtenances, complete and operable, as shown on the Drawings and as specified herein.

B. The items of equipment are for individual applications as separately enclosed items. Submittals made under this Section, for components and electrical items specified under other Sections, will be returned unreviewed.

Following is a list of the items presently covered by this Section:

1. Lightning Arrester and Surge Capacitor.
2. Wireway
3. Manual Transfer Switch
4. Control Operators
5. Indicator Lights
6. Control Relays and Timers
7. Power Factor Correction Capacitors
8. Plug-In Bus Duct
9. Polyethylene Warning Tape
10. Terminal Blocks
11. 30Amp, 480Volt Receptacles
12. Welding Receptacles w/ Disconnect Switches
13. Portable Generator Input Receptacle
14. Pedestal Cabinet
15. Intrinsically Safe Relays
16. Low Level Cutoff Relay and Probes
17. JIC Boxes for GF Receptacles
18. Alarm Horn and Light
19. Break Glass Emergency Station
20. Photocells
21. 24 Hour Programmable Timers
22. Corrosion Inhibitors
23. Equipment Identification Nameplates
24. Equipment Mounting Stands
25. Lighting Contactor
26. Digital Lighting Control Time Switches
27. Momentary Contact Adaptor
28. Digital Lighting Control Panel

1.02 RELATED WORK

A. Section 26 05 00 - Electrical – General Provisions

B. Section 26 05 73 - Power System Study

C. Section 26 05 90 - Cast-in-Place Concrete for Electrical Applications

D. Divisions 43 and 46 Equipment

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Division 1, Section 26 05 00 - Electrical – General Provision, and as specified herein.

B. Submittals shall also contain information on related equipment, with schematics and logic shown on the Drawings, to be furnished under this Specification but described in the related Sections and Divisions listed in the Related Work paragraph above. Incomplete submittals not containing the required information on the related equipment will be returned unreviewed. Submittals for equipment specified in other Sections, shall not be submitted under this Section. Such submittals will also be returned unreviewed.

C. The original equipment manufacturer shall create all equipment shop drawings, including all wiring diagrams, in the manufacturer's engineering department. All equipment shop drawings shall bear the original equipment manufacturer's MCC logo, drawing file numbers, and shall be maintained on file in the equipment manufacturer's archive file system. Photocopies of the ENGINEER's ladder schematics are unacceptable as shop drawings.

D. Submit to the OWNER/ENGINEER, shop drawings and product data, for the following:

1. Equipment outline drawings showing elevation and plan views, dimensions, weight, shipping splits and metering layouts. Indicate all options, special features, ratings and deviations from the Specifications.
2. Conduit entrance drawings, including floor penetrations.
3. Bus arrangement drawings.
4. Unit summary tables showing detailed equipment description and nameplate data for each item.
5. Product data sheets and catalog numbers for overcurrent protective devices, motor starters, control relays, control stations, meters, pilot lights, etc. List all options, trip adjustments and accessories furnished specifically for this project.
6. Provide control systems engineering to produce custom unit elementary drawings showing interwiring and interlocking between units and to remotely mounted devices. Show wire and terminal numbers. Indicate special identifications for electrical devices per the Drawings.
7. Master drawing index
8. Front view elevation
9. Floor plan
10. Top view
11. Single line
12. Schematic diagram
13. Nameplate schedule

14. UL Listing
15. Component list with application name of each detailed component.
16. Conduit entry/exit locations
17. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
18. Major component ratings including:
    a. Voltage
    b. Continuous current
    c. Interrupting ratings
19. Descriptive bulletins
20. Product data sheets
21. Cable terminal sizes
22. Key interlock scheme drawing and sequence of operations
23. Busway connection
24. Instruction and renewal parts books
25. Itemized list of spare parts furnished specifically for this project, including quantities, description and part numbers

E. Factory Tests. Submittals shall be made for factory tests specified herein.

F. Field Test Reports. Submittals shall be made for field tests specified herein.

G. Operation and Maintenance Manuals.
    1. Instillation, Operation and Maintenance manuals shall include the following information:
        a. Manufacturer's contact address and telephone number for parts and service.
        b. Instruction books and/or leaflets
        c. Recommended renewal parts list
        d. Record Documents for the product data and submittals required above.

1.04 REFERENCE CODES AND STANDARDS

A. All products and components shown on the Drawings and listed in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):
    1. NFPA 70 – National Electrical Code (NEC)
    2. NFPA 70E – Standard for Electrical Safety in the Workplace

3. NEMA Standard ICS 2 – 2000 Industrial Control and Systems
4. UL 508/508A – Industrial Control Enclosures
5. UL 1449, UL 1283 – Standard for Safety for TVSS
6. ANSI/IEEE C62.41, C64.45 – Guide in Surge Environment in 600V Power Circuits
7. NEMA LS-1 – Low Voltage Surge Protective Devices
8. NEC Art. 285 – Transient Voltage Surge Suppressors

B. All equipment specified in this section of the Specifications shall bear the appropriate label of Underwriters Laboratories.

1.05 QUALITY ASSURANCE

A. The manufacturer of these materials shall have produced similar electrical materials and equipment for a minimum period of five (5) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly. All assemblies shall be of the same manufacturer.

1.06 DELIVERY STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions.

B. Protect equipment and materials from exposure to the elements and keep thoroughly clean and dry until installation.

C. Equipment submitted shall fit within the space shown on the Drawings. Equipment which does not fit within the space is not acceptable.

D. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during jobsite storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year, from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the CONTRACTOR at no expense to the OWNER.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the Manufacturers listed in each product category are acceptable.

B. The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.

2.02 RATINGS

A. The service voltage, shall be as shown on the Drawings. The overall short circuit withstand and interrupting rating of the equipment and devices shall be equal to or greater than the overall short circuit withstand and interrupting rating of the feeder device immediately upstream of the equipment.

2.03 CONSTRUCTION

A. General

1. Refer to Drawings for: actual layout and location of equipment and components; current ratings of devices, bus bars, components; protective relays, voltage ratings of devices, components and assemblies; and other required details.
2. Furnish nameplates for each device as indicated on the Drawings. Nameplates shall be laminated plastic with black letters on white background. Nameplates shall be fastened by 316 stainless steel screws. There shall be a nameplate for each controller that indicates equipment ratings, manufacturer's name, shop order number and general information.

B. Enclosure

1. Enclosures shall be in accordance with the Area Classification and Enclosure Types as specified in Section 26 05 00 Electrical – General Provisions.

C. Internal Wiring

1. Wiring: Stranded copper, minimum size No. 14 AWG, with 600 Volt, 90 degree C, flame retardant, Type MTW thermoplastic insulation, NEMA Class II, Type B wiring. Line side power wiring shall be sized for the full rating or frame size of the connected device.
2. All wiring shall be tagged and coded with an identification number as shown on the Drawings. Coding shall be typed on a heat shrinkable tube applied to each end showing origination and destination of each wire. The marking shall be permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE, or equal.
3. All control wiring to draw out units shall be run through split type terminal blocks (draw out) which can be split to allow easy unit removal. Motor “T” leads shall bolt directly to starter or overloads and shall not be split type.

4. All wiring shall be neatly bundled with ty-raps and supported to wire way supports. Control wiring shall be bundled separately from power wiring. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.

D. Field Installed Internal Wiring

1. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported so that circuit terminations are not stressed. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.
2. All field wiring shall be tagged and coded with an identification number. Coding shall be typed on a heat shrinkable tube applied to each end of the wire. The marking shall be a permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE, or equal.
3. In general, all conduit entering or leaving equipment shall be stubbed up into the bottom of the enclosure directly below the area in which the conductors are to be terminated, or from the top if shown on the Drawings. Conduits shall not enter the side unless approved in writing by the OWNER/ENGINEER.

E. Signage

1. Provide 1 inch by 3 inch engraved unit nameplates of two ply laminated plastic, black face, white core, screw fastened to each door with 316 stainless steel screws. All component and control identification nameplates shall be engraved with the device name and number exactly as it appears on the Drawings and/or as approved by the OWNER/ENGINEER. For devices not shown on the single line drawing such as time delay relays, the names shall be as shown on the Control Schematic Drawings and/or as assigned by the OWNER/ENGINEER.

F. Control Power Transformers

1. Control power transformer ratios shall be provided where shown on the Drawings. Transformer shall be sized for the entire load, including space heaters, plus 25% spare capacity. Transformer mechanical ratings shall equal the short circuit rating of the circuit breaker or MCP.
2. Control power transformers shall be 120 volt grounded secondary. Primary side of the transformer shall be fused in both legs. One leg of the transformer secondary shall be solidly grounded while the other leg shall be fused.
3. All control power transformers shall have vacuum cast primary and secondary coils using epoxy resin.

G. Instrument Transformers

1. All instrument transformers shall be vacuum cast using polyurethane resin.
2. Current transformers shall be provided where shown on the Drawings. Transformer mechanical ratings shall equal the short circuit and momentary rating of the circuit breakers. Transformers, when mounted in the motor controller, shall be rated for the full voltage of the equipment.

3. Voltage transformers shall be fixed type, with primary and secondary fuses, transformer mounted, with short circuit and momentary rating equal to the motor controller.

2.04 EQUIPMENT

A. Lightning Arrester and Surge Capacitor

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   a. GE Industrial Solutions
   b. Eaton Cutler Hammer
   c. Siemens
   d. Allen Bradley
2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.
3. Lightning arrester shall be 650 Volt, 3 Phase, "Tranquell" type.
4. Surge Capacitor shall be 650 Volt, 3 Phase, non toxic liquid insulated.

B. Wireway

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   a. GE Industrial Solutions
   b. Eaton Cutler Hammer
   c. Siemens
   d. Allen Bradley
   e. Hoffman
2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.
3. NEMA 1 wireway shall be painted steel with screw covers.
4. NEMA 4 and 4X wireway shall be stainless steel with gasketed screw covers and stainless steel screws.

C. Pilot Devices

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   a. GE Industrial Solutions
   b. Eaton Cutler Hammer

c. Siemens

d. Allen Bradley

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

3. Control Operators: Heavy duty, full size 30mm, oil tight, with NEMA A600 contact rating. Types and quantities as shown on the Drawings, or integral with protective relay.

4. Indicator lights shall be full size 30mm, oil tight, low voltage, with push-to-test feature and long-lasting LED lamps. Colors and quantities as shown on the Drawings, or integral with protective relay.

D. Control relays and timers

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

a. GE Industrial Solutions

b. Eaton Cutler Hammer

c. Siemens

d. Allen Bradley

e. Potter & Brumfield

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

3. Control relays and timers: 300 volt, industrial rated, plug-in socket type, housed in a transparent polycarbonate dust cover, designed in accordance with UL Standard 508 for motor controller duty. Continuous contact rating shall be 10 amperes resistive, ¼ HP, at 120 VAC, operating temperature minus 10 to plus 55 degrees C. Provide spare N.O. & N.C. contacts. Relays shall have neon coil indicator light. Timing relays shall be 300 volt, solid state type, with rotary switch to select the timing range.

4. NEMA 4X enclosures shall be stainless steel

5. NEMA 7 enclosures shall be cast aluminum.

E. Power Factor Correction Capacitors

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

a. GE Industrial Solutions

b. Eaton Cutler Hammer

c. Siemens

d. Allen Bradley

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

3. Capacitors shall be 460 Volt, 3Phase, 60 Hz, with kvar ratings as shown on the Drawings.

4. Each capacitor unit shall be furnished with high interrupting capacity current limiting fuses. Fuses shall be equipped with “blown-fuse” indicators.

F. Plug-In Bus Duct

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

a. GE Industrial Solutions

b. Eaton Cutler Hammer

c. Siemens

d. Allen Bradley

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

3. Bus duct shall be pendant supported every 5-ft-0-in with mounting hardware available as accessories by the bus duct manufacturer.

4. Plug-in units shall be of the fusible, quick make, quick break switching type.

5. Fuses to be used with the plug-in units shall be of sizes shown on the Drawings and be of the dual element, time delay type as manufactured by Bussman Mfg. Co. or equal.

G. Polyethylene Warning Tape

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

a. Brady Detectable Identoline

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

3. Warning tape shall be red polyethylene film, 2 in minimum width, with embedded metallic wire for location tracing.

H. Terminal Blocks

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
    a. GE Industrial Solutions
    b. Eaton Cutler Hammer
    c. Siemens
    d. Allen Bradley
2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.
3. Terminal blocks shall be 600 Volt copper, channel mounted, with tubular screw and pressure plate.

I. 30 Amp, 480 Volt Receptacles

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
    a. Crouse Hinds Arktite style 2, Catalog No. ARE 3423
2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.
3. 30 Amp, 480 Volt receptacles shall be 3 Pole, 4 Wire, grounding pin and sleeve type, with circuit breaking capability.
4. Furnish and install one matching plug for each receptacle shown on the Drawings.

J. Welding Receptacles and Disconnect Switches

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
    a. Crouse Hinds Arktite Receptacles with Enclosed Safety Switches", Catalog No. WSR103542.
2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.
3. Welding receptacles and disconnect switches shall be rated 600 Volts, 100 Amp, 3 Pole, 4 Wire, 60 Hz. Receptacle shall be mechanically interlocked with its disconnect switch to prevent breaking the circuit with the receptacle and plug. Ground wire shall be bonded to the plug and receptacle housings. Enclosure type shall be NEMA 4.
4. Furnish and install one matching plug for the welder.

K. Pedestal Cabinet

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
    a. Traffic Control Technologies
    b. Approved Equal
2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.
3. Pedestal cabinet shall be outdoor weatherproof type suitable for mounting on a concrete pad and shall be sized as shown on the Drawings.
4. The pedestal cabinet shall be constructed of heavy gauge sheet aluminum and shall be weatherproof.
5. Cabinet shall have full size backboard of 3/4 in exterior plywood painted with two coats of polyurethane sealer.
6. Interior paint finish shall be baked enamel over a rust resistant primer.
7. Each door shall have three point latch and pin tumbler type door lock or provisions for padlocking. Furnish six keys.
8. Pedestal cabinet shall have an internally mounted fan with thermostat control and door mounted baffled louvers.
9. Pedestals shall be complete with all mounting hardware and accessories required for installation as shown on the Drawings.

L. Intrinsically Safe Relays

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
    a. Gems Solid State Safe Pak as manufactured by Gems Sensors, Division of Transamerica Delaval, Inc.
2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.
3. Intrinsically safe relays shall be solid state type with 5 Amp output contacts, suitable for use on a 120 Volt, 60 Hz power supply and shall be FM approved for pilot devices in Class I, Division 1, Group D hazardous atmospheres.

M. Low Level Cutoff Relay and Probes

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
    a. McGraw Edison Co. B/W Controls Division series 1500 C induction relay with 120 Volt, 60 Hz line voltage rating and secondary voltage suitable for the water in this well.

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

3. Probes shall be of a length as shown on the Drawings and shall be McGraw Edison Co., B/W Controls Division Series EIS with stainless steel electrodes and type SW suspension wire or equal.

4. Submit a sample of the well water to the relay manufacturer for testing to determine correct probe voltage.

N. JIC Boxes for GF Receptacles

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

   a. Hoffman, Catalog No. A 606 CHAL with Type L23 stainless steel fast operating JIC clamp.

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

3. JIC boxes shall be 6 in by 6 in by 4 in aluminum continuous hinge clamp cover boxes,

4. Install 1 1/2 in bushings in bottom of box for cord and plug to pass through.

O. Alarm Horn and Light

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

   a. Federal Signal Corp.; Catalog No. 350+WB for surface mounting, Catalog No. 350+FG+FB for flush mounting.

   b. Benjamin Co.

   c. Edwards Co.

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

3. Alarm horn shall be vibrating type for 120 Volts, 60 Hz.

4. Alarm light shall be a flashing strobe unit with red fresnel globe, for use on a 120 Volts, 60 Hz power supply.

P. Break Glass Emergency Station

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

   a. Key Systems Catalog 561S (Surface Mounting) (Semi-Flush mounting)

b. Crouse Hinds

c. Killark

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

3. Break Glass Emergency Station shall be of the break glass design with a cast metal outer case finished in fire red and have an attached chain hung "Hammer". A glass panel shall be mounted in front of the push button operator. Switch contacts shall be 1 open, 1 closed, rated 10 Amp, 600 Volts.

4. A black phenolic nameplate with engraved white lettering to read: Break in case of Emergency (28 characters maximum) shall be fastened to the outer case front.

Q. Photocells

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

a. Tork Model 2101

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

3. The photocells shall be suitable for power duty with individual fixtures or for pilot duty with contactors as detailed on the Drawings. Enclosure shall be NEMA 3R or 4. Contacts shall be rated for 2,000 watts continuous at 120 Volts. The unit shall turn on at 1.5 footcandles and off at 5.5 footcandles.

R. 24 Hour Programmable Timers

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

a. Intermatic

b. Paragon

c. Tork

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

3. Unless otherwise specified, time switches shall be of the programmable type capable of being programmed at the intervals as noted on the Drawings over a 24 hour day. Program tabs shall be easily set by hand without tools to obtain or to change the desired programming schedule. The switching condition shall be maintained when adjacent tabs are set alike.

4. The unit shall be powered by a self starting, enclosed, 120 Volt, synchronous motor capable of continuous accurate operation. A reserve power, precision wound spring and associated escapement device shall be integrally mounted to maintain time settings during power failures of up to 24 hours.
5. The switch mechanism shall be a self contained unit rated at not less than 20 Amps, 120 Volts, single pole, double throw and shall be readily replaceable in the field.
6. An omitting device shall be furnished as an integral part of the time switching operation to be skipped for any preselected day or days of the week.

S. Corrosion Inhibitors

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   a. Hoffman
   b. 3M
2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.
3. All equipment enclosures, terminal boxes, etc, located in a NEMA 4X rated area (where shown on the Drawings) that contains electrical or electronic equipment or terminal strips shall be furnished with an internally mounted, chemically treated corrosion inhibitor pad.

T. Equipment Identification Nameplates

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   a. GE Industrial Solutions
   b. Eaton Cutler Hammer
   c. Siemens
   d. Allen Bradley
2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.
3. All field mounted electrical equipment such as disconnects, push button stations, etc, shall be provided with a weather resistant engraved laminoid equipment identification nameplate screwed or bolted adjacent to the device. Nameplate shall identify the mechanical equipment controlled exactly as shown on the electrical single line drawings (i.e., P 95 Cooling Water Pump No. 1).

U. Equipment Mounting Stands

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
    a. GE Industrial Solutions
    b. Eaton Cutler Hammer
    c. Siemens
    d. Allen Bradley
2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.
3. Equipment mounting stands shall be custom fabricated from 1/4 in aluminum plate and 4 in aluminum channel, as shown on the Drawings.

V. Lighting Contactor

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
    a. GE Industrial Solutions
    b. Eaton Cutler Hammer
    c. Siemens
    d. Allen Bradley
2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.
3. Lighting contactor shall be of the electrically operated, mechanically held type mounted in NEMA 1, enclosures (except where noted otherwise on the Drawings) with number of poles as noted on the Drawings. Operating coils shall be rated for 120 Volts unless otherwise indicated on the Drawings and shall be for momentary operation.
4. Contactors shall be rated for 20 Amps, 600 VAC.

W. Digital Lighting Control Time Switches

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
    a. Tork, Catalog No. DZS 200-3/277 Volt.
2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.
3. Time switches for control of lighting with photocell ON/time OFF/time ON/photocell OFF (selected days); photocell ON / photocell OFF (every day); remote photocell; 9

Volt lithium battery back-up; manual override; photocell light level control adjustment; LCD digital display and NEMA III indoor/outdoor enclosures.

X. Momentary Contact Adaptor

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

   a. Tork, Catalog SMC-D

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

3. Momentary contact adaptor shall convert a SPST, 120 VAC input to momentary (2 second ON and OFF) operations. Input connections are made to a two position terminal strip. There shall be two sets of SPDT terminals for connecting to dry contacts (unpowered) - one set for "ON" pulse and one set for "OFF" pulse. Momentary contacts shall have 30 Amp inrush capacity for 120, 240, 277 VAC and 30 VDC. Enclosure shall be general purpose (NEMA III) non-metallic and complete assembly.

Y. Digital Lighting Control Panel

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

   a. Tork model DGLCY-120V

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

3. Furnish and install digital lighting control panels as herein specified.

4. All controls including contactors, relays lighting controller, etc shall be mounted in a NEMA 4X, 304 stainless steel hinged door enclosure with rear mounted photocell and cover mounted control switches.

5. Contactors: Electrically held, 120 VAC coil operator, suitable for tungsten, ballast, or resistive non-motor loads, with over current protection, control transformer and contact ratings and poles as shown on the Drawings.

6. Lighting Controller: Controller shall be a two circuit digital lighting controller. Circuit 1 shall be Photocontrol ON/Time OFF, Circuit 2 shall be Photocontrol ON/Photocontrol OFF.

PART 3 EXECUTION

3.01 INSTALLER'S QUALIFICATIONS

A. Installer shall be specialized in installing the equipment specified in this Section with minimum 5 years documented experience. Experience documentation shall be submitted for approval prior to beginning work on this project.

3.02 EXAMINATION

A. Examine installation area to assure there is enough clearance to install the equipment.

B. Housekeeping pads shall be included for the floor mounted equipment as detailed on the Drawings with the exception of equipment which is to be installed adjacent to an existing unit. Housekeeping pads for these (if used) should match the existing installation.

C. Check concrete pads and base plates for uniformity and level surface.

D. Verify that the equipment is ready to install.

E. Verify field measurements are as instructed by manufacturer.

3.03 INSTALLATION

A. The CONTRACTOR shall install all equipment per the manufacturer's recommendations and Contract Drawings.

B. Installed required safety labels.

3.04 FIELD QUALITY CONTROL

A. Inspect installed equipment for anchoring, alignment, grounding and physical damage.

B. Check tightness of all accessible electrical connections. Minimum acceptable values are specified in manufacturer's instructions.

3.05 FIELD ADJUSTING

A. Adjust all circuit breakers, switches, access doors, operating handles for free mechanical and electrical operation as described in manufacturer's instructions.

B. The breaker protective devices shall be set in the field by a qualified representative of the manufacturer, retained by the CONTRACTOR, in accordance with settings designated in a coordinated study of the system as required in Section 26 05 73 - Power System Study.

3.06 FIELD TESTING

A. Perform all electrical field tests recommended by the manufacturer. Disconnect all connections to solid-state equipment prior to testing.

B. Megger and record phase to phase and phase to ground insulation resistance. Megger, for 1 minute, at minimum voltage of 1000 VDC. Measured Insulation resistance shall be at least 1 megohm. Measured Insulation resistance shall be at least 1 megohm. In no case shall the manufacturer’s maximum test voltages be exceeded.

C. Test the ground fault protection system using a high current injection method.

3.07 CLEANING

A. Remove all rubbish and debris from inside and around the equipment. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint free rags. Do not use compressed air.

3.08 EQUIPMENT PROTECTION AND RESTORATION

A. Touch-up and restore damaged surfaces to factory finish, as approved by the manufacturer. If the damaged surface cannot be returned to factory specification, the surface shall be replaced.

3.09 MANUFACTURER'S CERTIFICATION

A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted, including all settings designated in the Power System Study, and tested in accordance with the manufacturer's recommendations.

B. The CONTRACTOR shall provide three (3) copies of the manufacturer's representative's certification.

END OF SECTION

SECTION 26 05 90 CAST-IN-PLACE CONCRETE FOR ELECTRICAL APPLICATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, tools, equipment and related items required to perform the cast-in-place concrete work.

1.02 RELATED WORK

A. Section 26 05 00 - Electrical – General Provisions

B. Section 26 05 10 - Excavation, Trenching, Backfilling and Compaction for Electrical Applications.

C. Section 26 05 33 - Raceways, Boxes, Fittings and Supports.

D. Section 26 05 43 - Underground System.

1.03 SUBMITTALS

A. Submit to the ENGINEER, in accordance with Division 1 and Section 26 05 00 - Electrical – General Provisions, product data for the following:

1. Submit test data for the proposed concrete design mix(es).
2. Submit manufacturer's technical literature, including application procedures, for the following products:
   a. Admixtures.
   b. Form-coating materials.
   c. Concrete finishing and coating products.
   d. Curing materials.
   e. Any products proposed for use by the CONTRACTOR and not specified herein. The OWNER/ENGINEER reserves the right to reject any proposed products.
3. Hot weather and cold weather concreting plans as required by the project conditions. Specifically note what constitutes hot or cold weather conditions.

B. Certificates

1. Reinforcing Steel. Submit the manufacturer's certificates providing the properties of the reinforcing steel proposed for use.
2. Submit mill certificates for all bulk cement.

C. Submit manufacturer's technical literature, including application procedures, for the following products:

1. Air entraining agents.
2. Admixtures.

3. Joint sealants.
4. Form-coating materials.
5. Concrete finishing and coating products.
6. Curing materials.
7. Any products proposed for use by the CONTRACTOR and not specified herein. The ENGINEER reserves the right to reject any proposed products.

D. It is the CONTRACTOR's responsibility to provide all information required by the ENGINEER to evaluate and approve an alternate to any product listed as a standard of quality in this specification. The ENGINEER reserves the right to reject any proposed alternates.

E. Miscellaneous Submittals

1. Protective coatings procedures, including written warranties as specified herein.
2. Hot weather and cold weather concreting plans as required by the project conditions. Specifically note what constitutes hot or cold weather conditions.

1.04 REFERENCE CODES AND STANDARDS

A. All products and components shown on the Drawings and listed in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. American Concrete Institute (ACI)
   a. ACI 301 Specifications for Concrete
   b. ACI 304R Guide to Measuring, Mixing, Transporting and Placing Concrete
   c. ACI 305R Hot Weather Concreting
   d. ACI 306R Cold Weather Concreting
   e. ACI 308 Standard Practice for Curing Concrete
   f. ACI 309R Guide to Consolidation of Concrete
   g. ACI 315 – Detailing Manual: Details and Detailing of Concrete Reinforcement.
   h. ACI 318 Building Code Requirements for Reinforced Concrete
   i. ACI 347 Guide to Formwork for Concrete
2. American Society for Testing and Materials (ASTM)
   a. ASTM A185 Specification for Welded Steel Wire Fabric for Concrete Reinforcement
   b. ASTM A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
   c. ASTM C31 Method of Making and Curing Concrete Test Specimens in the Field
   d. ASTM C33 Specification for Concrete Aggregates

e. ASTM C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens

f. ASTM C94 Specification for Ready-Mixed Concrete

g. ASTM C150 Specification for Portland Cement

h. ASTM C171 Specification for Sheet Materials for Curing Concrete

i. ASTM C172 Standard Practice for Sampling Freshly Mixed Concrete

j. ASTM C260 Specification for Air-Entraining Admixtures for Concrete

k. ASTM C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete

l. ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

3. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practices.

1.05 QUALITY ASSURANCE

A. The manufacturer of these materials shall have produced similar materials and equipment for a minimum period of five (5) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.06 DELIVERY STORAGE AND HANDLING

A. Materials shall be handled and stored in accordance with manufacturer's instructions.

B. Protect materials from exposure to the elements and keep thoroughly clean and dry until installation.

1.07 WARRANTY

A. The CONTRACTOR shall warrant the installation to be free from defects in material and workmanship for 1 year from date of final acceptance of the project. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the installation to new condition. Any warranty work requiring shipping or transporting of the equipment or materials shall be performed by the CONTRACTOR at no expense to the OWNER.

PART 2 PRODUCTS

2.01 MATERIALS

A. All concrete shall be normal weight concrete weighing not more than 145 pcf with compressive strength a minimum of 3000 psi at 28 days, unless specified otherwise.

B. Cement

1. Cement shall be Portland cement conforming to ASTM C150, Types IA or IIA.

a. Type/ASTM No. Description

(i) IA/C150 Standard Portland cement.

(ii) IIA/C150 Provides moderate sulfate resistance or moderate heat of hydration.

2. Only one type and brand, selected from one of the above two, shall be used on this project. Mixing of types will not be permitted.

C. Flyash

1. Conform to ASTM C618, Class F, unless specified otherwise.
2. Flyash shall be produced from a single known and consistent source.
3. The amount of flyash used shall not exceed 25 percent by volume of the specified cement volume (cement is specified by weight, which can be converted to an equivalent volume).

D. Aggregates

1. Fine aggregates shall conform to ASTM C33.
2. Coarse aggregates shall conform to ASTM C33, including the following size limitations:
   a. ≤ 1/5 the narrowest dimension between sides of forms.
   b. ≤ 1/3 the depth of slabs.
   c. ≤ 3/4 the minimum clear spacing between reinforcing.
   d. ≤ 1/2 the minimum clear spacing between electrical ducts.
3. Use coarse aggregate from only one source and fine aggregate from only one source for exposed concrete in a single structure.
4. Maximum coarse aggregate size shall be 3/4-inch.

E. Mixing Water shall be chloride free and potable.

F. Admixtures

1. Air entraining shall conform to ASTM C260.

G. Chlorides are not permitted in any form.

H. Reinforcing Steel

1. All reinforcing steel shall be sized as shown on the Drawings and shall conform to ASTM A615, Grade 60.
2. Clearly mark all bars with waterproof tags showing the number of bars, size, mark, length and yield strength.
3. Tie wire shall be 18-gage annealed steel.

I. Welded Wire Fabric

1. Welded wire fabric shall conform to ASTM A185.

2. Welded wire fabric shall be of the wire size, spacing and type as shown on the Drawings.

3. Furnish in flat sheets only. Rolled sheets are not acceptable.

J. Bar Supports

1. Bar supports and accessories shall be of the sizes required to provide the concrete cover specified. Where concrete surfaces are exposed to the weather, provide plastic accessories only. Use of galvanized or plastic-tipped metal is not permitted in these locations.

2. Precast concrete bar supports shall use the same class of concrete as specified for the structure. The height of the block shall be the height required to provide the cover specified for the reinforcing. The block shall contain wires for securing the block to the reinforcement.

K. Form work

1. Design and details of form work shall conform to ACI 347.

2. Use smooth forms on all concrete surfaces exposed to view or water. Rough forms may be used on all concrete surfaces not exposed to view or water. Form material shall have sufficient strength and thickness to withstand the hydraulic pressure of newly placed concrete without deformation.

   a. Smooth Forms

      (i) Material shall be one of the following:

         a) Steel.

         b) Smooth-dressed wood.

         c) Plastic-faced plywood.

         d) Fiberglass

         e) Other material approved by the OWNER/ENGINEER.

      (ii) Provide continuous, straight smooth surfaces. Form material shall be free of raised grain, torn surfaces, worn edges, patches, dents, or other defects.

   b. Rough forms shall be constructed of dressed or undressed lumber or plywood free of knots, splits, or other defects, or other material approved by the ENGINEER.

   c. Provide chamfer strips at all edges of concrete exposed to view. Size of chamfer shall be 3/4 inch unless shown otherwise on the drawings.

L. Form Ties shall be as follows:

1. No metal or any other material shall be left within 1-1/2 inches of the concrete surface.

2. The form tie assembly shall provide cone-shaped depressions 1 inch diameter at the surface and 1-1/2 inches deep to allow for patching of the tie holes.

3. Tie rods to remain in place shall provide tight fitting washers at midpoint. Washers are not required for multi-rod ties.
4. Tie rods to be removed shall be tapered at the portion passing through the concrete, the large end of the taper on the liquid side.

M. Form Coating

1. Conform to ACI 347.
2. Form coating must not bond with, stain, or adversely affect concrete surfaces.
3. Form coating must not impair subsequent treatment of concrete surfaces, including bonding agents, curing compounds, and waterproofing.
4. Form coating must be non-toxic or become non-toxic within 30 days.

N. Curing Materials

1. Membrane curing compounds shall conform to ASTM C309 as follows:
   a. Solids: 18%.
   b. Unit moisture loss: < 0.039 gm/cm2 maximum at 72 hours.
   c. Rate of application: per the manufacturer or between 150 to 200 ft2/gal.
2. Polyethylene film for curing concrete shall conform to ASTM C171.

O. Miscellaneous Associated Materials

1. Use of all materials in this section shall be in strict conformance with the respective manufacturers' recommendations. Unacceptable workmanship as a result of the CONTRACTOR not adhering to the manufacturers' recommendations will be repaired or replaced at the CONTRACTOR's sole expense.
2. Protective Coatings
   a. All protective coatings work shall be provided by a coating applicator approved by the coating manufacturer and the ENGINEER. The coating applicator shall obtain written procedures from the coatings manufacturer on application of the protective coatings under the project conditions, including surface preparation. All protective coatings work shall be in strict conformance with these written procedures.
   b. Coordinate all protective coatings work so as not to delay construction.

2.02 PROPORTIONING OF CONCRETE

A. Select proportions of ingredients to produce a concrete having proper workability, durability, strength, and appearance. Proportion ingredients to produce a mixture that will work readily into corners and angles of forms and around reinforcement by methods of placing and consolidation employed on the project. Concrete mix shall not allow materials to segregate or allow excess free water to collect on the surface.

B. Minimum cementations content shall be 564 lbs./cu yd.

C. The maximum allowable water/cement or water/cement-pozzolan ratio shall not exceed 0.4513. Include free water in the aggregate in all water/cement or water/cement-pozzolan ratio computations. Slump shall be approximately as follows:

	Condition	Slump (In.)
1.	Underground ducts or raceways	2 - 6
2.	All other applications	1- 4

D. Proportion admixtures according to the manufacturer's recommendations.

E. Minimum air content shall be as follows:

	Coarse Aggregate Size	Air Content
1.	¾”	6 +/- 1

2.03 MIXING NORMAL WEIGHT CONCRETE

A. Mix and transport ready-mixed concrete according to ASTM C94 and ACI 304R. In addition to normal batch plant procedures as outlined in ASTM C94, provisions must be made at the batch plant for the following items:

1. Provide a moisture meter to assure the amount of free water in fine aggregates is within 0.3 percent. Compensate for varying moisture contents of fine aggregates and change batch weights of materials, if necessary, before batching.
2. Provide adequate facilities for accurate measurement and control of each material used in each batch of concrete. The accuracy of weighing equipment must conform to applicable requirements of ASTM for such equipment. Computerized plants which automatically correct for weigh-out variations must do so within the batch being loaded. Correction only for succeeding batches is not acceptable.
3. Ticket information for each truck of delivered concrete must include the following information:
   a. Truck number.
   b. Time truck left batch plant.
   c. Time truck arrived at construction site.
   d. Time concrete discharge started.
   e. Time concrete discharge completed.
   f. Weights for cement and aggregates as batched.
   g. The difference between aggregates and cement as batched and as specified.
   h. Concrete batch number.
   i. Total amount of water.
   j. Types and amounts of admixtures.
   k. Discharge temperature.

B. Deliver recorded ticket copies with concrete. CONTRACTOR must provide one original copy for each truckload to both the OWNER's testing agency and the ENGINEER at the end of each day. Maintain a copy of tickets for each day as a part of the job records. Transit Mix Truck Requirements

1. Clean each truck drum before the truck proceeds to the batching plant.
2. Keep the water tank valve locked at all times of the truck that is in use. Any addition of water must be as directed by the OWNER/ENGINEER.
3. Equip each truck with a continuous, non-reversible, revolution counter showing the number of revolutions at mixing speeds.

C. Admixtures

1. Charge admixtures into the mixer as a solution using an automatic dispenser or similar metering device. Measure admixture to an accuracy within ±2 percent. Do not use admixtures in powdered form except for the red dye.
2. Two or more admixtures may be used in the same concrete, provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other. Inject the admixtures separately during the batching sequence.
3. Install red dye of 40 lbs per 10 cy. of concrete installed underground, at the jobsite.

2.04 FABRICATION OF CONCRETE REINFORCEMENT

A. Fabricate bars to the shapes shown on the drawings by cold bending. Bends shall conform to the minimum bend diameters specified in ACI 318. Do not straighten or re-bend bars.

B. Locate splices as shown on the drawings. Where it is necessary to splice reinforcement at locations other than as shown on the drawings, the splices shall be approved by the ENGINEER. Stagger splices in adjacent bars. Length of lap splices shall be in accordance with ACI 318, unless detailed otherwise on the drawings.

C. Fabricating and placing tolerances shall be in accordance with ACI 318, ACI 301, and the CRSI Manual of Standard Practice.

2.05 CONCRETE CURING MATERIALS

A. Concrete curing materials shall be compatible with all specified coatings.

PART 3 EXECUTION

3.01 REINFORCEMENT PLACEMENT

A. Place and hold reinforcement in position so that the concrete cover, as measured from the surface of the bar to the form surface, is as follows, unless noted otherwise on the drawings:

	Location	Cover (in.)
1.	Concrete cast against	3

and permanently exposed
to earth

2. All other concrete 3

B. Support reinforcing bars to prevent displacement by construction loads or concrete placement beyond the specified tolerances.

C. Do not bend reinforcement after being embedded in hardened concrete, unless approved by the ENGINEER.

D. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If bars are moved more than 1 bar diameter, or enough to exceed the specified tolerances, the resulting arrangement of bars shall be subject to approval by the ENGINEER.

E. Splices

1. Do not splice bars, except at locations shown on the drawings or the reviewed shop drawings, without approval of the ENGINEER.

2. Tie lap splices securely with wire to prevent displacement of splices during placement of concrete.

F. Place reinforcing continuous through construction joints, unless otherwise shown on the design drawings.

G. Install welded wire fabric in the largest sections practical. Lap adjoining pieces at least one full mesh plus 2 inches or 12 inches, whichever is larger. Lace splices with wire. Do not make end laps midway between supporting beams, or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps.

H. Reinforcing bars field cut on the job shall be cut by shearing or sawing. Field cutting with a torch is not acceptable.

I. Welding of reinforcing bars is prohibited.

3.02 FORM CONSTRUCTION AND HANDLING

A. Form joints shall be mortar tight. Grout leakage at joints is unacceptable.

B. Where necessary to maintain the specified tolerances, camber formwork to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete and construction loads.

C. Form panels shall be constructed in the largest sizes allowable by handling and load bearing requirements.

D. Plywood and other wood surfaces shall be sealed against absorption of moisture from the concrete.

E. Clean form surfaces before use and re-use.

F. Assemble forms so that they may be readily removed without damage to concrete surfaces.

G. Drill forms to suit ties used and to prevent leakage of concrete mortar around the holes. Do not damage forms by driving ties through improperly prepared holes.

H. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.

I. Removal of forms shall conform to ACI 347.

J. When repair of vertical surface defects or finishing is required before concrete is cured, remove formwork as soon as concrete has hardened sufficiently to resist damage from removal operations.

K. Remove form ties as soon as possible after formwork removal, not to exceed 48 hours.

3.03 INSPECTION

A. Before concrete placement, all reinforcement shall be free of mud, oil, coating or other materials that may adversely affect or reduce bond. Reinforcing with rust or mill scale **NOT** removable by wire brush, will be accepted provided the dimensions, weights and height of deformations of a cleaned sample are not less than required by the applicable ASTM specifications. All reinforcing steel shall be securely tied and supported to prevent displacement by construction loads or concrete placement beyond the tolerances specified in item 2.04. Forms shall be clean and free from loose material or debris.

B. Notify the ENGINEER twenty-four (24) hours prior to the start of concrete placement to allow for inspection of the reinforcing steel placement. Costs due to delays resulting from corrective work will be borne by the CONTRACTOR at no additional expense to the OWNER.

C. Physical properties of reinforcing steel are subject to testing by an independent laboratory for compliance with ASTM A615. Furnish samples required for such testing when requested by the ENGINEER.

D. Any costs due to embedded items not being placed prior to concrete placement shall be borne by the CONTRACTOR at no additional expense to the OWNER.

3.04 CONSTRUCTION JOINTS

A. Joints shall be located where shown on the drawings. The addition or deletion of joints is permitted only upon written approval by the ENGINEER.

B. Clean surface of the concrete at all joints and remove laitance.

3.05 CONVEYING

A. Handle concrete from mixer to placement as quickly as practical while providing concrete of required quality. Use methods which prevent loss of ingredients and segregation.

3.06 PLACEMENT OF CONCRETE

A. Placement of concrete shall conform to ACI 304R.

B. In the event of plant or equipment breakdowns, backup concrete placing equipment shall be available within 30 minutes. An alternate concrete source that can provide concrete in accordance with these specifications and the approved mix design shall be considered.

C. Concrete shall be placed in approximately 12 inches to 24 inches horizontal layers. Conform to ACI 309R.

D. Concrete shall not be dropped freely more than 4 feet or through a cage of reinforcing steel.

E. Bottom-dump buckets are acceptable as long as care is taking to avoid segregation caused by jarring or bumping the bucket.

F. Chutes

1. Chutes shall be metal or wood with metal lining. Aluminum is unacceptable.
2. Slope shall be between one vertical to two horizontal and one vertical to three horizontal.
3. A baffle shall be provided at the end of each chute unless a drop chute, tremie, or elephant truck is used.

G. Drop Chutes, Elephant Trunks, and Tremies

1. Drop chutes, elephant trunks, and/or tremies shall be used in walls and columns.
2. Drop chutes, elephant trunks, and tremies shall be moved at short intervals during the pour. Vibrators shall not be used in lieu of proper movement of this equipment.
3. Tremies shall be used for underwater pours and to avoid segregation.

H. Pumping

1. Pumping equipment shall be compatible with the slump and aggregate size specified.
2. Aluminum pump lines are unacceptable.
3. Loss of slump from the pump hopper to the delivery point shall not exceed 1-1/2 inches.

I. Conveying

1. Conveying equipment shall be designed to place concrete without segregation.
2. Conveying equipment shall deliver concrete continuously over the placement area without delays for equipment relocation.

J. Portholes may be placed in wall or column forms in order to limit the free fall of concrete to less than 4 feet. In walls, porthole spacing shall not exceed 6 feet to 8 feet.

K. Placing in Forms

1. At least 48 hours shall elapse before placement of an adjacent section of wall.
2. Vibration of successive layers of poured concrete is required. The vibrator shall not penetrate the underlying layer by more than 2 feet.
3. The use of vibrators to move concrete horizontally within the forms is unacceptable.
4. Vibrators
   a. Conform to ACI 309R.
   b. Vibrators shall be high frequency with a minimum frequency of 8,000 rpm.
   c. Continue vibration until the escape of large bubbles at the surface has ceased and before segregation occurs.
   d. Vibrators or sharp pointed concrete placing tools shall not be used on concrete placed in underground electrical duct trenches.
5. If forms become displaced in any way during placing of concrete, immediately stop the operation and do not resume placing until forms have been re-braced and brought back to required lines and levels.
6. Concrete placing procedures and equipment shall not dislodge reinforcing steel or other embedded items in concrete structure.

L. Weather Conditions
1. Do not place concrete during rain, sleet, snow or freezing weather.
2. Do not permit rainwater to increase mixing water or to damage the surface finish. If rainfall occurs after placing operations begin, provide adequate covering to protect the work.
3. Hot Weather
   a. Conform to ACI 305R.
   b. The hot weather concreting plan shall be submitted to the ENGINEER for review.
   c. The maximum permissible temperature of concrete during placement is 90 degrees F.
4. Cold Weather
   a. Conform to ACI 306R.
   b. When the temperature is 40 degrees F and rising, concrete may be placed as long as the water and/or aggregate are heated so that the concrete temperature is at least 55 degrees F at the time of pour. The placed concrete shall be maintained at 50 degrees F minimum for 7 days minimum.
   c. The cold weather concreting plan shall be submitted to the ENGINEER for review.

3.07 CONCRETE

A. Delivery Schedule. Mix concrete only in quantities for immediate use. Discard concrete which has set. Re-tempering of set concrete is not permitted. Completely discharge concrete at the site within 90 minutes after adding cement to aggregate. In hot weather,

the CONTRACTOR shall carefully monitor concrete quality and adjust delivery schedule and batching operations as required.

B. Indiscriminate addition of water to increase slump is prohibited. Do not exceed either the maximum specified water/cement or water/cement-pozzolan ratio or maximum slump. Any addition of water above the maximum water/cement or water/cement-pozzolan ratio is cause for rejection. If mixes continually arrive on the site with slump of 2 inches or less at the maximum allowable water/cement or water/cement-pozzolan ratio, revise concrete mix. The revised concrete mix shall be submitted to the ENGINEER for approval.

C. If concrete arrives with cement balls, balls shall be removed. Excessive balling is grounds for rejection of the truck. Trucks carrying balled concrete shall have their numbers taken. If the same truck arrives at the site carrying balled concrete three times, it will be rejected and not allowed to return to the site until it is opened up for inspection, cleanliness and damage noted, repairs made, and a final inspection for approval is made by the ENGINEER.

3.08 CURING AND PROTECTION

A. Curing shall conform to ACI 308.

B. Protect freshly deposited concrete from premature drying, excessively hot or cold temperatures, and excessive moisture loss for a period of time necessary for the hydration of the cement and proper hardening of the concrete.

C. Curing shall begin immediately following the initial set of concrete or surface finishing has been completed, as soon as surface marring will not occur as a result of curing operations.

D. Wall forms may be left in place as a means of curing unless the weather is hot and dry. Consult with the ENGINEER concerning weather conditions acceptable for leaving wall forms in place. Cure concrete immediately after the removal of forms in hot and dry weather, in accordance with the requirements and procedures specified herein.

E. During the curing period, protect concrete from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration. Protect finished concrete surfaces from damage caused by construction equipment, materials, or methods, and by rain or running water.

F. Curing Requirements and Procedures

3.09 CONCRETE FINISHING

A. Repairing Surface Defects

1. Repair surface defects immediately after the removal of forms.
2. Remove honeycombed and other defective concrete down to sound concrete and repair.
3. Patch tie holes immediately after removal of forms. Fill solid with patching material as submitted to and approved by the ENGINEER.

4. The CONTRACTOR shall submit patching material(s) and method(s) of application to the ENGINEER for approval.

B. Finishing of Formed Surfaces

1. Rough form finish shall be in accordance with ACI 301, Section 10.2.1.
2. Smooth form finish shall be in accordance with ACI 301, Section 10.2.2.
3. Smooth rubbed finish shall be in accordance with ACI 301, Section 10.3.1. A smooth rubbed finish requires an initial smooth form finish as required above.
4. Grout cleaned finish shall be in accordance with ACI 301, Section 10.3.2. A grout cleaned finish requires an initial smooth form finish as required above.
5. Tops of walls and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed. Float unformed surfaces to a texture consistent with that of the formed surfaces. Final treatment on formed surfaces shall continue uniformly across the unformed surfaces.

C. Finishing Slabs and Similar Flat Surfaces

1. Use strike-off templates or approved compacting-type screeds riding on screed strips or edge forms to bring concrete surface to the proper contour.
2. Thoroughly consolidate concrete in slabs.
3. Tolerances shall be checked by placing a straightedge of specified length anywhere on the slab. The gap between slab and straightedge must not exceed the tolerances listed below.

Class	Straightedge Length (ft.)	Tolerance (in.)
All	10	1/8

4. Floated Finish
   a. All equipment pads and slabs, installed indoors, shall have a floated finish, smooth and level.
   b. Replace any floated finishes, cut or damaged, during the Project.
   c. After concrete has been placed, struck off, consolidated and leveled, do not work further until ready for floating. Begin floating when water sheen has disappeared, or when the mix has stiffened sufficiently to permit proper operation of a power driven float. Consolidate the surface with power driven floats. Use hand floating with wood or cork faced floats in locations inaccessible to a power driven machine and on small, isolated slabs.
   d. Recheck tolerance of the surface after initial floating with a 10-foot straightedge applied at not less than two different angles. Cut down high spots and fill low spots to Class B tolerance. Immediately re-float slab to uniform, smooth, granular texture.
5. Troweled Finish
   a. Replace any troweled finishes, cut or damaged, during the Project.

b. To obtain a troweled finish, a floated finish as specified above must be applied. After power floating, use a power trowel to produce a smooth surface which is relatively free of defects but which may still contain some trowel marks. Do additional trowelings by hand after the surface has hardened sufficiently. Do final troweling when a ringing sound is produced as the trowel is moved over the surface. Thoroughly consolidate the surface by hand troweling operations.

c. Produce a finished surface free of trowel marks, uniform in texture and appearance and conforming to Class A tolerance. On surfaces intended to support floor coverings, remove defects which might show through covering by grinding.

6. Broom Finished Concrete

a. All equipment pads and slabs, installed outdoors, shall have a broomed finish, smooth and level.

b. Replace any broom, belt or rake finished concrete, cut or damaged during the Project.

c. To obtain a broom, belt, or rake finish, immediately upon completing a floated finish, draw a broom or rake across the surface to give a coarse transverse scored texture.

D. Protective Coatings or Sealers in accordance with Division 09.

3.10 TESTING AND CONTROL FURNISHED BY THE CONTRACTOR

A. In addition to the initial mix design, the CONTRACTOR shall, at his expense, employ a commercial testing laboratory, acceptable to the OWNER, to prepare and test the design mix for each class of concrete for which the material source has been changed.

3.11 TESTING OF DEFICIENT IN-PLACE CONCRETE

A. The strength of the concrete will be considered potentially deficient if the averages of two consecutive sets of strength test results fail to equal or exceed the specified strength or if any individual strength test result falls below the specified strength. Testing may be required as directed by the ENGINEER.

B. Concrete work not having the required strength, as determined by the ENGINEER, shall be replaced at the CONTRACTOR's expense.

C. The CONTRACTOR shall bear all costs incurred in providing the additional testing and/or analyses required as a result of deficient in-place concrete. All costs as a result of delays due to additional testing and/or analyses will be at the CONTRACTOR's expense, with no extension of contract length, regardless of the outcome of the testing.

3.12 ACCEPTANCE OF CONCRETE WORK

A. Formed surfaces resulting in a configuration of members smaller than permitted under the tolerances specified herein shall be considered deficient and repaired or replaced as directed by the ENGINEER.

B. Concrete members cast in the wrong location shall be rejected if the strength, appearance, or function of the structure is, in the ENGINEER's opinion, adversely affected or if misplaced members interfere with other construction. If rejected, remove members cast in the wrong location and repair or replace at the CONTRACTOR's expense as directed by the ENGINEER.

C. All work required under this section shall be at the CONTRACTOR's expense, with no extension of contract length.

3.13 WATERTIGHTNESS OF CONCRETE STRUCTURES

A. All concrete structures, such as transformer insulation fluid containments designed to contain or convey fluid, shall be tested for water-tightness by the CONTRACTOR by filling with water to levels approximating what will be attained during operation and testing as outlined in this section. These tests shall be repeated until watertightness is assured. Unless approved by the ENGINEER, perform tests prior to backfilling below-grade structures.

B. The CONTRACTOR shall provide the water and all equipment required to fill and drain the structure for watertightness testing. The source of water and the means of filling and draining shall be submitted to the ENGINEER for approval.

C. The CONTRACTOR is responsible for all costs associated with the watertightness requirements specified herein and the repairs required as a result of water leakage.

D. The rate of filling shall be limited to minimize shock effect to new concrete construction. Rate of filling shall be submitted to the ENGINEER for approval.

E. Whenever raceways or any other item terminates in or extends through a concrete manhole or handhole the CONTRACTOR shall install the embedded item in the concrete such that the watertightness of the structure is not impaired. Unless otherwise noted, all raceways penetrating hydraulic structures shall have pipe sleeves.

END OF SECTION

SECTION 26 09 13 POWER METERING AND PROTECTIVE RELAYS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section of the Specifications describes the requirements for power metering and protective relays to be furnished under other Sections of the Specifications as listed in the Related Work paragraph of this Section.

B. All equipment described herein shall be submitted and furnished as an integral part of equipment specified elsewhere in these Specifications.

1.02 RELATED WORK

A. Section 26 00 00 - Electrical – General Provisions

B. Section 26 24 00 - Distribution 480 Volt Switchboards

C. Section 26 23 00 - 480 Volt Switchgear

D. Section 26 24 19 - Motor Control Centers

E. Section 26 29 23 - Variable Frequency Drive Controllers

1.03 SUBMITTALS

A. Submittals for equipment specified herein shall be made as a part of equipment furnished under other Sections. Individual submittals for equipment specified herein will not be accepted and will be returned unreviewed.

B. Submit catalog data for all items supplied from this specification section as applicable. Submittal shall include catalog data, functions, ratings, inputs, outputs, displays, etc., sufficient to confirm that the meter or relay provides every specified requirement. Any options or exceptions shall be clearly indicated.

C. Installation, Operation and Maintenance Manuals.
   1. Installation, operation and Maintenance manuals shall include the following information:
      a. Manufacturer’s contact address and telephone number for parts and service.
      b. Instruction books and/or leaflets
      c. Recommended renewal parts list
      d. Record Documents for the information required by the Submittals above.

1.04 REFERENCE CODES AND STANDARDS

A. The equipment in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NEMA/ISCI – 109 Transient Overvoltage Withstand Test
2. IEEE Std. 472/ANSI C37.90A Surge Withstand Capability Tests

B. All meters, relays and associated equipment shall comply with the requirements of the National Electric Code and Underwriters Laboratories (UL) where applicable.

C. Each specified device shall also conform to the standards and codes listed in the individual device paragraphs.

1.05 QUALITY ASSURANCE

A. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. Equipment submitted shall fit within the space or location shown on the Drawings. Equipment which does not fit within the space or location is not acceptable.

C. For the equipment specified herein, the manufacturer shall be ISO 9001 2000 certified.

1.06 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year from date of acceptance of the equipment containing the items specified in this Section. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition.

PART 2 PRODUCTS

2.01 FEEDER PROTECTION SYSTEM (FP1)

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
1. GE Industrial Solutions/Multilin Model 750/760
2. Approved equal

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. General
1. Digital relay for management and primary protection of feeders, and management and backup protection of buses, transformers and transmission lines
2. The unit shall provide protection, control, and monitoring functions with both local and remote human interfaces.

3. The relay shall be of drawout construction.
4. All circuit boards shall have a harsh environment conformal coating to resist H_2S gas and other corrosive agents, including humidity.
5. All components, except terminating hardware, shall be mounted inside the relay.
6. The unit shall be suitable for semi-flush mounting in a panel.
7. It shall be equipped with a front panel display and keypad for programming and monitoring.

D. Protection
1. The relay shall have the following protective functions:
   a. Time phase overcurrent elements for all phases with level detectors.
      (i) The phase time overcurrent element shall be capable of dynamic adjustment of the pickup setting from manual close blocking, cold load pickup and voltage restrained overcurrent features;
   b. Time ground overcurrent elements with level detectors.
   c. Directional control of both phase and ground overcurrent elements.
   d. Two independent elements each for:
      (i) Undervoltage
      (ii) Overvoltage
      (iii) Underfrequency

E. Control
1. The relay shall be able to trip and close an associated circuit breaker and track the breaker position. The relay shall include a Red breaker closed LED.
2. Closing operations shall be supervised by a synchro-check scheme, with voltage source level or manual override provisions.
3. The relay shall be able to control the overcurrent elements in a cold load pickup or manual closing operating mode.
4. The relay shall have a minimum of 14 programmable logic inputs for manual commands or feature control
   a. Inputs shall be able to operate from internal and external dc power supplies.

F. Metering
1. The unit shall be able to measure / calculate and display:
   a. Line voltage
   b. Differentials between bus and line voltages
   c. Frequency
   d. Current
   e. Real, reactive and apparent power
   f. Power factor
   g. Watt-hour and var hour consumption
   h. Demand for current and power measurements
2. The relay shall have an input channel for measuring a 0-1 mA, 0-5 mA, 0-20 mA, or 4-20 mA (programmable) signal from an external transducer.
3. The relay shall have eight internal transducers, with 4-20 mA output signals to represent various measured / calculated parameters.
   a. Output channels shall be programmable to represent, as a minimum:

(i) Voltage
(ii) Frequency
(iii) Current
(iv) Power
(v) Demand
(vi) The distance to the most recently detected overcurrent fault.

G. Monitoring
1. The relay shall have measuring elements with programmable outputs to monitor:
a. Breaker trip and close coil continuity
b. Over frequency
c. Demand levels
d. Power factor
e. Summed breaker arcing current
2. The relay shall be able to display automatically at least 10 user-programmed protection settings or measured / calculated parameters.

H. System/Relay Operations and Maintenance
1. The relay shall have a sequence of events record and oscillographic capture of important events with a time base in 1 ms increments.
a. The event record shall store a minimum of 64 events.
b. The oscillograph shall capture a minimum of eight events.
2. The relay shall have a distance-to-fault feature that stores a minimum of eight faults.
3. The relay shall have a simulation feature to test the device without external injection of voltage and current signals.
4. Device firmware shall be stored in non-volatile flash memory, so that relay upgrades can be performed by downloading programs from a PC.

I. Control Power - The relay shall be suitable for HI or LO ranges of available control power.
1. HI Range: DC: 88-300 VDC; AC: 70-265 VAC, 48 to 62 Hz.
2. LO Range: DC: 20-60 VDC; AC: 20-48 VAC, 48 to 62 Hz.

J. Communication - Relay shall have three independent communications ports, two rear RS 485/422 ports and a front RS 232 port. All ports shall use the AEG Modicon ModBus protocol.]

2.02 POWER QUALITY METERING (PM1)

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
1. GE Industrial Solutions Multilin PQMII Power Quality Meter

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. General
   1. All circuit boards shall have a harsh environment conformal coating to resist H_2S gas and other corrosive agents, including humidity.

D. Monitoring and Metering
   1. Metering Functions with accuracy of 0.2 percent for A & V and 0.4 percent for power parameters
      a. A, V, VA, W, var, KWH, KVARH, KVAH, PF, Hz
      b. W, var, A, VA Demand
      c. A, V Unbalance
   2. Power Analysis Functions.
      a. Total Harmonic Distortion
      b. Individual harmonics
      c. Waveform capture
      d. Historical data
      e. Minimum and maximum metered values complete with time and date
      f. Record of last 40 events
      g. Two independent data logs

E. User Interface and Programming
   1. Integrated keypad to access actual values and setpoints.
      a. 2 - line, 40 character illuminated display for use with keypad. The display shall have:
         (i) Variable scrolling rates.
         (ii) Front mounted LEDs to display alarms, communication status, relay status, simulation mode, self test failure, and setpoint access status.
         (iii) Relay reset button to clear alarm and auxiliary conditions.
   2. Communications
      a. Communications with the meter shall be accomplished by the following methods:
         (i) 2 RS485 communications ports and 1 RS232 port. RS 485 ports shall be daisy chained together.
         (ii) An industry standard (open) protocol, Modbus® RTU, with user selectable baud rates to 19.2 K.
         (iii) Setpoint programming and actual values monitoring shall be available through all the serial ports.
      b. Interface software shall be in a Windows™ format.
   3. The meter shall have one alarm output relay with Form C contacts.
   4. Relay output shall be through alarm, auxiliary and pulse output functions.
   5. The meter shall provide a user configurable pulse output based on KWH, KVARH or KVAH.
   6. The meter shall provide a pulse input for demand synchronization.
   7. The meter shall include a simulation mode capability for testing the functionality and meter response to programmed conditions without the need for external inputs.
   8. The relay shall include a power systems option} consisting of harmonic analysis, triggered trace memory waveform capture, event record and data logger functions.

F. Control Power:
   1. Range of available control power: DC: 88-300 VDC; AC: 70-265 VAC, 48 to 62 Hz.
   2. LO Range: DC: 20-60 VDC; AC: 20-48 VAC, 48 to 62 Hz.

G. Communication - Relay shall have three independent communications ports, two rear RS 485/422 ports and a front RS 232 port. All ports shall use the AEG Modicon ModBus protocol.]

2.03 MOTOR PROTECTION SYSTEM (MP3)

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   1. GE Industrial Solutions Multilin 369

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. General
   1. All circuit boards shall have a harsh environment conformal coating to resist H_2S gas and other corrosive agents, including humidity.

D. Protection and Control
   1. Thermal model biased with RTD and negative sequence current feedback
   2. Phase short circuit
   3. Undervoltage, overvoltage
   4. Underfrequency
   5. Thermal overload
   6. Undercurrent for load loss
   7. Locked rotor / mechanical jam
      a. The relay shall protect the rotor during stall and acceleration. The stall/acceleration curve shall be voltage compensated and a speed switch input shall be available. The stator protective thermal model shall combine inputs from positive and negative sequence currents and RTD winding feedback. The model shall be dynamic in nature in order to follow the loading and temperature of the motor.
   8. Variable lockout time
   9. Current unbalance
   10. Ground fault O/C
   11. Phase reversal
   12. Starts/hour, time between starts
   13. Overtemperature 12 RTD's
   14. Back-Spin detection

E. Monitoring and Metering
   1. Metering Functions
      a. A, V, W, Var, VA, PF, Hz, WH, varh, demand

b. The system shall include complete power metering. An event record shall store the last 40 events. Sixteen cycles of waveform data shall be stored each time a trip occurs. A simulation feature shall be available for testing the function.

2. Fault diagnosis
3. Event record
4. Statistical information and learned motor data
5. Voltage/ frequency/power display
6. Four analog outputs
7. Oscillograph and data logger

F. Inputs and Outputs
1. 12 RTD's, programmable
2. Five assignable digital inputs
3. Four output relays
4. Four programmable analog outputs

G. Memory
1. Memory shall be non-volatile and programming shall remain intact upon power failure.
2. Interface software shall be provided in a Windows® format.

H. User Interface
1. A 40 character LCD display and associated keypad to provide access to actual values and set points.

I. Control Power:
1. Range of available control power: DC: 88-300 VDC; AC: 70-265 VAC, 48 to 62 Hz.
2. LO Range: DC: 20-60 VDC; AC: 20-48 VAC, 48 to 62 Hz.

J. Communications
1. Three independent rear RS485 ports, each daisy chained between systems, where shown on the Drawings.
2. Fiber Optic port.
3. Ethernet port.
4. Communication protocols.
   (i) Modbus RTU
   (ii) Device Net

2.04 REMOTE RTD METERING AND PROTECTION (RRTD)

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

1. GE Industrial Solutions Multilin RRTD

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions.

Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. General
   1. All circuit boards shall have a harsh environment conformal coating to resist H_2S gas and other corrosive agents, including humidity.

D. Protection and Control
   1. Overtemperature

E. Monitoring and Metering
   1. Temperature

F. Inputs and Outputs
   1. Inputs
      a. 12 three wire shielded RTD inputs, configurable type.
      b. [Six dry contacts, optically isolated, programmable.]
   2. Outputs
      a. Computer interface

G. Control Power:
   1. Range of available control power: DC: 50-300 VDC; AC: 40-265 VAC, 50 to 60 Hz.
   2. LO Range: DC: 20-60 VDC; AC: 20-48 VAC, 50 to 60 Hz.

H. Communications
   1. Three independent RS485 ports, each daisy chained between systems, where shown on the Drawings.
   2. Communication protocols.
      a. Modbus RTU

2.05 MOTOR PROTECTION SYSTEM (MP4)

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   1. GE Industrial Solutions Multilin 469

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. General
   1. All circuit boards shall have a harsh environment conformal coating to resist H_2S gas and other corrosive agents, including humidity.

D. Protection and Control
   1. Thermal model biased with RTD and negative sequence current feedback
   2. Start supervision and inhibit
   3. Locked rotor / mechanical jam

a. The relay shall protect the rotor during stall and acceleration. The stall/acceleration curve shall be voltage compensated and a speed switch input shall be available. The stator protective thermal model shall combine inputs from positive and negative sequence currents and RTD winding feedback. The model shall be dynamic in nature in order to follow the loading and temperature of the motor.

4. Voltage compensated acceleration
5. Undervoltage, overvoltage
6. Underfrequency
7. Stator differential protection
   a. Differential protection using CT inputs (6) from both sides of the machine winding Voltage transformer inputs shall be used to provide over voltage, under voltage, voltage phase reversal, over frequency and under frequency functions.
8. Thermal overload
9. Overtemperature 12 RTD's
10. Phase and ground overcurrent
11. Current unbalance
12. Power Elements
    a. Power factor
    b. Reactive power
    c. Underpower
    d. Reverse active power
    e. Overtorque
13. Torque protection
14. Reduced voltage starting control

E. Monitoring and Metering
1. Metering Functions
   a. A, V, W, Var, VA, PF, Hz, WH, varh, demand
   b. The system shall include complete power metering. An event record shall store the last 40 events. Sixteen cycles of waveform data shall be stored each time a trip occurs. A simulation feature shall be available for testing the function.
2. Torque, temperature
3. Event recorder
4. Oscillography and data logger
5. Statistical information and learned motor data
6. Motor starting reports

F. Inputs and Outputs
1. 12 RTD's, programmable
2. Five predefined and four assignable digital inputs
3. Six output relays
4. Four analog inputs
5. Four programmable analog outputs

G. Memory

1. Memory shall be non-volatile and programming shall remain intact upon power failure.
2. Interface software shall be provided in a Windows® format.

H. User Interface
1. A 40 character LCD display and associated keypad to provide access to actual values and set points.

I. Control Power:
1. Range of available control power: DC: 90-300 VDC; AC: 70-265 VAC, 48 to 62 Hz.
2. LO Range: DC: 20-60 VDC; AC: 20-48 VAC, 48 to 62 Hz.

J. Communications
1. One front RS232 port for set point programming.
2. Two independent rear RS485 ports, each daisy chained between systems, where shown on the Drawings.
3. Fiber Optic port
4. Ethernet port
5. Communication protocols.
   a. Modbus RTU
   b. Profibus
   c. Device Net

K. The relay shall have a draw-out construction to facilitate testing, maintenance and interchange flexibility.

2.06 PHASE PROTECTIVE RELAY (PPR)

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
1. Taylor Phase-Guard Model P
2. Approved Equal

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Protection
1. Indicators - LED
   a. Normal – Green.
   b. Phase loss or Low Voltage – Yellow.
   c. Reverse Phase – Red.
2. Enclosure
   a. As required in accordance with the Area Classification and Enclosure Types listed in Section 26 05 00 - Electrical – General Provisions.
3. Functions.
   a. Automatic Reset
   b. Phase Loss.

(i) 12% or more.
(ii) Delay 1-1/2 seconds.

c. Low Voltage Protection
(i) Drop at 70% of normal
(ii) Reset at 90% of normal

d. Time Delays
(i) Adjustable

e. Over Voltage Protection
(i) Greater than 15%
(ii) Reset at 5% greater than normal

2.07 ACCESSORIES

A. Furnish nameplates for each device as indicated in drawings. Color schemes shall be as indicated on Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. All equipment specified herein shall be factory installed, field adjusted, tested and cleaned as an integral part of equipment specified elsewhere in these Specifications.

END OF SECTION

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SECTION 26 22 13 DISTRIBUTION DRY-TYPE TRANSFORMERS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install single-phase and three-phase general purpose individually mounted dry-type transformers of the two-windings type, self-cooled as specified herein, and as shown on the Drawings.

B. The provisions of this Section shall apply to all dry-type distribution transformers, except as indicated otherwise.

1.02 RELATED WORK

A. Section 26 05 00 - Electrical – General Provisions

B. Section 26 05 90 - Cast-In-Place Concrete for Electrical Applications

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Division 1, Section 26 05 00 - Electrical – General Provisions and as specified herein.

B. All equipment supplied under this Section of the Specifications shall be products of the same Manufacturer and shall be contained in one single submittal. Partial submittals will be returned unreviewed. Submittals shall also contain information on related equipment to be furnished under this Specification but described in the related sections listed in the Related Work paragraph above. Incomplete submittals not containing the required information on the related equipment will also be returned unreviewed.

C. Equipment specified in Divisions 43 and 46 and supplied as an integral part of a process equipment manufacturer's package, but referred to this Section for component details, shall be submitted with the manufacturer's package submittal under Divisions 43 and 46.

D. Shop Drawings and Product Data. For each transformer specified under this Section, submit the following information:

1. Outline dimensions and weights
2. Technical certification sheet
3. Transformer ratings including:
    a. kVA
    b. Primary and secondary voltage
    c. Taps
    d. Basic impulse level (BIL) for equipment over 600 volts
    e. Design impedance

f. Insulation class and temperature rise

g. Sound level.

4. Product data sheets

5. Connection diagrams

6. Installation information

7. Date of manufacture for each transformer

8. Where applicable the following additional information shall be submitted to the ENGINEER:

a. Specified accessories

E. Installation, Operation and Maintenance Manuals.

1. Installation, Operation and Maintenance Manuals shall include the following information:

a. Manufacturer's contact address and telephone number for parts and service.

b. Instruction books and/or leaflets

c. Recommended renewal parts list

d. Record Drawings of information required by the Submittals part of this Section.

e. Project record drawings clearly indicating operating features and including as-built shop drawings, outline drawings, and schematic and wiring diagrams.

1.04 REFERENCE STANDARDS

A. The pad-mounted transformer(s) and all components shall be designed, manufactured and tested in accordance with the latest applicable NEMA and ANSI standards as follows:

1. NEMA TP1 2002 Standards for Energy Efficiency

2. ANSI C57.96 2004 Guide for Loading Dry-Type Distribution and Power Transformers

3. ASTM D635 – Standard Test Method for Insulation Materials

1.05 QUALITY ASSURANCE

A. Manufacturer shall be ISO 9002 or later certified.

B. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

C. The CONTRACTOR, at no additional cost to the OWNER, shall make structural, mechanical and electrical changes that are necessitated because the CONTRACTOR

selects equipment with dimensional, power or mechanical differences from that shown on the Drawings. All engineering costs associated with revisions shall also be borne by the CONTRACTOR.

D. Transformers manufactured more than twenty four (24) months prior to the date of this Contract will not be acceptable.

1.06 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. Two (2) copies of these instructions shall be included with the equipment at time of shipment, and shall be made available to the CONTRACTOR and OWNER.

B. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.

C. Equipment shall be equipped to be handled by crane. Where cranes are not available, equipment shall be suitable for skidding in place on rollers using jacks to raise and lower the groups.

D. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR’s choice and at the CONTRACTOR’s expense, until such time that the site is ready for permanent installation of the equipment.

E. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during jobsite storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the CONTRACTOR at no expense to the OWNER.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

1. GE Industrial Solutions
2. Cutler Hammer

3. Siemens

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.02 RATINGS

A. The ratings of the transformer shall be as follows:

1.	kVA Rating:	As shown on the Drawings.
2.	Impedance:	ANSI Standard Tolerance
3.	HV:	As shown on the Drawings.
4.	HV de-energized Taps:	+/- 2 - 2-1/2% full capacity
5.	LV:	As shown on the Drawings.

2.03 CONSTRUCTION

A. Insulation Systems

1. Transformer insulation system shall be as follows:

   a. 5 – 45 kVA, three-phase (to 37.5 kVA, single-phase): 185 degrees C insulation system with 115 degree C rise, encapsulated design; 75 kVA and above: 220 degrees C insulation system with □150 degree C rise, ventilated design.

2. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degrees C maximum ambient, and a 24-hour average ambient of 30 degrees C

3. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635.

B. Core and Coil Assemblies

1. Transformer core shall be constructed with high-grade, nonaging, silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10% above the nominal tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade copper with continuous wound construction.

2. On three-phase units rated 45 kVA and below and single-phase units rated □25 kVA and below, the core and coil assembly shall be completely encapsulated in a proportioned mixture of resin and aggregate to provide a moisture proof, shock-resistant seal. The core and coil encapsulation system shall minimize the sound level. Enclosure construction shall be encapsulated, totally enclosed, non-ventilated, NEMA 3R, with lifting eyes.

3. On three-phase units rated 75 kVA and above and single-phase units rated 37.5 kVA and above, the core and coil assembly shall be impregnated with non-

hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture. Enclosure construction shall be ventilated, NEMA 2, drip-proof, with lifting holes. All ventilation openings shall be protected against falling dirt. The assembly shall be installed on vibration-absorbing pads.

C. Taps

1. Three-phase transformers rated 15 through 500 kVA shall be provided with six 2-1/2% taps, two above and four below rated primary voltage.
2. All single-phase transformers, and three-phase transformers rated below 15 kVA and above 500 kVA, shall be provided with the manufacturer’s standard tap configuration.

D. FINISH

1. Enclosures shall be finished with ANSI 61 color, weather-resistant enamel.

E. ACCESSORIES

1. On ventilated outdoor units provide suitable weather shields over ventilation openings.
2. Lug kits shall be provided by the Manufacturer of the transformer.

2.04 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest applicable ANSI and NEMA standards.

1. Ratio tests at the rated voltage connection and at all tap connections
2. Polarity and phase relation tests on the rated voltage connection
3. Applied potential tests.
4. Induced potential test.
5. No-load and excitation current at rated voltage on the rated voltage connection

PART 3 EXECUTION

3.01 INSTALLATION

A. The CONTRACTORs shall install all equipment per the manufacturer's recommendations and the contract drawings.

B. Securely connect all neutrals and transformer enclosures to ground.

3.02 FIELD ADJUSTMENTS

A. Adjust taps to deliver appropriate secondary voltage.

3.03 FIELD TESTING

A. Measure primary and secondary voltages for proper tap settings.

END OF SECTION

SECTION 26 24 14 LOW VOLTAGE DISTRIBUTION SWITCHBOARDS (COMPARTMENTED)

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The CONTRACTOR shall furnish and install assemblies of the low voltage switchboard, together with appurtenances, complete and operable, as specified herein and as shown on the Contract Drawings.

1.02 RELATED WORK

A. Section 26 05 00 Electrical – General Provisions

B. Section 26 05 90 Cast-In-Place Concrete for Electrical Applications

C. Section 26 05 73 Power System Study

D. Section 26 09 13 Power Metering and Protective Relays

E. Section 26 24 16 Panelboards

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Divisions 1 and 26, and as specified herein.

B. Submittals shall also contain information on related equipment to be furnished under this Specification but described in the related sections listed in the Related Work paragraph above. Incomplete submittals not containing the required information on the related equipment will be returned unreviewed.

C. The original equipment manufacturer shall create all equipment shop drawings, including all wiring diagrams, in the manufacturer's Engineering Department. All equipment shop drawings shall bear the original equipment manufacturer's logo, drawing file numbers, and shall be maintained on file in the original equipment manufacturer's archive file system. Photocopies of the ENGINEER's ladder schematics are unacceptable as shop drawings.

D. Shop Drawings and Product Data. The following information shall be submitted to the ENGINEER:

1. Master drawing index

2. Front view elevation
3. Floor plan
4. Top view
5. Single line
6. Schematic diagram
7. Nameplate schedule
8. UL Listing documentation
9. Component list with detailed component information.
10. Conduit entry/exit locations
11. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
12. Major component ratings including:
    a. Voltage
    b. Continuous current
    c. Interrupting ratings
13. Descriptive bulletins
14. Product data sheets.
15. Cable terminal sizes.
16. Key interlock scheme drawing and sequence of operations
17. Busway connection.

E. Factory Tests. Submittals shall be made for factory tests specified herein.

F. Field Test Reports. Submittals shall be made for field tests specified herein.

G. Operation and Maintenance Manuals.

1. Installation, Operation, and maintenance manuals shall include the following information:
    a. Manufacturer's contact address and telephone number for parts and service.
    b. Instruction books and/or leaflets
    c. Recommended renewal parts list
    d. Record Documents for the information required by the Submittals paragraph above.

1.04 REFERENCE CODES AND STANDARDS

A. The low voltage distribution switchboard assembly and all components in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. UL 891 - Standard for Dead Front Switchboards
2. UL 489 – Standard for Safety for Molded-Case Circuit Breakers
3. ANSI/NFPA 70 – National Electrical Code (NEC)
4. UL 1449, UL 1283 – Standard for Safety for TVSS
5. ANSI/IEEE C62.41, C64.45 – Guide in Surge Environment in 600C Power Circuits
6. NEMA LS-1 – Low Voltage Surge Protective Devices
7. NEC Art. 285 – Transient Voltage Surge Suppressors

B. All equipment specified in this section of the Specifications shall bear the appropriate label of Underwriters Laboratories.

1.05 QUALITY ASSURANCE

A. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly. All assemblies shall be of the same manufacturer.

C. Equipment submitted shall fit within the space shown on the Drawings. Equipment which does not fit within the space is not acceptable.

D. For the equipment specified herein, the manufacturer shall be ISO 9001 2000 certified.

1.06 DELIVERY STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. Two (2) copies of these instructions shall be included with the equipment at time of shipment, and shall be made available to the CONTRACTOR and OWNER.

B. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.

C. Equipment shall be equipped to be handled by crane. Where cranes are not available, equipment shall be suitable for skidding in place on rollers using jacks to raise and lower the groups.

D. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR's choice and at the CONTRACTOR's expense, until such time that the site is ready for permanent installation of the equipment.

E. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during jobsite storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year from the date of final acceptance of the switchboard. Within such period of warranty, the Manufacturer shall promptly furnish all material and labor necessary to return the switchboard to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the CONTRACTOR at no expense to the OWNER.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

1. ABB/GE Industrial Solutions
2. Eaton/ Cutler-Hammer
3. Siemens

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.02 RATINGS

A. The switchboards described in this specification shall be designed for operation on the voltage systems as shown on the Drawings.

B. The switchboards and protective devices shall be fully rated for a short circuit current of 65,000 rms symmetrical amperes (minimum) or greater if shown on the Drawings. Systems employing series connected ratings shall not be used.

C. Bus bracing shall have a 30 cycle withstand rating.

D. The manufacturer shall design the switchboard, including devices, for continuous operation at its rated current in a 40 degree C ambient temperature.

E. The switchboard shall be UL listed and labeled as suitable for use as service entrance equipment.

2.03 CONSTRUCTION

A. General

1. Refer to Drawings for: actual layout and location of equipment and components; current ratings of devices, bus bars, components; protective relays, voltage ratings of devices, components and assemblies; and other required details.

2. Furnish nameplates for each device as indicated on the Drawings. Nameplates shall be laminated plastic with black letters on white background. Nameplates shall be fastened by 316 stainless steel screws. There shall be a master nameplate that indicates equipment ratings, manufacturer's name, shop order number and general information.

3. The switchboard shall be furnished with a sign marked "DANGER 480 VOLTS KEEP OUT". Letters shall be not less than 1 in high, 1/4 in stroke. Sign shall be laminated plastic with black letters on white background, fastened by stainless steel screws and OSHA approved.

4. Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.

5. All sections of the switchboard shall align front and rear with depth as shown on the drawings. All protective devices shall be compartmentalized with line and load bus connections. Devices shall be front removable and load connections rear accessible. Insulated rigid copper bus connections shall extend from the load side of overcurrent feeder devices into rear compartment where outgoing cable connections may be made without reaching into or near the main horizontal or vertical buses. Distribution sections shall be sectionalized to provide a front device section, an intermediate bus section and a rear feeder cable section. There shall be a vertical barrier of glass polyester between the device compartment and the bus compartment.

6. The assembly shall be provided with adequate lifting means.

B. The switchboard shall be arranged so that the uppermost operating handle shall not exceed 6-ft-6-in from the floor when the switchboard is mounted on a 4-in high equipment pad.

C. Provide cable pull section with utility as shown on the Drawings.

D. Enclosures

1. Indoor enclosures shall be indoor NEMA 1, freestanding, metal enclosed assemblies, consisting of dead front, completely metal enclosed vertical sections.

2. Where switchboards are shown outdoors, enclosure shall be non-walk-in and meet applicable NEMA 3R requirements of UL.

a. Enclosure shall have the roof sloping downward toward rear.

b. Outer sections shall be the same width as indoor structures, except each end of the outdoor assembly shall have an end trim.

c. The enclosure shall be provided with bolt-on rear covers for each section.

d. Doors shall have provisions for padlocking.

e. Ventilating openings shall be provided, complete with replaceable fiber glass air filters.

f. Each cubicle bay shall be supported on a heavy gauge, welded steel channel base extending around all four sides, constructed to exclude rodents, vermin, and dust. Apply a non-flammable undercoating to the base and to the underside of the cubicle floor plates.

g. Roof structure shall be watertight with a continuous drip edge channel on the front. Roof shall slope to the rear for water drainage. Apply a non-flammable, non-disintegrating, insulating compound to the underside of the roof to prevent moisture condensation. Holes for lifting eyes shall be blind tapped.

h. Provide tamper resistant, padlockable, weathertight, gasketed cubicle doors and switch handle covers, with stainless steel hinge pins.

i. Raintight, corrosion resistant ventilation louvers shall provide air circulation within the structure, while excluding insects, vermin, dust, and sand.

j. Each cubicle shall have heavy duty, 240 VAC, space heaters, thermostat controlled, of sufficient capacity to prevent condensation with the equipment de-energized, while operating at half their rated voltage. Heaters shall be provided with perforated metal guards and a circuit breaker disconnect. 120 VAC control power shall be provided from a remote source as shown on the Drawings.

k. Each cubicle shall have an exhaust fan, thermostatically controlled, for heat dissipation.

l. Cables shall enter and exit underground from the bottom of the cubicle as shown on the Drawings.

m. Furnish and install a weather-resistant non-conducting rubber floor mat, minimum ¾ inch thick by 4 feet wide, and extending the full length of the equipment lineup.

3. Where switchboard is shown on the Drawings to be installed in a Switchgear Building, the switchboard shall be as specified in Paragraph 1 above, and the entire lineup furnished factory installed in a Switchgear Building as specified elsewhere in this specification Section.

E. Busses

1. All buses shall be tin plated copper, sized as shown on the Drawings. Neutral bus shall be fully rated, if required

2. Buses shall be braced for the specified equipment short circuit current rating, and shall be braced for 30 cycle withstand capability.

3. All joint connections shall be welded or shall be joined with bolts and conical spring-type washers.
4. Feeder sections shall have full height vertical bus.
5. Provide an insulated/isolated bus barrier system that fully insulates and isolates each phase of the main and vertical bus bars from one another and from the cable area so that no live connections are accessible in the rear of each section except the breaker load side connections. Accessibility to joints shall be provided by replaceable glass-reinforced polyester covers/barriers. Phase barriers shall be glass-reinforced polyester solid insulation. The main bus shall be insulated between joint surfaces by a fluidized epoxy coating. Provide in addition to the insulated/isolated bus barrier system, glass reinforced polyester and metal barriers that shall allow easy access to cable neutral and ground bus connections.
6. Provide a tin-plated copper ground bus extending throughout the entire length of the switchboard, equipped with sufficient provisions for lugs for external ground connections, cable grounding conductors and conduit grounding, and sized for cables shown on the Drawings.
7. Unused spaces, or spaces indicated for future devices shall include doors, bus, device supports or mounting plates and connections.

F. Wiring and Terminations

1. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on the manufacturer’s wiring diagrams.
2. Mechanical-type terminals shall be provided for all line and load terminations suitable for copper cable rated for 75 degrees C of the size as indicated on the drawings.
3. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of external ground connections, cable grounding conductors and conduit grounding, and sized for cables shown on the Drawings.
4. All control wire shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first, be connected to conveniently accessible short-circuit terminal blocks, before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring. Wire tags shall be heat shrink type "Brady" or approved equal with the tag numbers typed with an indelible marking process. Character size shall be a minimum of 1/8" in height. Hand written tags shall not be acceptable. Tags relying on adhesives or taped-on markers are not acceptable.

G. Main Section

1. Where the main incoming conductors are shown to terminate in the main breaker section, sufficient vertical space shall be provided to route the cables from the conduit entry to the main compression type lugs without exceeding the cable manufacturer's minimum bending radius of any of the incoming cables. Incoming cables shall be top entry or bottom entry as shown or noted on the Drawings.
2. Where an auxiliary cable pull section is shown on the Drawings, provide bus extensions and compression lugs for the number and size of incoming cables. Sufficient vertical space shall be provided to route the cables from the conduit entry to the main compression type lugs without exceeding the cable manufacturer's minimum bending radius of any of the incoming cables. Incoming cables shall be top entry or bottom entry as shown or noted on the Drawings.
3. Where the switchboard is served by an incoming busway, the switchboard manufacturer shall be responsible for coordination, proper phasing and internal bussing to the incoming busway.
4. Where shown on the Drawings, the Main section shall contain a 3-phase, 600 volt, lightning arrester and capacitors, to protect the switchboard from lightning discharges.

H. Main Circuit Protective Devices

1. Unless otherwise shown on the Drawings, main and tie circuit breakers, greater than 1200 ampere rating, shall be insulated case (ICCB), 3 Pole, 600 Volt, fixed type, electrically operated with stored energy closing mechanism. Trip device shall be solid state with adjustable long time pickup, and delay; adjustable short time pickup and delay; short time i^2t switch; high range instantaneous (fixed at the breaker's short-time withstand rating), adjustable ground fault pickup and delay; ground fault delay and pickup trips for selective tripping; and overload, short circuit and ground fault indicator lights,
2. Unless otherwise shown on the Drawings, main and tie circuit breakers, 1200 ampere and less shall be molded case (MCCB), 3 Pole, 600 Volt, fixed type, manually operated with stored energy closing mechanism. Trip device shall be solid state with adjustable long time pickup, and delay; adjustable short time pickup and delay; short time i^2t switch; adjustable instantaneous, adjustable ground fault pickup and delay; overload, short circuit and ground fault indicator lights, ground fault delay and pickup trips for selective tripping.
3. Power Circuit Breakers
   a. Where shown on the Drawings, circuit breakers shall be individually mounted, drawout, low voltage power circuit breakers (PCB), electrically operated.
   b. The breakers shall have voltage and current interrupting ratings as shown on the Drawings and shall be rated to carry 100% of the current rating of the breaker continuously.
   c. Circuit breakers shall be metal frame construction. The interrupting mechanism shall contain arc chutes constructed to suppress arc and cool vented gases. "Flash shields" shall not be required in the breaker cubicle.

Interphase barriers of insulating material shall be provided to isolate each pole of the breaker.

d. Each breaker element shall consist of a three-pole electrically and mechanically trip free power circuit breaker, with self-aligning primary and secondary disconnecting contacts, integral solid state over-current trip programmer, arc quenchers, electrical stored-energy closing mechanism, position indicator, and equipped for mounting on the drawout mechanism in the circuit breaker compartment.

e. Circuit breakers shall have true 30 cycle withstand capability equal to its short time rating to help assure selectivity with downstream devices and minimize nuisance tripping when closing onto high inrush loads. The breaker shall not use a hidden instantaneous or making current release to achieve its short time withstand ratings. The breaker close and latch rating shall be equal to its short time rating.

f. Breakers shall contain a true two-step stored energy mechanism providing quick-make quick-break operation capable of charging after close operation. Closing speed shall be independent of the Operator or control power voltage level. The maximum closing time shall be 5 cycles at nominal control voltage.

g. Breakers shall utilize a spring charging motor, manual flush-mounted charging handle, electronic closing circuit with anti-pump feature, and a shunt trip device.

h. Complete breaker operating status shall be available from the front of the breaker. Indicators in the breaker escutcheon shall provide closing spring status (charge/discharge), breaker main contact status (close/open), and breaker drawout position (connects, test, disconnect).

i. Glass polyester shutters shall be supplied to cover the breaker primary line and load disconnects when a breaker is removed from its compartment.

j. Each breaker compartment shall be equipped with a metal instrument panel above each circuit breaker. The panel shall be used for mounting breaker control circuit fuses, pilot lights and breaker control test switches. Fuses for the breaker close and trip circuits shall be front mounted in deadfront, bayonet-type fuse holders. Three indicating lights shall be mounted on the front of the panel with lamps replaceable from the front. Toggle switches used for testing the close and trip circuits shall be mounted on the panels. Direct access to the control circuit devices shall be provided to facilitate routine maintenance and quick and safe replacement of fuses and lamps without opening the breaker cubicle door or panel. The auxiliary panel shall contain an engraved breaker circuit nameplate.

k. Each breaker shall have standard padlocking provisions on the front of the breaker to lock the breaker open and mechanically trip free.

l. Standard breaker interlocks shall include drawout interlock, which shall prevent the breaker from being closed unless it is in the TEST, or CONNECT position, a contact interlock which shall prevent moving the drawout breaker

unless the contacts are open. A test position shall be provided to permit operating the breaker while it is disconnected from the power circuit.

m. Circuit breakers shall employ a rejection system which prevents insertion of a breaker with a lower interrupting capability (IC) into a high IC cubicle or insertion of a higher ampere rated breaker into a lower ampere rated cubicle or both.

n. Breakers shall be complete with 120V AC motor operators.

o. Controls shall include close/open pushbuttons, control switches, red and green indicating lights to indicate breaker contact position, and other controls and indications as shown on the Drawings. The AC source shall be taken from a control power transformer internal to the switchgear assembly. Capacitor Trip Device to be provided for 120VAC control power.

p. Breaker Trip Unit

(i) The breaker trip unit shall be front mounted and shall allow full access to all trip unit information including trip status, pickup and delay settings, trip targets, and metering (where applicable) without opening the breaker cubicle door. A removable, sealable cover shall be provided over the trip unit to limit access to the trip unit. Trip settings, metering information and trip target information shall be accessible with the sealable cover installed. Trip unit settings cannot be changed unless the sealable cover is removed.

(ii) Each circuit breaker shall be equipped with a protective trip unit system to open the breaker for overloads, short circuits and ground faults as specified in the following subparagraphs. The protective trip unit system shall consist of a solid-state, microprocessor-based trip unit, current sensors, trip actuator and interchangeable rating plugs.

(iii) As a minimum, the trip unit shall have the following features and functions:

a) The housing shall be a metallic enclosure to protect against magnetic interference, dust, and other contaminants.

b) The protective system shall have reliable programmable controls with repetitive accuracy and precise unit settings. Overcurrent characteristics (pickup and delay) shall be selected via rotary switches with detent settings.

c) All current sensing shall employ true rms technology for detecting overloads, short time overcurrent conditions and ground fault conditions.

d) The module shall be equipped with long-life lithium batteries, with automatic time delay shut-off feature, to provide observation of trip targets. The module and batteries shall not be required for the trip unit to provide its protective functions.

e) UL listed field installable, interchangeable rating plugs. It shall not be necessary to change or remove the trip unit to change the trip rating. Rating plugs shall contain rejection features to prevent installation of a plug with an incorrect current sensor rating. Rating plugs shall also be used to provide the trip unit with ground fault protection. Rating plugs shall include ground fault pickup and delay setting switches.

f) Integral test jack for connection of a battery pack or test kit to the breaker.

g) The ground fault function shall contain a memory circuit to integrate low level arcing fault currents with time to sum intermittent ground fault current spikes.

h) A cover with provisions for sealing the rating plug and trip unit to make the installation tamper resistant. All trip unit settings, ratings, and target information shall be capable of being viewed with the cover in place.

i) The trip unit shall display trip targets for longtime, short time, instantaneous and ground fault trips.

(iv) The trip units for the main and tie breakers shall include the following protective functions:

a) Adjustable long time current settings.

b) Adjustable long time delay with four time delay bands.

c) Long time pickup warning indicator.

d) Trip targets for overload, short circuit and ground fault.

e) Adjustable short time pickup and delay, with three delay bands, and switchable I2t ramp.

f) Defeatable ground fault function with adjustable pickup and time delay, with three delay bands, and switchable I2t ramp.

(v) Current sensors shall be mounted on the breaker frame and shall use encapsulated construction to protect against damage and moisture. For ground fault protection, a fourth, neutral current, sensor shall be mounted in the cable compartment, and shall be compatible with the phase current sensors.

4. Breakers shall be rated for 100% continuous duty, and shall carry a UL 489 listing.

5. Main devices shall be equipped with contacts for remote status trip indication and “inhibit” function as shown on the Drawings. Device rating shall be as shown on the Drawings.

I. Feeder Protective Devices

1. Feeder circuit breakers, greater than 1200 ampere rating, shall be insulated case (ICCB), 3 Pole, 600 Volt, manually operated with stored energy closing

mechanism, fixed type trip device shall be solid state with adjustable long time pickup, and delay; adjustable short time pickup and delay; short time i2t switch; adjustable high range instantaneous, adjustable ground fault pickup and delay; ground fault delay and pickup trips for selective tripping; and overload, short circuit and ground fault indicator lights,

2. Feeder circuit breakers 600 ampere and less shall be molded case (MCCB), 3 Pole, 600 Volt, fixed type, manually operated with stored energy closing mechanism. Trip device shall be solid state with adjustable long time pickup, and delay; adjustable short time pickup and delay; short time i2t switch; adjustable high range instantaneous, adjustable ground fault pickup and delay; overload, short circuit and ground fault indicator lights, ground fault delay and pickup trips for selective tripping.

J. Interlocks

1. Kirk-Key interlocks shall be provided on breakers where shown on the Drawings.

K. Control Power Transformers

1. Control power transformer ratios shall be as shown on the Drawings. Transformer mechanical ratings shall equal the short circuit rating of the circuit breakers. Transformers, when mounted in switchboard assemblies, shall be rated for the full voltage of the switchboard.

2. All control power transformers shall have vacuum cast primary and secondary coils using epoxy resin.

L. Instrument Transformers

1. All instrument transformers shall be vacuum cast using polyurethane resin.

2. Current transformer ratios shall be as shown on the Drawings. Transformer mechanical ratings shall equal the short circuit and momentary rating of the circuit breakers. Transformers, when mounted in switchboard assemblies, shall be rated for the full voltage of the switchboard.

3. Voltage transformers shall be fixed type, with primary and secondary fuses, transformer mounted, with short circuit and momentary rating equal to the switchboard. Transformer ratios shall be as shown on the Drawings.

M. Transient Voltage Surge Suppression

1. Each switchboard shall contain a manufacturer provided and installed, TVSS system, meeting the following specifications:

   a. Maximum Surge Current - 150kA per mode, 300kA per phase.

   b. UL Symmetrical Fault Current Withstand Rating – 200,000 Amps.

   c. Minimum Repetitive Surge Current capacity

      (i) 1.2x50µs, 20kV, 8x20µs, 10kA Category C3 – 20,000 Impulses.

      (ii) 500V, 2kA, 10x1000µs long duration – 5000 impulses.

   d. UL SVR Rating – 1500 L-G.

e. MCOV – 170%

2. Connection to the switchboard shall be with a surge rated disconnect, mounted integral to the switchboard.
3. Noise attenuation shall not exceed 44db measured in accordance with the procedures outlined in accordance in NEMA LS 1 – 1992/MIL 220A.
4. Fusing shall be, a surge rated fuse, in combination with patented thermal fuse technology.
5. Monitoring devices shall include surge counter, indicating lights, audible alarm, Form C dry contacts @ 5 amps, 125V.
6. The TVSS shall have a warranty of not less than 5 years.

2.04 METERING – MAIN BREAKERS

A. Furnish where show on the Drawings, a Power Quality Meter, for each Main and Feeder Breaker, as shown on the Drawings and as specified in Section 26 09 13 Power Metering and Protective Relays.

B. A 100VA minimum UPS shall be provided, powered from the control power transformer to provide control power to the feeder management relays and power quality meters.

2.05 UTILITY METERING

A. Where indicated on the drawings, furnish a separate barriered-off utility metering compartment, complete with hinged sealable door. Bus work shall include provisions for mounting utility company current transformers and potential transformers, or potential taps as required by the utility company. Provide service entrance label and necessary applicable service entrance features per NEC and local code requirements.

2.06 COMMUNICATION

A. For each Main Breaker Section, connect all remote connections, (i.e. control, statuses, alarms, metering) to Section terminal strip for outgoing wiring to a PLC as shown on the Drawings.

B. Where all remote connections for a Main Breaker Section are multiplexed into a communications network, as shown on the Drawings, the connections from the metering and control devices shall be “daisy chained” from device to device, with the chain leaving the Section as a RS485/422 or RS232 as shown.

C. Where a RS485 Ethernet Converter is shown, furnish an Ethernet Converter, as specified in Section 26 09 13 Power Metering and Protective Relays to convert the “daisy chained” communications from RS485 to Ethernet.

2.07 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

1. The switchboard shall be completely assembled, wired, adjusted, and tested at the factory. After assembly, the complete switchboard shall be tested for operation under simulated service conditions to assure the accuracy of the wiring and the functioning of all equipment. The main circuits shall be given a dielectric test of 2200 volts for one (1) minute between live parts and ground, and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one (1) minute between live parts and ground.

B. The manufacturer shall provide three (3) certified copies of factory test reports as specified in Paragraph 1.03D.

2.08 SPARE PARTS

A. Provide the following spare parts:

1. 3 – Control fuses of type used.
2. One dozen each of cover bolts, spring nuts and door fasteners.
3. One quart of touch-up paint.

B. Spare parts shall be boxed or packaged for long term storage and clearly identified on the exterior of package. Identify each item with manufacturers name, description and part number.

PART 3 EXECUTION

3.01 MANUFACTURER’S REPRESENTATIVE

A. Provide the services of a qualified factory-trained manufacturer's field engineer to assist the CONTRACTOR in installation and start-up of the equipment specified under this section for a period of not less than 2 working days, with not less than one working day per switchboard. The manufacturer's field engineer shall provide technical direction and assistance to the CONTRACTOR in general assembly of the equipment, connections, and adjustments, and testing of the assembly and components contained therein.

B. The CONTRACTOR shall provide three (3) copies of the manufacturer's field start-up report.

3.02 INSTALLER’S QUALIFICATIONS

A. The installer shall be specialized in installing low voltage switchboards with minimum 5 years documented experience. Experience documentation shall be submitted for approval prior to beginning work on this project.

3.03 EXAMINATION

A. Examine installation area to assure there is enough clearance to install the switchboard.

B. Check concrete pads and base plates for uniformity and level surface.

C. Verify that the switchboard is ready to install.

D. Verify field measurements are as instructed by the manufacturer.

3.04 INSTALLATION

A. The CONTRACTOR shall install all equipment per the manufacturer's recommendations and Contract Drawings.

B. Installed required safety labels.

3.05 FIELD QUALITY CONTROL

A. Inspect installed switchboard for anchoring, alignment, grounding and physical damage.

B. Check tightness of all accessible electrical connections. Minimum acceptable values are specified in manufacturer's instructions.

3.06 FIELD ADJUSTING

A. Adjust all circuit breakers, switches, access doors, operating handles for free mechanical and electrical operation as described in manufacturer's instructions.

B. The breaker protective devices shall be set in the field by a qualified representative of the manufacturer, retained by the CONTRACTOR, in accordance with settings designated in a coordinated study of the system as required in Section 26 05 73 Power System Study.

C. Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with an approved short circuit and protective device coordination study shall be carried out by the CONTRACTOR at no additional cost to the OWNER.

3.07 FIELD TESTING

A. Perform all electrical field tests recommended by the manufacturer. Disconnect all connections to solid-state equipment prior to testing.

B. Megger and record phase to phase and phase to ground insulation resistance of each bus section. Megger for 1 minute for each measurement at minimum voltage of 1000 VDC. Measured Insulation resistance shall be at least 1 megohm.

C. Test each key interlock system for proper functioning.

3.08 CLEANING

A. Clean interiors of switchboards, panels, separate enclosures to remove construction debris, dirt, shipping materials.

3.09 EQUIPMENT PROTECTION AND RESTORATION

A. Touch-up and restore damaged surfaces to factory finish, as approved by the manufacturer. If the damaged surface cannot be returned to factory specification, the surface shall be replaced.

3.10 MANUFACTURER’S CERTIFICATION

A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.

B. The CONTRACTOR shall provide three (3) copies of the manufacturer's representative's certification.

3.11 TRAINING

A. Provide manufacturer's services for training of plant personnel in operation and maintenance of the equipment furnished under this Section.

B. The training shall be for a period of not less than one (1) eight hour day.

C. The cost of training program to be conducted with OWNER's personnel shall be included in the Contract Price. The training and instruction, insofar as practicable, shall be directly related to the system being supplied.

D. Provide detailed O&M manuals to supplement the training course. The manuals shall include specific details of equipment supplied and operations specific to the project.

E. The training session shall be conducted by a manufacturer's qualified representative. Training program shall include instructions on the assembly, circuit breaker, protective devices, metering, and other major components.

END OF SECTION

SECTION 26 24 16 PANELBOARDS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install panelboard(s) as specified herein and as shown on the Drawings.

B. The provisions of this Section shall apply to all panelboards, except as indicated otherwise.

1.02 RELATED WORK

A. Section 26 05 00 - Electrical – General Provisions

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Division 1, Section 26 05 00 - Electrical – General Provisions and as specified herein.

B. Submittals shall also contain information on related equipment to be furnished under this Specification but described in the related sections listed in the Related Work paragraph above. Incomplete submittals not containing the required information on the related equipment will be returned unreviewed.

C. Shop Drawings and Product Data. The following information shall be submitted to the ENGINEER:

1. Master drawing index
2. Front view elevation
3. Top view
4. Nameplate schedule
5. UL Listing
6. Conduit entry/exit locations
7. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
8. Major component ratings including:
    a. Voltage
    b. Continuous current
    c. Interrupting ratings
9. Descriptive bulletins

10. Product data sheets.
11. Cable terminal sizes.

D. Operation and Maintenance Manuals.

1. Operation and maintenance manuals shall include the following information:
   a. Manufacturer's contact address and telephone number for parts and service.
   b. Instruction books and/or leaflets
   c. Recommended renewal parts list
   d. Record Documents for the information required by the Submittals paragraph above.
   e. Field Test Reports

1.04 REFERENCE CODES AND STANDARDS

A. The low voltage panelboard assembly and all components in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. UL 67 - Panelboards
2. UL 50 - Cabinets and Boxes
3. NEMA PB-1 2006 - Panelboards
4. Fed. Spec. W-P-115C

B. Operation and Maintenance Manuals.

1. Equipment operation and maintenance manuals shall be provided in accordance with Section 26 05 00 - Electrical – General Provisions.
2. Instruction books and/or leaflets
3. Recommended renewal parts list
4. Drawings and information required by the SUBMITTALS part of this Section.

1.05 QUALITY ASSURANCE

A. Manufacturer shall be ISO 9001 2000 or later certified.

B. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

C. Equipment submitted shall fit within the space shown on the Drawings. Equipment which does not fit within the space is not acceptable.

1.06 DELIVERY, STORAGE AND HANDLING

A. Protect equipment during shipment, handling, and storage by suitable complete enclosures. Protect equipment from exposure to the elements and keep thoroughly dry.

B. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Repaint damaged painted surfaces to the satisfaction of the OWNER/ENGINEER.

C. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR's choice and at the CONTRACTOR's expense, until such time that the site is ready for permanent installation of the equipment.

D. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.

E. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the CONTRACTOR at no expense to the OWNER.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable.

1. GE Industrial Solutions
2. Cutler Hammer
3. Siemens

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.02 GENERAL

A. Rating

1. Panelboard ratings shall be as shown on the Drawings. All panelboards shall be rated for the intended voltage.
2. Circuit breaker panelboards shall be fully rated for the specified circuit breaker fault current interrupting capacity. Series connected short circuit ratings will not be acceptable.

2.03 MATERIALS

A. Interiors

1. All interiors shall be completely factory assembled with circuit breakers, wire connectors, etc. All wire connectors, except screw terminals, shall be have the anti turn solder less type and all shall be suitable for copper wire of the sizes indicated.
2. Interiors shall be so designed that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping.
3. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.
4. A nameplate shall be provided listing manufacturer's name, panel type and rating.

B. Buses

1. Bus bars for the mains shall be of tin plated copper. Full size neutral bars shall be included. Phase bussing shall be full height without reduction. Cross connectors shall be tin plated copper.
2. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.
3. Spaces for future circuit breakers shall be bussed for the maximum device that can be fitted into them.
4. Equipment ground bars, of tin-plated copper, shall be furnished.

C. Boxes

1. Boxes and trims shall be made from 316 stainless steel having multiple knockouts, unless otherwise noted. Boxes for use outdoors shall be of NEMA 3R, 316 stainless steel construction, without knockouts. Boxes shall be of sufficient size to provide a minimum gutter space of 4 in on all sides.
2. At least four studs for mounting the panelboard interior shall be furnished.

D. Trim

1. Hinged doors covering all circuit breaker handles shall be included in all panel trims.
2. Doors shall have semi flush type cylinder lock and catch, except that doors over 48 in. in height shall have a vault handle and 3 point catch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Furnish two keys for each lock. All locks shall be keyed alike; directory frame and card having a transparent cover shall be furnished on each door.
3. Indoor NEMA 1 trims shall be factory painted in the manufacturer's standard color.
4. Trims for flush panels shall overlap the box by at least 3/4 in all around. Surface trims shall have the same width and height as the box.

2.04 CIRCUIT BREAKERS

A. Panelboards shall be equipped with circuit breakers with frame size and trip settings as shown on the Drawings.

B. Circuit breakers shall be molded case, bolt in type.

C. Each circuit breaker used in 120/208 Volt panelboards shall have an interrupting capacity of not less than 22,000 Amps, RMS symmetrical.

D. Each circuit breaker used in 277/480 Volt and 480 Volt panelboards shall have an interrupting capacity of not less than 65,000 Amps, RMS symmetrical.

E. Circuit breakers shall be as manufactured by the panelboard manufacturer.

PART 3 EXECUTION

3.01 PREPARATION (NOT USED)

3.02 INSTALLATION

A. Mount boxes for surface mounted panelboards so there is at least 1/2 in air space between the box and the wall.

B. Connect panelboard branch circuit loads so that the load is distributed as equally as possible between the phase busses.

C. Type circuit directories giving location and nature of load served. Install circuit directories in each panelboard.

D. Install a 1 in by 3 in laminated plastic nameplate with 1/4 in white letters on a black background on each panelboard. Nameplate lettering shall be as shown on the Drawings. Nameplates shall be 316 stainless steel screw mounted.

END OF SECTION

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SECTION 26 24 19 LOW VOLTAGE MOTOR CONTROL CENTERS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The CONTRACTOR shall furnish and install assemblies of low voltage motor control centers (MCC's), together with appurtenances, complete and operable, as specified herein and as shown on the Contract Drawings.

B. Automatic transfer switches, adjustable frequency drives and programmable controllers shall be factory installed by the motor control center manufacturer as shown on the Drawings.

C. Motor control centers shall be sized to include all equipment, spares and spaces shown on the Drawings.

1.02 RELATED WORK

A. Section 26 05 00 - Electrical – General Provisions

B. Section 26 05 73 - Power System Study

C. Section 26 05 90 - Cast-In-Place Concrete for Electrical Applications

D. Section 26 09 13 - Power Metering and Protective Relays

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Division 1, Section 26 05 00 and as specified herein.

B. Submittals shall also contain information on related equipment to be furnished under this Specification but described in the related sections listed in the Related Work paragraph above. Incomplete submittals not containing the required information on the related equipment will be returned unreviewed.

C. The original MCC equipment manufacturer shall create all MCC shop drawings, including all wiring diagrams, in the manufacturer's engineering department. All MCC shop drawings shall bear the original equipment manufacturer's MCC logo, drawing file numbers, and shall be maintained on file in the manufacturer's MCC archive file system. Photocopies of the ENGINEER's ladder schematics are unacceptable as shop drawings.

D. Submit to the OWNER/ENGINEER, shop drawings and product data, for the following:

1. Equipment outline drawings showing elevation and plan views, dimensions, weight, shipping splits and metering layouts. Indicate all options, special features, ratings and deviations from the Specifications.
2. Conduit entrance drawings, including floor penetrations.
3. Bus arrangement drawings.

4. Unit summary tables showing detailed equipment description and nameplate data for each compartment.
5. Product data sheets and catalog numbers for overcurrent protective devices, motor starters, control relays, control stations, meters, pilot lights, etc. List all options, trip adjustments and accessories furnished specifically for this project.
6. Provide control systems engineering to produce custom unit elementary drawings showing interwiring and interlocking between units and to remotely mounted devices. Show wire and terminal numbers. Indicate special identifications for electrical devices per the Drawings.
7. Master drawing index
8. Front view elevation
9. Floor plan
10. Top view
11. Single line
12. Schematic diagram
13. Nameplate schedule
14. UL Listing
15. Component list with detailed component information.
16. Conduit entry/exit locations
17. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
18. Major component ratings including:
    a. Voltage
    b. Continuous current
    c. Interrupting ratings
19. Descriptive bulletins
20. Product data sheets.
21. Cable terminal sizes.
22. Key interlock scheme drawing and sequence of operations
23. Busway connection.
24. Instruction and renewal parts books.
25. Itemized list of spare parts furnished specifically for this project, including quantities, description and part numbers.

E. Harmonic distortion calculations for Adjustable Frequency Drives

F. Factory Tests. Submittals shall be made for factory tests specified herein.

G. Field Test Reports. Submittals shall be made for field tests specified herein.

H. Operation and Maintenance Manuals.

1. Installation, Operation and maintenance manuals shall include the following information:
   a. Manufacturer's contact address and telephone number for parts and service.
   b. Instruction books and/or leaflets
   c. Recommended renewal parts list
   d. Record Documents for the information required by the Submittals paragraph above.

1.04 REFERENCE CODES AND STANDARDS

A. The low voltage motor control centers and all components in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NEMA Standard ICS 2 – 2000 Industrial Control and Systems
2. UL 845 – Electric Motor Control Centers
3. NEMA Standard SG-3 – Low Voltage Power Circuit Breakers
4. NFPA 70 – National Electrical Code (NEC)
5. NFPA 70E – Standard for Electrical Safety in the Workplace
6. IEEE 519-1992 - Guide for harmonic content and control
7. UL508C - Power Conversion Equipment)
8. UL 1449, UL 1283 – Standard for Safety for TVSS
9. ANSI/IEEE C62.41, C64.45 – Guide in Surge Environment in 600V Power Circuits
10. NEMA LS-1 – Low Voltage Surge Protective Devices
11. NEC Art. 285 – Transient Voltage Surge Suppressors
12. UL 1008 – Transfer Switches
13. UL 991 - Tests for Safety-Related Controls Employing Solid-State Devices
14. NFPA 110 – Emergency and Standby Power Systems
15. NEMA ICS 10 – AC Transfer Switch Equipment
16. IEEE 446 – Recommended Practice for Emergency and Standby Power Systems

B. All equipment specified in this Section of the Specifications shall bear the appropriate label of Underwriters Laboratories.

1.05 QUALITY ASSURANCE

A. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly. All assemblies shall be of the same manufacturer.

C. Equipment submitted shall fit within the space shown on the Drawings. Equipment which does not fit within the space is not acceptable.

D. For the equipment specified herein, the manufacturer shall be ISO 9001 2000 certified.

1.06 DELIVERY STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. Two (2) copies of these instructions shall be included with the equipment at time of shipment, and shall be made available to the CONTRACTOR and OWNER/ENGINEER.

B. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.

C. Equipment shall be equipped to be handled by crane. Where cranes are not available, equipment shall be suitable for skidding in place on rollers using jacks to raise and lower the groups.

D. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR’s choice and at the CONTRACTOR’s expense, until such time that the site is ready for permanent installation of the equipment.

E. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during jobsite storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year, or 3 years for adjustable frequency drives, from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the CONTRACTOR at no expense to the OWNER.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

1. Cutler Hammer.
2. General Electric Co.
3. Siemens
4. Allen Bradley

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.02 RATINGS

A. The service voltage, overall short circuit withstand and interrupting rating of the equipment and devices shall be as shown on the Drawings. Main and feeder circuit protective devices shall be fully rated for the specified short circuit duty. Systems employing series connected ratings for main and feeder devices shall not be used. Motor starter units shall be tested and UL labeled for the specified short circuit duty in combination with the motor branch circuit protective device.

B. The continuous current rating of the main horizontal bus shall be as shown on the Drawings. Vertical busses shall be sized for the structure load and shall have a minimum rating of 2000 Amps. Bus bracing shall equal or exceed the specified equipment short circuit rating.

C. Motor control centers, including devices, shall be designed for continuous operation at rated current in a 40 degree C ambient temperature.

D. For additional ratings and construction notes, refer to the Drawings.

2.03 CONSTRUCTION

A. General

1. Refer to Drawings for: actual layout and location of equipment and components; current ratings of devices, bus bars, components; protective relays, voltage ratings of devices, components and assemblies; and other required details.
2. Provide engraved laminated nameplates as follows: Main equipment nameplate shall be located at the top of the MCC near the main breaker compartment. Individual compartment nameplates shall be attached to their respective doors. Provide control device nameplates for all devices screwed on near the vicinity of each device. A manufacturer's nameplate shall be attached to the MCC giving model number, bus amps, voltage, maintenance reference documents, and other

applicable information. All nameplates shall be attached with stainless steel screws.

3. Furnish and install a weather-resistant non-conducting rubber floor mat, minimum ¾ inch thick by 4 feet wide, and extending the full length of the equipment lineup.

B. Enclosure

1. Indoor enclosures shall be NEMA Type 1A unless noted otherwise on the Drawings.

   a. Fans shall be furnished for soft start starters and AFD's, as required by the manufacturer, to provide air circulation and cooling. The fan shall operate only when the drive is "ON" and for a cool-down period after the drive has stopped. Otherwise, the fan shall not run when the drive is "OFF". Louvers, if provided, shall have externally removable filters. The filter shall be metallic and washable.

   b. Fan motors shall be protected by an input circuit breaker. Metal squirrel cage ball bearing, three phase fan motors with 10-year design life shall be used in the drive design. Plastic muffin fans are not acceptable. Fan power shall be obtained from a tap on the main control power transformer.

   c. A "loss of cooling" fault shall be furnished. In the event of clogged filters or fan failure, the drive shall produce an alarm and then, in a predetermined time, shut down safely without electronic component failure.

   d. Redundant fans shall be provided in the drive design as backup in the event of fan failure.

   e. Each vertical section shall have heavy duty, 240 VAC, space heaters, thermostat controlled, of sufficient capacity to prevent condensation with the equipment de-energized, while operating at half their rated voltage. Heaters shall be provided with perforated metal guards and a circuit breaker disconnect. 120 VAC control power shall be provided from the MCC.

   f. Each cubicle shall have an exhaust fan, thermostatically controlled, for heat dissipation.

   g. All cables shall enter and exit underground from the bottom of the cubicle, unless otherwise shown on the Drawings.

C. Structure

1. Motor control centers shall consist of a series of metal enclosed, free standing, dead front vertical sections bolted together to form double wall construction between sections. Individual vertical sections shall be nominally 90 in high, 20 in wide and 20 in deep unless otherwise shown on the Drawings. Vertical sections shall be mounted on steel channel sills provided by the CONTRACTOR. Bottom channel sills shall be mounted front and rear of the vertical sections extending the full width of each shipping split. Top of each section shall have removable plates with lifting angle. Make provisions for field installation of additional sections to

each end and provide full depth cover plates (rodent barriers) at each end of the motor control center channel sills.

2. Provide continuous top and bottom horizontal wireways extending the full width of the line up, isolated from the horizontal bus. Provide a 4 in wide, full height, vertical wireway in each section, equipped with a hinged door and cable supports. Vertical wireway shall be isolated from the bus and device compartments. Wireways or other metal member's openings shall have rolled edges or protective grommets.
3. Provide individual, flange formed, pan type door with concealed hinges and quarter turn latches for each device compartment and future space. Doors shall be removable. Door removal shall not be required to withdraw starter units or feeder tap devices.
4. Motor control centers shall be designed for against the wall mounting. All wiring, bus joints and other mechanical parts requiring tightening or other maintenance shall be accessible from the front or top.
5. Each vertical section shall be divided into no more than six compartments which shall contain a feeder breaker, combination motor control unit, or other control assemblies connected to a common vertical power bus.
6. Vertical sections shall contain horizontal wire ways at top and bottom of the structure. The design shall be such to permit a continuous wiring trough from end to end of the entire width of the motor control center. End vertical sections shall have cover plates, which can be easily removed to allow continuation of wire ways and horizontal bus extensions for future addition of vertical sections.
7. The vertical section shall also have a continuous vertical raceway extending the full height of the structure and shall intersect with the horizontal raceways. This wire way shall be completely barriered from the bus compartments, the controller compartment, and the adjacent vertical units, and shall have its own separate hinged door or bolted cover.
8. Combination motor control units (Size 5 and smaller), as well as other electrical assemblies, including feeder tap units (225 amp and smaller), shall be provided with appropriately rated stab assemblies for draw out (plug-in) type construction.
9. Plug in provisions shall include a positive guide rail system and stab shrouds to insure alignment of stabs with the vertical bus. The stab shall be designed to increase bus contact pressure during a fault. The stab design shall assure a consistent low-resistance contact with the vertical bus, even after repeated insertions and removals. The unit shall be equipped with a latching mechanism to lock the drawer in an extended or stabbed position for maintenance and testing. Each draw out compartment shall have a separate hinged removable door.
10. Each unit compartment shall be provided with an individual front hinged door. Motor control and feeder units shall be interlocked mechanically with a unit disconnect device to prevent unintentional opening of the door while unit is energized. An interlock between the unit disconnect and the structure shall prevent the removal or reinsertion of the unit when the unit is in the "OFF" position. Means shall be provided for releasing the interlock for intentional access

and/or application of power. Pad locking arrangements shall permit locking the disconnect device in the "OFF" position.

11. The MCC shall be furnished as a completely factory assembled unit where transportation facilities and installation requirements permit. Minimize shipping splits if required.
12. All painted steel work shall be treated with a primer coat and a finish coat, or bonderized and finished with a coat of baked enamel at the factory, such that no field painting will be required except for "touching up" of damaged areas. Color shall be manufacturer's standard.
13. Furnish documentation with the equipment as follows: Compartments containing panel boards shall have a card holder on the inside of the door with the branch circuits clearly identified. Compartments containing motor starters shall each have an overload heater section table posted inside the door. All control compartments shall have a pocket on the inside of the door with a copy of the appropriate schematic and wiring diagram.

D. Unit Compartments

1. Provide individual compartments for each removable combination starter and feeder tap device unit. Each vertical section shall accommodate a maximum of six compartments. Steel barriers shall isolate the top, bottom and sides of each compartment from adjacent units and wireways. Removable units shall connect to the vertical bus in each section with tin plated, self aligning, pressure type copper plug connectors. Size 6 and larger starter units may be wired directly to the bus. Removable units shall be aligned in the structure on guide rails or shelves and secured with a cam latch mechanism or racking screw.
2. Provide individual, isolated compartments for fixed mounted devices such as circuit breakers, cable lugs, metering, relaying and control devices. Main and bus tie circuit breakers shall be wired directly to the main horizontal bus. All bus connections shall be fully rated.
3. Provide the following features:
   a. Provision to padlock removable units in a partially withdrawn TEST position, with the bus stabs disengaged.
   b. Provision to padlock unit disconnect handles in the OFF position with up to three padlocks.
   c. Mechanical interlock with bypass to prevent opening unit door with disconnect in the ON position, or moving disconnect to the ON position while the unit door is open.
   d. Mechanical split type terminal blocks for disconnecting external control wiring.
   e. Auxiliary contact on unit disconnect to isolate control power when fed from an external source.
   f. Disconnect operating handles and control devices mounted on the removable units.

E. Bus Systems

1. The bus support system shall be high dielectric strength, low moisture absorbing high impact material.
2. Bus bracing shall be 65,000 amperes RMS symmetrical unless otherwise indicated on the Contract Drawings.
3. Buses shall be of uniform cross sectional area throughout their length. Tapered bus will not be acceptable.
4. All bolted bus mating surfaces and splicing material shall be of the same plated material as the bus.
5. The main horizontal bus shall extend the entire length of the motor control center. The main bus, bars shall be rated as shown on the Contract Drawings, but shall not be less than 1200 amperes.
6. Main horizontal bus: Tin plated copper, bolted joints, accessible from the front of the structure, fully rated throughout the lineup, and factory insulated by taping. All field assembled joints shall be taped after installation, equal to the factory bus taping.
7. Vertical section bus: Tin plated copper, full height, totally insulated and isolated by labyrinth design barrier of glass-reinforced polyester, or sandwich insulated/isolated busses, with shutters to cover stab openings when units are withdrawn. Provide fish tape barriers to isolate bottom wireways from lower ends of vertical bus. Bus shall be provided in each vertical draw out section.
8. Vertical buses used for a tie circuit breaker or tie feeder lugs shall be rated for a continuous capacity equivalent to the main horizontal bus rating.
9. Horizontal ground bus: Provide a 300A minimum, continuous tin plated copper ground bus in each section equipped with lugs for termination of feeder and branch circuit ground conductors. Connect to ground bus in adjacent sections with splice plates. Provide ground bolted connectors for 4/0 AWG wire at each end of the bus.

F. Wiring

1. Wiring: Stranded copper, minimum size No. 14 AWG, with 600 Volt, 90 degree C, flame retardant, Type MTW thermoplastic insulation, NEMA Class II, Type B. Line side power wiring shall be sized for the full rating or frame size of the connected device.
2. Identification: Numbered sleeve type wire markers at each termination point, color coding per NEMA standards and the NEC. Foreign voltage control wiring shall be yellow.
3. All control wiring to draw out units shall be run through split type terminal blocks (draw out) which can be split to allow easy unit removal. Motor “T” leads shall bolt directly to starter or overloads and shall not be split type. Terminal blocks shall be of the fully shielded, tubular screw clamp type, resilient collar design to eliminate loose connections. Terminal blocks shall be nickel or tin plated, and have exposed

wire numbering corresponding to the connected wires. Terminals shall have a maximum of two wires per terminal.

4. All wiring shall be neatly bundled with ty-raps and supported to wire way supports. Control wiring shall be bundled separately from power wiring. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.

5. Where “shipping splits” are required between the control compartments and the starter cubicles, interconnecting jumper wires shall be provided for field re-connection.

6. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported so that circuit terminations are not stressed. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.

7. In general, all conduit entering or leaving a motor control center shall enter the motor control center from the top. Conduits shall not enter the motor control center from the side unless approved in writing by the OWNER/ENGINEER.

8. All field wiring shall be tagged and coded with an identification number as shown on the Drawings. Coding shall be typed on a heat shrinkable tube applied to each end showing origination and destination of each wire. The marking shall be permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE, or equal.

G. Main Section

1. The MCC main sections shall include the main and tie breakers, metering and power feeder entrance to the MCC. Where a power feeder entrance is shown on the Drawings, the power feeder entrance section shall be provided. Provide bus extensions and compression lugs for number and size of incoming cables as shown on the Drawings. Where main and tie breakers are shown to be key interlocked, interlocks shall be of the Kirk-Key type.

H. Main Circuit Protective Device

1. Unless otherwise shown on the Drawings, main and tie circuit breakers, larger than a 2000 ampere rating, shall be insulated case (ICCB), 3 Pole, 600 Volt, fixed type,electrically operated with stored energy closing mechanism. Trip device shall be solid state with adjustable long time pickup, and delay; adjustable short time pickup and delay; short time i2t switch; high range instantaneous (fixed at the breaker’s short-time withstand rating), adjustable ground fault pickup and delay; ground fault delay and pickup trips for selective tripping], and overload, short circuit and ground fault indicator lights.

2. Unless otherwise shown on the Drawings, main and tie circuit breakers 2000 ampere rating and less shall be molded case (MCCB), 3 Pole, 600 Volt, fixed type, electrically operated with stored energy closing mechanism. Trip device shall be solid state with adjustable long time pickup, and delay; adjustable short time pickup and delay; short time i2t switch; [adjustable ground fault pickup and delay, and ground fault delay and pickup trips for selective tripping.

3. Where shown on the Drawings, breakers shall be rated for 100% continuous duty, and shall carry a UL 489 listing
4. Main devices shall be equipped with contacts for remote status trip indication and “inhibit” function as shown on the Drawings. Device rating shall be as shown on the Drawings.

I. Automatic Transfer Switches (ATS)

1. The ATS shall be outside rated, free standing or pad mounted 2000 amp, 4-pole switch for 3 phase 4 wire systems.
2. The switch shall initiate transfer of the load to the emergency source when any phase of the normal source drops below 90 percent of normal voltage.
3. The transfer switch shall be adequately constructed to carry full rated current on a continuous 24 hour basis in all approved enclosures and shall not show excessive heating or be subject to derating. The transfer switches shall be capable of withstanding all available system fault currents without parting of or damage to contacts during the fault clearing time of the system over current device.
4. The transfer switches shall be of inherently 4 Pole double throw construction and shall have three positions operation: closed to normal source, open, closed to emergency source. Time delay between opening of the closed contacts and closing of the open contacts shall be a minimum of 15 seconds to allow for load stabilization before transfer is complete.
5. The following accessories shall be furnished:
   a. Close differential adjustable phase sensing relay set to drop out at 80 percent of rated voltage and pick up at 90 percent of rated voltage.
   b. Adjustable 0.5 to 6.0 second time delay to override normal source power outages (set at 2 seconds).
   c. Two auxiliary contacts to open on normal source failure (for combustion air damper control).
   d. Two auxiliary contacts to close on normal source failure (for remote alarm and engine start).
   e. Neutral (off) position adjustable time delay 0.1 to 10 seconds.
   f. Adjustable time delay on retransfer to normal (1 to 300 seconds). with 0 to 25 minute adjustable unloaded engine running time after retransfer.
6. Withstand ratings shall be the same rating as for the MCC, but shall not be less than 65000 amps AIC.
7. A maintained contact test auto switch and normal/emergency pilot lights shall be mounted on the door

J. Feeder Protective Devices (Non-Motor Loads)

1. Unless otherwise shown on the Drawings, feeder circuit breakers shall be molded case, 3 Pole, 600 Volt, fixed type, manually operated with stored energy closing mechanism. Trip device shall be solid state with adjustable long time pickup,

adjustable instantaneous, adjustable ground fault pickup and delay; ground fault delay and pickup trips for selective tripping; and overload, short circuit [and ground fault] indicator lights.

K. All circuit breakers, 400 ampere frame and larger, shall have trip units of the modular type for easy changing of trip range.

L. All Main and Feeder circuit breakers shall have provision for lock out/tag out padlocking in the OFF position.

M. Interlocks

1. Electrical, mechanical and Kirk-Key interlocks shall be provided on breakers where shown on the Drawings.

N. Control Power Transformers

1. Furnish control power transformers where shown on the Drawings. Transformer mechanical ratings shall equal the short circuit rating of the circuit breakers. Transformers, when mounted in motor control centers, shall be rated for the full voltage of the motor control center.
2. All control power transformers shall have vacuum cast primary and secondary coils using epoxy resin.

O. Instrument Transformers

1. All instrument transformers shall be vacuum cast using polyurethane resin.
2. Furnish current transformer ratios shall be as shown on the Drawings. Transformer mechanical ratings shall equal the short circuit and momentary rating of the circuit breakers. Transformers, when mounted in the motor control center, shall be rated for the full voltage of the switchboard.
3. Voltage transformers shall be fixed type, with primary and secondary fuses, transformer mounted, with short circuit and momentary rating equal to the motor control center. Transformer ratios shall be as shown on the Drawings.

P. Transient Voltage Surge Suppression

1. Each motor control center shall contain a manufacturer provided and installed, TVSS system, meeting the following specifications:
   a. Maximum Surge Current - 150kA per mode, 300kA per phase.
   b. UL Symmetrical Fault Current Withstand Rating – 200,000 Amps.
   c. Minimum Repetitive Surge Current capacity
      (i) 1.2x50µs, 20kV, 8x20µs, 10kA Category C3 – 20,000 Impulses.
      (ii) 500V, 2kA, 10x1000µs long duration – 5000 impulses.
   d. UL SVR Rating – 1500 L-G.
   e. MCOV – 170%

2. Connection to the motor control center shall be with a surge rated disconnect, mounted integral to the motor control center.
3. Noise attenuation shall not exceed 44db measured in accordance with the procedures outlined in accordance in NEMA LS 1 – 1992/MIL 220A.
4. Fusing shall be, a surge rated fuse, in combination with patented thermal fuse technology.
5. Monitoring devices shall include surge counter, indicating lights, audible alarm, Form C dry contacts @ 5 amps, 125V.
6. The TVSS shall have a warranty of not less than 10 years.]

Q. Provide three valve type lightning arresters and surge capacitors on each incoming line where shown on the Drawings. Arresters and capacitors shall be the product of the MCC manufacturer and factory installed

R. Furnish lugs for incoming line feeders, sizes as specified. Allow adequate clearance for bending and terminating of cable size and type specified.

2.04 MOTOR CONTROLLERS

A. General

1. The Drawings indicate the approximate horsepower and intended control scheme of the motor driven equipment. Provide the NEMA size starter, circuit breaker trip ratings, control power transformers and thermal overload heater element ratings matched to the motors and control equipment actually supplied, in compliance with the NEC and the manufacturer's heater selection tables. All variations necessary to accommodate the motors and controls as actually furnished shall be made without extra cost to the OWNER.
2. Motor starters shall be as shown on the Drawings. All motor starters shall be combination units, full voltage non-reversing (FVNR), with adjustable instantaneous trip magnetic only circuit breakers, or motor circuit protectors (MCP), unless otherwise specified or shown on the Drawings. NEMA starter sizes and breaker trip ratings shall be as required for the horsepower indicated, but shall be in no case less than NEMA Size 1. If the manufacturer of the equipment utilizing the motor, supplies a motor horsepower larger than that shown on the Drawings, the CONTRACTOR shall supply a motor starter sufficient in size to control the motor supplied. International (IEC) starters shall not be acceptable.
3. Each motor starter shall have a 120 volt operating coil unless otherwise noted.
4. NEMA Size 5 and smaller shall be draw out design with stab-on connectors engaging the vertical buses. Larger units shall be of the fixed (bolt-in) design.
5. Overload relays shall be standard Class 20, ambient compensated, manually reset by pushbutton located on front of the compartment door. A normally closed contact shall be directly used in the start circuit and a normally open contact shall be wire to a terminal board for overload alarm.
6. Control power transformers shall be 120 volt grounded secondary. Primary shall be fused in each phase. One leg of the transformer secondary shall be solidly

grounded while the other leg shall be fused. The transformer shall be oversized for auxiliary loads as indicated on drawings, but in no case be smaller than 100 VA.

7. Combination starters shall include a motor circuit protector (MCP) in series with a motor controller and an overload protective device. The MCP shall have an adjustable magnetic trip range up to 1000 percent of rated continuous current and a trip test feature. MCP's shall be labeled in accordance with UL489.]

B. Magnetic Motor Starters

1. Motor starters shall be 2 or 3 pole, single or 3 phase as required, 60 Hertz, 600 volt, magnetically operated, full voltage nonreversing except as shown on the Drawings. NEMA sizes shall be as required for the horsepower shown on the Drawings. IEC rated starters are unacceptable.
2. Each motor starter shall have a 120 volt operating coil, and control power transformer. Starters shall have motor overload protection in each phase. Auxiliary contacts shall be provided as shown on the Drawings. A minimum of one N.O. and one N.C. auxiliary contacts shall be provided in addition to the contacts shown on the Drawings.
3. Overload relays shall be adjustable, ambient compensated and manually reset.
4. Control power transformers shall be sized for additional load of 100VA or an additional 10% whichever is larger. Transformer primary and secondary shall be equipped with time delay fuses. Control power transformers shall not be located behind other components and shall be accessible for removal or replacement without removing any other component.
5. Built in control stations and indicating lights shall be furnished where shown on the Drawings.
6. All wires shall be terminated on terminal blocks and shall be tagged.
7. Provide as built wiring diagram and post it in a protective cover inside the cell.

C. Combination Magnetic Motor Starters

1. Motor starters shall be a combination motor circuit protector and contactor, 2 or 3 pole, single or 3 phase as required, 60 Hertz, 600 volt, magnetically operated, full voltage non reversing unless otherwise shown on the Drawings. NEMA starter frame sizes shall be as shown on the Drawings. If the motor supplied by the equipment supplier is larger than that shown on the Drawings, the CONTRACTOR shall supply a larger frame size corresponding to the motor supplied. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall be current limiting type, with additional current limiters if required. IEC rated starters are unacceptable.
2. Each motor starter shall have a 120 volt operating coil, and control power transformer. Starters shall have motor overload protection in each phase. Auxiliary contacts shall be provided as shown on the Drawings. A minimum of one

N.O. and one N.C. auxiliary contacts shall be provided in addition to the contacts shown on the Drawings.

3. Overload relays shall be adjustable, ambient compensated and manually reset.
4. Control power transformers shall be sized for additional load of 100VA or an additional 10% whichever is larger. Transformer primary and secondary shall be equipped with time delay fuses.
5. Built in control stations and indicating lights shall be furnished where shown on the Drawings.
6. All wires shall be terminated on terminal blocks and shall be tagged.
7. Provide as built wiring diagram and post it inside the enclosure.

D. Multi-Speed and Reversing Starters

1. Multi speed and reversing starters shall include two motor rated contactors mechanically and electrically interlocked so that only one device may be energized at any time.

E. Reduced Voltage Starters

1. Reduced Voltage Solid State Type Starters (RVSS).
   a. The solid-state reduced-voltage starter shall be an integrated unit with power SCRs, logic board, paralleling bypass and output contactors, and electronic overload relay enclosed in a single molded housing.
   b. The SCR-based power section shall consist of six (6) back-to-back SCRs and shall be rated for a minimum peak inverse voltage rating of 1500 volts PIV
   c. Units using triacs or SCR/diode combinations shall not be acceptable.
   d. Resistor/capacitor snubber networks shall be used to prevent false firing of SCRs due to dV/dT effects.
   e. The logic board shall be mounted for ease of testing, service and replacement.
   f. The logic board shall be identical for all ampere ratings and voltage classes and shall be conformably coated to protect environmental concerns.
   g. The paralleling run bypass contactor shall energize when the motor reaches 90 of full speed and close/open under one (1) times motor current
   h. The paralleling run bypass contactor shall utilize an intelligent coil controller to limit contact bounce and optimize coil voltage during varying system conditions.
   i. Starter shall be provided with electronic overload protection as standard and shall be based on inverse time-current algorithm. Overload protection shall be capable of being disabled during ramp start for long acceleration loads via a DIP switch setting on the device keypad.
   j. Overload protection shall be adjusted via the device keypad and shall have a motor full load ampere adjustment from 30 to 100% of the maximum continuous ampere rating of the starter.

k. Starter shall have selectable overload class setting of 5, 10, 20 or 30 via a DIP switch setting on the device keypad

l. Starter shall be capable of either an electronic or mechanical reset after a fault

m. Units using bimetal overload relays are not acceptable

n. Overtemperature protection (on heat sink) shall be provided.

o. Starters shall provide protection against improper line-side phase rotation. Starter shall shut down if a line-side phase rotation other than A-B-C exists. Provision for disabling shall be provided via a DIP switch on the device keypad.

p. Starters shall provide protection against a phase loss or unbalance condition. Starter shall shut down if a 50% current differential between any two phases is encountered. Provision for disabling shall be provided via a DIP switch on the device keypad

q. Start shall provide protection against a motor stall condition as standard. This feature can be disabled via a DIP switch on the device keypad

r. Starter shall provide protection against a motor jam condition as standard. This feature can be disabled via a DIP switch on the device keypad

s. Starter shall be provided with a Form C normally open (NO), normally closed (NC) contact that shall change state when a fault condition exists. Contacts shall be rated 60 VA (resistive load) and 20 VA (inductive load). In addition, an LED display on the device keypad shall indicate type of fault (Overtemperature, Phase Loss, Jam, Stall, Phase Reversal and Overload)

t. The following control function adjustments on the device keypad are required:

   (i) Selectable Torque Ramp Start or Current Limit Start

   (ii) Adjustable Kick Start Time: 0–2 seconds.

   (iii) Adjustable Kick Start Torque: 0–85%

   (iv) Adjustable Ramp Start Time: 0.5–180 seconds.

   (v) Adjustable Initial Starting Ramp Torque: 0–85%

   (vi) Adjustable Smooth Stop Ramp Time: 0–60 seconds.

u. Maximum continuous operation shall be at 115% of continuous ampere rating.

v. Pump Control Option.

   (i) Provide control algorithm for pump start-up and shut down sequences. Control algorithm shall reduce the potential for water hammer in a centrifugal pump system. Upon a start command, the speed of the motor shall increase, under the control of the soft starter microprocessor, to achieve a gentle start. After the speed has reached its nominal value, the bypass contactors shall close and the pump shall run at design speed. Upon a stop command, the bypass contactors shall open and the motor

speed decreased in a tapered slope, to gradually slow the flow until the motor is brought to a stop. The start and stop ramp times shall be adjustable for the application requirements. The pump control option shall be factory installed.

F. Adjustable Frequency Drives (AFD's)

1. The AFD shall be a sinusoidal Pulse width modulated (PWM) type, with sensor-less Dynamic Torque Vector Control capability, designed for use with standard induction motors, constant or variable torque as required for the load application, with current limiting input fuses, incoming line reactors and/or active filters, circuit breaker disconnect, motor isolation contactor, control transformer overload relays and process signal follower card. Drives shall be UL listed. Adjustable frequency drives manufactured for HVAC applications are not acceptable.
2. The Drawings indicate the approximate horsepower and intended control scheme of the motor driven equipment. Provide the AFD, auxiliary components and equipment where shown or specified, and matched to the motors and control equipment actually supplied, in compliance with the NEC. All variations necessary to accommodate the motors and controls as actually furnished shall be made without extra cost to the OWNER.
3. The AFD, for variable torque applications, shall be sized for a motor one NEMA size larger than the motor being supplied.
4. The AFD inverter/chopper shall be of the pulse width modulated (PWM), neutral point clamp (NPC) type, converting the utility input voltage and frequency to a variable voltage and frequency output via a two-step operation. Adjustable Current Source AFD's are not acceptable. The output devices shall be Insulated Gate Bipolar Transistors (IGBT's). Bipolar Junction Transistors, GTO's or SCR's are not acceptable.
5. Drive output voltage shall vary with frequency to maintain a constant volts/hertz ratio up to base speed (60 hertz) output. Constant or linear voltage output shall be supplied at frequencies greater than base speed (60 hertz).
6. The Drive shall be capable of a minimum of 100% rated current in continuous operation.
7. The drive one minute overload current rating shall be 110% of rated current.
8. Each AFD shall have an HMCP or thermal magnetic circuit breaker to provide a disconnect means. Operating handle shall protrude through the door. The disconnect shall not be mounted on the door. The handle position shall indicate ON, OFF, and TRIPPED condition. The handle shall have provisions for lock out/ tag out padlocking in the OFF position with at least three (3) padlocks. Interlocks shall prevent unauthorized opening or closing of the AFD door with the disconnect handle in the ON position. Door handle interlock shall have provision for defeating by qualified maintenance personnel.
9. Each AFD shall have an AC output contactor to provide a means for positive disconnection of the drive output from the motor terminals.

10. Where the cables from the AFD to the motor exceed 100 feet in length, a properly sized line reactor shall be installed at the AFD output to reduce dv/dt levels and the resultant peak voltage overshoots at the motor terminals.
11. Make provisions to accept a remote dry contact closure to start and stop the drive(s) with the drive control system in the AUTO mode.
12. Where shown on the Drawings, furnish a three contactor bypass, including a drive input disconnect, an AFD input isolation contactor, bypass contactor and an AFD output contactor that is electrically and mechanically interlocked with the bypass contactor. This circuit shall include control logic, status lights and motor over-current relays. The complete bypass system Inverter-Off-Bypass][Hand-Off-Auto with Inverter-Bypass selector switch(s), and Inverter/Bypass pilot lights shall be packaged with the AFD. The unit shall be set up for ([Automatic] bypass operation upon an AFD trip.
13. Where shown on the Drawings, make provisions to accept a 4 20 mA DC input signal for remote speed control. Input shall be isolated at the drive and active with the drive control system in the AUTO mode.
14. Where shown on the Drawings, furnish a 120 VAC control to allow AFD to interface with remote dry contacts
15. Where shown on the Drawings, furnish a motor over-current relay to provide sensing of a given level of load current.
16. Provide a 4-20 mADC isolated output signal proportional to speed for remote speed indication.
17. Provide two sets of Form C auxiliary dry contacts for remote indication of VFD running status.
18. Provide two sets of Form C auxiliary dry contacts for remote indication of VFD fault
19. Following an over or undervoltage trip, the drive shall automatically restart after a short time delay after the incoming line voltage is within the specified range.
20. The equipment manufacturer shall provide a harmonic analysis showing that the drives meet IEEE 519 at the Point of common Coupling. The Point of Common coupling shall be defined as the MCC bus. Total harmonic distortion shall be calculated under worst-case condition in accordance with the procedure outlined in IEEE Standard 519-1992. Copies of these calculations shall be submitted for approval. The worst case condition of operation is defined as follows:
21. The voltage harmonic distortion, at the point of common coupling, shall not exceed 5% as indicated in Table 10.2 of IEEE 519.
22. The current harmonic distortion, at the point of common coupling, shall not exceed the limits in Table 10.3 of IEEE 519.
23. The harmonic analysis shall include all voltage and current harmonics to the 50th.
24. Each AFD shall, as a minimum, contain a 5% line reactor. The manufacturer may additionally use individual matrix filters or an active harmonic filter on the MCC bus, for mitigating harmonic distortion. All AFD's of a single drive size shall have

the same type and size of mitigating device. Other types of mitigation are not acceptable.

25. Compliance shall be verified with onsite field measurements of both the voltage and current harmonic distortion at the point of common coupling with operating conditions as defined above.

26. In the event that the harmonic distortion does not meet the specified limits in the field tests, the manufacturer shall provide and the CONTRACTOR shall provide and install, at no additional expense to the OWNER, additional filtering sufficient to meet IEEE 519 as specified. The manufacturer may substitute new AFD's containing matrix filters or an additional section on the MCC containing an active harmonic filter connected to the MCC bus, to meet the specified requirements. All AFD's of a single drive size must still shall have the same type and size of mitigating device. Any Field modifications to the AFD's, their wiring, their enclosures, or relocation of cells in the MCC requiring motor or control conductor splicing to meet the specified requirements, will not be acceptable.

27. Service Conditions

    a. Input power: MCC voltage plus 10 percent, minus 5 percent, 3 Phase, 60 Hz.

    b. Input frequency: 57 to 63 Hz.

    c. Ambient temperature: 0 to 40 degrees C (Enclosed).

    d. Elevation: Up to 3300 feet above mean sea level.

    e. Relative humidity: Up to 90 percent non-condensing.

28. Minimum Drive Efficiency: The AFD shall have efficiency at full load and speed that exceeds 95% for AFD's below 15 HP and 97% for drives 15 HP and above. The efficiency shall exceed 90% at 50% speed and load.

29. Displacement Power Factor: 0.95 or better at any speed, measured at drive input terminals.

30. Drive Output: 100 percent rated current continuous, suitable for operation of the driven equipment over a 30:1 speed range without overloading or low speed cogging. Drives shall be capable of a continuous overload up to 110 percent rated current and a maximum 150 percent overload for 1 minute. Starting torque shall be matched to the load.

31. Voltage Regulation: plus or minus 1 percent of rated value, no load to full load.

32. Output Frequency Drift: No more than plus or minus 0.5 percent from set point.

33. Drives shall withstand five cycle transient voltage dips of up to 15 percent of rated voltage without an undervoltage trip or fault shutdown, while operating a variable torque load.

34. Protection of power semiconductor components shall be accomplished without the use of fast acting semiconductor output fuses. Subjecting the controller to any of the following conditions shall not result in component failure or the need for fuse replacement.

    a. Short circuit at controller output

b. Ground fault at controller output

c. Open circuit at controller output

d. Input undervoltage

e. DC bus overvoltage

f. Loss of input phase

g. AC line switching transients

h. Instantaneous overload

i. Sustained overload exceeding 115 percent of controller rated current

j. Overtemperature responsive to a thermal switch in the motor or an overload relay

35. The controller electronics shall contain light emitting diodes (LED's) to monitor and indicate the following conditions.

a. Undervoltage

b. Overvoltage

c. Ground Fault

d. Instantaneous Overcurrent

e. Overtemperature

f. Power UP Delay/Reset

g. Drive Enabled

h. Bus Capacitors Charged]

G. Combination Contactors

1. Combination contactors shall be a circuit breaker and contactor, 600 Volt, 3 Pole, 60 Hz, magnetically operated. NEMA size shall be as required for the kilowatt ratings shown on the Drawings, but shall be not less than NEMA size 1.

2. Contactors shall have a 120 Volt operating coil and control power transformer. Furnish the control power transformer with extra capacity for the unit heater fan.

H. Control Stations

1. Control stations shall be heavy duty type, with full size operators. Momentary contact stop buttons shall have a lockout latch that can be padlocked in the open position.

I. Pushbuttons, Indicating Lights and Selector Switches

1. Provide heavy-duty, 30mm, oiltight type pushbuttons, selector switches, indicating lights and stations, push-to-test, for these devices. Indicating lights shall be of the LED type.

2. Provide devices meeting the requirements of NEMA ICS 2, and having individual, extra large nameplates indicating their specific function. Provide pushbutton

stations with laminated plastic nameplates indicating the drive they control, stainless steel screw attached. Provide contacts with NEMA designation rating A600. Install provisions for locking pushbuttons and selector switches in the OFF position wherever lockout provisions are indicated.

J. Control Relays

1. Control relays shall be 300 volt, industrial rated, plug-in socket type, housed in a transparent polycarbonate dust cover, designed in accordance with UL Standard 508 for motor controller duty. Continuous contact rating shall be 10 amperes resistive, ¼ HP at 120 VAC, operating temperature minus 10 to plus 55 degrees C. Provide spare N.O. & N.C. contacts. Relays shall be Potter & Brumfield KRP Series or equal with neon coil indicator light. Timing relays shall be 300 Volt, solid state type, with rotary switch to select the timing range.

2.05 METERING AND PROTECTIVE RELAYS

A. A 100VA minimum UPS shall be provided, powered from the control power transformer to provide control power to the feeder management relays and power quality meters.

B. Furnish where shown on the Drawings, a Phase Protective Relay (PPR), as shown on the Drawings, and as specified in Section 26 09 13 Power Metering and Protective Relays.

C. Furnish where shown on the Drawings, a Motor Protection System (MP3), as shown on the Drawings, and as specified in Section 26 09 13 Power Metering and Protective Relays.

D. Furnish where shown on the Drawings, a Remote RTD Metering and Protection (RRTD), as shown on the Drawings, and as specified in Section 26 09 13 Power Metering and Protective Relays.

E. Furnish where shown on the Drawings, a Motor Protection System (MP4), as shown on the Drawings, and as specified in Section 26 09 13 Power Metering and Protective Relays.

F. Furnish where shown on the Drawings, a Power Quality Meter (PM1), for each Main or Feeder Breaker, as shown on the Drawings and as specified in Section 26 09 13 Power Metering and Protective Relays.

2.06 COMMUNICATION

A. For each Main Breaker Section, connect all remote connections, (i.e. control, statuses, alarms, metering) to Section terminal strip for outgoing wiring to a PLC as shown on the Drawings.

B. Where all remote connections for a Main Breaker Section are multiplexed into a communications network, as shown on the Drawings, the connections from the metering and control devices shall be “daisy chained” from device to device, with the chain leaving the Section as a RS485/422 or RS232 as shown.

C. Where a RS485 Ethernet Converter is shown, furnish an Ethernet Converter, as specified in Section 26 09 13 Power Metering and Protective Relays to, convert the “daisy chained” communications from RS485 to Ethernet.

2.07 SPARE PARTS

A. Provide the following spare parts:

1. 3 – Control fuses of type used.
2. One dozen each of cover bolts, spring nuts and door fasteners.
3. One quart of touch-up paint.

B. Spare parts shall be boxed or packaged for long term storage and clearly identified on the exterior of package. Identify each item with manufacturers name, description and part number.

2.08 FACTORY TESTING

A. The Motor Control Center shall be completely assembled, wired, and adjusted at the factory and shall be given the manufacturer’s routine shop tests and any other additional operational test to insure the workability and reliable operation of the equipment.

B. Prior to factory testing, the manufacturer shall check to see that all selections and settings required by the Power System Study Engineer have been performed.

C. Factory test equipment and test methods shall conform with the latest applicable requirements of ANSI, IEEE, UL, and NEMA standards.

D. The operational test shall include the proper connection of supply and control voltage and, as far as practical, a mockup of simulated control signals and control devices shall be fed into the boards to check for proper operation.

E. The manufacturer shall provide three (3) certified copies of factory test reports as specified in Paragraph 1.03D.

PART 3 EXECUTION

3.01 MANUFACTURER’S REPRESENTATIVE

A. Provide the services of a qualified factory-trained manufacturer's field engineer to assist the CONTRACTOR in installation and start-up of the equipment specified under this section for a period of not less than 2 working days, with not less than one working day per motor control center. The manufacturer's field engineer shall provide technical direction and assistance to the CONTRACTOR in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.

B. The CONTRACTOR shall provide three (3) copies of the manufacturer's field testing report.

3.02 METERING AND PROTECTIVE RELAYS INSTALLATION

A. The CONTRACTOR shall provide Multilin, as specified in Section 26 05 00 Electrical - General Provisions.

3.03 ADJUSTABLE FREQUENCY DRIVES INSTALLATION

A. The CONTRACTOR shall provide the services of a manufacturer’s field engineer to assist the CONTRACTOR in installation, adjusting, programming, startup, testing and training on the AFD’s furnished and installed as a part of the MCC’s.

3.04 INSTALLER’S QUALIFICATIONS

A. Installer shall be specialized in installing low voltage motor control centers with minimum 5 years documented experience. Experience documentation shall be submitted for approval prior to beginning work on this project.

3.05 EXAMINATION

A. Examine installation area to assure there is enough clearance to install the equipment.

B. Housekeeping pads shall be included for the motor control centers as detailed on the Drawings with the exception of motor control centers which are to be installed adjacent to an existing unit. Housekeeping pads for these (if used) should match the existing installation.

C. Check concrete pads and base plates for uniformity and level surface.

D. Verify that the equipment is ready to install.

E. Verify field measurements are as instructed by manufacturer.

3.06 INSTALLATION

A. The CONTRACTOR shall install all equipment per the manufacturer's recommendations and Contract Drawings.

B. Install required safety labels.

3.07 FIELD QUALITY CONTROL

A. Inspect installed equipment for anchoring, alignment, grounding and physical damage.

B. Check tightness of all accessible electrical connections. Minimum acceptable values are specified in manufacturer's instructions.

3.08 FIELD ADJUSTING

A. Adjust all circuit breakers, switches, access doors, operating handles for free mechanical and electrical operation as described in manufacturer's instructions.

B. The manufacturer's field engineer shall check to confirm that all settings, designated in a coordinated study of the system as required in Section 26 05 73 - Power System Study, have been made.

C. Return "odd" Kirk keys to the OWNER after final acceptance.

3.09 FIELD TESTING

A. The manufacturer's field engineer shall make all electrical field tests recommended by the manufacturer. Disconnect all connections to solid-state equipment prior to testing.

B. Megger and record phase to phase and phase to ground insulation resistance of each bus section. Megger, for 1 minute, at minimum voltage of 1000 VDC. Measured Insulation resistance shall be at least 1 megohm. In no case shall the manufacturer's maximum test voltages be exceeded.

C. Complete the following test forms:

1. Motor Control Center Test Report: Before energizing the motor control center, the CONTRACTOR shall perform megohm meter tests. The measurements shall be made on all phase busing and the data checked for conformance with typical manufacturer's data. The tests must adhere to manufacturer's testing recommendations for the proper testing methods and test voltage levels for each piece of equipment. Readings that fall below manufacturer's recommended values will not be acceptable and the CONTRACTOR shall be required to perform any necessary remedial action before the busing is energized. A data sheet shall be submitted to the OWNER/ENGINEER for the MCC. The test report shall include the following equipment information:

   a. MCC (SB OR PNL) NAME AND NUMBER:

   b. MCC (SB OR PNL) MANUFACTURER

   c. MCC (SB OR PNL) NAMEPLATE DATA:
      VOLTS:
      HORIZONTAL BUS AMPS:
      MAIN BREAKER AMPS:

   d. INSULATION TEST (MEASURED):
      PHASE A-B:
      PHASE B-C:
      PHASE C-A:
      PHASE A-G:
      PHASE B-G:
      PHASE C-G:

   e. EQUIPMENT DISCONNECTED DURING TEST:

   f. DATE OF TEST:

   g. TESTED BY:

D. Where test reports show unsatisfactory results, the OWNER/ENGINEER may require the removal of all defective or suspected materials, equipment and/or apparatus, and

their replacement with new items, all at no cost to the OWNER. The CONTRACTOR shall bear all cost for any retesting.

E. Test each key interlock system for proper functioning.

F. The manufacturer’s field engineer shall perform field measurements, of both the voltage and current harmonic distortion at the point of common coupling with operating conditions to determine compliance with the Specifications.

3.10 CLEANING

A. Remove all rubbish and debris from inside and around the equipment. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint free rags. Do not use compressed air.

3.11 EQUIPMENT PROTECTION AND RESTORATION

A. Touch-up and restore damaged surfaces to factory finish, as approved by the manufacturer. If the damaged surface cannot be returned to factory specification, the surface shall be replaced.

3.12 MANUFACTURER’S CERTIFICATION

A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted, including all settings designated in the Power System Study, and tested in accordance with the manufacturer's recommendations.

B. The CONTRACTOR shall provide three (3) copies of the manufacturer's representative's certification.

3.13 TRAINING

A. Provide manufacturer's services for training of plant personnel in operation and maintenance of the equipment furnished under this Section.

B. The training shall be for a period of not less than one (1) eight hour day.

C. The cost of training program to be conducted with OWNER's personnel shall be included in the Contract Price. The training and instruction, insofar as practicable, shall be directly related to the system being supplied.

D. Provide detailed O&M manuals to supplement the training course. The manuals shall include specific details of equipment supplied and operations specific to the project.

E. The training session shall be conducted by a manufacturer's qualified representative. Training program shall include instructions on the assembly, motor starters, protective devices, metering, and other major components.

END OF SECTION

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SECTION 26 27 26 LIGHT SWITCHES AND RECEPTACLES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and install wiring devices as shown on the Drawings and as specified herein.

B. Provide all interconnecting conduit and branch circuit wiring for receptacle circuits in accordance with the NEC.

1.02 RELATED WORK

A. Section 26 05 00 - Electrical – General Provisions

B. Section 26 05 33 - Raceways, Boxes, Fittings and Supports

C. Section 26 05 19 - Wires and Cables (600 Volt Maximum)

1.03 SUBMITTALS

A. Shop Drawings

1. Submit catalog data of all switches, receptacles and other specified items under this Section, with all options, application locations and exceptions clearly indicated.

1.04 REFERENCE STANDARDS

A. Wiring devices shall comply with the requirements of the National Electrical Code (NEC) and shall be Underwriters Laboratories (UL) labeled.

1.05 QUALITY ASSURANCE

A. The manufacturer of these materials shall have produced similar electrical materials and equipment for a minimum period of five (5) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly. All assemblies shall be of the same manufacturer.

1.06 DELIVERY STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. Two (2) copies of these instructions shall be included with the equipment at time of shipment, and shall be made available to the CONTRACTOR and OWNER.

B. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within

seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR's choice and at the CONTRACTOR's expense, until such time that the site is ready for permanent installation of the equipment.

C. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during jobsite storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the Manufacturers listed in each product category are acceptable.

B. The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.

2.02 RATINGS

A. The service voltage, shall be as shown on the Drawings. The overall short circuit withstand and interrupting rating of the equipment and devices shall be equal to or greater than the overall short circuit withstand and interrupting rating of the feeder device immediately upstream of the equipment.

2.03 MATERIALS

A. Wall switches shall be heavy duty, industrial specification grade, toggle action, flush mounting quiet type. All switches shall conform to the latest revision of Federal Specification WS 896. Wall switches shall be of the following types and manufacturer:

1. Single pole, 20 Amp, 120/277 Volt - Cooper, Catalog No. 2221V, similar to Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.
2. Double pole, 20 Amp, 120/277 Volt - Cooper, Catalog No. 2222V, similar by Hubbell, Inc.; Pass & Seymour, Inc. or equal.
3. Three way, 20 Amp, 120/277 Volt - Cooper, Catalog No. 2223V, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.
4. Four way, 20 Amp, 120/277 Volt - Cooper, Catalog No. 2224V, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

5. Single pole, 20 Amp, 120/277 Volt - key operated, Cooper Catalog No. AH1191N, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

6. Single pole, 20 Amp, 120 Volt - red pilot-lighted handle, Cooper, Catalog No. 2221PL, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

7. Single pole, 20 Amp, 120 Volt, clear lighted handle, Cooper, Catalog No. 2221LTV, similar by Harvey Hubbell, Inc or equal.

8. Momentary contact, three position, 2 circuit, center off - Cooper, Catalog No. 1995V, similar by Harvey Hubbell Inc.; Pass & Seymour, Inc. or equal.

B. Fluorescent wall box dimmer switch for 120/277 Volt control of rapid start fluorescent lamps with a dimming range of 100 percent to .5 percent light for 120 Volt and 100 to 1 percent light for 277 Volt. Dimmer switch controls shall be as manufactured by Lutron Electronics Co., Inc., similar by Lithonia Control Systems; Valmont Electric, Inc. or equal.

C. Explosion-proof single pole factory sealed switches shall be for 20 Amps, 120/277 volts, mounted in copper free aluminum boxes and be similar and equal to Crouse-Hinds EDS Series, similar by Appleton Electric Co.; Killark or equal.

D. Receptacles shall be heavy duty, corrosion resistant, specification grade of the following types and manufacturer or equal. Receptacles shall conform to Fed Spec WC596.

1. Single, 20 Amp, 125 Volt, 2 Pole, 3 Wire Grounding, high impact, arc and moisture resistant yellow nylon construction, heavy nickel plating on metal parts; Cooper, Catalog No. 5361CRGY, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

2. Duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire Grounding, high impact, arc and moisture resistant yellow nylon construction, heavy nickel plating on metal parts; Cooper, Catalog No. 5362CRGY, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

3. Single, 20 Amp, 250 Volt, 2 Pole, 3 Wire; Cooper, Catalog No. 5461V, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

4. Weatherproof/corrosion resistant single, 20 Amp, 125 Volt, 2 Pole, 3 Wire Grounding Receptacle, as specified above, with wet location spring door cover and gasket; Crouse-Hinds Co., Catalog No. WLRS-5-20, similar by Appleton Electric or equal.

5. Weatherproof/corrosion resistant duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire Grounding Receptacle, as specified above, with wet location spring door cover and gasket; Crouse-Hinds Co., Catalog No. WLRD-5-20, similar by Appleton Electric or equal.

6. Ground fault interrupter, industrial grade, duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire, GFCI feed thru type with "test" and "reset" buttons. Cooper, Catalog No. XHGF20V, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

7. Duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire, transient voltage surge suppressor and audio alarm or indicating light to indicate bad ground or failed MOV. Cooper, Catalog No. 1210V, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

8. Clock hanger single, 15 Amp, 125 Volt, 2 Pole, 3 Wire, with hanging hook on device plate. Cooper, Catalog No. 452, similar by Harvey Hubbell, Inc.; Pass & Seymour Inc. or equal.

9. Single, corrosion resistant locking, 20 Amp, 125 Volt, 2 Pole, 3 Wire; Cooper, Catalog No. CRL520R and plug Cooper, Catalog No. CRL520P, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

10. Single twist-lock, 30 Amp, 125 Volt, 2 Phase, 3 Wire; Cooper, Catalog No. CRL530R; plug: Cooper, Catalog No. CRL530P, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

11. Single twist-lock, 20 Amp, 250 Volt, 2 Phase, 3 Wire; Cooper, Catalog No. CRL620R; plug: Cooper Catalog No. CRL620P, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

12. Single twist-lock, 30 Amp, 250 Volt, 2 Phase, 3 Wire; Cooper, Catalog No. CRL630R; plug: Cooper, Catalog No. CRL630P, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

13. Explosion-proof single, 20 Amp, 125 Volt, 2 Phase, 3 Wire; Appleton Electric, Catalog No. CPCI-2350 and plug, Appleton Electric Catalog No. CPP-2033 similar to Crouse-Hinds; Harvey Hubbell Inc or equal.

14. Explosion-proof duplex, 20 Amp, 125 Volt, 2 Phase, 3 Wire; Appleton Electric, Catalog No. CPC2-2350 and plug, Appleton Electric Catalog No. CPP-2023 similar by Crouse-Hinds; Harvey Hubbell, Inc. or equal.

E. Device Plates

1. Plates for indoor flush mounted devices shall be of the required number of gangs for the application involved and shall be as follows:

   a. Administration type buildings: Smooth, high impact nylon of the same manufacturer and color as the device. Final color to be as selected by the Architect.

   b. Where permitted in other areas of the plant, flush mounted devices in cement block construction shall be Type 302 high nickel (18-8) stainless steel of the same manufacturer as the devices.

2. Plates for indoor surface mounted device boxes shall be cast metal of the same material as the box, Crouse-Hinds No. DS23G and DS32G, or equal.

3. Oversized plates shall be installed where standard plates do not fully cover the wall opening.

4. Device plates for switches mounted outdoors or indicated as weatherproof shall be gasketed, cast aluminum with provisions for padlocking switches "On" and "Off", Crouse Hinds No. DS185, or equal.

5. Multiple surface mounted devices shall be ganged in a single, common box and provided with an adapter, if necessary, to allow mounting of single gang device plates on multigang cast boxes.

6. Engraved device plates shall be provided where required.

7. Weatherproof, gasketed cover for GFI receptacle mounted in a FS/FD box shall be Cooper, Catalog No. 4501-FS, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

F. Three Phase Power Receptacles

1. Three phase power receptacles and plugs shall be rated for the voltage and current ratings of the connected load unless otherwise shown on the Drawings.
2. Receptacles and plug housings shall be constructed of hi-impact, corrosion resistant non-metallic materials, stainless steel or copper free aluminum listed to UL standard 498 for watertight construction. Hardware shall be stainless steel.
3. Performance
   a. Maximum working voltage: 600 Volts RMS.
   b. Dielectric withstand voltage: 3000 Volts.
   c. Full load break capability at rated current.
   d. 5000 connect/disconnect cycles at rated voltage and current.
4. Furnish and install one mating plug with each receptacle.
5. Provide the following features:
   a. Color coded by voltage.
   b. One piece housing/angled back box
   c. Shrouded pins
   d. Self closing gasketed cover.
   e. Watertight cable entrances/stress relief grips.
   f. Mating keys.
6. Acceptable manufacturers:
   a. Hubbell (North American Rated Series II)
   b. GE Industrial Solutions
   c. Cooper

G. Interlocked Three Phase Power Receptacles

1. Interlocked three phase power receptacles shall include a combination receptacle and a mechanically interlocked disconnect switch. The two units shall be interlocked to prevent removal or insertion of the plug unless the switch is in the OFF position.
2. Provide a matching plug for every unit furnished.
3. Switch, power receptacle and mating plug shall be constructed of hi-impact, corrosion resistant non-metallic material, stainless steel or copper free aluminum.
4. Assembly shall be listed to UL Standard 498 for watertight- construction.
5. Hardware shall be stainless steel.
6. Performance:

a. Maximum working voltage: 600 Volts RMS.

b. Dielectric withstand voltage: 3000 Volts.

c. Full load break capability at rated current.

d. 5000 connect/disconnect cycles at rated voltage and current.

7. Provide the following features:

a. Color coded by voltage.

b. One piece housing/angled back box

c. Shrouded pins

d. Self closing gasketed cover.

e. Watertight cable entrances/stress relief grips.

f. Mating keys.

8. The disconnect switch shall be unfused with ratings as hereinbefore specified. Provide lockout provisions on the disconnect switch handle.

9. Acceptable manufacturers:

a. Crouse-Hinds

b. Appleton

c. Killark

d. Hubbell

H. Poke-Thru Service Fittings

1. Poke-thru service fittings shall be installed in a 2-in core drilled hole, fit floor thicknesses of 2-1/2-in to 7-in and be fire rated.

2. Poke-thru service fittings shall be barriered to handle both high and low tension services and be designed for both new construction and building retrofit.

3. Service fitting heads shall each contain a 20 Amp, 125 Volt, 2 Pole, 3 Wire duplex receptacle on one side and provisions for up to 2-25 pair telephone cables on the remaining side.

4. Complete poke-thru services fitting shall be as manufactured by Raceway Components similar by Walker; Square D or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Switch and receptacles outlets shall be installed flush with the finished wall surfaces in areas with stud frame and gypboard construction, in dry areas with cement block construction or when raceways are shown as concealed on the Drawings.

B. Do not install flush mounted devices in areas designated DAMP, WET or WET/CORROSIVE on the Drawings. Provide surface mounted devices in these areas.

C. Provide weatherproof devices covers in areas designated WET or WET/CORROSIVE on the Drawings.

D. Unless otherwise shown on the Drawings, wall switches and other wall mounted controls shall be installed at 4’-6” AFF.

E. Convenience outlets shall be 12-in above the floor unless otherwise required.

F. Convenience outlets installed outdoors and in rooms where equipment may be hosed down shall be 18-in above floor or grade. Switches shall be ganged together under one cover plate.

G. The location of all devices is shown, in general, on the Drawings and may be varied within reasonable limits so as to avoid any piping or other obstruction without extra cost, subject to the approval of the OWNER. Coordinate the installation of the devices for piping and equipment clearance.

3.02 FIELD QUALITY CONTROL

A. Test wiring devices to ensure electrical continuity of grounding. Energize the circuit to demonstrate compliance with the requirements.

END OF SECTION

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SECTION 26 28 16 LOW VOLTAGE ENCLOSED CIRCUIT BREAKERS AND DISCONNECT SWITCHES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The CONTRACTOR shall furnish and install low voltage enclosed circuit breakers and disconnect switches, together with appurtenances, complete and operable, as specified herein and as shown on the Contract Drawings.

1.02 RELATED WORK

A. Section 25 05 00 - Electrical – General Provisions

B. Section 26 05 90 - Cast-In-Place Concrete for Electrical Applications

C. Section 26 05 73 - Power System Study

D. Divisions 43 and 46 Equipment

E. Division 40 Instrumentation

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Division 1, Section 26 05 00 - Electrical – General Provisions and as specified herein.

B. Submittals shall also contain information on related equipment to be furnished under this Specification but described in the related sections listed in the Related Work paragraph above. Incomplete submittals not containing the required information on the related equipment will be returned unreviewed.

C. The original equipment manufacturer shall create all equipment shop drawings, including all wiring diagrams, in the manufacturer's Engineering department. All equipment shop drawings shall bear the original equipment manufacturer's logo, drawing file numbers, and shall be maintained on file in the original equipment manufacturer's archive file system. Photocopies of the ENGINEER's ladder schematics are unacceptable as shop drawings.

D. Submit to the OWNER/ENGINEER, shop drawings and product data, for the following:

1. Product data sheets and catalog numbers for overcurrent protective trip devices on circuit breakers and switches, relaying, meters, pilot lights, etc. The manufacturer's name shall be clearly visible on the each cut sheet submitted. List all options, trip adjustments and accessories furnished specifically for this project.
2. Provide control systems engineering to produce custom unit elementary drawings showing interwiring and interlocking between components and to remotely mounted devices. Include and identify all connecting equipment and remote devices on the schematics. The notation "Remote Device" will not be acceptable.

Show wire and terminal numbers. Indicate special identifications for electrical devices per the Drawings.

3. Provide plan and elevation drawings of each controller or enclosure, with dimensions, exterior and interior views, showing component layouts, controls, terminal blocks, etc..
4. Schematic diagram
5. Nameplate schedule
6. UL Listing
7. Component list with detailed component information.
8. Conduit entry/exit locations
9. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
10. Major component ratings including:
    a. Voltage
    b. Continuous current
    c. Interrupting ratings
11. Cable terminal sizes.
12. Key interlock scheme drawing and sequence of operations
13. Busway connection.
14. Instruction and renewal parts books.

E. Factory Tests. Submittals shall be made for factory tests specified herein.

F. Field Test Reports. Submittals shall be made for field tests specified herein.

G. Operation and Maintenance Manuals.
1. Operation and maintenance manuals shall include the following information:
    a. Manufacturer's contact address and telephone number for parts and service.
    b. Instruction books and/or leaflets
    c. Recommended renewal parts list
    d. Record Documents for the information required by Paragraph D above.

1.04 REFERENCE CODES AND STANDARDS

A. All products and components shown on the Drawings and listed in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NEMA Standard AB1 – Molded Case Circuit Breakers, Molded Case Switches and Circuit Breaker Enclosures
2. NFPA 70 – National Electrical Code (NEC)
3. NFPA 70E – Standard For Electrical Safety in the Workplace
4. IEEE 242 – Protection and Coordination of Industrial and Commercial Power Systems
5. IEEE 399 – Power Systems Analysis
6. UL 489 – Molded Case Circuit Breakers and Circuit Breaker Enclosures
7. UL 1066 – Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures.

B. All equipment specified in this section of the Specifications shall bear the appropriate label of Underwriters Laboratories.

1.05 QUALITY ASSURANCE

A. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly. All assemblies shall be of the same manufacturer.

C. Equipment submitted shall fit within the space shown on the Drawings. Equipment which does not fit within the space is not acceptable.

D. For the equipment specified herein, the manufacturer shall be ISO 9001 2000 certified.

1.06 DELIVERY STORAGE AND HANDLING

A. Protect equipment during shipment, handling, and storage by suitable complete enclosures. Protect equipment from exposure to the elements and keep thoroughly dry.

B. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Repaint damaged painted surfaces to the satisfaction of the OWNER/ENGINEER.

C. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR’s choice and at the CONTRACTOR’s expense, until such time that the site is ready for permanent installation of the equipment.

D. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.

E. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment or components shall be performed by the CONTRACTOR at no expense to the OWNER.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

1. Cutler Hammer
2. GE Industrial Solutions
3. Siemens
4. Allen Bradley

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. All equipment furnished under this Section shall be of the same manufacturer.

2.02 RATINGS

A. The service voltage, shall be as shown on the Drawings. The overall short circuit withstand and interrupting rating of the equipment and devices shall be equal to or greater than the overall short circuit withstand and interrupting rating of the feeder device immediately upstream of the circuit breaker or switch. Systems employing series connected ratings for main and feeder devices shall not be used.

B. Circuit breakers, safety switches and associated devices shall be designed for continuous operation at rated current in a 50 degree C ambient temperature.

C. For additional ratings and construction notes, refer to the Drawings.

2.03 CONSTRUCTION

A. General

1. Refer to Drawings for: actual layout and location of equipment and components; current ratings of devices, components; protective relays, voltage ratings of devices, components and assemblies; and other required details.

2. Furnish nameplates for each device as indicated on the Drawings. Nameplates shall be laminated plastic with black letters on white background. Nameplates shall be fastened by 316 stainless steel screws. There shall be a nameplate for each device that indicates equipment ratings, manufacturer's name and general information.

B. Enclosure

1. Enclosures shall be in accordance with the Area Classification and Enclosure Types as specified in Section 26 05 00 Electrical – General Provisions.

2. NEMA 1 enclosures shall be of sheet aluminum for wall mounting, or have mounting feet where self-standing. Enclosure panels shall have continuously welded seams. Welds shall be ground smooth. Enclosures shall be flanged and shall not have holes or knockouts. Enclosures shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. All enclosures shall have hinged gasketed doors. Enclosures shall be furnished with terminal mounting straps and brackets.

3. NEMA 4X enclosures shall be Type 316 stainless steel for wall mounting, or have mounting feet where self-standing. Enclosures shall have continuously welded seams. Welds shall be ground smooth. Enclosures shall be flanged and shall not have holes or knockouts. Enclosures shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. All enclosures shall have hinged gasketed doors with a 3-point latch (single operator). Enclosures shall be furnished with terminal mounting straps and brackets.

4. NEMA 7 enclosures shall be of copper-free cast aluminum, with stainless steel cover bolts, and extruded aluminum hinges. Enclosure shall be rated NEMA 7 (and listed for use in the area classifications shown) for “Class I Div. 1 Group D” and “Class I Div. 2 Group D” hazardous locations shown on the Drawings.

5. All NEMA 1 and NEMA 4enclosures shall be lockable, and others if lockable..

6. Provide a flange mounted, or through the door, disconnect operating handle with mechanical interlock having a bypass that will allow the enclosure door to open only when the circuit breaker or switch is in the OFF position.

C. Internal Wiring

1. Wiring: Stranded copper, minimum size No. 14 AWG, with 600 Volt, 90 degree C, flame retardant, Type MTW thermoplastic insulation, NEMA Class II, Type B wiring. Line side power wiring shall be sized for the full rating or frame size of the connected device.

2. All wiring shall be tagged and coded with an identification number as shown on the Drawings. Coding shall be typed on a heat shrinkable tube applied to each end showing origination and destination of each wire. The marking shall be permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE, or equal.

3. All wiring shall be neatly bundled with ty-raps and supported to wire way supports. Control wiring shall be bundled separately from power wiring. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.

D. Field Installed Internal Wiring

1. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported so that circuit terminations are not stressed. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.

2. All field wiring shall be tagged and coded with an identification number. Coding shall be typed on a heat shrinkable tube applied to each end of the wire. The marking shall be a permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE, or equal

3. In general, all conduit entering or leaving equipment shall be stubbed up into the bottom of the enclosure directly below the area in which the conductors are to be terminated, or from the top if shown on the Drawings. Conduits shall not enter the side unless approved in writing by the OWNER/ENGINEER.

E. Nameplates

1. Provide 1 inch by 3 inch engraved unit nameplates of two ply laminated plastic, black face, white core, screw fastened to each door with 316 stainless steel screws. All component and control identification nameplates shall be engraved with the device name and number exactly as it appears on the Drawings and/or as approved by the OWNER/ENGINEER. For devices not shown on the single line drawing such as time delay relays, the names shall be as shown on the Control Schematic Drawings and/or as assigned by the OWNER/ENGINEER.

2.04 OVERCURRENT AND SHORT CIRCUIT PROTECTIVE DEVICES

A. General

1. The Drawings indicate the type, voltage, current and interrupting rating of the circuit breaker or safety switch.

2. Furnish lugs for incoming wiring, sizes as shown on the Drawings. Allow adequate clearance for bending and terminating of cable size and type specified.

3. Built in control stations and indicating lights shall be furnished where shown on the Drawings.

4. All wires shall be terminated on the protective device.

B. Circuit Breakers

1. Insulated Case Circuit Breakers (ICCB's)

    a. Unless otherwise shown on the Drawings, circuit breakers, larger than a 2000 ampere rating, shall be insulated case (ICCB), 3 Pole, 600 Volt, fixed type, with stored energy closing mechanism.

    b. Breakers shall be manually operated unless indicated as electrically operated (EO) on the Drawings.

    c. Electrically operated breakers shall be complete with close/open pushbuttons or a control switch, as shown on the Drawings, with red and green indicating lights to indicate breaker contact position, and 120 VAC motor operators.

    d. Contractor to calculate minimum symmetrical interrupting capacity, per specification 26 05 73 - Power System Study, and verify the interrupting capacity shown on the Drawings. To ensure a selective system, all circuit breakers shall have 30-cycle short-time withstand ratings equal to 18 times their frame ratings. Insulated case circuit breakers without an instantaneous trip element adjustment shall be equipped with a fixed internal instantaneous override set at that level.

    e. All insulated case circuit breakers shall be constructed and tested in accordance with UL 1066. The circuit breakers shall carry a UL label.

    f. All insulated case circuit breakers shall have an adjustable long time pickup, and delay; adjustable short time pickup and delay; short time i2t switch; high range instantaneous (fixed at the breaker's short-time withstand rating), adjustable ground fault pickup and delay; ground fault delay and pickup trips for selective tripping], and overload, short circuit, and ground fault indicator lights.

2. Molded Case Circuit Breakers (MCCB's)

    a. Unless otherwise shown on the Drawings, circuit breakers 20 to 225 ampere frame rating shall be molded case (MCCB), 3 Pole, 600 Volt, fixed type, with stored energy closing mechanism. Breakers shall be manually operated unless indicated as electrically operated (EO) on the Drawings. Trip device shall be solid state with adjustable long time pickup, and delay; adjustable short time pickup and delay; short time i2t switch; adjustable ground fault pickup and delay, and ground fault delay and pickup trips for selective tripping.

    b. Unless otherwise shown on the Drawings, circuit breakers less than 225 ampere frame rating shall be molded case, 3 Pole, 600 Volt, fixed type, manually operated with stored energy closing mechanism. Circuit breakers shall have inverse time and instantaneous tripping characteristics.

3. Where shown on the Drawings, breakers shall be rated for 100% continuous duty, and shall carry a UL 489 listing.

C. Disconnect Switches

1. Disconnect switches shall be heavy duty, quick make, quick break, visible blades, 600 Volt, 3 Pole with full cover interlock, interlock defeat and flange mounted operating handle.

D. Fused Disconnect Switches

1. Fused disconnect switches shall be heavy duty, quick make, quick break, visible blades, 600 Volt, 3 Pole with full cover interlock, interlock defeat and flange mounted operating handle.
2. Fuses shall be rejection type, 600 Volts, 200,000 A.I.C., dual element, time delay, Bussman Fusetron, Class RK 5 or equal.

2.05 SPARE PARTS

A. Provide the following spare parts:

1. 3 – Fuses of each type used.

B. Spare parts shall be boxed or packaged for long term storage and clearly identified on the exterior of package. Identify each item with manufacturers name, description and part number

2.06 FACTORY TESTING

A. The circuit breakers and disconnects shall be completely assembled, wired, and adjusted at the factory and shall be given the manufacturer's routine shop tests and any other additional operational test to insure the workability and reliable operation of the equipment.

B. Factory test equipment and test methods shall conform to the latest applicable requirements of ANSI, IEEE, UL, and NEMA standards.

C. Factory test equipment and test methods shall conform to the latest applicable requirements of ANSI, IEEE, UL, and NEMA standards, and shall be subject to the OWNER/ENGINEER's approval.

PART 3 EXECUTION

3.01 INSTALLER'S QUALIFICATIONS

A. Installer shall be specialized in installing low voltage circuit breakers and disconnect switches with minimum 5 years documented experience. Experience documentation shall be submitted for approval prior to beginning work on this project.

3.02 EXAMINATION

A. Examine installation area to assure there is enough clearance to install the equipment.

B. Verify that the equipment is ready to install.

C. Verify field measurements are as instructed by the manufacturer.

3.03 INSTALLATION

A. The CONTRACTOR shall install all equipment per the manufacturer's recommendations and Contract Drawings.

B. Installed required safety labels.

3.04 FIELD QUALITY CONTROL

A. Inspect installed equipment for anchoring, alignment, grounding and physical damage.

B. Check tightness of all accessible electrical connections. Minimum acceptable values are specified in manufacturer's instructions.

3.05 FIELD ADJUSTING

A. Adjust all circuit breakers, switches, access doors, operating handles for free mechanical and electrical operation as described in manufacturer's instructions.

B. The breaker protective devices shall be set in the field by a qualified representative of the manufacturer, retained by the CONTRACTOR, in accordance with settings designated in a coordinated study of the system as required in Section 26 05 73 - Power System Study.

3.06 FIELD TESTING

A. Perform all electrical field tests recommended by the manufacturer. Disconnect all connections to solid-state equipment prior to testing.

B. Megger and record phase to phase and phase to ground insulation resistance. Megger, for 1 minute, at minimum voltage of 1000 VDC. Measured Insulation resistance shall be at least 1 megohm. Measured Insulation resistance shall be at least 1 megohm. In no case shall the manufacturer’s maximum test voltages be exceeded.

C. Test the ground fault protection system using a high current injection method.

D. Test the rating plug for correct rating.

3.07 CLEANING

A. Remove all rubbish and debris from inside and around the equipment. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint free rags. Do not use compressed air.

3.08 EQUIPMENT PROTECTION AND RESTORATION

A. Touch-up and restore damaged surfaces to factory finish, as approved by the manufacturer. If the damaged surface cannot be returned to factory specification, the surface shall be replaced.

END OF SECTION

SECTION 26 29 13 LOW VOLTAGE MOTOR CONTROLLERS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The CONTRACTOR shall furnish and install low voltage motor controllers, together with appurtenances, complete and operable, as specified herein and as shown on the Contract Drawings.

1.02 RELATED WORK

A. Section 26 05 00 - Electrical – General Provisions

B. Section 26 05 73 - Power System Study

C. Section 26 05 90 - Cast-In-Place Concrete for Electrical Applications

D. Section 26 09 13 - Power Metering and Protective Relays

E. Section 26 28 16 - Low Voltage Circuit Breakers and Fusible Switches

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Division 1, Section 26 05 00 - Electrical – General Provisions and as specified herein.

B. Submittals shall also contain information on related equipment to be furnished under this Specification but described in the related sections listed in Related Work paragraph above. Incomplete submittals not containing the required information on the related equipment will be returned unreviewed.

C. The original equipment manufacturer shall create all equipment shop drawings, including all wiring diagrams, in the manufacturer's Engineering department. All equipment shop drawings shall bear the original equipment manufacturer's logo, drawing file numbers, and shall be maintained on file in the original equipment manufacturer's archive file system. Photocopies of the ENGINEER's ladder schematics are unacceptable as shop drawings.

D. Submit to the OWNER/ENGINEER, shop drawings and product data, for the following:

1. Product data sheets and catalog numbers for overcurrent protective devices, motor starters, control relays, control stations, meters, pilot lights, etc. The manufacturer's name shall be clearly visible on the each cut sheet submitted. List all options, trip adjustments and accessories furnished specifically for this project.
2. Provide control systems engineering to produce custom unit elementary drawings showing interwiring and interlocking between components and to remotely mounted devices. Include and identify all connecting equipment and remote devices on the schematics. The notation "Remote Device" will not be acceptable.

Show wire and terminal numbers. Indicate special identifications for electrical devices per the Drawings.

3. Provide plan and elevation drawings of each controller or enclosure, with dimensions, exterior and interior views, showing component layouts, controls, terminal blocks, etc..
4. Schematic diagram
5. Nameplate schedule
6. UL Listing
7. Component list with detailed component information.
8. Conduit entry/exit locations
9. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
10. Major component ratings including:
    a. Voltage
    b. Continuous current
    c. Interrupting ratings
11. Cable terminal sizes.
12. Key interlock scheme drawing and sequence of operations
13. Busway connection.
14. Instruction and renewal parts books.

E. Factory Tests. Submittals shall be made for factory tests specified herein.

F. Field Test Reports. Submittals shall be made for field tests specified herein.

G. Installation, Operation and Maintenance Manuals.

1. Installation, Operation and maintenance manuals shall include the following information:
    a. Manufacturer’s contact address and telephone number for parts and service.
    b. Instruction books and/or leaflets
    c. Recommended renewal parts list
    d. Record Documents for the information required by the Submittals paragraph above.

1.04 REFERENCE CODES AND STANDARDS

A. All products and components shown on the Drawings and listed in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NEMA Standard ICS 2 – 2000 Industrial Control and Systems
2. NFPA 70 – National Electrical Code (NEC)
3. NFPA 70E – Standard For Electrical Safety in the Workplace
4. UL 1449, UL 1283 – Standard for Safety for TVSS
5. ANSI/IEEE C62.41, C64.45 – Guide in Surge Environment in 600V Power Circuits
6. NEMA LS-1 – Low Voltage Surge Protective Devices
7. NEC Art. 285 – Transient Voltage Surge Suppressors

B. All equipment specified in this section of the Specifications shall bear the appropriate label of Underwriters Laboratories.

1.05 QUALITY ASSURANCE

A. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly. All assemblies shall be of the same manufacturer.

C. Equipment submitted shall fit within the space shown on the Drawings. Equipment which does not fit within the space is not acceptable.

D. For the equipment specified herein, the manufacturer shall be ISO 9001 2000 certified.

1.06 DELIVERY STORAGE AND HANDLING

A. Protect equipment during shipment, handling, and storage by suitable complete enclosures. Protect equipment from exposure to the elements and keep thoroughly dry.

B. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Repaint damaged painted surfaces to the satisfaction of the OWNER/ENGINEER.

C. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR’s choice and at the CONTRACTOR’s expense, until such time that the site is ready for permanent installation of the equipment.

D. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.

E. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the CONTRACTOR at no expense to the OWNER.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

1. Cutler Hammer
2. GE Industrial Solutions
3. Siemens
4. Allen Bradley

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.02 RATINGS

A. The service voltage, shall be as shown on the Drawings. The overall short circuit withstand and interrupting rating of the equipment and devices shall be equal to or greater than the overall short circuit withstand and interrupting rating of the feeder device immediately upstream of the motor controller. Systems of motor controllers employing series connected ratings for main and feeder devices shall not be used. Motor starter units shall be tested and UL labeled for the specified short circuit duty in combination with the motor branch circuit protective device.

B. Motor controllers, including associated devices, shall be designed for continuous operation at rated current in a 40 degree C ambient temperature.

C. For additional ratings and construction notes, refer to the Drawings.

2.03 CONSTRUCTION

A. General

1. Refer to Drawings for: actual layout and location of equipment and components; current ratings of devices, bus bars, components; protective relays, voltage ratings of devices, components and assemblies; and other required details.

2. Furnish nameplates for each device as indicated on the Drawings. Nameplates shall be laminated plastic with black letters on white background. Nameplates shall be fastened by 316 stainless steel screws. There shall be a nameplate for each controller that indicates equipment ratings, manufacturer's name, shop order number and general information.

B. Enclosure

1. Enclosures shall be in accordance with the Area Classification and Enclosure Types as specified in Section 26 05 00 Electrical – General Provisions.

C. Internal Wiring

1. Wiring: Stranded copper, minimum size No. 14 AWG, with 600 Volt, 90 degree C, flame retardant, Type MTW thermoplastic insulation, NEMA Class II, Type B wiring. Line side power wiring shall be sized for the full rating or frame size of the connected device.

2. All wiring shall be tagged and coded with an identification number as shown on the Drawings. Coding shall be typed on a heat shrinkable tube applied to each end showing origination and destination of each wire. The marking shall be permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE, or equal.

3. All control wiring to draw out units shall be run through split type terminal blocks (draw out) which can be split to allow easy unit removal. Motor “T” leads shall bolt directly to starter or overloads and shall not be split type.

4. All wiring shall be neatly bundled with ty-raps and supported to wire way supports. Control wiring shall be bundled separately from power wiring. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.

D. Field Installed Internal Wiring

1. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported so that circuit terminations are not stressed. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.

2. All field wiring shall be tagged and coded with an identification number. Coding shall be typed on a heat shrinkable tube applied to each end of the wire. The marking shall be a permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE, or equal

3. In general, all conduit entering or leaving equipment shall be stubbed up into the bottom of the enclosure directly below the area in which the conductors are to be

terminated, or from the top if shown on the Drawings. Conduits shall not enter the side unless approved in writing by the OWNER/ENGINEER.

E. Signage

1. Provide 1 inch by 3 inch engraved unit nameplates of two ply laminated plastic, black face, white core, screw fastened to each door with 316 stainless steel screws. All component and control identification nameplates shall be engraved with the device name and number exactly as it appears on the Drawings and/or as approved by the OWNER/ENGINEER. For devices not shown on the single line drawing such as time delay relays, the names shall be as shown on the Control Schematic Drawings and/or as assigned by the OWNER/ENGINEER.

F. Control Power Transformers

1. Control power transformers shall be provided where shown on the Drawings. Transformer shall be sized for all the load, including space heaters, plus 25% spare capacity. Transformer mechanical ratings shall equal the short circuit rating of the circuit breaker or MCP.
2. Control power transformers shall be 120 volt grounded secondary. Primary side of the transformer shall be fused in both legs. One leg of the transformer secondary shall be solidly grounded while the other leg shall be fused.
3. All control power transformers shall have vacuum cast primary and secondary coils using epoxy resin.

G. Instrument Transformers

1. All instrument transformers shall be vacuum cast using polyurethane resin.
2. Current transformers shall be provided where shown on the Drawings. Transformer mechanical ratings shall equal the short circuit and momentary rating of the circuit breakers. Transformers, when mounted in the motor controller, shall be rated for the full voltage of the equipment.
3. Voltage transformers shall be fixed type, with primary and secondary fuses, transformer mounted, with short circuit and momentary rating equal to the motor controller.

H. Transient Voltage Surge Suppression (TVSS)

1. Where a Transient Voltage Surge Suppressor is shown on the Drawings, it shall meet the following specifications:
   a. Maximum Surge Current - 150kA per mode, 300kA per phase.
   b. UL Symmetrical Fault Current Withstand Rating – 200,000 Amps.
   c. Minimum Repetitive Surge Current capacity
      (i) 1.2x50μs, 20kV, 8x20μs, 10kA Category C3 – 20,000 Impulses.
      (ii) 500V, 2kA, 10x1000μs long duration – 5000 impulses.
   d. UL SVR Rating – 1500 L-G.

e. MCOV – 170%

2. Connection to the motor controller shall be with a surge rated disconnect, mounted integral to the motor controller.
3. Noise attenuation shall not exceed 44db measured in accordance with the procedures outlined in accordance in NEMA LS 1 – 1992/MIL 220A.
4. Fusing shall be, a surge rated fuse, in combination with patented thermal fuse technology.
5. Monitoring devices shall include surge counter, indicating lights, audible alarm, Form C dry contacts @ 5 amps, 125V.
6. The TVSS shall have a warranty of not less than 10 years.]

I. Lightning Arresters and Surge Capacitors

1. Provide three valve type lightning arresters and surge capacitors in the motor controller where shown on the Drawings. Arresters and capacitors shall be the product of the motor controller manufacturer and factory installed.

2.04 MOTOR CONTROLLERS

A. General

1. The Drawings indicate the approximate horsepower and intended control scheme of the motor driven equipment. Provide the NEMA size starter, circuit breaker trip ratings, control power transformers and thermal overload heater element ratings matched to the motors and control equipment actually supplied, in compliance with the NEC and the manufacturer's heater selection tables. All variations necessary to accommodate the motors and controls as actually furnished shall be made without extra cost to the OWNER.
2. Furnish lugs for incoming wiring, sizes as shown on the Drawings. Allow adequate clearance for bending and terminating of cable size and type specified.
3. Motor starters shall be as shown on the Drawings. All motor starters shall be combination units, full voltage non-reversing (FVNR), with adjustable instantaneous trip magnetic only circuit breakers, or motor circuit protectors (MCP), unless otherwise specified or shown on the Drawings. NEMA starter sizes and breaker trip ratings shall be as required for the horsepower indicated, but shall be in no case less than NEMA Size 1. If the manufacturer of the equipment utilizing the motor, supplies a motor horsepower larger than that shown on the Drawings, the CONTRACTOR shall supply a motor starter sufficient in size to control the motor supplied. International (IEC) starters shall not be acceptable.
4. Each motor starter shall have a 120 volt operating coil unless otherwise noted.
5. Overload relays shall be standard Class 20, ambient compensated, manually reset by pushbutton located on front of the starter door. A normally closed contact shall be directly used in the start circuit and a normally open contact shall be wire to a terminal board for overload alarm.
6. Combination starters shall include a motor circuit protector (MCP) in series with a motor controller and an overload protective device. The MCP shall have an

adjustable magnetic trip range up to 1000 percent of rated continuous current and a trip test feature. MCP's shall be labeled in accordance with UL489.]

B. Magnetic Motor Starters

1. Motor starters shall be 2 or 3 pole, single or 3 phase as required, 60 Hertz, 600 volt, magnetically operated, full voltage nonreversing except as shown on the Drawings. NEMA sizes shall be as required for the horsepower shown on the Drawings. IEC rated starters are unacceptable.
2. Each motor starter shall have a 120 volt operating coil, and control power transformer. Starters shall have motor overload protection in each phase. Auxiliary contacts shall be provided as shown on the Drawings. A minimum of one N.O. and one N.C. auxiliary contacts shall be provided in addition to the contacts shown on the Drawings.
3. Overload relays shall be adjustable, ambient compensated and manually reset.
4. Built in control stations and indicating lights shall be furnished where shown on the Drawings.
5. All wires shall be terminated on terminal blocks and shall be tagged.
6. Provide as built wiring diagram and post it in a protective cover inside the cell.

C. Combination Magnetic Motor Starters

1. Motor starters shall be a combination motor circuit protector and contactor, 2 or 3 pole, single or 3 phase as required, 60 Hertz, 600 volt, magnetically operated, full voltage non reversing unless otherwise shown on the Drawings. NEMA sizes shall be as required for the horsepower shown on the Drawings. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall be current limiting type, with additional current limiters if required. IEC rated starters are unacceptable.
2. Each motor starter shall have a 120 volt operating coil, and control power transformer. Starters shall have motor overload protection in each phase. Auxiliary contacts shall be provided as shown on the Drawings. A minimum of one N.O. and one N.C. auxiliary contacts shall be provided in addition to the contacts shown on the Drawings.
3. Overload relays shall be adjustable, ambient compensated and manually reset.
4. Built in control stations and indicating lights shall be furnished where shown on the Drawings.
5. All wires shall be terminated on terminal blocks and shall be tagged.
6. Provide as built wiring diagram and post it inside the enclosure.

D. Multi-Speed and Reversing Starters

1. Multi speed and reversing starters shall include two motor rated contactors mechanically and electrically interlocked so that only one device may be energized at any time.

E. Reduced Voltage Starters

1. Reduced Voltage Solid State Type Starters (RVSS).

   a. The solid-state reduced-voltage starter shall be an integrated unit with power SCRs, logic board, paralleling bypass and output contactors, and electronic overload relay enclosed in a single molded housing.

   b. The SCR-based power section shall consist of six (6) back-to-back SCRs and shall be rated for a minimum peak inverse voltage rating of 1500 volts PIV

   c. Units using triacs or SCR/diode combinations shall not be acceptable.

   d. Resistor/capacitor snubber networks shall be used to prevent false firing of SCRs due to dV/dT effects.

   e. The logic board shall be mounted for ease of testing, service and replacement.

   f. The logic board shall be identical for all ampere ratings and voltage classes and shall be conformably coated to protect environmental concerns.

   g. The paralleling run bypass contactor shall energize when the motor reaches 90% of full speed and close/open under one (1) times motor current.

   h. The paralleling run bypass contactor shall utilize an intelligent coil controller to limit contact bounce and optimize coil voltage during varying system conditions.

   i. Starter shall be provided with electronic overload protection as standard and shall be based on inverse time-current algorithm. Overload protection shall be capable of being disabled during ramp start for long acceleration loads via a DIP switch setting on the device keypad.

   j. Overload protection shall be adjusted via the device keypad and shall have a motor full load ampere adjustment from 30 to 100% of the maximum continuous ampere rating of the starter.

   k. Starter shall have selectable overload class setting of 5, 10, 20 or 30 via a DIP switch setting on the device keypad.

   l. Starter shall be capable of either an electronic or mechanical reset after a fault.

   m. Units using bimetal overload relays are not acceptable.

   n. Overtemperature protection (on heat sink) shall be provided.

   o. Starters shall provide protection against improper line-side phase rotation. Starter shall shut down if a line-side phase rotation other than A-B-C exists. Provision for disabling shall be provided via a DIP switch on the device keypad.

   p. Starters shall provide protection against a phase loss or unbalance condition. Starter shall shut down if a 50% current differential between any two phases is encountered. Provision for disabling shall be provided via a DIP switch on the device keypad.

q. Start shall provide protection against a motor stall condition as standard. This feature can be disabled via a DIP switch on the device keypad.

r. Starter shall provide protection against a motor jam condition as standard. This feature can be disabled via a DIP switch on the device keypad.

s. Starter shall be provided with a Form C normally open (NO), normally closed (NC) contact that shall change state when a fault condition exists. Contacts shall be rated 60 VA (resistive load) and 20 VA (inductive load). In addition, an LED display on the device keypad shall indicate type of fault (Overtemperature, Phase Loss, Jam, Stall, Phase Reversal and Overload).

t. The following control function adjustments on the device keypad are required:

(i) Selectable Torque Ramp Start or Current Limit Start

(ii) Adjustable Kick Start Time: 0–2 seconds

(iii) Adjustable Kick Start Torque: 0–85%

(iv) Adjustable Ramp Start Time: 0.5–180 seconds

(v) Adjustable Initial Starting Ramp Torque: 0–85%

(vi) Adjustable Smooth Stop Ramp Time: 0–60 seconds.

u. Maximum continuous operation shall be at 115% of continuous ampere rating

v. Pump Control.

(i) Provide control algorithm for pump start-up and shut down sequences. Control algorithm shall reduce the potential for water hammer in a centrifugal pump system. Upon a start command, the speed of the motor shall increase, under the control of the soft starter microprocessor, to achieve a gentle start. After the speed has reached its nominal value, the bypass contactors shall close and the pump shall run at design speed. Upon a stop command, the bypass contactors shall open and the motor speed decreased in a tapered slope, to gradually slow the flow until the motor is brought to a stop. The start and stop ramp times shall be adjustable for the application requirements. The pump control option shall be factory installed.]

F. Combination Contactors

1. Combination contactors shall be a circuit breaker and contactor, 600 Volt, 3 Pole, 60 Hz, magnetically operated. NEMA size shall be as required for the kilowatt ratings shown on the Drawings, but shall be not less than NEMA size 1.

2. Contactors shall have a 120 Volt operating coil and control power transformer. Furnish the control power transformer with extra capacity for the unit heater fan.

G. Control Stations

1. Control stations shall be heavy duty type, with full size 30mm operators. Momentary contact stop buttons shall have a lockout latch that can be padlocked in the open position.

H. Pushbuttons, Indicating Lights and Selector Switches

1. Provide heavy-duty, 30mm, oiltight type pushbuttons, selector switches, indicating lights and stations, push-to-test, for these devices. Indicating lights shall be of the LED type.

2. Provide devices meeting the requirements of NEMA ICS 2, and having individual, extra large nameplates indicating their specific function. Provide pushbutton stations with laminated plastic nameplates indicating the drive they control, stainless steel screw attached. Provide contacts with NEMA designation rating A600. Install provisions for locking pushbuttons and selector switches in the OFF position wherever lockout provisions are indicated.

I. Control Relays

1. Control relays shall be 300 volt, industrial rated, plug-in socket type, housed in a transparent polycarbonate dust cover, designed in accordance with UL Standard 508 for motor controller duty. Continuous contact rating shall be 10 amperes resistive, ¼ HP at 120 VAC, operating temperature minus 10 to plus 55 degrees C. Provide spare N.O. & N.C. contacts. Relays shall be Potter & Brumfield KRP Series or equal, or solid state, with neon coil indicator light. Timing relays shall be 300 Volt, solid state type, with rotary switch to select the timing range.

2.05 METERING AND PROTECTIVE RELAYS

A. A 100VA minimum UPS shall be provided, powered from the control power transformer to provide control power to the feeder management relays and power quality meters.

B. Furnish where shown on the Drawings, a Phase Protective Relay (PPR), as shown on the Drawings, and as specified in Section 26 09 13 Power Metering and Protective Relays.

C. Furnish where shown on the Drawings, a Motor Protection System (MP3), as shown on the Drawings, and as specified in Section 26 09 13 Power Metering and Protective Relays.

D. Furnish where shown on the Drawings, a Remote RTD Metering and Protection (RRTD), as shown on the Drawings, and as specified in Section 26 09 13 Power Metering and Protective Relays.

E. Furnish where shown on the Drawings, a Motor Protection System (MP4), as shown on the Drawings, and as specified in Section 26 09 13 Power Metering and Protective Relays.

F. Furnish where shown on the Drawings, a Power Quality Meter (PM1), for each Main or Feeder Breaker, as shown on the Drawings and as specified in Section 26 09 13 Power Metering and Protective Relays.

2.06 SPARE PARTS

A. Provide the following spare parts:

1. 3 – Control fuses of type used.
2. One dozen each of cover bolts, spring nuts and door fasteners.
3. One quart of touch-up paint.

B. Spare parts shall be boxed or packaged for long term storage and clearly identified on the exterior of package. Identify each item with manufacturers name, description and part number.

2.07 FACTORY TESTING

A. The motor controllers shall be completely assembled, wired, and adjusted at the factory and shall be given the manufacturer’s routine shop tests and any other additional operational test to insure the workability and reliable operation of the equipment.

B. Factory test equipment and test methods shall conform to the latest applicable requirements of ANSI, IEEE, UL, and NEMA standards.

C. The operational test shall include the proper connection of supply and control voltage and, as far as practical, a mockup of simulated control signals and control devices shall be fed into the boards to check for proper operation.

D. Factory test equipment and test methods shall conform to the latest applicable requirements of ANSI, IEEE, UL, and NEMA standards, and shall be subject to the OWNER/ENGINEER’s approval.

PART 3 EXECUTION

3.01 MANUFACTURER’S REPRESENTATIVE

A. Provide the services of a qualified factory-trained manufacturer's field engineer to assist the CONTRACTOR in installation and start-up of each type of the equipment specified below for a period of not less than 2 working days, with not less than one working day per starter. The manufacturer's field engineer shall provide technical direction and assistance to the CONTRACTOR in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.

1. Soft Start Reduced Voltage Type Starters.
2. Metering and Protective Relays

3.02 INSTALLER’S QUALIFICATIONS

A. Installer shall be specialized in installing low voltage motor controllers with minimum 5 years documented experience. Experience documentation shall be submitted for approval prior to beginning work on this project.

3.03 METERING AND PROTECTIVE RELAYS INSTALLATION

A. The CONTRACTOR shall provide the services of a factory trained Multilin programmer to assist the CONTRACTOR in installation, adjusting, programming, startup, testing and training on the Multilin furnished and installed under this section of the Specifications.

3.04 SOFT START REDUCED VOLTAGE STARTER INSTALLATION

A. The CONTRACTOR shall provide the services of a manufacturer’s field engineer to assist the CONTRACTOR in installation, adjusting, programming, startup, testing and training on the soft start reduced voltage starters furnished and installed under this section of the Specifications.

3.05 EXAMINATION

A. Examine installation area to assure there is enough clearance to install the equipment.

B. Housekeeping pads shall be included for the floor mounted motor controllers as detailed on the Drawings with the exception of motor controllers which are to be installed adjacent to an existing unit. Housekeeping pads for these (if used) should match the existing installation.

C. Check concrete pads and base plates for uniformity and level surface.

D. Verify that the equipment is ready to install.

E. Verify field measurements are as instructed by manufacturer.

3.06 INSTALLATION

A. The CONTRACTOR shall install all equipment per the manufacturer's recommendations and Contract Drawings.

B. Installed required safety labels.

3.07 FIELD QUALITY CONTROL

A. Inspect installed equipment for anchoring, alignment, grounding and physical damage.

B. Check tightness of all accessible electrical connections. Minimum acceptable values are specified in manufacturer's instructions.

3.08 FIELD ADJUSTING

A. Adjust all circuit breakers, switches, access doors, operating handles for free mechanical and electrical operation as described in manufacturer's instructions.

B. The breaker protective devices shall be set in the field by a qualified representative of the manufacturer, retained by the CONTRACTOR, in accordance with settings

designated in a coordinated study of the system as required in Section 26 05 73 - Power System Study.

C. Return “odd” Kirk keys to the OWNER after final acceptance.

3.09 FIELD TESTING

A. Perform all electrical field tests recommended by the manufacturer. Disconnect all connections to solid-state equipment prior to testing.

B. Megger and record phase to phase and phase to ground insulation resistance. Megger, for 1 minute, at minimum voltage of 1000 VDC. Measured Insulation resistance shall be at least 1 megohm. Measured Insulation resistance shall be at least 1 megohm. In no case shall the manufacturer’s maximum test voltages be exceeded.

C. Test each key interlock system for proper functioning.

D. Test all control logic before energizing the motor or equipment.

3.10 CLEANING

A. Remove all rubbish and debris from inside and around the motor controllers. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint free rags. Do not use compressed air.

3.11 EQUIPMENT PROTECTION AND RESTORATION

A. Touch-up and restore damaged surfaces to factory finish, as approved by the manufacturer. If the damaged surface cannot be returned to factory specification, the surface shall be replaced.

3.12 MANUFACTURER’S CERTIFICATION

A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted, including all settings designated in the Power System Study, and tested in accordance with the manufacturer's recommendations.

B. The CONTRACTOR shall provide three (3) copies of the manufacturer's representative's certification.

3.13 TRAINING

A. Provide manufacturer's services for training of plant personnel in operation and maintenance of the soft start starters furnished under this Section.

B. The training for each type of equipment shall be for a period of not less than one (1) eight-hour day.

C. The cost of training program to be conducted with OWNER's personnel shall be included in the Contract Price. The training and instruction, insofar as practicable, shall be directly related to the system being supplied.

D. Provide detailed O&M manuals to supplement the training course. The manuals shall include specific details of equipment supplied and operations specific to the project.

E. The training session shall be conducted by a manufacturer's qualified representative. Training program shall include instructions on the assembly, motor starters, protective devices, metering, and other major components.

F. The OWNER reserves the right to videotape the training sessions for the OWNER's use.

END OF SECTION

SECTION 26 29 23 LOW VOLTAGE ADJUSTABLE FREQUENCY DRIVES (AFD'S)

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The CONTRACTOR shall furnish and install separately enclosed low voltage adjustable frequency drives, together with appurtenances, complete and operable, as specified herein and as shown on the Contract Drawings.

B. All equipment supplied under this Section of the Specifications shall be products of the same Manufacturer, and shall be contained in one single submittal. Partial submittals will be returned unreviewed. Submittals shall also contain information on related equipment to be furnished under this Specification but described in the related sections listed in the Related Work paragraph above. Incomplete submittals not containing the required information on the related equipment will also be returned unreviewed.

C. Equipment specified in Divisions 43 and 46 and supplied as an integral part of a process equipment manufacturer's package, but referred to this Section for component details, shall be submitted with the manufacturer's package submittal under Divisions 43 and 46.

D. The minimum requirements for functionality, and control and alarm inputs and outputs, are specified herein. Additional requirements shall be as specified in Divisions 43 and 46 Equipment, Division 40Instrumentation, and the Contract Drawings.

E. The AFD manufacturer shall coordinate with the motor manufacturer for the motor being furnished, and shall provide a certification that the AFD is suitable for the application.

1.02 RELATED WORK

A. Section 26 05 00 - Electrical – General Provisions

B. Section 26 05 90 - Cast-In-Place Concrete for Electrical Applications

C. Section 26 05 73 - Power System Study

D. Section 26 09 13 - Power Metering and Protective Relays

E. Section 26 28 16 - Low Voltage Circuit Breakers and Fusible Switches

F. Division 03 Concrete Pads

G. Divisions 43 and 46 Equipment

H. Division 40 Instrumentation

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Division 1, Section 26 05 00 - Electrical – General Provisions and as specified herein.

B. Submittals shall also contain information on related equipment to be furnished under this Specification but described in the related sections listed in Paragraph 1.02 above. Incomplete submittals not containing the required information on the related equipment shall be returned unreviewed.

C. The original equipment manufacturer shall create all equipment shop drawings, including all wiring diagrams, in the manufacturer's Engineering department. All equipment shop drawings shall bear the original equipment manufacturer's logo, drawing file numbers, and shall be maintained on file in the original equipment manufacturer's archive file system. Photocopies of the ENGINEER's ladder schematics are unacceptable as shop drawings.

D. Submit to the OWNER/ENGINEER, shop drawings and product data, for the following:

1. Product data sheets and catalog numbers for all components of the drives, including motor contactors, drive components, control relays, control stations, meters, pilot lights, etc. The manufacturer's name shall be clearly visible on the each cut sheet submitted. List all options, trip adjustments and accessories furnished specifically for this project.
2. Provide drive performance specifications. Submit a manufacturer's harmonics test on each type of drive being furnished. The test may be on a similar unit with identical components.
3. Provide control systems engineering to produce custom unit elementary drawings showing interwiring and interlocking between components and to remotely mounted devices. Include and identify all connecting equipment and remote devices on the schematics. The notation "Remote Device" shall not be acceptable. Show wire and terminal numbers. Indicate special identifications for electrical devices per the Drawings.
4. Provide plan and elevation drawings of each controller or enclosure, with dimensions, exterior and interior views, showing component layouts, controls, terminal blocks, etc.
5. Schematic diagram
6. Nameplate schedule
7. UL Listing
8. Component list with detailed component information.
9. Conduit entry/exit locations
10. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage

c. Continuous current

d. Trip curves for each specified product

11. Major component ratings including:

a. Voltage

b. Continuous current

c. Interrupting ratings

12. Cable terminal sizes.

13. Instruction and renewal parts books.

E. Certification that the AFD being supplied is suitable for the application.

F. Factory Tests. Submittals shall be made for factory tests specified herein.

G. Field Test Reports. Submittals shall be made for field tests specified herein.

H. Operation and Maintenance Manuals.

1. Operation and maintenance manuals shall include the following information:

a. Manufacturer's contact address and telephone number for parts and service.

b. Instruction books and/or leaflets

c. Recommended renewal parts list

d. Record Documents for the information required by the Submittals paragraph above.

1.04 REFERENCE CODES AND STANDARDS

A. All products and components shown on the Drawings and listed in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NEMA Standard ICS 2 – 2000 Industrial Control and Systems

2. NFPA 70 – National Electrical Code (NEC)

3. NFPA 70E – Standard for Electrical Safety in the Workplace

4. UL 1449, UL 1283 – Standard for Safety for TVSS

5. ANSI/IEEE C62.41, C64.45 – Guide in Surge Environment in 600V Power Circuits

6. NEMA LS-1 – Low Voltage Surge Protective Devices

7. NEC Art. 285 – Transient Voltage Surge Suppressors

8. IEEE 519 (latest revision) - Guide for Harmonic Control and Reactive Compensation of static Power Converters

9. UL 508C – Power Conversion Equipment

10. NEMA ICS 2 – Starters, Contactors, Overload Relays, Rated Not More Than 200 Volts AC or 750 Volts DC.
11. NEMA ICS 6 – Industrial Control and Systems Enclosures
12. NEMA ICS 7.0 – Industrial Controls & Systems for AFD
13. IEC 61200-2 – Vibration Levels
14. IEC 61800-02 and -3 – Adjustable Speed Electrical Power Drive Systems
    a. Fulfill all EMC immunity requirements
15. EN 50082-1 and -2 – Test Standards

B. In the case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

C. All equipment specified in this section of the Specifications shall bear the appropriate label of Underwriters Laboratories.

1.05 QUALITY ASSURANCE

A. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly. All assemblies shall be of the same manufacturer.

C. Equipment submitted shall fit within the space shown on the Drawings. Equipment which does not fit within the space is not acceptable.

D. For the equipment specified herein, the manufacturer shall be ISO 9001 2000 certified.

1.06 DELIVERY STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. Two (2) copies of these instructions shall be included with the equipment at time of shipment, and shall be made available to the CONTRACTOR and OWNER/ENGINEER.

B. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.

C. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR’s choice and at the CONTRACTOR’s expense, until such time that the site is ready for permanent installation of the equipment.

D. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 3 years for 18-pulse drives and 2 years for 6-pulse drives, both to commence on the date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment or components shall be performed by the Manufacturer at no expense to the OWNER.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

1. Cutler Hammer
2. GE Industrial Solutions
3. Siemens
4. Allen Bradley

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. All equipment furnished under this Section shall be of the same manufacturer.

2.02 RATINGS

A. Service Conditions

1. The Drawings indicate the approximate horsepower and intended control scheme of the motor driven equipment. Provide the AFD, auxiliary components and equipment where shown or specified, and matched to the motors and control equipment actually supplied, in compliance with the NEC. All variations necessary to accommodate the motors and controls as actually furnished shall be made without extra cost to the OWNER.
2. The service voltage, shall be as shown on the Drawings. The overall short circuit withstand and interrupting rating of the AFD and devices shall be equal to or greater than the overall short circuit withstand and interrupting rating of the feeder device immediately upstream of the adjustable frequency drives. Adjustable frequency drives shall be tested and UL labeled for the specified short circuit duty in combination with the motor branch circuit protective device.

3. The drive shall be UL and cUL listed and not require external fuses. The drive shall also be CE labeled and comply with standards EN 61800-3 for EMC compliance and EN 61800-2 for low voltage compliance.
4. The drive shall be capable of operating in compliance with IEEE 519-1992.
5. Input power: Selectable for 200-240 or 380-480 VAC, 3-phase power input.
6. Input frequency: 57 to 63 Hz.
7. Ambient temperature: -10 degrees C to 50 degrees C (Enclosed).
8. Elevation: Up to 3300 feet above mean sea level.
9. Relative humidity: Up to 90 percent non-condensing.

B. The AFD output shall be 100 percent rated current continuous, suitable for operation of the driven equipment over a 30:1 speed range without overloading or low speed cogging. Drives shall be capable of a continuous overload up to 110 percent rated current and a maximum 150 percent overload for 1 minute. Starting torque shall be matched to the load.

C. Rated output voltage shall be programmable for motor ratings from 180 to 240 volts, or from 320 to 480 volts.

D. The Drive shall be able to operate after a voltage dip below 175 VAC on 230 VAC input power and 310 VAC on 460 VAC input power for 15 milliseconds at 85% full load current without any disturbances in output power delivered to the load.

E. The AFD output voltage shall vary with frequency to maintain a constant volts/hertz ratio up to base speed (60 hertz) output. Constant or linear voltage output shall be supplied at frequencies greater than base speed (60 hertz).

F. The AFD overload current rating shall be 110% of rated current for one minute for variable torque applications and 150% of rated current for constant torque applications.

G. The AFD shall have efficiency at full load and speed that exceeds 95% for AFD's below 15 HP and 97% for drives 15 HP and above. The efficiency shall exceed 90% at 50% speed and load.

H. The true power factor shall be 0.95 or better at any speed, measured at drive input terminals.

I. The voltage regulation shall be plus or minus 1 percent of rated value, no load to full load.

J. Output Frequency Drift shall be not more than plus or minus 0.5 percent from set point.

K. AFD's shall withstand five cycle transient voltage dips of up to 15 percent of rated voltage without an undervoltage trip or fault shutdown, while operating a variable torque load.

L. Line notching, transients, and harmonics on the incoming line shall not affect drive performance.

M. The AFD's shall meet IEC 61200-2 for vibration levels.

N. The AFD's shall be able to withstand voltage variations of -15% to +10% and imbalance no greater than 3% without tripping or affecting drive performance.

O. For additional ratings and construction notes, refer to the Drawings.

2.03 CONSTRUCTION

A. General

1. Refer to Drawings for: actual layout and location of equipment and components; current ratings of devices, components; protective relays, voltage ratings of devices, components and assemblies; and other required details.
2. Furnish nameplates for each device as indicated on the Drawings. Nameplates shall be laminated plastic with black letters on white background. Nameplates shall be fastened by 316 stainless steel screws. There shall be a nameplate for each AFD that indicates equipment ratings, manufacturer's name, shop order number and general information.
3. Each AFD shall have an HMCP or thermal magnetic circuit breaker, as shown on the Drawings, to provide a disconnect means. AFD's above 75HP shall have a solid state circuit breaker. Disconnecting means shall have a through the door lockable handle, mechanically interlocked with the enclosure door. The disconnect shall not be mounted on the door. The handle position shall indicate ON, OFF, and TRIPPED condition. The handle shall have provisions for lock out/tagout padlocking in the OFF position with at least three (3) padlocks. Interlocks shall prevent unauthorized opening or closing of the AFD door with the disconnect handle in the ON position. Door handle interlock shall be defeatable only by qualified maintenance personnel.
4. Each AFD shall have the application specific, Hand-Off-Remote and Auto-Manual selector switches for local and remote Auto-Manual operation, provisions to accept a remote dry contact closure to start and stop the drive with the drive control system in the AUTO mode, provisions to accept a 4 20 mA dc input signal for remote speed control, and other input, output and communications interfaces as shown on the Drawings. Inputs shall be isolated at the drive and active with the drive control system in the AUTO mode.
5. Provide two sets of Form C auxiliary dry contacts for remote indication of VFD running status.
6. Provide two sets of Form C auxiliary dry contacts for remote indication of VFD fault.
7. All relays provided in the equipment shall be NEMA rated. IEC rated relays are not acceptable.
8. Each AFD shall be microprocessor based with an LED and LCD display to monitor operating conditions. The Drive display section shall allow for local operation and

setting of Drive function codes and display fault indication and reasons associated with the fault. The LED display shall offer nine (9) different display settings and the LCD shall have the capacity to display five (5) lines of information at a time. The keypad shall be capable of copying, uploading and downloading drive function codes. Displays and settings shall be as specified for each of the horsepower ranges of AFD's.

9. Each AFD shall have an RS485 port as a standard and options for communicating with recognized industry standard device level networks such as Modbus Plus, Profibus, Modbus Plus, and Device Net.
10. Where the cables from the AFD to the motor exceed 60 feet in length, a properly sized output filter, or line reactor, shall be installed at the AFD output to reduce dv/dt levels and the resultant peak voltage overshoots at the motor terminals.
11. Where shown on the Drawings, furnish a motor over-current relay, or other protective or monitoring relays, as specified herein.
12. Where shown on the Drawings, the AFD shall have an AC output contactor to provide a means for positive disconnection of the drive output from the motor terminals.
13. Where shown on the Drawings, furnish a three contactor bypass, including a drive input disconnect, an AFD input isolation contactor, bypass contactor and an AFD output contactor that is electrically and mechanically interlocked with the bypass contactor. This circuit shall include control logic, status lights and motor over-current relays. The complete bypass system shall have controls, pilot lights, etc., as shown on the Drawings

B. Enclosure

1. Enclosures shall be in accordance with the Area Classification and Enclosure Types as specified in Section 26 05 00 Electrical – General Provisions.
2. NEMA 1 enclosures shall be of sheet aluminum for wall mounting, or have mounting feet where self-standing. Enclosure panels shall have continuously welded seams. Welds shall be ground smooth. Enclosures shall be flanged and shall not have holes or knockouts. Enclosures shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. All enclosures shall have hinged, gasketed doors. Enclosures shall be furnished with terminal mounting straps and brackets. Panels shall be furnished with hinged doors, terminal mounting straps and brackets.
3. NEMA 4X enclosures shall be Type 316 stainless steel for wall mounting, or have mounting feet where self-standing. Enclosures shall have continuously welded seams. Welds shall be ground smooth. Enclosures shall be flanged and shall not have holes or knockouts. Enclosures shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. All enclosures shall have hinged gasketed doors with a 3-point latch (single operator). Panels shall be furnished with terminal mounting straps and brackets. Enclosures shall be furnished with hinged doors, terminal mounting straps and brackets.
4. NEMA 7 enclosures shall be of copper-free aluminum, with stainless steel cover bolts, and extruded aluminum hinges. Enclosure shall be rated NEMA 7 (and

listed for use in the area classifications shown) for “Class I Div. 1 Group D” and “Class I Div. 2 Group D” hazardous locations shown on the Drawings.

5. All enclosures shall be lockable.
6. Provide a flange mounted, or through the door, disconnect operating handle with mechanical interlock having a bypass that shall allow the enclosure door to open only when the circuit breaker or switch is in the OFF position.
7. The AFD shall have complete front accessibility with easily removable assemblies.

C. Cooling Fans

1. Fans shall be furnished for AFD’s, as required by the manufacturer, to provide air circulation and cooling. The fan shall be controlled by a thermostat and shall operate only when the drive is “ON” and for a cool-down period after the drive has stopped. Otherwise the fan shall not run when the drive is “OFF”. Louvers, if provided, shall have externally removable filters. The filter shall be metallic and washable.
2. Fan motors shall be protected by an input circuit breaker. Metal squirrel cage ball bearing, three phase fan motors with 10-year design life shall be used in the drive design. Plastic muffin fans are not acceptable. Fan power shall be obtained from a tap on the main control power transformer.
3. A “loss of cooling” fault shall be furnished. In the event of clogged filters or fan failure, the drive shall produce an alarm and then, in a predetermined time, shut down safely without electronic component failure.
4. Redundant fans shall be provided in the drive design as backup in the event of fan failure.

D. Internal Wiring

1. Wiring: Stranded copper, minimum size No. 14 AWG, with 600 Volt, 90 degree C, flame retardant, Type MTW thermoplastic insulation, NEMA Class II, Type B wiring. Line side power wiring shall be sized for the full rating or frame size of the connected device.
2. Identification: Numbered sleeve type wire markers at each termination point, color coding per NEMA standards and the NEC. Foreign voltage control wiring shall be yellow.
3. All wiring shall be tagged and coded with an identification number as shown on the Drawings. Coding shall be typed on a heat shrinkable tube applied to each end showing origination and destination of each wire. The marking shall be permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE, or equal.
4. All wiring shall be neatly bundled with ty-raps and supported to wire way supports. Control wiring shall be bundled separately from power wiring. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.

E. Field Installed Internal Wiring

1. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported so that circuit terminations are not stressed. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.
2. All field wiring shall be tagged and coded with an identification number. Coding shall be typed on a heat shrinkable tube applied to each end of the wire. The marking shall be a permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE, or equal
3. In general, all conduit entering or leaving equipment shall be stubbed up into the bottom of the enclosure directly below the area in which the conductors are to be terminated, or from the top if shown on the Drawings. Conduits shall not enter the side unless approved in writing by the OWNER/ENGINEER.

F. Signage

1. Provide 1 inch by 3 inch engraved unit nameplates of two ply laminated plastic, black face, white core, screw fastened to each door with 316 stainless steel screws. All component and control identification nameplates shall be engraved with the device name and number exactly as it appears on the Drawings and/or as approved by the OWNER/ENGINEER. For devices not shown on the single line drawing such as time delay relays, the names shall be as shown on the Control Schematic Drawings and/or as assigned by the OWNER/ENGINEER.

G. Control Power Transformers

1. Control power transformer ratios shall be provided where shown on the Drawings. Transformer shall be sized for all of the load, including space heaters, plus 25% spare capacity. Transformer mechanical ratings shall equal the short circuit rating of the circuit breaker or MCP.
2. Control power transformers shall be 120 volt grounded secondary. Primary side of the transformer shall be fused in both legs. One leg of the transformer secondary shall be solidly grounded while the other leg shall be fused.
3. All control power transformers shall have vacuum cast primary and secondary coils using epoxy resin.

H. Instrument Transformers

1. All instrument transformers shall be vacuum cast using polyurethane resin.
2. Current transformers shall be provided where shown on the Drawings. Transformer mechanical ratings shall equal the short circuit and momentary rating of the circuit breakers. Transformers, when mounted in the AFD, shall be rated for the full voltage of the equipment.
3. Voltage transformers shall be fixed type, with primary and secondary fuses, transformer mounted, with short circuit and momentary rating equal to the AFD controller.

I. Control Stations

1. Control stations shall be heavy duty type, with full size operators. Momentary contact stop buttons shall have a lockout latch that can be padlocked in the open position.

J. Pushbuttons, Indicating Lights and Selector Switches

1. Provide heavy-duty, 30mm, oiltight type pushbuttons, selector switches, indicating lights and stations, push-to-test, for these devices. Indicating lights shall be of the LED type.
2. Provide devices meeting the requirements of NEMA ICS 2, and having individual, extra large nameplates indicating their specific function. Provide pushbutton stations with laminated plastic nameplates indicating the drive they control, stainless steel screw attached. Provide contacts with NEMA designation rating A600. Install provisions for locking pushbuttons and selector switches in the OFF position wherever lockout provisions are indicated.

K. Control Relays

1. Control relays shall be 300 volt, industrial rated, plug-in socket type, housed in a transparent polycarbonate dust cover, designed in accordance with UL Standard 508 for motor controller duty. Continuous contact rating shall be 10 amperes resistive, ¼ HP at 120 VAC, operating temperature minus 10 to plus 55 degrees C. Provide spare N.O. & N.C. contacts. Relays shall be equipped with neon coil indicator light. Timing relays shall be 300 Volt, solid state type, with rotary switch to select the timing range. All relays provided in the equipment shall be NEMA rated. IEC rated relays are not acceptable.

L. Transient Voltage Surge Suppression (TVSS)

1. Where a Transient Voltage Surge Suppressor is shown on the Drawings, it shall meet the following specifications:
   a. Maximum Surge Current - 150kA per mode, 300kA per phase.
   b. UL Symmetrical Fault Current Withstand Rating – 200,000 Amps.
   c. Minimum Repetitive Surge Current capacity
      (i) 1.2x50µs, 20kV, 8x20µs, 10kA Category C3 – 20,000 Impulses.
      (ii) 500V, 2kA, 10x1000µs long duration – 5000 impulses.
   d. UL SVR Rating – 1500 L-G.
   e. MCOV – 170%
2. Connection to the AFD shall be with a surge rated disconnect, mounted integral to the AFD.
3. Noise attenuation shall not exceed 44db measured in accordance with the procedures outlined in accordance in NEMA LS 1 – 1992/MIL 220A.
4. Fusing shall be, a surge rated fuse, in combination with patented thermal fuse technology.

5. Monitoring devices shall include surge counter, indicating lights, audible alarm, Form C dry contacts @ 5 amps, 125V.

6. The TVSS shall have a warranty of not less than 10 years.]

M. Lightning Arresters and Surge Capacitors

1. Provide three valve type lightning arresters and surge capacitors ahead of the VFD controller where shown on the Drawings. Arresters and capacitors shall be factory installed.

2.04 ADJUSTABLE FREQUENCY DRIVES (AFD'S) FOR MOTORS 60 HP AND SMALLER

A. General

1. Each AFD shall be a 6 pulse, Pulse Width Modulated (PWM) design converting the utility input voltage and frequency to a variable voltage and frequency output via a two-step operation, designed for use with standard induction motors, constant or variable torque as required for the load application, with current limiting input fuses, incoming line reactors, circuit breaker disconnect, output contactor, control transformer overload relays and process signal follower card. Drives shall be UL listed. Adjustable frequency drives manufactured for HVAC applications are not acceptable. Adjustable Current Source AFD's are not acceptable. The output devices shall be Insulated Gate Bipolar Transistors (IGBT's). Bipolar Junction Transistors, GTO's or SCR's are not acceptable.

2. The AFD shall have an EMI/RFI filter as standard.

3. Each AFD shall consist of the following general components:

   a. Full wave diode rectifier to convert supply AC to a fixed DC voltage.

   b. DC link capacitors

   c. Insulated Gate Bipolar Transistor (IGBT) power section. The power section shall use vector dispersal pulse width modulated (PWM) control and soft switching IGBT's.

   d. Microprocessor based control and display section.

4. Each AFD shall, as a minimum, contain a 5% input line reactor, as standard.

5. The AFD shall be able to start into a spinning motor. The AFD shall be able to determine the motor speed in any direction and resume operation without tripping. If the motor is spinning in the reverse direction, the AFD shall start into the motor in the reverse direction, bring the motor to a controlled stop, and then accelerate the motor to the preset speed.

6. The Drive shall maintain set frequency regardless of load fluctuations.

7. The Drive shall be able to operate after a voltage dip below 175 VAC on 230 VAC input power and 310 VAC on 460 VAC input power for 15 milliseconds at 85% full load current without any disturbances in output power delivered to the load. If power exceeds this level, six (6) different modes or active and inactive restart modes shall be available. The decrease in motor speed shall be adjustable in the event of a momentary power outage.

8. The Drive shall have a programmable start frequency, adjustable from 0.1 to 60 hertz, with a 1 hertz resolution (refer to 7.9), with a holding time adjustable from 0.1 to 10 seconds.
9. The Drive shall have IGBT soft switching and a low noise control power supply system to reduce the noise from the drive.
10. The Drive shall have a frequency bias (starting frequency) function programmable from -120 to +120 Hz of maximum frequency, with 0.1 Hz resolution.
11. Drive frequency gain shall be programmable from 0-200%, with 0.1% resolution.
12. The Drive shall be capable of motor slowdown or stop by selectable regenerative (to the DC link) dynamic braking while following one of the four selectable deceleration ramps, and control the braking torque by setting it's value from 0, 20 to 150%, 999 (no limit) of Drive rating. It shall also be capable of changing the rate of deceleration automatically by stopping the braking action long enough to avoid Drive over-voltage trip.
13. The Drive shall be capable of starting into a rotating load (forward or reverse) and shall smoothly accelerate or decelerate to the set point without experiencing component damage.
14. The Drive shall be capable of stopping by selectable DC injection braking. It shall be adjustable from 0 to 100% braking level and have a programmable starting frequency for DC braking (0.2-60 hertz) and programmable braking time (0.1 to 30.0 seconds).
15. The Drive shall have a start Frequency Setting that incorporates a Holding Time at the Frequency Setting, adjustable up to 10 seconds in duration.
16. The Drive shall provide at least three selectable skip frequencies with programmable band widths, adjustable 0 to 30 Hz , which shall not allow operation at or near mechanical resonance speeds.
17. The Drive shall provide selectable slip compensation, which shall sense output current and adjust output
18. The Drive shall have Droop operation, balancing drooping characteristics to speed and load variations. This function shall be adjustable from –9.9 to 0.0 Hz.
19. The Drive shall have a selectable Torque Limiting function for both motoring and braking that shall sense an overload condition and shall reduce frequency and current temporarily until the load reaches acceptable levels. If the overload condition is not settled in the proper amount of time, the Drive shall trip on overload. The Torque Limiting shall be programmable from 20-150% of Drive rated motor torque (30 HP and below) and from 20-150% of Drive rated motor torque (40 HP and above), with 1% resolution.
20. The Drive shall have a selectable electronic inverse time thermal overload function as required by NEC and UL Standard 991 for an AC Induction Motor (Refer to applicable codes for specific installation requirements). The overload shall be programmable from 20 - 135% of Drive rated current.
21. The Drive shall have an over-voltage protection function that operates if supply voltage rises above rated value or by motor's regeneration.

22. The Drive shall treat short circuits in either the output load or the output module as an over-current.

23. If the Drive heat sink temperature exceeds approximately 100oC, the Drive shall shut down on over temperature fault.

24. The Drive shall provide output ground fault protection.

B. Control and Monitor Interface

1. The Control shall have a graphic back-lit liquid crystal display (LCD) which can be configured to display frequency, current, function code set points, or drive status and fault codes. It shall display lines with characters of text, providing display at a minimum of:

   a. Monitor

   b. Operate

   c. Parameter setup

   d. Actual parameter values

   e. Active faults

   f. Fault history

   g. LCD adjustments

2. Setups and Adjustments

   a. Start command from keypad, remote or communications port

   b. Speed command from keypad, remote or communications port

   c. Motor direction selection

   d. Maximum and minimum speed limits

   e. Acceleration and deceleration times, two settable ranges

   f. Critical (skip) frequency avoidance

   g. Torque limit

   h. Multiple attempt restart function

   i. Multiple preset speeds adjustment

   j. Catch a spinning motor start or normal start selection

   k. Programmable analog output

   l. DC brake current magnitude and time

   m. PID process controller

3. System Interfaces

   a. Remote manual/auto

   b. Remote start/stop

   c. Remote forward/reverse

d. Remote preset speeds

e. Remote external trip

f. Remote fault reset

g. Process control speed reference interface, 4-20mA DC

h. Potentiometer and 1-10VDC speed reference interface

i. RS-232 programming and operation interface port

j. Two RS-485 programming and operation interface ports

C. Outputs – A minimum of two (2) discrete programmable digital outputs, one (1) programmable open collector output, and one (1) programmable analog output shall be provided, with the following available at minimum:

1. Programmable relay outputs with one (1) set of Form C contacts for each, selectable with the following available at minimum:

   a. Fault

   b. Run

   c. Ready

   d. Reversed

   e. Jogging

   f. At speed

   g. Torque Limit Supervision

   h. Motor rotation direction opposite of commanded

   i. Over-temperature

2. Programmable open collector output with available 24VDC power supply and selectable with the following available at minimum:

   a. Fault

   b. Run

   c. Ready

   d. Reversed

   e. Jogging

   f. At speed

   g. Torque Limit Supervision

   h. Motor rotation direction opposite of commanded

   i. Over-temperature

3. Programmable analog output signal, selectable with the following available at minimum:

   a. Motor current

b. Output frequency

c. Frequency reference

d. Motor speed

e. Motor torque

f. Motor power

g. Motor voltage

h. DC-bus voltage

i. AI1 (Analog Input 1)

j. AI2 (Analog Input 2)

D. Communications

1. One front RS232 port for set point programming.

2. Two independent rear RS485 ports, each daisy chained between systems, where shown on the Drawings.

3. Ethernet port.

4. Communication protocols.

a. Modbus RTU

b. Ethernet/IP

2.05 ADJUSTABLE FREQUENCY DRIVES (AFD'S) FOR MOTORS LARGER THAN 60 HP

A. General

1. Each drive shall be an 18-pulse, IGBT based sinusoidal PWM type AC Drive capable of operating a squirrel cage induction motor with a full load current equal to or less than the continuous output of the Drive. The drive panel shall incorporate a phase shift transformer and an 18 pulse converter. Regulator technology shall be software configurable to either V/Hz (single or multi motor) mode or Sensorless Dynamic Torque Vector mode (single motor). Full, closed loop flux vector control shall be available for constant torque applications. In V/Hz mode at base speed (60 hertz) and below, the Drive shall operate in constant volts per hertz mode. Above base speed (60 hertz), the Drive may selectively operate in either a constant volt per hertz mode or a constant voltage extended frequency mode.

2. The AFD shall be able to start into a spinning motor. The AFD shall be able to determine the motor speed in any direction and resume operation without tripping. If the motor is spinning in the reverse direction, the AFD shall start into the motor in the reverse direction, bring the motor to a controlled stop, and then accelerate the motor to the preset speed.

3. The Drive shall maintain set frequency regardless of load fluctuations.

4. The Drive shall be able to operate after a voltage dip below 175 VAC on 230 VAC input power and 310 VAC on 460 VAC input power for 15 milliseconds at 85% full

load current without any disturbances in output power delivered to the load. If power exceeds this level, six (6) different modes or active and inactive restart modes shall be available. The decrease in motor speed shall be adjustable in the event of a momentary power outage.

5. The Drive shall have a programmable start frequency, adjustable from 0.1 to 60 hertz, with a 1 hertz resolution (refer to 7.9), with a holding time adjustable from 0.1 to 10 seconds.
6. The Drive shall have IGBT soft switching and a low noise control power supply system to reduce the noise from the drive.
7. The Drive shall have a frequency bias (starting frequency) function programmable from -120 to +120 Hz of maximum frequency, with 0.1 Hz resolution.
8. Drive frequency gain shall be programmable from 0-200%, with 0.1% resolution.
9. The Drive shall be capable of motor slowdown or stop by selectable regenerative (to the DC link) dynamic braking while following one of the four selectable deceleration ramps, and control the braking torque by setting it's value from 0, 20 to 150%, 999 (no limit) of Drive rating. It shall also be capable of changing the rate of deceleration automatically by stopping the braking action long enough to avoid Drive over-voltage trip.
10. The Drive shall be capable of starting into a rotating load (forward or reverse) and shall smoothly accelerate or decelerate to the set point without experiencing component damage.
11. The Drive shall be capable of stopping by selectable DC injection braking. It shall be adjustable from 0 to 100% braking level and have a programmable starting frequency for DC braking (0.2-60 hertz) and programmable braking time (0.1 to 30.0 seconds).
12. The Drive shall have a start Frequency Setting that incorporates a Holding Time at the Frequency Setting, adjustable up to 10 seconds in duration.
13. The Drive shall provide at least three selectable skip frequencies with programmable band widths, adjustable 0 to 30 Hz, which shall not allow operation at or near mechanical resonance speeds.
14. The Drive shall provide selectable slip compensation, which shall sense output current and adjust output
15. The Drive shall have Droop operation, balancing drooping characteristics to speed and load variations. This function shall be adjustable from –9.9 to 0.0 Hz.
16. The Drive shall have a selectable Torque Limiting function for both motoring and braking that shall sense an overload condition and shall reduce frequency and current temporarily until the load reaches acceptable levels. If the overload condition is not settled in the proper amount of time, the Drive shall trip on overload. The Torque Limiting shall be programmable from 20-150% of Drive rated motor torque (30 HP and below) and from 20-150% of Drive rated motor torque (40 HP and above), with 1% resolution.
17. The Drive shall have a selectable electronic inverse time thermal overload function as required by NEC and UL Standard 991 for an AC Induction Motor

(Refer to applicable codes for specific installation requirements). The overload shall be programmable from 20 - 135% of Drive rated current.

18. The Drive shall have an over-voltage protection function that operates if supply voltage rises above rated value or by motor's regeneration.
19. The Drive shall treat short circuits in either the output load or the output module as an over-current.
20. If the Drive heat sink temperature exceeds approximately 100oC, the Drive shall shut down on over temperature fault.
21. The Drive shall provide output ground fault protection.

B. Control and Monitor Interface

1. The Control shall have a graphic back-lit liquid crystal display (LCD) which can be configured to display frequency, current, function code set points, or drive status and fault codes. It shall display lines with characters of text, providing display at a minimum of:
   a. Monitor
   b. Operate
   c. Parameter setup
   d. Actual parameter values
   e. Active faults
   f. Fault history
   g. LCD adjustments
2. Setups and Adjustments
   a. Start command from keypad, remote or communications port
   b. Speed command from keypad, remote or communications port
   c. Motor direction selection
   d. Maximum and minimum speed limits
   e. Acceleration and deceleration times, two settable ranges
   f. Critical (skip) frequency avoidance
   g. Torque limit
   h. Multiple attempt restart function
   i. Multiple preset speeds adjustment
   j. Catch a spinning motor start or normal start selection
   k. Programmable analog output
   l. DC brake current magnitude and time
   m. PID process controller

3. System Interfaces
    a. Remote manual/auto
    b. Remote start/stop
    c. Remote forward/reverse
    d. Remote preset speeds
    e. Remote external trip
    f. Remote fault reset
    g. Process control speed reference interface, 4-20mA DC
    h. Potentiometer and 1-10VDC speed reference interface
    i. RS-232 programming and operation interface port
    j. Two RS-485 programming and operation interface ports

C. Outputs – A minimum of two (2) discrete programmable digital outputs, one (1) programmable open collector output, and one (1) programmable analog output shall be provided, with the following available at minimum:
    1. Programmable relay outputs with one (1) set of Form C contacts for each, selectable with the following available at minimum:
        a. Fault
        b. Run
        c. Ready
        d. Reversed
        e. Jogging
        f. At speed
        g. Torque Limit Supervision
        h. Motor rotation direction opposite of commanded
        i. Over-temperature
    2. Programmable open collector output with available 24VDC power supply and selectable with the following available at minimum:
        a. Fault
        b. Run
        c. Ready
        d. Reversed
        e. Jogging
        f. At speed
        g. Torque Limit Supervision

h. Motor rotation direction opposite of commanded

i. Over-temperature

3. Programmable analog output signal, selectable with the following available at minimum:

a. Motor current

b. Output frequency

c. Frequency reference

d. Motor speed

e. Motor torque

f. Motor power

g. Motor voltage

h. DC-bus voltage

i. AI1 (Analog Input 1)

j. AI2 (Analog Input 2)

D. Communications

1. One front RS232 port for set point programming.

2. Two independent rear RS485 ports, each daisy chained between systems, where shown on the Drawings.

3. Fiber Optic port.

4. Ethernet port

5. One USB port.

6. Communication protocols.

a. Modbus RTU

b. Profibus

c. Device Net

2.06 METERING AND PROTECTIVE RELAYS

A. A 100VA minimum UPS shall be provided, powered from the control power transformer to provide control power to the feeder management relays and power quality meters.

B. Furnish where shown on the Drawings, a Phase Protective Relay (PPR), as shown on the Drawings, and as specified in Section 26 09 13 - Power Metering and Protective Relays.

C. Furnish where shown on the Drawings, a Motor Protection System (MP3), as shown on the Drawings, and as specified in Section 26 09 13 - Power Metering and Protective Relays.

D. Furnish where shown on the Drawings, a Remote RTD Metering and Protection (RRTD), as shown on the Drawings, and as specified in Section 26 09 13 - Power Metering and Protective Relays.

E. [Furnish where shown on the Drawings, a Motor Protection System (MP4), as shown on the Drawings, and as specified in Section 26 09 13 - Power Metering and Protective Relays.

F. Furnish where shown on the Drawings, a Power Quality Meter (PM1), for each Main or Feeder Breaker, as shown on the Drawings and as specified in Section 26 09 13 - Power Metering and Protective Relays.

2.07 SPARE PARTS

A. Provide the following spare parts:

1. 3 – Control fuses of type used.
2. One quart of touch-up paint.

B. Spare parts shall be boxed or packaged for long term storage and clearly identified on the exterior of package. Identify each item with manufacturers name, description and part number

2.08 FACTORY TESTING

A. The AFD’s shall be completely assembled, wired, and adjusted at the factory and shall be given the manufacturer’s routine shop tests and any other additional operational test to insure the workability and reliable operation of the equipment.

B. Prior to factory testing, the manufacturer shall check to see that all selections and settings required by the Power System Study Engineer have been performed.

C. Factory test equipment and test methods shall conform to the latest applicable requirements of ANSI, IEEE, UL, and NEMA standards.

D. The operational test shall include the proper connection of supply and control voltage and, as far as practical, a mockup of simulated control signals and control devices shall be fed into the boards to check for proper operation.

PART 3 EXECUTION

3.01 MANUFACTURER’S REPRESENTATIVE

A. Provide the services of a qualified factory-trained manufacturer's field engineer to assist the CONTRACTOR in installation and start-up of each type of the equipment specified below for a period of not less than 2 working days, with not less than one working day per AFD. The manufacturer's field engineer shall provide technical direction and assistance to the CONTRACTOR in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.

3.02 INSTALLER'S QUALIFICATIONS

A. Installer shall be specialized in installing low voltage adjustable frequency drives with minimum 5 years documented experience. Experience documentation shall be submitted for approval prior to beginning work on this project.

3.03 METERING AND PROTECTIVE RELAYS INSTALLATION

A. The CONTRACTOR shall provide the services of a Multilin factory trained CONTRACTOR to make changes to the existing plant wide Multilin based HMI system, as specified in Section 26 05 00 - Electrical – General Provisions.

3.04 EXAMINATION

A. Examine installation area to assure there is enough clearance to install the equipment.

B. Housekeeping pads shall be included for the floor mounted motor controllers as detailed on the Drawings with the exception of motor controllers which are to be installed adjacent to an existing unit. Housekeeping pads for these (if used) should match the existing installation.

C. Check concrete pads and base plates for uniformity and level surface.

D. Verify that the equipment is ready to install.

E. Verify field measurements are as instructed by manufacturer.

3.05 INSTALLATION

A. The CONTRACTOR shall install all equipment per the manufacturer's recommendations and Contract Drawings.

B. Installed required safety labels.

3.06 FIELD QUALITY CONTROL

A. Inspect installed equipment for anchoring, alignment, grounding and physical damage.

B. Check tightness of all accessible electrical connections. Minimum acceptable values are specified in manufacturer's instructions.

3.07 FIELD ADJUSTING

A. Adjust all circuit breakers, switches, access doors, operating handles for free mechanical and electrical operation as described in manufacturer's instructions.

B. The breaker protective devices shall be set in the field by a qualified representative of the manufacturer, retained by the CONTRACTOR, in accordance with settings designated in a coordinated study of the system as required in Section 26 05 73 - Power System Study.

3.08 FIELD TESTING

A. The AFD manufacturer’s field engineer shall perform all electrical field tests recommended by the manufacturer, and make all control adjustments required for the individual application of the drive.

3.09 CLEANING

A. Remove all rubbish and debris from inside and around the motor controllers. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint free rags. Do not use compressed air.

3.10 EQUIPMENT PROTECTION AND RESTORATION

A. Touch-up and restore damaged surfaces to factory finish, as approved by the manufacturer. If the damaged surface cannot be returned to factory specification, the surface shall be replaced.

3.11 MANUFACTURER’S CERTIFICATION

A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted, including all settings designated in the Power System Study, and tested in accordance with the manufacturer's recommendations.

B. The CONTRACTOR shall provide three (3) copies of the manufacturer's representative's certification.

3.12 TRAINING

A. Provide manufacturer's services for training of plant personnel in operation and maintenance of the adjustable frequency drives furnished under this Section.

B. The training for each type of equipment shall be for a period of not less than one (1) eight hour day.

C. The cost of training program to be conducted with OWNER's personnel shall be included in the Contract Price. The training and instruction, insofar as practicable, shall be directly related to the system being supplied.

D. Provide detailed Instillation and O&M manuals to supplement the training course. The manuals shall include specific details of equipment supplied and operations specific to the project.

E. The training session shall be conducted by a manufacturer's qualified representative. Training program shall include instructions on the assembly, motor starters, protective devices, metering, and other major components.

F. The OWNER reserves the right to videotape the training sessions for the OWNER’s use.

END OF SECTION

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SECTION 26 29 86 MECHANICAL EQUIPMENT MANUFACTURER'S PROVIDED CONTROL PANELS (MEM'S)

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install functional control panels to manually or automatically operate control systems as specified in the detailed requirements of this Section and as shown on the Drawings and described in the Divisions 43 and 46 equipment specifications.

B. **All submittals for equipment specified under this section shall be submitted as a part of the mechanical equipment manufacturer's submittal under Divisions 43 and 46.**

1.02 RELATED WORK

A. Section 26 05 00 - Electrical – General Provisions

B. Section 26 05 73 - Power System Study

C. Section 26 05 90 - Cast-In-Place Concrete for Electrical Applications

D. Section 26 09 13 - Power Metering and Protective Relays

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Division 1, Divisions 43 and 46 and as specified herein.

B. Submittals shall also contain information on related equipment to be furnished under this Specification but described in the related sections listed in the Related Work paragraph above. Incomplete submittals not containing the required information on the related equipment will be returned unreviewed.

C. The mechanical equipment manufacturer shall create all equipment shop drawings, including all wiring diagrams, in the manufacturer's Engineering department. All equipment shop drawings shall bear the mechanical equipment manufacturer's logo, drawing file numbers, and shall be maintained on file in the mechanical equipment manufacturer's archive file system.

D. Submit to the OWNER/ENGINEER, shop drawings and product data, for the following:

1. The mechanical equipment manufacturer shall use in his design, to the maximum extent possible, devices for which he maintains a stock at his factory. Provide a list of all devices to be used in the control panel, with his factory part number for each part. Product data sheets and catalog numbers for overcurrent protective devices, motor starters, control relays, control stations, meters, pilot lights, etc. The mechanical equipment manufacturer's part number name shall be clearly visible on each cut sheet submitted. List all options, trip adjustments and accessories furnished specifically for this project.

2. The mechanical equipment manufacturer shall use his control systems engineering department to produce custom unit elementary drawings. Drawings shall be on the mechanical equipment manufacturer's drawing sheets and shall include all schematics for control logic as described in the individual equipment specifications in Divisions 43 and 46, and any associated control schematics shown on the ENGINEER's Drawings for this project. Show interwiring and interlocking between components and to remotely mounted devices. Include and identify all connecting equipment and remote devices on the schematics. The notation "Remote Device" will not be acceptable. Show wire and terminal numbers. Indicate special identifications for devices as required by the mechanical equipment manufacturer or as may be shown on the Drawings.
3. Equipment outlines drawings showing elevation, plan and interior views, front panel arrangement, dimensions, weight, shipping splits, conduit entrances and anchor bolt pattern. Indicate all options, special features, ratings and deviations from this Section.
4. Power and control schematics including external connections. Show wire and terminal numbers and color-coding.
5. Instruction and replacement parts books.
6. As-built final drawings.
7. Documentation that the panel assembly facility is a UL-certified facility.
8. Facsimile of the UL label that is to be applied to the completed panel.
9. Furnish complete Bill of Materials indicating manufacturer's name and part numbers.
10. Manufacturer's cut sheets for every component used in the panel assembly adequately marked to show the items being included. The manufacturer's name shall be clearly visible on the each cut sheet submitted.
11. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
12. Major component ratings including:
    a. Voltage
    b. Continuous current
    c. Interrupting ratings
13. Cable terminal sizes.
14. Instruction and renewal parts books.

E. Factory Tests. Submittals shall be made for factory tests specified herein.

F. Field Test Reports. Submittals shall be made for field tests specified herein.

G. Operation and Maintenance Manuals.

1. Operation and maintenance manuals shall include the following information:

   a. Manufacturer's contact address and telephone number for parts and service.

   b. Instruction books and/or leaflets

   c. Recommended renewal parts list

   d. Record Documents for the information required by the Submittals paragraph above.

1.04 REFERENCE CODES AND STANDARDS

A. All products and components shown on the Drawings and listed in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NEMA Standard ICS 2 – 2000 Industrial Control and Systems
2. NFPA 70 – National Electrical Code (NEC)
3. NFPA 70E – Standard For Electrical Safety in the Workplace
4. UL 508/508A – Industrial Control Enclosures
5. UL 1449, UL 1283 – Standard for Safety for TVSS
6. ANSI/IEEE C62.41, C64.45 – Guide in Surge Environment in 600V Power Circuits
7. NEMA LS-1 – Low Voltage Surge Protective Devices
8. NEC Art. 285 – Transient Voltage Surge Suppressors

B. All equipment specified in this section of the Specifications shall bear the appropriate label of Underwriters Laboratories.

1.05 QUALITY ASSURANCE

A. The manufacturer of this equipment shall have produced similar control equipment for a minimum period of five (5) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The control panel shall be assembled in the mechanical equipment manufacturer's facility. The facility shall be experienced in the assembled of control panels for wastewater and water treatment systems. A submittal of the documentation, that certifies the panel fabrication facility is a UL-certified facility, is required.

C. Equipment components and devices shall be UL labeled wherever UL standards exist for such equipment. The completed control panel shall be UL Labeled in accordance with UL 508 and 508A and other applicable UL standards. The panel shall also be UL labeled for the environment in which it is to be placed. A UL label shall be affixed to the inside of the external door by the panel fabrication assembly. Submit a facsimile of the UL label in the submittal information.

D. Equipment submitted shall fit within the space shown on the Drawings. Equipment which does not fit within the space is not acceptable.

1.06 DELIVERY STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. Two (2) copies of these instructions shall be included with the equipment at time of shipment, and shall be made available to the CONTRACTOR and OWNER/ENGINEER.

B. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.

C. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR’s choice and at the CONTRACTOR’s expense, until such time that the site is ready for permanent installation of the equipment.

D. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for the same length of time as the associated mechanical equipment, but not less than 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the Manufacturer at no expense to the OWNER.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. The manufacturer of the control panel shall be the manufacturer of the mechanical equipment being controlled. The manufacturer shall assume complete responsibility for operation of the panel as specified and compability between the control panel and the equipment which the manufacturer is supplying

2.02 RATINGS

A. The service voltage shall be as specified and as shown on the Drawings. The overall short circuit withstand and interrupting rating of the equipment and devices shall be equal to or greater than the overall short circuit withstand and interrupting rating of the feeder device immediately upstream of the Control Panel, but not less than 22,000

amperes RMS symmetrical at 480 Volts, including all circuit breakers and combination motor starters. Systems of motor controllers employing series connected ratings for main and feeder devices shall not be used. Motor starter units shall be tested and UL labeled for the specified short circuit duty in combination with the motor branch circuit protective device.

B. There shall be selective device coordination between the Main Breaker, Feeder Breakers and control circuit protective devices. When using a circuit breaker or fuses as a main protective device, the instantaneous trip levels of the main protective device must be higher than the available fault current to the control panel. If fuses are utilized in the control panel design, the protective devices for 3 phase loads shall contain single phase protection of such equipment. If a hard fault occurs in the circuit of one load of a design with a backup load, the feeder protective device should not remove both loads from the control system.

C. Use ground fault sensing on grounded wye systems.

D. The complete control panel assembly shall be UL certified or carry a UL listing for "Industrial Control Panels".

E. The control panel shall meet all applicable requirements of the National Electrical Code.

F. The control panel enclosure shall be NEMA rated as indicated in Section 26 05 00 - Electrical – General Provisions of the Electrical Specifications.

G. Motor controllers, including associated devices, shall be designed for continuous operation at rated current in a 40 degree C ambient temperature.

H. For additional ratings and construction notes, refer to the mechanical equipment specifications and the Drawings.

2.03 CONSTRUCTION

A. Construction

1. The mechanical equipment manufacturer may use his standard equipment and components which he normally factory stocks, in the design of the control panel. However, for equipment used in the control panel, and not regularly stocked in the mechanical equipment manufacturer’s factory for immediate service replacement, the components supplied, shall be equal in electrical standards and construction to those as specified in the following paragraphs.

B. Enclosure

1. Enclosures shall be in accordance with the Area Classification and Enclosure Types as specified in Section 26 05 00 - Electrical – General Provisions.

2. NEMA 1 enclosures shall be of painted or galvanized steel for wall mounting, or have mounting feet where self-standing. Enclosure panels shall have continuously

welded seams. Welds shall be ground smooth. Enclosures shall be flanged and shall not have holes or knockouts. Enclosures shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. All enclosures shall have hinged gasketed doors with 3-point latch. Enclosures shall be furnished with terminal mounting straps and brackets. Panels shall be furnished with hinged doors, terminal mounting straps and brackets. Enclosures shall be Concept Series as manufactured by Hoffman Engineering Co. or equal.

3. NEMA 4X enclosures shall be Type 316 stainless steel for wall mounting, or have mounting feet where self-standing. Enclosures shall have continuously welded seams. Welds shall be ground smooth. Enclosures shall be flanged and shall not have holes or knockouts. Enclosures shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. All enclosures shall have hinged gasketed doors with a 3-point latch (single operator). Panels shall be furnished with terminal mounting straps and brackets. Enclosures shall be furnished with hinged doors, terminal mounting straps and brackets. Enclosures shall be Concept Series as manufactured by Hoffman Engineering Co. or equal.
4. All enclosures shall be lockable, and keyed alike.
5. The enclosure shall incorporate a removable back panel on which control components shall be mounted. Back panel shall be secured to the enclosure with collar studs. The enclosure door shall be interlocked with the main circuit breaker by a door mounted operating mechanism. Back panel shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any components.
6. All panels installed outdoors shall have a factory applied, suitable primer and final coat of weather-proof white paint.
7. The enclosure outer door shall have a rear mounted pocket, containing laminated copies of the Control schematics.
8. Overload tables shall be laminated and adhered to the inside of the door.
9. All operating control devices and instruments shall be securely mounted on the panel door. All controls shall be clearly labeled to indicate function and shall be NEMA rated as indicated on the Drawings, and in accordance with the electrical area classification specified in Section 26 05 00. Auxiliary contacts shall be provided for remote run indication and indication of each status and alarm condition. Additional controls shall be provided as specified herein and as required by the detailed mechanical and electrical equipment requirements.
    a. Indicator lamps shall be 30 mm heavy duty, LED oiltight, with nameplates. Lens color shall be green for OFF, red for ON and amber for FAIL or ALARM. For all control applications, except NEMA 7, indicator lamps shall incorporate a push-to-test feature. A separate single lamp test push-button shall be incorporated on NEMA 7 control panels.
    b. Mode selector switches (HAND-OFF-AUTO, LOCAL-OFF-REMOTE, PUMP SELECTOR, LEAD-LAG, etc) shall be heavy duty, 30 mm, oiltight, as shown on the Drawings, with nameplates. Units shall have the number of positions and contact arrangements, as required. Each HOA, LOR switch shall have an extra dry contact for remote monitoring.

c. Push-button, shall be heavy-duty, 30 mm, oiltight, with momentary or maintained contacts as required by the Drawings, with nameplates. Button color shall be red for EMERGENCY STOP or START and green for STOP. Contact arrangement shall be as required.

d. A six digit, non-resettable elapsed time meter shall be connected to each motor starter. Meter shall be Bulletin 705, HK Series by Eagle Signal or equal.

e. A failure alarm with horn and beacon light shall be provided when required or specified. Silence and reset buttons shall be furnished. Alarm horn and beacon shall be by Federal Signal; Crouse-Hinds (NEMA 7) or equal.

10. Enclosure Condensate Heaters

a. A self-contained enclosure condensation heater with thermostat and fan shall be mounted inside the control panel, if panel is mounted outdoors or in a non-air-conditioned space.

(i) Enclosure heaters shall be energized from 120 volt, single-phase power supply and sized to prevent condensation within the enclosure.

(ii) Locate enclosure heaters to avoid overheating electronic hardware or producing large temperature fluctuations on the hardware.

(iii) Enclosure heaters shall have an internal fan for heat distribution and shall be controlled with adjustable thermostats. The thermostat shall have an adjustment range of 40 degrees Fahrenheit to 90 degrees Fahrenheit. Provide a circuit breaker or fused disconnect switch within the enclosure.

(iv) Enclosure heaters shall be Hoffman type DAH or equal.

b. Strip heaters may be provided if they are 240 volt rated, powered at 120 volts AC and do not have a surface temperature higher than 60°C. Strip heaters and thermostats shall be as manufactured by Chromolox or equal.

(i) Strip heaters shall be Chromalox, Type OT, 1.5-in wide, 240 Volts, single phase, 150 watts, energized at 120 volts, with rust resisting iron sheath, Catalog No. OT-715, Product Code No. 129314. Provide sufficient wattage in heaters to prevent condensation should the interior temperature of the enclosure drop below the dew point.

(ii) A control thermostat mounted inside the control Panel shall be Chromalox, Type WR, single stage, Catalog No. WR-80, Product Code No.263177.

(iii) The strip heater terminals shall be guarded by a protective terminal cover.

(iv) High temperature connecting lead wire shall be used between the thermostat and the heater terminals. Wire shall be No. 12 AWG stranded nickel-plated copper with Teflon glass insulation and shall be the product of Chromalox, Catalog No. 6-CFI-12, Product Code No. 263783.

11. NEMA 4X Enclosure Air Conditioner

a. NEMA 4X enclosures containing electronic devices or electrical equipment shall have air conditioners, with foam insulation, that will maintain the internal

temperature at or below the equipment rating without violating the NEMA 4X rating of the enclosure.

b. The manufacturer shall provide panel internal heat rise calculations to show that the panel internal temperatures will be maintained below the maximum operating temperatures of the panel components.

(i) For enclosures mounted indoors in non-air-conditioned spaces, include an ambient air temperature of 40 degree C and a humidity of 100% non-condensing.

(ii) For enclosures mounted in direct sunlight add the appropriate solar heat gain component to the calculation, and raise the ambient temperature to 45 degrees C.

(iii) The calculation shall show all the internal and external heat gain loads, the expected internal temperature rise in degrees C above the specified ambient without the air conditioner. Provide a calculation showing the expected temperature rise in degrees C above the specified ambient with the air conditioner running.

c. The air conditioner shall have the following features:

(i) Use CFC-free R134a refrigerant.

(ii) Have fully gasketed flanges on all four mounting edges for a watertight seal that maintains NEMA 4X rating of the panel.

(iii) Thermostatic low temperature control to provide energy efficient operation and prevents over-cooling.

(iv) EMI/RFI suppressor to minimize transient spikes during compressor on/off cycling.

(v) Separated blower-driven evaporator and condenser air systems for closed loop cooling.

(vi) UL listed.

(vii) Stainless steel enclosure.

(viii) Internal corrosion resistant coating and/or galvanized steel components.

(ix) Low ambient kit.

(x) Short cycle protector.

(xi) Provide an air conditioner manufactured by Circle AW or equal.

12. Enclosure Fans

a. Fans shall be furnished for soft start starters and AFD’s, as required by the manufacturer, to provide air circulation and cooling. . Fans shall be controlled by a temperature switch. The fan shall operate only when the drive is “ON” and for a cool-down period after the drive has stopped Otherwise the fan shall not run when the drive is “OFF”. Louvers, if provided, shall have externally removable filters. The filter shall be metallic and washable.

b. Fan motors shall be protected by an input circuit breaker. Metal squirrel cage ball bearing, three phase fan motors with 10-year design life shall be used in the drive design. Plastic muffin fans are not acceptable. Fan power shall be obtained from a tap on the main control power transformer.

c. A “loss of cooling” fault shall be furnished. In the event of clogged filters or fan failure, the drive shall produce an alarm and then, in a predetermined time, be shut down safely without electronic component failure by the temperature switch.

d. Redundant fans shall be provided in the drive design as backup in the event of fan failure.

13. Corrosion Protection

a. Provide corrosion protection in each control panel with a corrosion-Inhibiting vapor capsule as manufactured by Northern Instruments; Model Zerust VC, or Hoffman Engineering; Model A-HCI.

C. Internal Wiring

1. Power and control wiring shall be stranded copper, minimum size No. 16 AWG, with 600 Volt, 90 degree C, flame retardant, Type MTW thermoplastic insulation. Line side power wiring shall be sized for the full rating or frame size of the connected device, and as shown on the Drawings.

2. Analog signal wires shall be 300 Volt Class, insulated stranded tinned copper, twisted shielded #16 AWG pair.

3. All interconnecting wires between panel mounted equipment and external equipment shall be terminated at numbered terminal blocks. Field wiring shall not be terminated directly on any panel-mounted device.

4. All wiring shall be tagged and coded with an identification number as shown on the Drawings. Coding shall be typed on a heat shrinkable tube applied to each end showing origination and destination of each wire. The marking shall be permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE, or equal.

5. All wiring shall be enclosed in PVC wire trough with slotted side openings and removable cover. Plan wire routing such that no low twisted shielded pair cable conducting analog 4-20 mA signals or low voltage analog signals are routed in the same wire trough as conductors carrying discrete signals or power.

D. Field Installed Internal Wiring

1. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported so that circuit terminations are not stressed. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.

2. All field wiring shall be tagged and coded with an identification number. Coding shall be typed on a heat shrinkable tube applied to each end of the wire. The marking shall be a permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE, or equal

3. In general, all conduit entering or leaving equipment shall be stubbed up into the bottom of the enclosure directly below the area in which the conductors are to be terminated, or from the top if shown on the Drawings. Conduits shall not enter the side unless approved in writing by the OWNER/ENGINEER.

E. Terminal Blocks

1. Terminal blocks shall be DIN-rail-mounted one-piece molded plastic blocks with tubular-clamp-screw type and end barriers. Terminal blocks shall be rated for 600 volts except for control and instrumentation circuits, or 4-20 mA analog signal conductors.
2. Provide 600 volt rated terminal blocks for any conductor carrying any voltage over 120 volts to ground.
3. Provide 600 volt rated strap screw terminal blocks for any power conductors carrying over 20 amps, at any voltage. Terminals shall be double sided and supplied with removable covers to prevent accidental contact with live circuits.
4. Power conductors carrying over 20 amps, at any voltage shall be terminated to strap-screw type terminal blocks with crimp type, pre-insulated, ring-tongue lugs. Lugs shall be of the appropriate size for the terminal block screws and for the number and size of the wires terminated. Do not terminate more than one conductor in any lug, and do not land more than two conductors under any strap-screw terminal point.
5. Terminals shall have permanent, legible identification, clearly visible with the protective cover removed. Each terminal block shall have 20 percent spare terminals, but not less than two spare terminals.
6. Do not land more than one conductor per terminal point. Use the manufacturer's provided bridge connectors to interconnect terminal blocks terminating common or ground conductors.
7. Twisted shielded pair or triad cables shall have each individual conductor and shield drain wire landed on individual terminal blocks. Use the manufacturer's provided bridge connectors to interconnect terminal blocks terminating the shield drain wire conductors.
8. Control circuits, 120 volts and below, and 4-20 mA analog signal conductors shall be terminated with manufacturer's recommended ferrules. Ferrules shall be provided with plastic sleeves.
9. Provide an AC ground bar bonded to the panel enclosure (if metal) with 20 percent spare terminals.
10. Provided ground terminal blocks for each twisted-shielded pair drain wire.

F. Nameplates

1. Provide 2-in by 5-in, nominal, engraved lamicoid master nameplate on the control panel fastened with stainless steel screws. Nameplate shall be black with white core, 3/8-in high lettering and shall indicate equipment designation as shown on the Drawing. Screw holes shall be sealed such that the NEMA rating of the enclosure is maintained.

2. Provide 1 inch by 3 inch engraved unit nameplates of two ply laminated plastic, black face, white core, screw fastened to each door with 316 stainless steel screws. All component and control identification nameplates shall be engraved with the device name and number exactly as it appears on the Drawings and/or as approved by the OWNER/ENGINEER. For devices not shown on the single line drawing such as time delay relays, the names shall be as shown on the Control Schematic Drawings and/or as assigned by the OWNER/ENGINEER.

3. Provide permanent warning signs as follows:

   a. "Danger- High Voltage- Keep Out" on all doors.

   b. "Warning- Hazard of Electric Shock - Disconnect Power Before Opening or Working On This Unit" on main power disconnect.

G. Control Power Transformers

1. Control power transformers shall be provided where required. Transformer shall be sized for all of the load, including space heaters, plus 25% spare capacity, and shall be not less than 100VA.

2. Transformer mechanical ratings shall equal the short circuit rating of the circuit breaker or MCP.

3. Control power transformers shall be 120 volt grounded secondary. Primary side of the transformer shall be fused in both legs. One leg of the transformer secondary shall be solidly grounded while the other leg shall be fused.

4. All control power transformers shall have vacuum cast primary and secondary coils using epoxy resin.

H. Instrument Transformers

1. All instrument transformers shall be vacuum cast using polyurethane resin.

2. Current transformers shall be provided where required. Transformer mechanical ratings shall equal the short circuit and momentary rating of the circuit breakers. Transformers, when mounted in the motor controller, shall be rated for the full voltage of the equipment.

3. Voltage transformers shall be fixed type, with primary and secondary fuses, transformer mounted, with short circuit and momentary rating equal to the motor controller.

I. Transient Voltage Surge Suppression (TVSS)

1. Where a Transient Voltage Surge Suppressor is specified or shown on the Drawings, it shall meet the following specifications:

   a. Maximum Surge Current - 150kA per mode, 300kA per phase.

   b. UL Symmetrical Fault Current Withstand Rating – 200,000 Amps.

   c. Minimum Repetitive Surge Current capacity

      (i) 1.2x50µs, 20kV, 8x20µs, 10kA Category C3 – 20,000 Impulses.

      (ii) 500V, 2kA, 10x1000µs long duration – 5000 impulses.

d. UL SVR Rating – 1500 L-G.

e. MCOV – 170%

2. Connection to the motor controller shall be with a surge rated disconnect, mounted integral to the motor controller.

3. Noise attenuation shall not exceed 44db measured in accordance with the procedures outlined in accordance in NEMA LS 1 – 1992/MIL 220A.

4. Fusing shall be, a surge rated fuse, in combination with patented thermal fuse technology.

5. Monitoring devices shall include surge counter, indicating lights, audible alarm, Form C dry contacts @ 5 amps, 125V.

6. The TVSS shall have a warranty of not less than 10 years.]

J. Lightning Arresters and Surge Capacitors

1. Provide three valve type lightning arresters and surge capacitors in the motor controller where specified or shown on the Drawings. Arresters and capacitors shall be the product of the motor controller manufacturer and factory installed.]

2.04 MAIN CIRCUIT PROTECTIVE DEVICE

A. Unless otherwise shown on the Drawings, the main circuit protective device shall be a molded case (MCCB), 3 Pole, 600 Volt, fixed type, manually operated with stored energy closing mechanism. Trip device shall be solid state with adjustable long time pickup, and delay; adjustable short time pickup and delay; short time i2t switch; adjustable ground fault pickup and delay, and ground fault delay and pickup trips for selective tripping.

B. Provide a flange mounted main power disconnect operating handle with mechanical interlock having a bypass that will allow the panel door to open only when the switch is in the OFF position. Where panels are shown or specified with inner and outer doors, disconnecting handles and controls shall be located on the inner door.

2.05 PROGRAMMABLE LOGIC CONTROLLER (PLC)

A. Where the control panel contains a programmable logic controller (PLC) for programming of the control logic, the manufacturer shall provide the address list, and an Ethernet interface to connect to the OWNER’s plant monitoring system for monitoring of the PLC’s operation.

B. Provide a scripted program file for all PLC’s.

2.06 MOTOR CONTROLLERS

A. Manufacturers

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

a. Cutler Hammer

b. GE Industrial Solutions

c. Siemens

d. Allen Bradley

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

B. General

1. The Drawings indicate the approximate horsepower and intended control scheme of the motor driven equipment. Provide the NEMA size starter, circuit breaker trip ratings, control power transformers and thermal overload heater element ratings matched to the motors and control equipment actually supplied, in compliance with the NEC and the manufacturer’s heater selection tables. All variations necessary to accommodate the motors and controls as actually furnished shall be made without extra cost to the OWNER.

2. Furnish lugs for incoming wiring, sizes as shown on the Drawings. Allow adequate clearance for bending and terminating of cable size and type specified.

3. A NEMA rated combination magnetic motor starter shall be furnished for each motor. Each motor starter shall be provided with a motor circuit protector and equipped to provide undervoltage release and overload protection on all three phases. Motor starter sizes shall be as shown on the Drawings. All motor starters shall be combination units, full voltage non-reversing (FVNR), with adjustable instantaneous trip magnetic only circuit breakers, or motor circuit protectors (MCP), unless otherwise specified or shown on the Drawings. The MCP shall have an adjustable magnetic trip range up to 1000 percent of rated continuous current and a trip test feature. MCP's shall be labeled in accordance with UL489.]NEMA starter sizes and breaker trip ratings shall be as required for the horsepower indicated, but shall be in no case less than NEMA Size 1. If the manufacturer of the equipment utilizing the motor, supplies a motor horsepower larger than that shown on the Drawings, the CONTRACTOR shall supply a motor starter sufficient in size to control the motor supplied. International (IEC) or NEMA/IEC starters will not be acceptable.

4. A mechanical disconnect mechanism, with bypass, shall be installed on each motor circuit protector, capable of being locked in the "OFF" position to provide a means of disconnecting power to each motor. Disconnects mechanisms shall be located inside the enclosure such that the main circuit breaker handle is the only device interlocked with the panel door.

5. Each motor starter shall have a 120 volt operating coil unless otherwise noted.

6. Overload relays shall be standard Class 20, ambient compensated, manually reset by pushbutton located on front of the starter door. A normally closed contact shall be directly used in the start circuit and a normally open contact shall be wire to a terminal board for overload alarm.

7. All interfaces between control panel and remote devices shall be isolated via an interposing relay. Interposing relays shall have contacts rated for 250 VAC and 10 Amps continuous. Relays shall be Control Relays as specified herein.

C. Magnetic Motor Starters

1. Motor starters shall be 2 or 3 pole, single or 3 phase as required, 60 Hertz, 600 volt, magnetically operated, full voltage non reversing except as shown on the Drawings. NEMA sizes shall be as required for the horsepower shown on the Drawings. IEC rated starters are unacceptable.
2. Each motor starter shall have a 120 volt operating coil, and control power transformer. Starters shall have motor overload protection in each phase. Auxiliary contacts shall be provided as shown on the Drawings. A minimum of one N.O. and one N.C. auxiliary contacts shall be provided in addition to the contacts shown on the Drawings.
3. Overload relays shall be adjustable, ambient compensated and manually reset.
4. Built in control stations and indicating lights shall be furnished where shown on the Drawings.
5. All wires shall be terminated on terminal blocks and shall be tagged.
6. Provide as built wiring diagram and post it in a protective cover inside the cell.

D. Combination Magnetic Motor Starters

1. Motor starters shall be a combination motor circuit protector and contactor, 2 or 3 pole, single or 3 phase as required, 60 Hertz, 600 volt, magnetically operated, full voltage non reversing unless otherwise shown on the Drawings. NEMA sizes shall be as required for the horsepower shown on the Drawings. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall be current limiting type, with additional current limiters if required. IEC rated starters are unacceptable.
2. Each motor starter shall have a 120 volt operating coil, and control power transformer. Starters shall have motor overload protection in each phase. Auxiliary contacts shall be provided as shown on the Drawings. A minimum of one N.O. and one N.C. auxiliary contacts shall be provided in addition to the contacts shown on the Drawings.
3. Overload relays shall be adjustable, ambient compensated and manually reset.
4. Built in control stations and indicating lights shall be furnished where shown on the Drawings.
5. All wires shall be terminated on terminal blocks and shall be tagged.
6. Provide as built wiring diagram and post it inside the enclosure.

E. Combination Contactors

1. Combination contactors shall be a circuit breaker and contactor, 600 Volt, 3 Pole, 60 Hz, magnetically operated. NEMA size shall be as required for the kilowatt ratings shown on the Drawings, but shall be not less than NEMA size 1.
2. Contactors shall have a 120 Volt operating coil and control power transformer. Furnish the control power transformer with extra capacity for the unit heater fan.

F. Control Stations

1. Control stations shall be heavy duty type, with full size operators. Momentary contact stop buttons shall have a lockout latch that can be padlocked in the open position.

G. Pushbuttons, Indicating Lights and Selector Switches

1. Provide heavy-duty, 30mm, oiltight type pushbuttons, selector switches, indicating lights and stations, push-to-test, for these devices. Indicating lights shall be of the LED type.
2. Provide devices meeting the requirements of NEMA ICS 2, and having individual, extra large nameplates indicating their specific function. Provide pushbutton stations with laminated plastic nameplates indicating the drive they control, stainless steel screw attached. Provide contacts with NEMA designation rating A600. Install provisions for locking pushbuttons and selector switches in the OFF position wherever lockout provisions are indicated.

H. Control Relays

1. Control relays shall be 300 volt, industrial rated, plug-in socket type, housed in a transparent polycarbonate dust cover, designed in accordance with UL Standard 508 for motor controller duty. Continuous contact rating shall be 10 amperes resistive, ¼ HP at 120 VAC, operating temperature minus 10 to plus 55 degrees C. Provide spare N.O. & N.C. contacts. Relays shall be Potter & Brumfield KRP Series or equal with neon coil indicator light. Timing relays shall be 300 Volt, solid state type, with rotary switch to select the timing range.

2.07 SPARE PARTS

A. Provide the following spare parts for each control panel in the quantities specified:

1. One dozen replacement fuses, all types and sizes
2. One dozen replacement lamps for pilot lights
3. Four of each color replacement lens caps for pilot lights
4. One starter coil for each NEMA size furnished.
5. One, 3-pole set of replacement overload heaters of each size range used.
6. One, 3-pole set of starter contacts of each NEMA size used.
7. One can of aerosol touch-up paint

B. Spare parts shall be boxed or packaged for long term storage. Identify each item with manufacturer’s name, description and part number on the exterior of the package.

2.08 FACTORY TESTING

A. The entire control panel shall be completely assembled, wired, and adjusted at the factory and shall be given the manufacturer's routine shop tests and any other additional operational test to insure the workability and reliable operation of the equipment.

B. Factory test equipment and test methods shall conform to the latest applicable requirements of ANSI, IEEE, UL, and NEMA standards.

C. The operational test shall include the proper connection of supply and control voltage and, as far as practical, a mockup of simulated control signals and control devices shall be fed into the boards to check for proper operation.

D. Factory test equipment and test methods shall conform to the latest applicable requirements of ANSI, IEEE, UL, and NEMA standards, and shall be subject to the OWNER/ENGINEER's approval.

PART 3 EXECUTION

3.01 INSTALLER'S QUALIFICATIONS

A. Installer shall be specialized in installing low voltage motor controllers with minimum 5 years documented experience. Experience documentation shall be submitted for approval prior to beginning work on this project.

3.02 EXAMINATION

A. Examine installation area to assure there is enough clearance to install the equipment.

B. Housekeeping pads shall be included for the floor mounted motor controllers as detailed on the Drawings with the exception of motor controllers which are to be installed adjacent to an existing unit. Housekeeping pads for these (if used) should match the existing installation.

C. Check concrete pads and base plates for uniformity and level surface.

D. Verify that the equipment is ready to install.

E. Verify field measurements are as instructed by manufacturer.

3.03 INSTALLATION

A. The CONTRACTOR shall install all equipment per the manufacturer's recommendations and Contract Drawings.

B. Conduits entering a control Panel or box containing electrical equipment, shall not enter the enclosure through the top, and the raceway shall be sealed with Dow

Corning Silicone Sealant or GE RTV Silicone sealant to prevent the entrance of moisture or water.

C. Installed required safety labels.

3.04 FIELD QUALITY CONTROL

A. Inspect installed equipment for anchoring, alignment, grounding and physical damage.

B. Check tightness of all accessible electrical connections. Minimum acceptable values are specified in manufacturer's instructions.

3.05 FIELD ADJUSTING

A. Adjust all circuit breakers, switches, access doors, operating handles for free mechanical and electrical operation as described in manufacturer's instructions.

B. The breaker protective devices shall be set in the field by a qualified representative of the manufacturer, retained by the CONTRACTOR, in accordance with settings designated in a coordinated study of the system as required in Section 26 05 73 - Power System Study.

3.06 FIELD TESTING

A. Perform all electrical field tests recommended by the manufacturer. Disconnect all connections to solid-state equipment prior to testing.

B. Megger and record phase to phase and phase to ground insulation resistance. Megger, for 1 minute, at minimum voltage of 1000 VDC. Measured Insulation resistance shall be at least 1 megohm. Measured Insulation resistance shall be at least 1 megohm. In no case shall the manufacturer’s maximum test voltages be exceeded.

C. Test each key interlock system for proper functioning.

D. Test all control logic before energizing the motor or equipment.

3.07 CLEANING

A. Remove all rubbish and debris from inside and around the motor controllers. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint free rags. Do not use compressed air.

3.08 EQUIPMENT PROTECTION AND RESTORATION

A. Touch-up and restore damaged surfaces to factory finish, as approved by the manufacturer. If the damaged surface cannot be returned to factory specification, the surface shall be replaced.

3.09 MANUFACTURER'S CERTIFICATION

A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted, including all settings designated in the Power System Study, and tested in accordance with the manufacturer's recommendations.

B. The CONTRACTOR shall provide three (3) copies of the manufacturer's representative's certification.

3.10 TRAINING

A. Provide manufacturer's services for training of plant personnel in operation and maintenance of the soft start starters furnished under this Section.

B. The training for each type of equipment shall be for a period of not less than one (1) eight hour day.

C. The cost of training program to be conducted with OWNER's personnel shall be included in the Contract Price. The training and instruction, insofar as practicable, shall be directly related to the system being supplied.

D. Provide detailed O&M manuals to supplement the training course. The manuals shall include specific details of equipment supplied and operations specific to the project.

E. The training session shall be conducted by a manufacturer's qualified representative. Training program shall include instructions on the assembly, motor starters, protective devices, metering, and other major components.]

F. The OWNER reserves the right to videotape the training sessions for the OWNER's use.

END OF SECTION

SECTION 26 29 87 ELECTRICAL MANUFACTURER'S PROVIDED CONTROL PANELS (OEM'S)

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install functional control panels to manually or automatically operate control systems as specified in the detailed requirements of this Section, and logic and schematics as shown on the Electrical Drawings.

B. Control panels as specified in Divisions 43 and 46, 40 and 15 shall not be submitted under this Section. Control panels, specified in Divisions 43 and 46, shall meet the requirements of Section 26 29 86 - Mechanical Equipment Manufacturer's Control Panels, and shall be submitted as a part of the mechanical equipment manufacturer's submittal under Divisions 43 and 46. Control panels specified under Division 13 shall be submitted as a part of Division 13 submittals. Control panels specified under Division 15 shall be submitted as a part of Division 15 submittals.

1.02 RELATED WORK

A. Section 26 05 00 - Electrical – General Provisions

B. Section 26 05 73 - Power System Study

C. Section 26 05 90 - Cast-In-Place Concrete for Electrical Applications

D. Section 26 09 13 - Power Metering and Protective Relays

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Division 1, Section 26 05 00 - Electrical – General Provisions and as specified herein.

B. Submittals shall also contain information on related equipment to be furnished under this Specification but described in the related sections listed in the Related Work paragraph above. Incomplete submittals not containing the required information on the related equipment will be returned unreviewed.

C. The original equipment manufacturer shall create all equipment shop drawings, including all wiring diagrams, in the manufacturer's Engineering department. All equipment shop drawings shall bear the original equipment manufacturer's logo, drawing file numbers, and shall be maintained on file in the original equipment manufacturer's archive file system. Photocopies of the ENGINEER's ladder schematics are unacceptable as shop drawings.

D. Submit to the OWNER/ENGINEER, shop drawings and product data, for the following:

1. Product data sheets and catalog numbers for overcurrent protective devices, motor starters, control relays, control stations, meters, pilot lights, etc. The manufacturer's name shall be clearly visible on each cut sheet submitted. List all options, trip adjustments and accessories furnished specifically for this project.
2. Provide control systems engineering to produce custom unit elementary drawings showing interwiring and interlocking between components and to remotely mounted devices. Include and identify all connecting equipment and remote devices on the schematics. The notation "Remote Device" will not be acceptable. Show wire and terminal numbers. Indicate special identifications for electrical devices per the Drawings.
3. Equipment outline drawings showing elevation, plan and interior views, front panel arrangement, dimensions, weight, shipping splits, conduit entrances and anchor bolt pattern. Indicate all options, special features, ratings and deviations from this Section.
4. Power and control schematics including external connections. Show wire and terminal numbers and color-coding.
5. Instruction and replacement parts books.
6. As-built final drawings.
7. Documentation that the panel assembly facility is a UL-certified panel shop.
8. Facsimile of the UL label that is to be applied to the completed panel.
9. Furnish complete Bill of Materials indicating manufacturer's name and part numbers.
10. Manufacturer's cut sheets for every component used in the panel assembly adequately marked to show the items being included. The manufacturer's name shall be clearly visible on the each cut sheet submitted.
11. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
12. Major component ratings including:
    a. Voltage
    b. Continuous current
    c. Interrupting ratings
13. Cable terminal sizes.
14. Instruction and renewal parts books.

E. Factory Tests. Submittals shall be made for factory tests specified herein.

F. Field Test Reports. Submittals shall be made for field tests specified herein.

G. Installation, Operation and Maintenance Manuals.

1. Operation and maintenance manuals shall include the following information:

   a. Manufacturer's contact address and telephone number for parts and service.

   b. Instruction books and/or leaflets

   c. Recommended renewal parts list

   d. Record Documents for the information required by the Submittals paragraph above.

1.04 REFERENCE CODES AND STANDARDS

A. All products and components shown on the Drawings and listed in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NEMA Standard ICS 2 – 2000 Industrial Control and Systems
2. NFPA 70 – National Electrical Code (NEC)
3. NFPA 70E – Standard for Electrical Safety in the Workplace
4. UL 508/508A – Industrial Control Enclosures
5. UL 1449, UL 1283 – Standard for Safety for TVSS
6. ANSI/IEEE C62.41, C64.45 – Guide in Surge Environment in 600V Power Circuits
7. NEMA LS-1 – Low Voltage Surge Protective Devices
8. NEC Art. 285 – Transient Voltage Surge Suppressors

B. All equipment specified in this section of the Specifications shall bear the appropriate label of Underwriters Laboratories.

1.05 QUALITY ASSURANCE

A. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The control panel shall be assembled in a UL-certified panel shop, experienced in the assembled of control panels for wastewater and water treatment systems. A submittal of the documentation, that certifies the panel fabrication shop is a UL-certified shop, is required.

C. Equipment components and devices shall be UL labeled wherever UL standards exist for such equipment. The completed control panel shall be UL Labeled in accordance with UL 508 and 508A and other applicable UL standards. The panel shall also be UL labeled for the environment in which it is to be placed. A UL label

shall be affixed to the inside of the external door by the panel fabrication assembly. Submit a facsimile of the UL label in the submittal information.

D. Equipment submitted shall fit within the space shown on the Drawings. Equipment which does not fit within the space is not acceptable.

1.06 DELIVERY STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. Two (2) copies of these instructions shall be included with the equipment at time of shipment, and shall be made available to the CONTRACTOR and OWNER/ENGINEER.

B. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.

C. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR’s choice and at the CONTRACTOR’s expense, until such time that the site is ready for permanent installation of the equipment.

D. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the CONTRACTOR at no expense to the OWNER.

PART 2 PRODUCTS

2.01 RATINGS

A. The service voltage, shall be as shown on the Drawings. The overall short circuit withstand and interrupting rating of the equipment and devices shall be equal to or greater than the overall short circuit withstand and interrupting rating of the feeder device immediately upstream of the Control Panel, but not less than 22,000 amperes RMS symmetrical at 480 Volts, including all circuit breakers and combination motor starters. Systems of motor controllers employing series connected ratings for main and feeder devices shall not be used. Motor starter

units shall be tested and UL labeled for the specified short circuit duty in combination with the motor branch circuit protective device.

B. The complete control panel assembly shall be UL certified or carry a UL listing for "Industrial Control Panels".

C. The control panel shall meet all applicable requirements of the National Electrical Code.

D. The control panel enclosure shall be NEMA rated as indicated in Section 26 05 00 of the Electrical Specifications.

E. Motor controllers, including associated devices, shall be designed for continuous operation at rated current in a 40 degree C ambient temperature.

F. For additional ratings and construction notes, refer to the Drawings.

2.02 CONSTRUCTION

A. Construction

1. Refer to the Drawings for: schematics, actual layout and location of equipment and components; current ratings of devices, bus bars, components; protective relays, voltage ratings of devices, components and assemblies; and other required details.

B. Enclosure

1. Enclosures shall be in accordance with the Area Classification and Enclosure Types as specified in Section 26 05 00 Electrical – General Provisions.
2. NEMA 1 enclosures shall be of sheet aluminum for wall mounting, or have mounting feet where self-standing. Enclosure panels shall have continuously welded seams. Welds shall be ground smooth. Enclosures shall be flanged and shall not have holes or knockouts. Enclosures shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. All enclosures shall have hinged gasketed doors with 3-point latch. Enclosures shall be furnished with terminal mounting straps and brackets. Panels shall be furnished with hinged doors, terminal mounting straps and brackets. Enclosures shall be Concept Series as manufactured by Hoffman Engineering Co. or equal.
3. NEMA 4X enclosures shall be Type 316 stainless steel for wall mounting, or have mounting feet where self-standing. Enclosures shall have continuously welded seams. Welds shall be ground smooth. Enclosures shall be flanged and shall not have holes or knockouts. Enclosures shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. All enclosures shall have hinged gasketed doors with a 3-point latch (single operator). Panels shall be furnished with terminal mounting straps and brackets. Enclosures shall be furnished with hinged doors, terminal mounting straps and brackets. Enclosures shall be Concept Series as manufactured by Hoffman Engineering Co. or equal.
4. All enclosures shall be lockable, and keyed alike.

5. The enclosure shall incorporate a removable back panel on which control components shall be mounted. Back panel shall be secured to the enclosure with collar studs. The enclosure door shall be interlocked with the main circuit breaker by a door mounted operating mechanism. Back panel shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any components.
6. All panels installed outdoors shall have a factory applied, suitable primer and final coat of weather-proof white paint.
7. The enclosure outer door shall have a rear mounted pocket, containing laminated copies of the Control schematics.
8. Overload tables shall be laminated and adhered to the inside of the door.
9. All operating control devices and instruments shall be securely mounted on the panel door. All controls shall be clearly labeled to indicate function and shall be NEMA rated as indicated on the Drawings, and in accordance with the electrical area classification specified in Section 26 05 00. Auxiliary contacts shall be provided for remote run indication and indication of each status and alarm condition. Additional controls shall be provided as specified herein and as required by the detailed mechanical and electrical equipment requirements.
    a. Indicator lamps shall be 30 mm heavy duty, LED oiltight, with nameplates. Lens color shall be green for OFF, red for ON and amber for FAIL or ALARM. For all control applications, except NEMA 7, indicator lamps shall incorporate a push-to-test feature. A separate single lamp test push-button shall be incorporated on NEMA 7 control panels.
    b. Mode selector switches (HAND-OFF-AUTO, LOCAL-OFF-REMOTE, PUMP SELECTOR, LEAD-LAG, etc) shall be heavy duty, 30 mm, and oiltight, as shown on the Drawings, with nameplates. Units shall have the number of positions and contact arrangements, as required. Each HOA, LOR switch shall have an extra dry contact for remote monitoring.
    c. Push-button, shall be heavy-duty, 30 mm, oiltight, with momentary or maintained contacts as required by the Drawings, with nameplates. Button color shall be red for EMERGENCY STOP or START and green for STOP. Contact arrangement shall be as required.
    d. A six digit, non-resettable elapsed time meter shall be connected to each motor starter. Meter shall be Bulletin 705, HK Series by Eagle Signal or equal.
    e. When shown on the Drawings, a failure alarm with horn and beacon light shall be provided. Silence and reset buttons shall be furnished. Alarm horn and beacon shall be by Federal Signal; Crouse-Hinds (NEMA 7) or equal.
10. Enclosure Condensate Heaters
    a. A self-contained enclosure condensation heater with thermostat and fan shall be mounted inside the control panel, if panel is mounted outdoors or in a non-air-conditioned space.

(i) Enclosure heaters shall be energized from 120 volt, single-phase power supply and sized to prevent condensation within the enclosure.

(ii) Locate enclosure heaters to avoid overheating electronic hardware or producing large temperature fluctuations on the hardware.

(iii) Enclosure heaters shall have an internal fan for heat distribution and shall be controlled with adjustable thermostats. The thermostat shall have an adjustment range of 40 degrees Fahrenheit to 90 degrees Fahrenheit. Provide a circuit breaker or fused disconnect switch within the enclosure.

(iv) Enclosure heaters shall be Hoffman type DAH or equal.

b. Strip heaters may be provided if they are 240 volt rated, powered at 120 volts AC and do not have a surface temperature higher than 60°C. Strip heaters and thermostats shall be as manufactured by Chromalox or equal.

(i) Strip heaters shall be Chromolox, Type OT, 1.5-in wide, 240 Volts, single phase, 150 watts, energized at 120 volts, with rust resisting iron sheath, Catalog No. OT-715, Product Code No. 129314. Provide sufficient wattage in heaters to prevent condensation should the interior temperature of the enclosure drop below the dew point.

(ii) A control thermostat mounted inside the control Panel shall be Chromalox, Type WR, single stage, Catalog No. WR-80, Product Code No.263177.

(iii) The strip heater terminals shall be guarded by a protective terminal cover.

(iv) High temperature connecting lead wire shall be used between the thermostat and the heater terminals. Wire shall be No. 12 AWG stranded nickel-plated copper with Teflon glass insulation and shall be the product of Chromalox, Catalog No. 6-CFI-12, Product Code No. 263783.

11. NEMA 4X Enclosure Air Conditioner

a. NEMA 4X enclosures containing electronic devices or electrical equipment shall have air conditioners that will maintain the internal temperature at or below the equipment rating without violating the NEMA 4X rating of the enclosure.

b. The panel builder shall provide panel internal heat rise calculations to show that the panel internal temperatures will be maintained below the maximum operating temperatures of the panel components.

(i) For enclosures mounted indoors in non-air-conditioned spaces, include an ambient air temperature of 40 degree C and a humidity of 100% non-condensing.

(ii) For enclosures mounted in direct sunlight add the appropriate solar heat gain component to the calculation, and raise the ambient temperature to 45 degrees C.

(iii) The calculation shall show all the internal and external heat gain loads, the expected internal temperature rise in degrees C above the specified ambient without the air conditioner. Provide a calculation showing the expected temperature rise in degrees C above the specified ambient with the air conditioner running.

c. The air conditioner shall have the following features:

(i) Use CFC-free R134a refrigerant.

(ii) Have fully gasketed flanges on all four mounting edges for a watertight seal that maintains NEMA 4X rating of the panel.

(iii) Thermostatic low temperature control to provide energy efficient operation and prevents over-cooling.

(iv) EMI/RFI suppressor to minimize transient spikes during compressor on/off cycling.

(v) Separated blower-driven evaporator and condenser air systems for closed loop cooling.

(vi) UL listed.

(vii) Stainless steel enclosure.

(viii) Internal corrosion resistant coating and/or galvanized steel components.

(ix) Low ambient kit.

(x) Short cycle protector.

(xi) Provide an air conditioner manufactured by Circle AW or equal.

12. Enclosure Fans

a. Fans shall be furnished for soft start starters and AFD's, as required by the manufacturer, to provide air circulation and cooling. .Fans shall be controlled by a temperature switch. The fan shall operate only when the drive is "ON" and for a cool-down period after the drive has stopped Otherwise the fan shall not run when the drive is "OFF". Louvers, if provided, shall have externally removable filters. The filter shall be metallic and washable.

b. Fan motors shall be protected by an input circuit breaker. Metal squirrel cage ball bearing, three phase fan motors with 10-year design life shall be used in the drive design. Plastic muffin fans are not acceptable. Fan power shall be obtained from a tap on the main control power transformer.

c. A "loss of cooling" fault shall be furnished. In the event of clogged filters or fan failure, the drive shall produce an alarm and then, in a predetermined time, be shut down safely without electronic component failure by the temperature switch.

d. Redundant fans shall be provided in the drive design as backup in the event of fan failure.

13. Corrosion Protection

    a. Provide corrosion protection in each control panel with a corrosion-Inhibiting vapor capsule as manufactured by Northern Instruments; Model Zerust VC, or Hoffman Engineering; Model A-HCI.

C. Internal Wiring

1. Power and control wiring shall be stranded copper, minimum size No. 16 AWG, with 600 Volt, 90 degree C, flame retardant, Type MTW thermoplastic insulation. Line side power wiring shall be sized for the full rating or frame size of the connected device, and as shown on the Drawings.
2. Analog signal wires shall be 300 Volt Class, insulated stranded tinned copper, twisted shielded #16 AWG pair.
3. All interconnecting wires between panel mounted equipment and external equipment shall be terminated at numbered terminal blocks. Field wiring shall not be terminated directly on any panel-mounted device.
4. All wiring shall be tagged and coded with an identification number as shown on the Drawings. Coding shall be typed on a heat shrinkable tube applied to each end showing origination and destination of each wire. The marking shall be permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE, or equal.
5. All wiring shall be enclosed in PVC wire trough with slotted side openings and removable cover. Plan wire routing such that no low twisted shielded pair cable conducting analog 4-20 mA signals or low voltage analog signals are routed in the same wire trough as conductors carrying discrete signals or power.

D. Field Installed Internal Wiring

1. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported so that circuit terminations are not stressed. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.
2. All field wiring shall be tagged and coded with an identification number. Coding shall be typed on a heat shrinkable tube applied to each end of the wire. The marking shall be a permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE, or equal
3. In general, all conduit entering or leaving equipment shall be stubbed up into the bottom of the enclosure directly below the area in which the conductors are to be terminated, or from the top if shown on the Drawings. Conduits shall not enter the side unless approved in writing by the OWNER/ENGINEER.

E. Terminal Blocks

1. Terminal blocks shall be DIN-rail-mounted one-piece molded plastic blocks with tubular-clamp-screw type and end barriers. Terminal blocks shall be rated for 600 volts except for control and instrumentation circuits, or 4-20 mA analog signal conductors.

2. Provide 600 volt rated terminal blocks for any conductor carrying any voltage over 120 volts to ground.
3. Provide 600 volt rated strap screw terminal blocks for any power conductors carrying over 20 amps, at any voltage. Terminals shall be double sided and supplied with removable covers to prevent accidental contact with live circuits.
4. Power conductors carrying over 20 amps, at any voltage shall be terminated to strap-screw type terminal blocks with crimp type, pre-insulated, ring-tongue lugs. Lugs shall be of the appropriate size for the terminal block screws and for the number and size of the wires terminated. Do not terminate more than one conductor in any lug, and do not land more than two conductors under any strap-screw terminal point.
5. Terminals shall have permanent, legible identification, clearly visible with the protective cover removed. Each terminal block shall have 20 percent spare terminals, but not less than two spare terminals.
6. Do not land more than one conductor per terminal point. Use the manufacturer’s provided bridge connectors to interconnect terminal blocks terminating common or ground conductors.
7. Twisted shielded pair or triad cables shall have each individual conductor and shield drain wire landed on individual terminal blocks. Use the manufacturer’s provided bridge connectors to interconnect terminal blocks terminating the shield drain wire conductors.
8. Control circuits, 120 volts and below, and 4-20 mA analog signal conductors shall be terminated with manufacturer’s recommended ferrules. Ferrules shall be provided with plastic sleeves.
9. Provide an AC ground bar bonded to the panel enclosure, if metal, with 20 percent spare terminals.
10. Provided ground terminal blocks for each twisted-shielded pair drain wire.

F. Signage

1. Provide 2-in by 5-in, nominal, engraved lamicoid master nameplate on the control panel fastened with stainless steel screws. Nameplate shall be black with white core, 3/8-in high lettering and shall indicate equipment designation as shown on the Drawing. Screw holes shall be sealed such that the NEMA rating of the enclosure is maintained.
2. Provide 1 inch by 3 inch engraved unit nameplates of two ply laminated plastic, black face, white core, screw fastened to each door with 316 stainless steel screws. All component and control identification nameplates shall be engraved with the device name and number exactly as it appears on the Drawings and/or as approved by the OWNER/ENGINEER. For devices not shown on the single line drawing such as time delay relays, the names shall be as shown on the Control Schematic Drawings and/or as assigned by the OWNER/ENGINEER.
3. Provide permanent warning signs as follows:
   a. "Danger- High Voltage- Keep Out" on all doors.

b. "Warning- Hazard of Electric Shock - Disconnect Power Before Opening or Working On This Unit" on main power disconnect.

G. Control Power Transformers

1. Control power transformers shall be provided where shown on the Drawings. Transformer shall be sized for all of the load, including space heaters, plus 25% spare capacity, and shall be not less than 100VA.
2. Transformer mechanical ratings shall equal the short circuit rating of the circuit breaker or MCP.
3. Control power transformers shall be 120 volt grounded secondary. Primary side of the transformer shall be fused in both legs. One leg of the transformer secondary shall be solidly grounded while the other leg shall be fused.
4. All control power transformers shall have vacuum cast primary and secondary coils using epoxy resin.

H. Instrument Transformers

1. All instrument transformers shall be vacuum cast using polyurethane resin.
2. Current transformers shall be provided where shown on the Drawings. Transformer mechanical ratings shall equal the short circuit and momentary rating of the circuit breakers. Transformers, when mounted in the motor controller, shall be rated for the full voltage of the equipment.
3. Voltage transformers shall be fixed type, with primary and secondary fuses, transformer mounted, with short circuit and momentary rating equal to the motor controller.

I. Transient Voltage Surge Suppression (TVSS)

1. Where a Transient Voltage Surge Suppressor is shown on the Drawings, it shall meet the following specifications:
   a. Maximum Surge Current - 150kA per mode, 300kA per phase.
   b. UL Symmetrical Fault Current Withstand Rating – 200,000 Amps.
   c. Minimum Repetitive Surge Current capacity
      (i) 1.2x50µs, 20kV, 8x20µs, 10kA Category C3 – 20,000 Impulses.
      (ii) 500V, 2kA, 10x1000µs long duration – 5000 impulses.
   d. UL SVR Rating – 1500 L-G.
   e. MCOV – 170%
2. Connection to the motor controller shall be with a surge rated disconnect, mounted integral to the motor controller.
3. Noise attenuation shall not exceed 44db measured in accordance with the procedures outlined in accordance in NEMA LS 1 – 1992/MIL 220A.
4. Fusing shall be, a surge rated fuse, in combination with patented thermal fuse technology.

5. Monitoring devices shall include surge counter, indicating lights, audible alarm, Form C dry contacts @ 5 amps, 125V.
6. The TVSS shall have a warranty of not less than 10 years.

J. Lightning Arresters and Surge Capacitors

1. Provide three valve type lightning arresters and surge capacitors in the motor controller where shown on the Drawings. Arresters and capacitors shall be the product of the motor controller manufacturer and factory installed.

2.03 MAIN CIRCUIT PROTECTIVE DEVICE

A. Unless otherwise shown on the Drawings, the main circuit protective device shall be a molded case (MCCB), 3 Pole, 600 Volt, fixed type, manually operated with stored energy closing mechanism. Trip device shall be solid state with adjustable long time pickup, and delay; adjustable short time pickup and delay; short time i2t switch; adjustable ground fault pickup and delay, and ground fault delay and pickup trips for selective tripping.

B. Provide a flange mounted main power disconnect operating handle with mechanical interlock having a bypass that will allow the panel door to open only when the switch is in the OFF position. Where panels are shown or specified with inner and outer doors, disconnecting handles and controls shall be located on the inner door.

2.04 PROGRAMMABLE LOGIC CONTROLLER

A. Description

1. The Applications Engineering System Supplier (AESS) shall be responsible for providing and programming the Programmable Logic Controllers (PLC). Refer to section 40 61 00 - Instrumentation and Control – General Provisions for additional information.

B. The manufacturer shall provide the address list and an Ethernet interface to connect to the OWNER’s plant monitoring system for monitoring of the PLC’s operation.

2.05 MOTOR CONTROLLERS

A. Manufacturers

1. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   a. Cutler Hammer
   b. GE Industrial Solutions
   c. Siemens
   d. Allen Bradley

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

B. General

1. The Drawings indicate the approximate horsepower and intended control scheme of the motor driven equipment. Provide the NEMA size starter, circuit breaker trip ratings, control power transformers and thermal overload heater element ratings matched to the motors and control equipment actually supplied, in compliance with the NEC and the manufacturer’s heater selection tables. All variations necessary to accommodate the motors and controls as actually furnished shall be made without extra cost to the OWNER.

2. Furnish lugs for incoming wiring, sizes as shown on the Drawings. Allow adequate clearance for bending and terminating of cable size and type specified.

3. A NEMA rated combination magnetic motor starter shall be furnished for each motor. Each motor starter shall be provided with a motor circuit protector and equipped to provide undervoltage release and overload protection on all three phases. Motor starter sizes shall be as shown on the Drawings. All motor starters shall be combination units, full voltage non-reversing (FVNR), with adjustable instantaneous trip magnetic only circuit breakers, or motor circuit protectors (MCP), unless otherwise specified or shown on the Drawings. The MCP shall have an adjustable magnetic trip range up to 1000 percent of rated continuous current and a trip test feature. MCP's shall be labeled in accordance with UL489.NEMA starter sizes and breaker trip ratings shall be as required for the horsepower indicated, but shall be in no case less than NEMA Size 1. If the manufacturer of the equipment utilizing the motor, supplies a motor horsepower larger than that shown on the Drawings, the CONTRACTOR shall supply a motor starter sufficient in size to control the motor supplied. International (IEC) or NEMA/IEC starters will not be acceptable.

4. A mechanical disconnect mechanism, with bypass, shall be installed on each motor circuit protector, capable of being locked in the "OFF" position to provide a means of disconnecting power to each motor. Disconnects mechanisms shall be located inside the enclosure such that the main circuit breaker handle is the only device interlocked with the panel door.

5. The main protective device and each motor starter, operating at voltages greater than 120 volts ac, shall be steel barriered from each other and from other controls operating at 120 volts and lower.

6. Each motor starter shall have a 120 volt operating coil unless otherwise noted.

7. Overload relays shall be standard Class 20, ambient compensated, manually reset by pushbutton located on front of the starter door. A normally closed contact shall be directly used in the start circuit and a normally open contact shall be wire to a terminal board for overload alarm.

8. All interfaces between control panel and remote devices shall be isolated via an interposing relay. Interposing relays shall have contacts rated for 250 VAC and 10 Amps continuous. Relays shall be Control Relays as specified herein.

C. Magnetic Motor Starters

1. Motor starters shall be 2 or 3 pole, single or 3 phase as required, 60 Hertz, 600 volt, magnetically operated, full voltage nonreversing except as shown on the Drawings. NEMA sizes shall be as required for the horsepower shown on the Drawings. IEC rated starters are unacceptable.
2. Each motor starter shall have a 120 volt operating coil, and control power transformer. Starters shall have motor overload protection in each phase. Auxiliary contacts shall be provided as shown on the Drawings. A minimum of one N.O. and one N.C. auxiliary contacts shall be provided in addition to the contacts shown on the Drawings.
3. Overload relays shall be adjustable, ambient compensated and manually reset.
4. Built in control stations and indicating lights shall be furnished where shown on the Drawings.
5. All wires shall be terminated on terminal blocks and shall be tagged.
6. Provide as built wiring diagram and post it in a protective cover inside the cell.

D. Combination Magnetic Motor Starters

1. Motor starters shall be a combination motor circuit protector and contactor, 2 or 3 pole, single or 3 phase as required, 60 Hertz, 600 volt, magnetically operated, full voltage non reversing unless otherwise shown on the Drawings. NEMA sizes shall be as required for the horsepower shown on the Drawings. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall be current limiting type, with additional current limiters if required. IEC rated starters are unacceptable.
2. Each motor starter shall have a 120 volt operating coil, and control power transformer. Starters shall have motor overload protection in each phase. Auxiliary contacts shall be provided as shown on the Drawings. A minimum of one N.O. and one N.C. auxiliary contacts shall be provided in addition to the contacts shown on the Drawings.
3. Overload relays shall be adjustable, ambient compensated and manually reset.
4. Built in control stations and indicating lights shall be furnished where shown on the Drawings.
5. All wires shall be terminated on terminal blocks and shall be tagged.
6. Provide as built wiring diagram and post it inside the enclosure.

E. Combination Contactors

1. Combination contactors shall be a circuit breaker and contactor, 600 Volt, 3 Pole, 60 Hz, magnetically operated. NEMA size shall be as required for the kilowatt ratings shown on the Drawings, but shall be not less than NEMA size 1.
2. Contactors shall have a 120 Volt operating coil and control power transformer. Furnish the control power transformer with extra capacity for the unit heater fan.

F. Control Stations

1. Control stations shall be heavy duty type, with full size operators. Momentary contact stop buttons shall have a lockout latch that can be padlocked in the open position.

G. Pushbuttons, Indicating Lights and Selector Switches

1. Provide heavy-duty, 30mm, oiltight type pushbuttons, selector switches, indicating lights and stations, push-to-test, for these devices. Indicating lights shall be of the LED type.
2. Provide devices meeting the requirements of NEMA ICS 2, and having individual, extra large nameplates indicating their specific function. Provide pushbutton stations with laminated plastic nameplates indicating the drive they control, stainless steel screw attached. Provide contacts with NEMA designation rating A600. Install provisions for locking pushbuttons and selector switches in the OFF position wherever lockout provisions are indicated.

H. Control Relays

1. Control relays shall be 300 volt, industrial rated, plug-in socket type, housed in a transparent polycarbonate dust cover, designed in accordance with UL Standard 508 for motor controller duty. Continuous contact rating shall be 10 amperes resistive, ¼ HP at 120 VAC, operating temperature minus 10 to plus 55 degrees C. Provide spare N.O. & N.C. contacts. Relays shall be Potter & Brumfield KRP Series or equal with neon coil indicator light. Timing relays shall be 300 Volt, solid state type, with rotary switch to select the timing range.

2.06 SPARE PARTS

A. Provide the following spare parts for each control panel in the quantities specified:

1. One dozen replacement fuses, all types and sizes
2. One dozen replacement lamps for pilot lights
3. Four of each color replacement lens caps for pilot lights
4. One starter coil for each NEMA size furnished
5. One, 3-pole set of replacement overload heaters of each size range used
6. One, 3-pole set of starter contacts of each NEMA size used.
7. One can of aerosol touch-up paint

B. Spare parts shall be boxed or packaged for long term storage. Identify each item with manufacturer's name, description and part number on the exterior of the package.

2.07 FACTORY TESTING

A. The entire control panel shall be completely assembled, wired, and adjusted at the factory and shall be given the manufacturer's routine shop tests and any other additional operational test to insure the workability and reliable operation of the equipment.

B. Factory test equipment and test methods shall conform with the latest applicable requirements of ANSI, IEEE, UL, and NEMA standards.

C. The operational test shall include the proper connection of supply and control voltage and, as far as practical, a mockup of simulated control signals and control devices shall be fed into the boards to check for proper operation.

D. Factory test equipment and test methods shall conform to the latest applicable requirements of ANSI, IEEE, UL, and NEMA standards, and shall be subject to the OWNER/ENGINEER's approval.

PART 3 EXECUTION

3.01 INSTALLER'S QUALIFICATIONS

A. Installer shall be specialized in installing low voltage motor controllers with minimum 5 years documented experience. Experience documentation shall be submitted for approval prior to beginning work on this project.

3.02 EXAMINATION

A. Examine installation area to assure there is enough clearance to install the equipment.

B. Housekeeping pads shall be included for the floor mounted motor controllers as detailed on the Drawings with the exception of motor controllers which are to be installed adjacent to an existing unit. Housekeeping pads for these (if used) should match the existing installation.

C. Check concrete pads and base plates for uniformity and level surface.

D. Verify that the equipment is ready to install.

E. Verify field measurements are as instructed by manufacturer.

3.03 INSTALLATION

A. The CONTRACTOR shall install all equipment per the manufacturer's recommendations and Contract Drawings.

B. Conduits entering a control Panel or box containing electrical equipment, shall not enter the enclosure through the top, and the raceway shall be sealed with Dow Corning Silicone Sealant or GE Industrial Solutions RTV Silicone sealant to prevent the entrance of moisture or water.

C. Installed required safety labels.

3.04 FIELD QUALITY CONTROL

A. Inspect installed equipment for anchoring, alignment, grounding and physical damage.

B. Check tightness of all accessible electrical connections. Minimum acceptable values are specified in manufacturer's instructions.

3.05 FIELD ADJUSTING

A. Adjust all circuit breakers, switches, access doors, operating handles for free mechanical and electrical operation as described in manufacturer's instructions.

B. The breaker protective devices shall be set in the field by a qualified representative of the manufacturer, retained by the CONTRACTOR, in accordance with settings designated in a coordinated study of the system as required in Section 26 05 73 - Power System Study.

3.06 FIELD TESTING

A. Perform all electrical field tests recommended by the manufacturer. Disconnect all connections to solid-state equipment prior to testing.

B. Megger and record phase to phase and phase to ground insulation resistance. Megger, for 1 minute, at minimum voltage of 1000 VDC. Measured Insulation resistance shall be at least 1 megohm. Measured Insulation resistance shall be at least 1 megohm. In no case shall the manufacturer’s maximum test voltages be exceeded.

C. Test each key interlock system for proper functioning.

D. Test all control logic before energizing the motor or equipment.

3.07 CLEANING

A. Remove all rubbish and debris from inside and around the motor controllers. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint free rags. Do not use compressed air.

3.08 EQUIPMENT PROTECTION AND RESTORATION

A. Touch-up and restore damaged surfaces to factory finish, as approved by the manufacturer. If the damaged surface cannot be returned to factory specification, the surface shall be replaced.

3.09 MANUFACTURER’S CERTIFICATION

A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted, including all settings designated in the Power System Study, and tested in accordance with the manufacturer's recommendations.

B. The CONTRACTOR shall provide three (3) copies of the manufacturer's representative's certification.

3.10 TRAINING

A. Provide manufacturer's services for training of plant personnel in operation and maintenance of the soft start starters furnished under this Section.

B. The training for each type of equipment shall be for a period of not less than one (1) eight hour day.

C. The cost of training program to be conducted with OWNER's personnel shall be included in the Contract Price. The training and instruction, insofar as practicable, shall be directly related to the system being supplied.

D. Provide detailed Installation, O&M manuals to supplement the training course. The manuals shall include specific details of equipment supplied and operations specific to the project.

E. The training session shall be conducted by a manufacturer's qualified representative. Training program shall include instructions on the assembly, motor starters, protective devices, metering, and other major components.

END OF SECTION

SECTION 26 32 13 STANDBY GENERATOR SET

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install Standby Generator Sets with all appurtenances as shown on the Drawings and specified herein.

B. Each generator size as shown on the drawings is a minimum size around which the electrical conductors and circuit breakers have been sized. The CONTRACTOR shall provide each engine-generator set that meets all the performance criteria, and shall increase the size of the engine generator, if necessary, to meet the specified criteria. If the generator size increases, the CONTRACTOR shall increase the breakers, conductors, and all associated equipment, including the automatic transfer switch, to accommodate the larger generator size. All sizing of associated equipment shall be in accordance with the NEC.

C. The CONTRACTOR shall provide fuel for startup and testing. At the completion of startup and testing, the CONTRACTOR shall fill the respective generator tank.

1.02 RELATED WORK

A. Section 26 05 00 - Electrical – General Provisions

B. Section 26 05 73 - Power System Study

C. Section 26 05 90 - Cast-In-Place Concrete for Electrical Applications

D. Section 26 09 13 - Power Metering and Protective Relays

E. Section 26 28 16 - Low Voltage Enclosed Circuit Breakers and Fusible Switches

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Division 1, Section 26 05 00 - Electrical – General Provisions and as specified herein.

B. Submittals shall also contain information on related equipment to be furnished under this Specification but described in the related sections listed in the Related Work paragraph above. Incomplete submittals not containing the required information on the related equipment will be returned unreviewed.

C. The original equipment manufacturer shall create all equipment shop drawings, including all wiring diagrams, in the manufacturer's Engineering department. All equipment shop drawings shall bear the original equipment manufacturer's logo, drawing file numbers, and shall be maintained on file in the original equipment manufacturer's archive file system. Photocopies of the ENGINEER's ladder schematics are unacceptable as shop drawings.

D. Submit to the OWNER/ENGINEER, shop drawings and product data, for the following:

1. Equipment outline drawings showing elevation and plan views, dimensions, weight, anchor details, and required operating clearances.
2. Conduit entrance drawings.
3. Product data sheets and catalog numbers for the engine, AC generator, battery charger, generator set control system, electronic governor system, control stations, meters, relays, pilot lights, circuit breaker, etc. List all options and accessories furnished specifically for this project.
4. Provide control systems engineering to produce custom unit elementary drawings showing interwiring and interlocking between components and to remotely mounted devices. Include and identify all connecting equipment and remote devices on the schematics. The notation “Remote Device” will not be acceptable. Show wire and terminal numbers. Indicate special identifications for electrical devices per the Drawings.
5. Provide plan and elevation drawings of each Generator Set, with dimensions, exterior and interior views, showing component layouts, controls, terminal blocks, etc.
6. Schematic diagram
7. Nameplate schedule
8. UL Listing
9. Component list with detailed component information.
10. Conduit entry/exit locations
11. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
12. Major component ratings including:
    a. Voltage
    b. Continuous current
    c. Interrupting ratings
13. Cable terminal sizes.
14. Key interlock scheme drawing and sequence of operations
15. Instruction and renewal parts books.

E. Factory Tests. Submittals shall be made for factory tests specified herein.

F. Field Test Reports. Submittals shall be made for field tests specified herein.

G. Operation and Maintenance Manuals.

1. Installation, Operation and maintenance manuals shall include the following information:
    a. Manufacturer's contact address and telephone number for parts and service.
    b. Instruction books and/or leaflets
    c. Recommended renewal parts list
    d. Record Documents for the information required by the Submittals above.

1.04 REFERENCE CODES AND STANDARDS

A. All products and components shown on the Drawings and listed in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NEMA Standard ICS 2 – 2000 Industrial Control and Systems
2. NFPA 70 – National Electrical Code (NEC)
3. NFPA 70E – Standard for Electrical Safety in the Workplace
4. NFPA 110 for level 1 Systems.
5. OSHA for rotating parts.
6. NEMA MG1 temperature limits.
7. UL508
8. CSA282-M1989
9. IEC 8528 part 4
10. Mil – Std 461C part 9
11. IEC Std 801.2, 801.3, 801.5
12. IEEE587
13. ASTM D2794-93
14. ASTM D2247-92
15. UL listing for fuel tanks

B. All equipment specified in this section of the Specifications shall bear the appropriate label of Underwriters Laboratories.

1.05 QUALITY ASSURANCE

A. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly. All assemblies shall be of the same manufacturer.

C. The standby generator sets shall be the product of a manufacturer who shall also be the manufacturer of the engine and alternator supplied.

D. Equipment submitted shall fit within the space shown on the Drawings. Equipment which does not fit within the space is not acceptable.

E. For the equipment specified herein, the manufacturer shall be ISO 9001 2000 certified.

1.06 DELIVERY STORAGE AND HANDLING

A. Protect equipment during shipment, handling, and storage by suitable complete enclosures. Protect equipment from exposure to the elements and keep thoroughly dry.

B. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Repaint damaged painted surfaces to the satisfaction of the OWNER/ENGINEER.

C. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR's choice and at the CONTRACTOR's expense, until such time that the site is ready for permanent installation of the equipment.

D. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.

E. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the CONTRACTOR at no expense to the OWNER.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

1. Cummins
2. Caterpillar

3. Generac Industrial Power
4. Approved Equal

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.02 RATINGS

A. The service voltage, shall be as shown on the Drawings.

B. Power: Standby, minimum size as shown on the Drawings, at 0.8 PF, based on site elevation of 3300 feet and ambient temperatures up to 50 degrees C.

2.03 PERFORMANCE

A. Voltage Regulation: Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.

B. Frequency Regulation: Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.

C. Load Pick Up: The diesel engine generator set shall be capable of picking up the entire mixed type load in one step, with starting and running voltage dips not exceeding 15% and frequency variation not more than +/- 5%. CONTRACTOR shall submit calculations showing that the generator sizing is correct for the voltage and frequency variations specified. Calculations based upon running voltage dips exceeding 15% and frequency variation exceeding +/- 5% will not be accepted.

2.04 ENGINE

A. Each engine shall be diesel, minimum of 4 cycle, radiator and fan cooled, with 4 cylinders. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable. Engine accessories and features shall include:

1. Governor System: An electronic governor system shall provide automatic isochronous frequency regulation.
2. Radiator and Cooling System: Skid mounted radiator and cooling system rated for full load operation in 122 degrees F (50 degrees C) ambient as measured at the generator air inlet. Radiator shall be provided with a duct adapter flange. The equipment supplier shall fill the cooling system with 50/50-ethylene glycol/water mixture. Rotating parts shall be guarded against accidental contact per OSHA requirements.

3. Electric System: An electric starter capable of three complete cranking cycles without overheating.
4. Lubrication Oil Pump: Positive displacement, mechanical, full pressure, lubrication oil pump.
5. Oil Filters: Full flow lubrication oil filters with replaceable spin on canister elements and dipstick oil level indicator.
6. Fuel Pumps: An engine driven, mechanical, positive displacement fuel pump. Fuel filter with replaceable spin on canister element.
7. Air cleaner: Replaceable dry element air cleaner with restriction indicator.
8. Fuel Lines: Flexible supply and return fuel lines.
9. Battery Charging Alternator: Engine mounted battery charging alternator, 45-ampere minimum, and solid state voltage regulator.

2.05 AC GENERATOR

A. General: Each AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 125 degrees Centigrade over a 50-degree Centigrade ambient.

B. Power: Each generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

C. Excitation: A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

D. Provide 120V, 1 phase anti-condensation heater for each generator set.

2.06 CONTROL

A. General: The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

B. Mounting: The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

C. Standards: The control shall be UL508 listed, CSA282 M1989 certified, and meet IEC8528 part 4. All switches lamps and meters shall be oil tight and dust tight and the enclosure door shall be gasketed. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts. The controls shall meet or exceed the requirements of Mil Std 461C part 9, and IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions. The entire control shall be tested and meet the requirements of IEEE587 for voltage surge resistance.

D. Features:

1. Mode Select Switch: The mode select switch shall initiate the following control modes. When in the RUN or Manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage. A dry contract shall be provided to indicate auto position of the selector switch.

2. Emergency Stop Switch: Switch shall be Red "mushroom head" push button. A protective cover shall be provided to prevent accidental operation. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.

3. Reset Switch: The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

4. Panel Lamp Switch: Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

5. Analog Output Metering: The generator set shall be provided with a metering set including the following features and functions: Analog voltmeter, ammeter, frequency meter, and kilowatt (kW) meter. Voltmeter and ammeter shall display all three phases. Ammeter and kW meter scales shall be color coded in the following fashion: readings from 0 90% of generator set standby rating: green; readings from 90 100% of standby rating: amber; readings in excess of 100%: red.

6. Digital Metering Set: Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output kW, kW hours, and power factor. Generator output voltage shall be available in line to line and line to neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.

7. Generator Set Alarm Display: The generator set shall be provided with alarm and status indicating lamps to indicate non automatic generator status, and existing alarm and shutdown conditions. The lamps shall be high intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on a digital display panel:

a. Low oil pressure (alarm)
b. Low oil pressure (shutdown)
c. Oil pressure sender failure (alarm)
d. Low coolant temperature (alarm)
e. High coolant temperature (alarm)
f. High coolant temperature (shutdown)
g. Engine temperature sender failure (alarm)
h. Low coolant level (alarm or shutdown selectable)
i. Fail to crank (shutdown)
j. Over crank (shutdown)
k. Over speed (shutdown)
l. Low DC voltage (alarm)
m. High DC voltage (alarm)
n. Weak battery (alarm)
o. Low fuel day tank (alarm)
p. High AC voltage (shutdown)
q. Low AC voltage (shutdown)
r. Under frequency (shutdown)
s. Over current (warning)
t. Over current (shutdown)
u. Short circuit (shutdown)
v. Over load (alarm)
w. Emergency stop (shutdown)
x. Fuel leak (alarm)

8. Special Alarm or Shutdown Conditions: Provisions shall be made for indication of two additional alarm or shutdown conditions. Labeling of the alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions
9. Engine Status Monitoring: The following information shall be available from a digital status panel on the generator set control:
    a. Engine oil pressure (psi. or kPA.)
    b. Engine coolant temperature (degrees F or C)
    c. Engine oil temperature (degrees F or C)
    d. Engine speed (rpm)
    e. Number of hours of operation (hours)

f. Number of start attempts

g. Battery voltage (DC volts)

10. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

11. A set of Form C dry type contacts shall be provided for customer remote alarm indication.

2.07 CONTROL FUNCTIONS

A. Cycle Cranking System: The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.

B. Idle Mode Control: The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.

C. Engine Governor Control: The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting. The governor control shall be suitable for use in paralleling applications without component changes.

D. Time Delay Start: The control system shall include time delay start (adjustable 0 300 seconds) and time delay stop (adjustable 0 600 seconds) functions.

E. Sender Failure Monitoring: The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed senders or wiring components, and an actual failure conditions.

2.08 ALTERNATOR CONTROL FUNCTIONS

A. Alternator Control Functions

B. Digital voltage Regulation: The generator set shall include an automatic digital voltage regulation system that is matched and prototype tested with the governing system provided. It shall be immune from misoperation due to load induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of 58 59 HZ. The voltage regulator shall include adjustments for gain, damping, and frequency roll off.

Adjustments shall be broad range, and made via digital raise-lower switches, with alpha-numeric LED readout to indicate setting level.

C. Output Current: Controls shall be provided to monitor the output current of the generator set and initiate an alarm when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator.

D. Output Power: Controls shall be provided to monitor the kW load on the generator set, and initiate an alarm condition when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load-shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

E. Over/under Voltage Monitor: An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

F. Battery Monitoring System: A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine starting, the low voltage limit shall be disabled, and if DC voltage drops to less than 24 volts for more than two seconds a "weak battery" alarm shall be initiated.

2.09 CONTROL INTERFACES FOR REMOTE MONITORING

A. General: All control and interconnection points from the generator set to remote components shall be brought to a separate connection box. No field connections shall be made in the control enclosure or in the AC power output enclosure. Provide the following features in the control system:

B. Alarm or Shutdown: Form "C" dry common alarm contact set rated 2A @ 30VDC to indicate existence of any alarm or shutdown condition on the generator set.

C. Generator set on: Two sets of contacts rated 2A @ 30VDC to indicate generator set is ready to load. The contacts shall operate when voltage and frequency are greater than 90% of rated condition.

D. Power Supply Circuit – Switched: A fused 10 amp switched 24VDC-power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

E. Power Supply Circuit – Continuous: A fused 20 amp nominal 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.

F. Following alarms and status shall be monitored:

1. Common Fault

2.10 COMMUNICATION

A. For each Generator Set, connect all remote connections, (i.e. control, statuses, alarms, metering) to a terminal strip for outgoing wiring to a PLC as shown on the Drawings.

B. Where all remote connections are multiplexed into a communications network, as shown on the Drawings, the connections from the metering and control devices shall be “daisy chained” from device to device, with the chain leaving the Section as a RS485/422 or RS232 as shown.

C. Where a RS485 Ethernet Converter is shown, furnish an Ethernet Converter, as specified in Section 26 09 13 - Power Metering and Protective Relays to, convert the “daisy chained” communications from RS485 to Ethernet.

D. The communication protocol between generator control unit and PLC/HMI should be Modbus TCP/IP.

2.11 BASE

A. The engine generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.

2.12 AUXILIARY EQUIPMENT AND ACCESSORIES

A. Coolant Heater: Engine mounted thermostatically controlled, coolant heater for each engine. Heater voltage shall be 480V, 1 phase. The coolant heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolants heaters shall be installed using quick disconnect couplers to isolate the heater for replacement of the heater element. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss. The coolant heater shall be provided with a thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the coolant heater system. The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 100F (40C) in a 40F ambient, in compliance with NFPA110 requirements.

B. Furnish and install lube oil heaters. Power to the heater shall be at 120V, 1 phase.

C. Vibration Isolators: Vibration isolators, spring/pad type, and quantity as recommended by the generator set manufacturer.

D. Starting and Control Batteries: Starting battery bank, calcium/lead antimony type, 24 volt DC, sized as recommended by the generator set manufacturer, shall be supplied for each generator set with battery cables and connectors.

E. Exhaust Silencer: Exhaust muffler(s) shall be provided for each engine, size and type as recommended by the generator set manufacturer. The mufflers shall be critical grade. Exhaust system shall be installed according to the generator set manufacturers recommendations and applicable codes and standards.

2.13 BATTERY CHARGER

A. UL listed/CSA certified 10-amp voltage regulated battery charger shall be provided in the engine generator set enclosure. Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float, taper and equalize charge settings. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30VDC for remote indication of:

1. Loss of AC power red light
2. Low battery voltage red light
3. High battery voltage red light
4. Analog DC voltmeter and ammeter, 12 hour equalize charge timer, AC and DC fuses shall also be provided on the charger.

2.14 OUTDOOR WEATHER-PROTECTIVE HOUSING

A. Generator set housing shall be provided factory assembled to generator set base and radiator cowling, and shall be of the sound-attenuated type. Housing shall provide ample airflow for generator set operation at rated load in the ambient conditions previously specified. The housing shall have hinged side access doors and rear control door. All doors shall be lockable. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color using a two step electro-coating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating, which meets the following requirements:

1. Primer thickness: 0.5-2.0 mils. Top coat thickness, 0.8-1.2 mils.
2. Gloss, per ASTM D523-89, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.
3. Crosshatch adhesion, per ASTM D3359-93, 4B-5B.
4. Impact resistance, per ASTM D2794-93, 120-160 inch-pounds.
5. Salt Spray: per ASTM B117-90, 1000+ hours.
6. Humidity: per ASTM D2247-92, 1000+ hours.
7. Water Soak: per ASTM D2247-92, 1000+ hours.
8. Painting of hoses, hose clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and

designed to minimize marring of the painted surface when removed for normal installation or service work.

B. Sound Attenuation

1. Housing shall be sound attenuating type, producing a noise level not greater than 75 dBa at 7 meters.

2.15 FUEL STORAGE TANK

A. Provide a dual-wall sub base fuel storage tank. The tank shall be sized to provide 24 hours usable capacity at 100% load. The tank shall be constructed of corrosion resistant steel and shall be UL listed. The equipment, as installed, shall meet all local and regional requirements for above ground tanks. Provide the fuel tank with a low fuel level switch and a leak detector. The fuel tank shall be constructed to place the fill spout on the generator end so to facilitate access from the generator enclosure entry door as shown on the Drawings.

2.16 VIBRATION ISOLATOR

A. Furnish and install spring type vibration- isolators between the sub – base tank and the generator set. A minimum of six (6) isolators shall be used, properly sized for the generator set supplied.

2.17 CIRCUIT BREAKERS

A. Furnish and install a generator mounted molded case circuit breaker of the rating and size as indicated on the drawing. The circuit breaker shall meet the specification in Section 26 18 16 Low Voltage Enclosed Circuit Breakers and Disconnect Switches.

B. Where shown on the Drawings, furnish and install two mounted main line circuit breakers, sized to carry the rated output current of the generator set at 480/277 volts 3 phase and 240/120 volts 3 phase.

C. The circuit breakers shall be rated at 65kAIC.

2.18 AUTOMATIC TRANSFER SWITCH

A. Automatic transfer switches shall be designed for an emergency and normal source of 480/277 Volt, 3 Phase, 4 Wire, 60 Hz. Current ratings and feeder arrangements shall be as shown on the Drawings. Switches shall be listed under UL 1008.

B. The switches shall initiate transfer of the load to the emergency source when any phase of the normal source drops below 90 percent of normal voltage.

C. The transfer switches shall be adequately constructed to carry full rated current on a continuous 24 hour basis in all approved enclosures and shall not show excessive heating or be subject to de rating. The transfer switches shall be capable of withstanding all available system fault currents without parting of or damage to contacts during the fault clearing time of the system over current device.

D. Automatic transfer switches shall have 10 cycles withstand ratings as shown on the Drawings.

E. The transfer switches shall be of inherently 3 Pole double throw construction and shall have three positions operation: closed to normal source, open, closed to emergency source. Time delay between opening of the closed contacts and closing of the open contacts shall be a minimum of 15 seconds to allow for load stabilization before transfer is complete.

F. The following accessories shall be furnished:

1. Close differential adjustable phase sensing relay set to drop out at 80 percent of rated voltage and pick up at 90 percent of rated voltage.
2. Adjustable 0.5 to 6.0 second time delay to override normal source power outages (set at 2 seconds).
3. Two auxiliary contacts to open on normal source failure (for combustion air damper control).
4. Two auxiliary contacts to close on normal source failure (for remote alarm and engine start).
5. Neutral (off) position adjustable time delay 0.1 to 10 seconds.
6. Adjustable time delay on retransfer to normal (1 to 300 seconds) with 0 to 25 minute adjustable unloaded engine running time after retransfers.
7. Refer to Drawings for: actual layout and location of equipment and components; current ratings of devices, bus bars, components; protective relays, voltage ratings of devices, components and assemblies; and other required details.
8. Furnish nameplates for each device as indicated on the Drawings. Nameplates shall be laminated plastic with black letters on white background. Nameplates shall be fastened by 316 stainless steel screws. There shall be a nameplate for each controller that indicates equipment ratings, manufacturer's name, shop order number and general information.

G. Enclosure

1. Enclosures installed outdoors shall be NEMA 4X, 316 stainless steel. Enclosures installed indoors shall be NEMA 12, Aluminum.

H. Controls

1. A maintained contact test auto switch and normal/emergency pilot lights shall be mounted on the door.

2.19 SPARE PARTS

A. Provide the following spare parts in the quantities specified:

1. 2 air cleaner elements of each type.
2. 2 Fuses of each type.
3. 1 Radiator hoses of each type.

4. 2 Fuel filters of each type.
5. 2 Oil filters of each type.
6. 1 Belts of each type.

2.20 FACTORY TESTING

A. The standby generator shall be completely assembled, wired, and adjusted at the factory and shall be given the manufacturer's routine shop tests and any other additional operational test to insure the workability and reliable operation of the equipment.

B. Factory test equipment and test methods shall conform with the latest applicable requirements of ANSI, IEEE, UL, and NEMA standards.

PART 3 EXECUTION

3.01 MANUFACTURER'S REPRESENTATIVE

A. Provide the services of a qualified factory-trained manufacturer's field engineer to assist the CONTRACTOR in installation and start-up of each type of the equipment specified below for a period of not less than 2 working days, with not less than one working day per standby generator. The manufacturer's field engineer shall provide technical direction and assistance to the CONTRACTOR in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.

3.02 INSTALLER'S QUALIFICATIONS

A. Installer shall be specialized in installing standby generators with minimum 5 years documented experience. Experience documentation shall be submitted for approval prior to beginning work on this project.

3.03 EXAMINATION

A. Examine installation area to assure there is enough clearance to install the equipment.

B. Concrete pads shall be installed as shown on the Drawings.

C. Check concrete pads and base plates for uniformity and level surface.

D. Verify that the equipment is ready to install.

E. Verify field measurements are in conformance with the manufacturer's recommendations.

3.04 INSTALLATION

A. The CONTRACTOR shall install all equipment per the manufacturer's recommendations and Contract Drawings.

B. Install the generator set with sub – base fuel tank on the concrete pad as shown on the drawings. Install the vibro-isolators between the sub – base fuel tank and the generator set. Installation shall be in accordance with the manufacturer's recommendations.

C. Installed required safety labels.

3.05 FIELD QUALITY CONTROL

A. Inspect installed equipment for anchoring, alignment, grounding and physical damage.

B. Check tightness of all accessible electrical connections. Minimum acceptable values are specified in manufacturer's instructions.

3.06 FIELD ADJUSTING

A. Adjust all circuit breakers, switches, access doors, operating handles for free mechanical and electrical operation as described in manufacturer's instructions.

B. The breaker protective devices shall be set in the field by a qualified Engineer of the manufacturer, retained by the CONTRACTOR, in accordance with settings designated in a coordinated study of the system as required in Section 26 05 73 - Power System Study.

3.07 EQUIPMENT START-UP

A. Operate unit to demonstrate ability to operate continuously without vibration, jamming, leakage or overheating and to perform specified functions, after installation and after manufacturer's Engineer's check of installed equipment.

B. Comply with manufacturer's operating and maintenance instructions during start up and operation.

C. Promptly correct improper installation of equipment.

D. Cooperate with supplier of equipment at time of start up and in making of all final adjustments necessary to place equipment in satisfactory working order. Start up shall not commence without the presence of the manufacturer's Engineer.

3.08 FIELD TEST

A. Upon completion of the installation and as soon as conditions permit, the emergency power supply system including the engine driven generator, electrical circuits, controls, transfer switch and other devices shall be tested in the presence of the OWNER/ENGINEER by the CONTRACTOR and the service representative for the manufacturer of the engine driven generator unit to assure that the system functions as specified.

B. Prior to scheduling the test, notify the OWNER/ENGINEER in writing that all requirements and provisions of the Contract Documents have been fulfilled, that all

apparatus shall be clean, properly adjusted and ready for operation and that the Instruction Manuals, parts lists and record drawings have been submitted.

C. The manufacturers' Engineer shall make such changes in wiring or connections and such adjustments, repairs or replacements necessary to make the circuit, device or control system function as specified and otherwise comply with the Contract Documents.

D. As part of the field test, the automatic shutdown devices shall be tested and the respective values recorded at which the devices will stop the engine. Any adjustments required shall be made in the devices to make the operating values correspond to those recommended by the engine manufacturer and as recorded during the stop test.

E. After a two hour test has been completed, additional testing shall be performed to demonstrate the emergency power supply system's ability to meet the automatic starting, load transfer and motor starting requirements.

F. If the emergency power supply system fails to fulfill the performance requirements of this specification, corrective action shall be taken and the system retested to assure full compliance. All expenses associated with the field tests, including any corrective action, shall be borne to the CONTRACTOR.

3.09 CLEANING

A. Remove all rubbish and debris from inside and around the motor controllers. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint free rags. Do not use compressed air.

3.10 EQUIPMENT PROTECTION AND RESTORATION

A. Touch-up and restore damaged surfaces to factory finish, as approved by the manufacturer. If the damaged surface cannot be returned to factory specification, the surface shall be replaced.

3.11 MANUFACTURER’S CERTIFICATION

A. A qualified factory-trained manufacturer's Engineer shall certify in writing that the equipment has been installed, adjusted, including all settings designated in the Power System Study, and tested in accordance with the manufacturer's recommendations.

B. The CONTRACTOR shall provide three (3) copies of the manufacturer's Engineer's certification.

3.12 TRAINING

A. Provide manufacturer's services for training of plant personnel in operation and maintenance of the Standby Generator Sets furnished under this Section.

B. The training for each type of equipment shall be for a period of not less than one (1) eight hour day.

C. The cost of training program to be conducted with OWNER's personnel shall be included in the Contract Price. The training and instruction, insofar as practicable, shall be directly related to the system being supplied.

D. Provide detailed Installation and O&M manuals to supplement the training course. The manuals shall include specific details of equipment supplied and operations specific to the project.

E. The training session shall be conducted by a manufacturer's qualified representative. Training program shall include instructions on the assembly, circuit breaker, engine, alternator, protective devices, metering, and other major components.

F. The OWNER reserves the right to videotape the training session for the OWNER’s use.

END OF SECTION

SECTION 26 34 13 NEMA FRAME INDUCTION MOTORS, 600 VOLTS AND BELOW

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Provide electric motors, accessories, and appurtenances complete and operable, in conformance with the individual driven equipment specifications and other sections of the Contract Documents.

B. The provisions of this Section shall apply to all low voltage NEMA Frame AC squirrel cage induction motors, except as indicated otherwise.

1.02 RELATED WORK

A. Section 26 05 00 - Electrical – General Provisions

B. Section 26 24 19 - Low Voltage Motor Control Centers

C. Section 26 09 13 - Power Metering and Protective Relays

D. Appropriate Mechanical Sections

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Division 1, Section 26 05 00 - Electrical – General Provisions and as specified herein.

B. Submittals shall also contain information on related equipment to be furnished under this Specification but described in the related sections listed in Related Work above. Incomplete submittals not containing the required information on the related equipment will be returned unreviewed.

C. The following information shall be submitted with the motor drawings for review.

1. Name of Drive
2. Horsepower of Motor
3. Phase
4. Efficiency at 1/2, 3/4, Full Load
5. Voltage
6. Power Factor at 1/2, 3/4, Full Load
7. Speed
8. NEMA Design Starting Torque
9. NEMA Frame and Dimensions
10. Full Load Current
11. Locked Rotor Current

12. Insulation Class
13. Temperature Rise at 1.15 SF
14. Enclosure
15. Bearing life design
16. Special features (i.e., space heaters, RTDs, oversize conduit box and corrosion resistant features).
17. Nameplate Drawing with Information, as specified, shown.

D. Suppliers of fractional horsepower motors below frame 143T will not be required to submit operational characteristics.

E. Factory Tests. Submittals shall be made for factory tests as specified above.

F. Field Test Reports. Submittals shall be made for field tests specified herein.

G. Operation and Maintenance Manuals.

1. Operation and maintenance manuals shall include the following information:
   a. Manufacturer's contact address and telephone number for parts and service.
   b. Instruction books and/or leaflets
   c. Recommended renewal parts list
   d. Record Documents for the information required by the submitted motor information above.

1.04 REFERENCE STANDARDS

A. Motors shall be designed, built, and tested in accordance with the latest revision of the following standards:

1. National Electrical Manufacturers Association Inc. (NEMA)
   a. NEMA MG1 - Motors and Generators.
   b. NEMA MG2 - Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators.
   c. NEMA MG3 - Sound Level Prediction for Installed Rotating Electrical Machines.
2. National Fire Protection Association (NFPA)
   a. NFPA-70 - National Electrical Code.
3. Underwriters Laboratories, Inc. (UL)
   a. UL-1004 - Electric Motors.
4. Institute of Electrical and Electronics Engineers, Inc. (IEEE)
   a. IEEE Std 1 - General Principles for Temperature Limits in the Rating of Electric Equipment.

b. IEEE Std 43 - Recommended Practice for Testing Insulation Resistance of Rotating Machinery.

c. IEEE Std 85 - Test Procedures for Airborne Sound Measurements on Rotating Electric Machinery.

d. IEEE Std 112 – Standard Test Procedure for Polyphase Induction Motors and Generators.

e. IEEE Std 275 - Recommended Practice for Thermal Evaluation of Insulation Systems for AC Electric Machinery Employing Form-wound Pre-insulated Stator Coils, Machines Rated 6,900 V and below.

f. IEEE Std 429 - Standard Test Procedure for the Evaluation of Sealed Insulation Systems for AC Electric Machinery Employing Form-wound Stator Coils.

g. IEEE Std 1349 – Guide for the Application of Electric Motors in Class 1, Div 2 Hazardous Locations.

5. Anti-Friction Bearing Manufacturer's Association Inc. (AFBMA):

a. AFBMA-9 & 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 DEFINITIONS

A. Motors specified herein are three-phase, squirrel cage induction type for ½ HP and above, and single phase for less than ½ HP, except as specifically specified elsewhere in these Specifications.

B. Exclusion. Any self contained portable appliance, which includes the motor with or without control that is specifically referred to, by catalog number on the Drawings or in other sections of the Specifications (more specifically fan coil unit motors, exhaust fan motors, unit heater motors, and blower ventilation motors) are not covered by this Section of the Specifications.

C. The word "Drive" shall be construed to mean the driven equipment, i.e. pump, hoist, fan, compressor, or adjustable frequency drive connected with the motor.

D. If there is inconsistency of size on different Drawing sheets or between Drawings and other sections of Specifications, relating to the horsepower designation, then the larger size shall be required.

1.06 QUALITY ASSURANCE

A. Motor Compatibility. The CONTRACTOR shall satisfy himself that the motor included with the drive is compatible with driven equipment and complies with these Specifications. In the event that the motors described in these Specifications can not be applied to the application or equipment offered, the CONTRACTOR may submit an exception, stating clearly the deviations and the reasons for such deviations. The acceptance or rejection of such deviations shall be at the sole discretion of the OWNER/ENGINEER.

B. When motors are furnished with driven equipment, the driven equipment supplier shall be responsible for mounting the motor and driven equipment as a complete unit, correctly aligned and coupled with the coupling or sheave specified on the driven equipment data sheet, and for designing vibration, special, or unbalanced forces resulting from equipment operation.

C. Motors manufactured more than twenty four (24) months prior to the date of this Contract will not be acceptable.

1.07 DELIVERY, STORAGE AND HANDLING

A. Protect equipment during shipment, handling, and storage by suitable complete enclosures. Protect equipment from exposure to the elements and keep thoroughly dry.

B. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Repaint damaged painted surfaces to the satisfaction of the OWNER/ENGINEER.

C. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR's choice and at the CONTRACTOR's expense, until such time that the site is ready for permanent installation of the equipment.

D. Where space heaters are provided in motors, provide temporary electrical power and operate space heaters, during jobsite storage and after motors are installed in permanent location, until equipment is placed in service.

E. The motor shaft shall be rotated on a monthly basis, if such is recommended or required by the motor manufacturer; the date recorded, and copies of the record provided to the OWNER/ENGINEER and the manufacturer. The manufacturer shall confirm receipt of the rotation record.

1.08 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

1. ABB/Baldor Motors
2. Siemens

3. Reliance
4. TECO – Westinghouse
5. Approved Equal

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.02 GENERAL REQUIREMENTS

A. Each motor provided shall have an Identification Tag Number, conforming to the numbering system and equipment name shown on the Drawings.

B. Specific motor data such as HP, RPM, enclosure type, etc., is specified under the detailed specification for the mechanical equipment with which the motor is supplied.

C. The motor manufacturer's nameplates shall be engraved or embossed on stainless steel and fastened to the motor frame with stainless steel screws or drive pins. Nameplates shall indicate clearly all of the items of information enumerated in NEMA Standard MGI, as applicable, including but not limited to the following information:

1. Horsepower (output).
2. RPM at full load.
3. Time rating.
4. Frequency.
5. Number of phases.
6. Model number.
7. Rated voltage.
8. Service factor.
9. Full load amps.
10. Insulation class.
11. NEMA design letter.
12. NEMA code letter.
13. Temperature Rise.
14. NEMA Frame size.
15. Date of manufacture.
16. Thermal protection (if supplied).

D. Where frequent starting occurs, the design for frequent starting duty shall be equal to the duty service required by the driven equipment.

E. Hazardous Environments

1. Motors located in hazardous classified areas shall be provided with a box for potting compound to seal connections in accordance with NEMA MG 1.
2. Class I, Division 1: Totally-enclosed fan-cooled, explosion proof, UL listed and labeled. Motors shall be UL rated for operation with VFD units for VFD applications.
3. Class I, Division 2: Motors shall comply with IEEE 1349 for construction and temperature rise.
4. Class II, Division 1, Groups E, F, and G: Totally enclosed fan-cooled, dust-ignition proof, UL listed and labeled
5. Class III: Totally enclosed fan-cooled. Motor shall be capable of operating at full rating without exceeding the maximum surface temperatures as limited by NEC 503.

F. Altitude: Under 3300 FT. For applications above 3300 FT, motors shall be specifically designed and certified for operation at the specific altitude.

G. Motors shall have sufficient horsepower and torque capacity to drive the equipment without overloading under all conditions, without exceeding the nameplate rating of the motor and without use of the service factor.

H. Motors shall have a breather drain in each end bracket of the TEFC motor enclosure. Stainless steel automatic breather drains shall be provided in the lowest part of both end brackets to allow drainage of condensation.

I. Motors shall be slide rail mounted for all belt or chain-driven applications.

J. Air inlets and outlets shall be protected by vermin-proof, corrosion resistant louvers. The air inlets shall be located on end or side as required by the application.

K. Motors shall have an oversized, gasketed, cast iron conduit box, field adjustable in 90-degree increments unless the box contains equipment, diagonally split with tapped NPT threaded conduit entrance hole, and shall exceed the minimum volumes defined in IEEE 841-2001. Neoprene conduit box cover gasket and neoprene lead seal gasket with flexible nipples to ensure the seal is maintained as the leads are moved shall be furnished. Provision for grounding shall be provided in the conduit box utilizing a mounted clamp-type lug.

L. Provide separate accessory lead conduit boxes. Minimum size entrance hub shall be ¾”C. Resistance temperature detector leads shall not occupy the same box with any other type of power or monitoring leads.

M. Motor frames, end brackets, and conduit box shall be of cast-iron.

N. Provide lifting lugs on the motor frame.

O. Motors shall be NEMA Design B standard, unless otherwise specified.

P. Service factor shall be 1.15 for all motors when operated on sine wave power, and 1.0 service factor when operated on PWM inverter power.

Q. Motors shall meet NEMA MG 1 (NEMA Premium) efficiencies. If the motor horsepower, or speed, is not covered in the Tables of Part 4 of this Section, provide the manufacturer's "Energy Efficient" type.

R. All motors shall be continuous time rated suitable for operation in a 40 degrees C ambient, unless specified otherwise.

S. Unless otherwise indicated or specified, motors shall be totally enclosed fan cooled (TEFC), for all applications. See the mechanical specifications for pumps and other equipment that require additional enclosure requirements.

T. TEFC Motors shall have corrosion resistant enclosures, epoxy paint, corrosion resistant fittings and stainless steel or aluminum nameplates similar to “Mill and Chemical”, “Corro-Duty”, “Chemical Processing” motors, or equal.

U. The motors are to be bi-directional. If the fan must be uni-directional, it shall be the motor manufacturer's responsibility to obtain the direction required from the drive manufacturer.

V. Guards

1. Exposed moving parts shall be provided with guards in accordance with the requirements of OSHA. Guards shall be fabricated of flattened expanded metal screen, 3/4-inch No. 10, to provide visual inspection of moving parts without removal of the guard.
2. Guards shall be galvanized after fabrication and shall be designed to be readily removable to facilitate maintenance of moving parts. Windows shall be provided in the guard for access to the lubricating fittings.

2.03 FRACTIONAL HORSEPOWER MOTORS – LESS THAN ½ HP

A. Motor voltage shall be single phase, 115 V, 60 Hz, unless otherwise shown on the Drawings.

B. Enclosures shall be TEFC or TENV.

C. Motors shall have a built-in manual or automatic reset thermal protector, or an integrally mounted, enclosed manual reset, motor overload switch.

2.04 MOTORS ½ HP AND LARGER

A. Motor voltage shall be single voltage, as shown on the Drawings, and in compliance with IEEE 841.

B. Motors shall have NEMA standard Class "F" insulation with Class "B" temperature rise above 40 Deg C ambient on a continuous operation or intermittent duty at nameplate horsepower.

C. Motors shall have non-hygroscopic encapsulated windings. Motor leads shall be Class F rated, with permanent identification.

D. Motor rotors, exceeding Code G, shall be fabricated copper. Rotors on frames 213T and above shall be keyed to the shaft and rotating assembly dynamically balanced. Balance weights, if required, shall be secured to the rotor resistance ring by penned integrally cast sprees. Machine screws and nuts are not acceptable. The rotating assembly shall be coated with a corrosion-resistant epoxy.

E. Motors larger than 15 HP shall have a locked rotor inrush kVA not exceeding Code G (6.29 KVA/HP).

F. Motors shall meet or exceed the minimum guaranteed efficiencies, listed in the Tables of Part 4 of this Section, at the approximate nameplate current values at 460 volts.

G. The motor insulation system for motors controlled with VFD's shall have full capability to handle the common mode voltage conditions imposed by the VFD. Motor insulation system shall conform to all of the requirements of the latest version of NEMA MG1, Part 31 for peak voltage withstand capability.

H. The critical speed of the shaft and rotor assembly shall exceed the operating speed by a minimum of 10 percent.

I. The no-load sound pressure level, based on the A-weighted scale at 3 feet, when measured in accordance with IEEE Std. 85 shall not exceed 85 dBA.

J. Vibration limits shall not exceed 0.2-in/sec at any frequency.

K. Motors shall have a minimum of two brass grounding pads on each motor frame.

L. Bearings

1. Motors 1/2 through 5 HP shall have permanently lubricated sealed antifriction ball-bearings with L10 lifetime of 50,000 HRS.
2. Motors 5 through 50 HP, for direct connected or coupled applications, shall have oil or grease-lubricated antifriction ball-bearings with L10 lifetime of 100,000 HRS.
3. Motors 50 HP and larger shall have oil or grease-lubricated antifriction ball-bearings with L10 lifetime of 50,000 HRS.
4. Vertical motor thrust and guide bearings shall conform to AFBMA standards and shall have L10 lifetime ratings as specified for ball-bearings of the same horsepower range. Down thrust information shall be provided to the motor manufacturer by the equipment supplier.
5. Anti friction motor bearings shall be designed to be regreasable and initially shall be filled with grease suitable to ambient temperature of 40 degrees C.
6. Grease lubricated bearings, except those specified to be factory sealed and lubricated, shall be fitted with easily accessible grease supply, flush, drain and relief fittings. Extension tubes shall be used when necessary. Grease supply fittings shall be standard hydraulic type as manufactured by the Alemite Division of the Stewart Warner Corporation.

7. Sealed bearings shall be contact seal (lip) or non contact labyrinth type.

M. Space Heaters

1. Space heaters shall be supplied with all 3 phase motors and shall conform to the following:

   a. Heaters shall be of the cartridge or flexible wrap around type installed within the motor enclosure adjacent to core iron. Heaters shall be rated for 120 V, single phase with wattage as required. The heater wattage and voltage shall be embossed on the motor nameplate. Power leads for heaters shall be brought out at the motor accessory lead junction box.

N. Stator Temperature Detection

1. Winding temperature detectors of the bi-metallic switch type shall be provided for all motors above 75 hp through 150 hp, and for all motors through 150 hp controlled by adjustable frequency drives. Provide the detectors factory installed, embedded, with leads terminating in the main conduit box. Device shall protect the motor against damage from overheating caused by single phasing, overload, high ambient temperature, abnormal voltage, locked rotor, frequent starts or ventilation failure. The switch shall have normally closed contacts. Not less than three detectors shall be furnished with each motor.

2. Winding temperature detectors of the resistance-type temperature detector type shall be provided for all motors larger than 150 hp. Each detector shall be of the 100-ohm platinum type. Each phase winding shall have two detectors for a total of six. Install the detectors between stator coils where the highest temperature will occur. One set in each phase shall be operational and one set spare.

3. Wire all temperature detectors to separate terminal box on the motor. Terminal box shall be weatherproof NEMA 4 with barrier-type screw-post terminals.

O. Bearing Temperature Detection

1. Where specified elsewhere or shown on the Drawings, bearing temperature detectors of the resistance-type temperature detector type (RTD) shall be provided in each pump, blower, or as specified in the equipment specifications. For vertical motors, provide a detector in each thrust bearing and lower radial guide bearing. Each detector shall be of the 100-ohm platinum type.

P. Motors 100 HP and larger shall be corrected to 95 percent lagging power factor with the use of power factor correction capacitors.

Q. For motors utilizing power factor correction capacitors connected to the starter output terminals, the motor overload elements or trip settings shall be adjusted downwards to reflect the reduction in line current resulting from power factor correction. Power factor correction capacitors shall not be applied to the load side of adjustable frequency drives.

R. A Motor Protection Relay shall be provided, for each motor, to monitor winding and bearing temperature detectors. Motor Protection relays shall be as specified in Section 26 09 13 - Power Metering and Protective Relays. Location of the Motor Protection Relays shall be as specified elsewhere or as shown on the Drawings.

2.05 FACTORY TESTING

A. Motors rated 300 HP and larger shall be standard motor tested. Except where specific testing or witnessed shop tests are required by the specifications for driven equipment, factory test reports may be copies of routine test reports of electrically duplicate motors. Test report shall indicate test procedure and instrumentation used to measure and record data. Test report shall be certified by the motor manufacturer's test personnel and be submitted to the ENGINEER for approval.

B. When specified under the detailed mechanical section, provide a complete test per NEMA MG1 and IEEE Standard 112 consisting of the following:

1. Full Load Heat Run
2. Temperature Test (Actual loading method)
3. Performance Test
4. Locked Rotor
5. No Load Saturation
6. Speed Torque
7. Winding Resistance (A 118 and 43)
8. High Potential
9. Noise Test (A 85)

C. Balance and vibration shall meet NEMA standards MG1-12.05 and MG1-12.06.

PART 3 EXECUTION

3.01 INSTALLATION

A. The CONTRACTOR shall install motors in accordance with the manufacturer’s instructions.

B. Make a visual and mechanical inspection.

C. Check for physical damage.

D. Compare equipment nameplate information with single line diagram and report any discrepancies.

E. Inspect for proper mounting, grounding, connection, and lubrication.

F. Inspect each motor for the proper installation, rated voltage, phase and speed.

G. Check for proper phase and ground connections, Check to see that multi-voltage motors are connected for the proper voltage.

3.02 TESTS

A. Test for proper rotation prior to connection to the driven equipment.

B. Test the insulation (megger test) of all new motors, 10 hp and above, in accordance with NEMA MG-1. Test voltage shall be 1000 VAC plus twice the rated voltage of the motor.

C. For motors 300 hp and larger, test duration shall be for 10 minutes with resistances tabulated every 15 seconds for the first minute and then every minute for the next ten. The megohm rating at the end of the 10 minutes shall be at least twice as high as the 1 minute reading. Dielectric absorption ratio and polarization index shall be calculated.

D. Perform a rotation test to ensure proper shaft direction.

E. Where a motor is inverter fed, the direction of rotation shall be checked by momentary application of voltage to the motor, to confirm that the phase sequence is the same as the incoming power to the inverter.

F. Measure running current and evaluate relative to load conditions and nameplate full load amperes.

G. Inspect for unusual mechanical or electrical noise or signs of overheating during initial test run.

H. Monitor motors during startup and commissioning to record operating amps, voltage and operating vibration levels.

I. Submit test report and all recorded field data. Submit copies of the raw data recorded in the field, signed by the person recording the data, and typewritten reports certified by the CONTRACTOR. The motors will not be accepted until the reports are submitted and approved.

PART 4 TABLES OF MOTOR EFFICIENCIES

OPEN DRIP-PROOF (ODP)								
FULL-LOAD EFFICIENCIES OF ENERGY EFFICIENT MOTORS								
OPEN MOTORS								
	2 POLE (3600 RPM)		4 POLE (1800 RPM)		6 POLE (1200 RPM)		8 POLE (900 RPM)	
HP	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.
1.0	--	--	82.5	80.0	80.0	77.0	74.0	70.0
1.5	82.5	80.0	84.0	81.5	84.0	81.5	75.5	72.0
2.0	84.0	81.5	84.0	81.5	85.5	82.5	85.5	82.5
3.0	84.0	81.5	86.5	84.0	86.5	84.0	86.5	84.0
5.0	85.5	82.5	87.5	85.5	87.5	85.5	87.5	85.5
7.5	87.5	85.5	88.5	86.5	88.5	86.5	88.5	86.5
10.0	88.5	86.5	89.5	87.5	90.2	88.5	89.5	87.5
15.0	89.5	87.5	91.0	89.5	90.2	88.5	89.5	87.5
20.0	90.2	88.5	91.0	89.5	91.0	89.5	90.2	88.5
25.0	91.0	89.5	91.7	90.2	91.7	90.2	90.2	88.5
30.0	91.0	89.5	92.4	91.0	92.4	91.0	91.0	89.5
40.0	91.7	90.2	93.0	91.7	93.0	91.7	91.0	89.5
50.0	92.4	91.0	93.0	91.7	93.0	91.7	91.7	90.2
60.0	93.0	91.7	93.6	92.4	93.6	92.4	92.4	91.0
75.0	93.0	91.7	94.1	93.0	93.6	92.4	93.6	92.4
100.0	93.0	91.7	94.1	93.0	94.1	93.0	93.6	92.4
125.0	93.6	92.4	94.5	93.6	94.1	93.0	93.6	92.4
150.0	93.6	92.4	95.0	94.1	94.5	93.6	93.6	92.4
200.0	94.5	93.6	95.0	94.1	94.5	93.6	93.6	92.4
250.0	94.5	93.6	95.4	94.5	95.4	94.5	94.5	93.6
300.0	95.0	94.1	95.4	94.5	95.4	94.5	--	--
350.0	95.0	94.1	95.4	94.5	95.4	94.5	--	--
400.0	95.4	94.5	95.4	94.5	--	--	--	--
450.0	95.8	95.0	95.8	95.0	--	--	--	--
500.0	95.8	95.0	95.8	95.0	--	--	--	--

TOTALLY ENCLOSED - FAN COOLED (TEFC)								
ENCLOSED MOTORS								
	2 POLE (3600 RPM)		4 POLE (1800 RPM)		6 POLE (1200 RPM)		8 POLE (900 RPM)	
HP	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.
1.0	75.5	72.0	82.5	80.0	80.0	77.0	74.0	70.0
1.5	82.5	80.0	84.0	81.5	85.5	82.5	77.0	74.0
2.0	84.0	81.5	84.0	81.5	86.5	84.0	82.5	80.0
3.0	85.5	82.5	87.5	85.5	87.5	85.5	84.0	81.5
5.0	87.5	85.5	87.5	85.5	87.5	85.5	85.5	82.5
7.5	88.5	86.5	89.5	87.5	89.5	87.5	85.5	82.5
10.0	89.5	87.5	89.5	87.5	89.5	87.5	88.5	86.5
15.0	90.2	88.5	91.0	89.5	90.2	88.5	88.5	86.5
20.0	90.2	88.5	91.0	89.5	90.2	88.5	89.5	87.5
25.0	91.0	89.5	92.4	91.0	91.7	90.2	89.5	87.5
30.0	91.0	89.5	92.4	91.0	91.7	90.2	91.0	89.5
40.0	91.7	90.2	93.0	91.7	93.0	91.7	91.0	89.5
50.0	92.4	91.0	93.0	91.7	93.0	91.7	91.7	90.2
60.0	93.0	91.7	93.6	92.4	93.6	92.4	91.7	90.2
75.0	93.0	91.7	94.1	93.0	93.6	92.4	93.0	91.7
100.0	93.6	92.4	94.5	93.6	94.1	93.0	93.0	91.7
125.0	94.5	93.6	94.5	93.6	94.1	93.0	93.6	92.4
150.0	94.5	93.6	95.0	94.1	95.0	94.1	93.6	92.4
200.0	95.0	94.1	95.0	94.1	95.0	94.1	94.1	93.0
250.0	95.4	94.5	95.0	94.1	95.0	94.1	94.5	93.6
300.0	95.4	94.5	95.4	94.5	95.0	94.1	--	--
350.0	95.4	94.5	95.4	94.5	95.0	94.1	--	--
400.0	95.4	94.5	95.4	94.5	--	--	--	--
450.0	95.4	94.5	95.4	94.5	--	--	--	--
500.0	95.4	94.5	95.8	95.0	--	--	--	--

END OF SECTION

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SECTION 26 41 00 LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified, and required to furnish and install an Underwriters Laboratories listed Master Labeled Lightning Protection System for all structures.

B. The CONTRACTOR shall employ the services of a licensed lightning protection systems engineering company to design and install the lightning protection system and prepare detailed installation drawings and material specifications.

1.02 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Layouts showing the lightning protection system for each structure and the site.
2. Manufacturer's technical information for the materials proposed for use in the systems.

1.03 REFERENCE CODES AND STANDARDS

A. All products and components shown on the Drawings and listed in this specification shall be designed, manufactured, and installed according to latest revision of the following standards (unless otherwise noted):

1. NFPA 70 – National Electrical Code (NEC)
2. NFPA 780 – Lightning Protection Code
3. UL 96A – Installation Requirements for Lightning Protection Systems

B. All equipment specified in this section of the Specifications shall bear the appropriate label of Underwriters Laboratories.

1.04 QUALITY ASSURANCE

A. The manufacturer of these materials shall have produced similar lightning protection systems for a minimum period of five (5) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar systems shall be provided demonstrating compliance with this requirement.

B. Equipment submitted shall fit within the space shown on the Drawings. Equipment which does not fit within the space is not acceptable.

1.05 DELIVERY STORAGE AND HANDLING

A. Protect equipment during shipment, handling, and storage by suitable complete enclosures. Protect equipment from exposure to the elements and keep thoroughly dry.

B. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Repaint damaged painted surfaces to the satisfaction of the OWNER/ENGINEER.

C. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR's choice and at the CONTRACTOR's expense, until such time that the site is ready for permanent installation of the equipment.

D. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.

E. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.06 WARRANTY

A. The Manufacturer shall warrant the system and equipment to be free from defects in material and workmanship for 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the CONTRACTOR at no expense to the OWNER.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

1. Thompson Lightning Protection Company, St. Paul, Minnesota.
2. Heary Bros. Lightning Protection, Springville, NY.
3. Harger Lightning Protection, Inc., Libertyville, IL.
4. Or equal.

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.02 MATERIALS

A. Class 1 Materials: Furnish conductors, fittings, and fixtures necessary to protect ordinary buildings and structures not exceeding 75 feet (23 m) in height.

B. Materials, Class I. Table I give minimum sizes and weights for air terminals, and main and secondary conductors. Secondary conductors, which are used for bonding and

interconnecting metallic bodies to the main conductor, and which will not be required to carry the main lightning current, may be reduced in size, but not less than No. 6 AWG aluminum or equivalent. Use main conductor size for interconnection to metal water systems, steam or hot water heating systems, or other metallic masses having a low resistance to ground.

1. Table I: Class I Material Requirements.

Type of Conductor	Dimension	Aluminum Standard
Air Terminal Solid	Min. Diameter Min. Length	5/8 inch 18 Inches
Main Conductor,	Thickness	#6 AWG Min.
Secondary Conductor,	Thickness	#6 AWG Min.

2. All air terminal bases shall be cast bronze with stainless steel bolt pressure cable connectors.
3. All air terminal bases for flat roof areas shall be of the adhesive type.

C. Conductors

1. Conductors shall be aluminum, consist of wire size, stranding, and weight in accordance with NFPA 780, and installed in accordance with the UL Code. Conductors on the flat roof areas may be run exposed. Ground connections shall be made to the main down conductor at a maximum of 60 ft 0 in on centers.

D. Fasteners

1. Conductor fasteners shall be an approved type of non corrosive metal, have ample strength to support conductors and shall be spaced not to exceed 3 ft 0 in centers. Masonry type cable fasteners spaced every 3 ft 0 in on masonry. Adhesive type cable fasteners spaced every 3 ft 0 in on flat roofs.

E. Cable Connectors

1. All cable connectors shall be cast bronze with screw pressure type stainless steelbolts and nuts.

F. Where any part of a protection system is exposed to potential mechanical injury, protect it by covering it with molding or tubing. If ferrous metal pipe or tubing is used around the conductor, connect the conductor electrically to the pipe or tubing at both ends.

PART 3 EXECUTION

3.01 INSTALLATION

A. All materials shall be installed by experienced workmen that specialize in this type of work. The lightning protection system shall be installed per approved shop drawings and UL and NFPA recommended practices.

B. Install two-foot high air terminals on structure steel framework bonded to the down coming cables at intervals not to exceed twenty feet.

C. Bond structure steel framework to the down-coming cables.

D. Bond all metal pipes and metal structures to the down-coming cables.

E. All concealed conductors shall be installed in Schedule 40 PVC conduit.

F. All components of the system, on or above the roof, shall be connected to the system ground.

3.02 TESTING

A. Test the complete system for continuity and for resistance to ground and verify that the resistance to ground from the farthest point in the system is 5 ohms or less.

B. Inspect the system for proper installation.

C. Inspection and testing to be performed by personnel regularly engaged in the installation and testing of Master Labeled lightning protection systems.

D. The CONTRACTOR shall employ the services of a UL field inspector, for inspection of the system upon completion of the installation. The CONTRACTOR shall assume full responsibility for the correctness of the installation and shall make any and all corrections and additions deemed necessary by the UL inspector. The CONTRACTOR shall pay for all costs of the UL inspection and any subsequent re-inspections as required.

END OF SECTION

SECTION 26 50 00 LIGHTING SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install a complete lighting system ready for operation as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Section 26 05 00 - Electrical – General Provisions

B. Section 26 05 73 - Power System Study

C. Section 26 28 16 - Low Voltage Circuit Breakers and Fusible Switches

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Division 1, Section 26 05 00 - Electrical – General Provisions and as specified herein.

B. Submittals shall also contain information on related equipment to be furnished under this Specification but described in the related sections listed in the Related Work paragraph above. Incomplete submittals not containing the required information on the related equipment will be returned unreviewed.

C. Manufacturer's technical information for the materials proposed for use in the systems.

1.04 QUALITY ASSURANCE

A. All fixtures shall be of the energy-efficient type.

B. The manufacturer of these materials shall have produced similar lighting fixtures for a minimum period of five (5) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar systems shall be provided demonstrating compliance with this requirement.

C. Equipment submitted shall fit within the space shown on the Drawings. Equipment which does not fit within the space is not acceptable.

1.05 DELIVERY STORAGE AND HANDLING

A. Protect equipment during shipment, handling, and storage by suitable complete enclosures. Protect equipment from exposure to the elements and keep thoroughly dry.

B. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Repaint damaged painted surfaces to the satisfaction of the OWNER/ENGINEER.

C. Equipment shall not be stored onsite without written approval of the OWNER/ENGINEER. Equipment must be installed in its permanent location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within

seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, in an air conditioned, bonded, warehouse of the CONTRACTOR's choice and at the CONTRACTOR's expense, until such time that the site is ready for permanent installation of the equipment.

D. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.

E. Where space heaters are provided in equipment, provide temporary electrical power and operate space heaters during storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.06 WARRANTY

A. The Manufacturer shall warrant the system and equipment to be free from defects in material and workmanship for 1 year from date of final acceptance of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the CONTRACTOR at no expense to the OWNER.

PART 2 PRODUCTS

2.01 MATERIALS

A. Lighting Fixtures

1. Lighting fixture types shall be furnished as required by the "Lighting Fixture Schedule" on the Drawings. The catalog numbers are given as a guide to the design and quality of fixture desired. Equivalent designs and equal quality fixtures of other manufacturers will be acceptable upon approval by the OWNER/ENGINEER.
2. Where specified to match existing fixtures, fixtures of the same manufacturer and type shall be installed.

B. Lamps

1. Fluorescent lamps shall be medium bi-pin, recessed, double contact, rapid start, tri-phosphor, 4100 Kelvin and compact types all as shown on the "Fixture Schedule".
2. Mercury vapor lamps shall be deluxe white of the size and type as shown on the "Lighting Fixture Schedule."
3. High pressure sodium lamps shall be clear and of the size and type as shown on the "Lighting Fixture Schedule."
4. Metal halide lamps shall be clear and of the size and type as shown on the "Lighting Fixture Schedule."
5. Incandescent lamps shall be inside frosted, extended service, 2500 hour life with medium base.
6. Furnish PL lamps where listed.
7. LED lighting module. Useful life should be 95,000 to 100,000 hours LM-80 lifetime. LED module shall be composed of distinct, individual high performance LEDs.

System must include an integral TVSS. Individual LEDs, if they fail, shall fail short keeping the rest of the LED light source operating. Operational voltage should be 120 – 277 Volts. Color temperature should be neutral white, 4000 Kelvin nominal.

8. All lamps shall be of one manufacturer and shall be as manufactured by Osram/Sylvania Electric Products, Inc.; General Electric Co.; North American Philips Lighting Corp. or equal.

C. Ballasts

1. Unless otherwise indicated in the Lighting Fixture Schedule, fluorescent ballasts shall be electronic, high-frequency, full-output rapid-start type for use on 265 mA, T8 lamps.

   a. All ballasts shall be UL listed, ETL certified, Class "P", high power factor (minimum 0.90).

   b. Ballasts shall have an "A" sound rating or better.

   c. All ballasts used in exterior applications shall have a minimum starting temperature of 0 degrees F unless otherwise specified.

   d. All interior ballasts shall have a minimum starting temperature of 50 degrees F.

   e. Ballasts shall be series wired type and designed to operate the number and length of lamps specified.

   f. The total harmonic distortion (THD) of each ballast shall be in accordance with the requirements of the utility company and in no case shall it be less than 10 percent THD.

   g. Ballasts shall have a minimum ballast factor of 0.88.

   h. Ballasts shall have nominal power factor 0.90 or higher.

   i. Ballasts shall have a maximum lamp current crest factor of 1.7.

   j. Ballast shall provide normal rated life for the lamp specified.

   k. All electronic ballasts shall be warranted for parts and replacement for 1 full year from the date of installation.

   l. Electronic ballasts shall be as manufactured by Advance, Model Mark V, similar by Valmont; Osram/Sylvania; MagneTek or equal.

2. Mercury vapor ballasts shall be of the constant wattage auto-transformer type, with multitap windings, of the correct size and voltage for the fixture it is to serve as shown on the "Lighting Fixture Schedule". All ballasts shall be as manufactured by Holophane Lighting, similar by MagneTek Universal; Advance Transformer Company or equal.

3. High pressure sodium ballasts shall be of the constant wattage type, with multitap windings, of the correct size and voltage for the fixture it is to serve as shown on the "Lighting Fixture Schedule". All ballasts shall be as manufactured by Advance Transformer Co., similar by Holophane Lighting; MagneTek Universal Manufacturing or equal.

4. Metal halide ballast shall be of the constant voltage auto-transformer type, with multitap windings, of the correct size and voltage for the fixture it is to serve as shown

on the "Lighting Fixture Schedule". All ballasts shall be as manufactured by Holophone Lighting; MagneTek Universal Manufacturing; Advance Transformer Co. or equal.

D. Flexible Fixture Hangers

1. Flexible fixture hangers used in non-hazardous areas shall be type ARB and flexible fixture supports used in hazardous areas shall be Type ECHF as manufactured by the Crouse-Hinds Co., similar by Appleton Electric Co.; Killark Electrical Mfg. Co. or equal.

E. Explosion-proof Portable Handlamp

1. An explosion-proof handlamp complete with heavy duty, Type S0, 50-ft cord and plug shall be furnished. The handlamp shall be manufactured by Appleton Electric Co.; the plug shall be manufactured by Appleton Electric Co., similar to Daniel Woodhead Co. or equal.

F. Vapor-tight Portable Handlamp

1. A vapor-tight handlamp with reflector shall be furnished complete with 50-ft cord and grounding plug. The handlamp shall be manufactured by Daniel Woodhead Co., similar by Appleton Electric Co. or equal.

G. Lamp Changing Equipment

1. Lamp changing equipment shall be able to handle BT-37, E-18, E-23-1/2 and E-28 type H.I.D. lamps in open luminaries.
2. Equipment shall consist of three 5-ft steel poles each similar and equal to McGill Catalog No. 160-P and two lamp holders similar and equal to McGill Catalog Nos. 158C and 161C.

H. Emergency Lighting Battery Units

1. Emergency lighting units and remote lighting heads shall be as specified in the "Lighting Fixture Schedule" shown on the Drawings.
2. Battery units shall be of the self-contained, fully automatic type with sealed lead acid batteries, volt-meters and time delay relays where used in H.I.D. lighted areas.
3. Unit enclosures shall be compatible to their environment and units shall comply with the requirements of NFPA 70 (NEC).
4. All necessary mounting hardware shall be provided.

PART 3 EXECUTION

3.01 INSTALLATION

A. The location of lighting fixtures shown on the Drawings is approximate. The CONTRACTOR shall install the lighting fixtures after major ducts and piping are installed, to avoid conflicts. He shall install the fixtures to avoid shadows and blocking of light, relocating the fixtures as necessary, at no cost to the OWNER.

B. Each fixture shall be a completely finished unit with all components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designated location and shall be completely wired ready for connection to the branch circuit wires at the outlet.

C. All flush mounted fixtures shall be supported from the structure and shall not be dependent on the hung ceilings for their support.

D. Fixtures noted to be installed flush in suspended ceilings shall be of mounting types suited for the type ceiling involved. It shall be the responsibility of the CONTRACTOR to verify the ceiling types prior to ordering fixtures.

E. Flexible fixture hangers shall be used for all pendant mounted fixtures. Fixtures 2-ft long and larger shall be supported with a minimum of two fixture hangers.

F. Conduit run in areas with hung ceilings shall be installed in the space above the hung ceiling as close to the structure as possible. Conduits shall be supported from the structure.

G. Exterior lighting poles shall be mounted plumb.

H. Fixture locations are shown on the Drawings in approximate locations; however exact locations shall be coordinated so as to avoid conflicts with HVAC ducts, equipment and other obstacles.

3.02 REPLACEMENT

A. Lamps (except for H.I.D.) used during the building construction, prior to 2 weeks from completion of the work, shall be removed and replaced with new lamps.

3.03 CLEANING UP

A. Plastic dust cover bags to be provided with new parabolic reflector lighting fixtures shall be removed after all construction activity that may cause dust formation on reflector surfaces has been completed.

B. All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the OWNER/ENGINEER.

END OF SECTION

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SECTION 31 00 00 SITE GRADING AND EARTHWORK

PART 1 - GENERAL

1.1 Work Included

A. General excavation and fill operations, rough grading and contouring of site, and drainage ditches.

B. Aggregate fill and earth fill material classifications and requirements.

1.2 Quality Assurance

A. All materials to be used whether excavated on-site or imported as offsite borrow, shall be tested for compliance with the requirements of this section prior to placement.

B. Referenced Standards:
   1. ASTM D 698 Moisture Density Relationship of Soils using Standard Effort.
   2. ASTM D 2487 Classification of Soils for Engineering Purposes.
   3. ASTM D 4253 Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

C. Notify OWNER when bearing material (bottom of excavation) is reached for observation of founding strata.

D. Provide the services of an EPA approved laboratory to perform a toxic contaminant scan of composite soil samples representative of each off-site separate borrow source, in accordance with EPA protocol for the list of contaminants contained in 40 CFR, Part 261, Appendix VIII, by EPA methods SW-846, prior to importing any soil borrow. Any potential off-site soil borrow on which the test results indicate the presence of contaminants above background levels should be rejected. Soil materials derived from the excavation of underground petroleum storage tanks should not be used as fill on this project.

E. Prior to furnishing any soils to the site, CONTRACTOR shall furnish a written, notarized certification from the landowner of each proposed offsite soil borrow source stating that to the best of the landowner's knowledge and belief, there has never been contamination at the borrow source site with hazardous toxic materials.

1.3 Submittals

A. Submit test reports for all specified parameters for each material classification used prior to placing material and at intervals of 500 cy for site fill during placement. Obtain representative samples from multiple locations from stockpiles for each test.

B. Submit certifications and results of toxic contaminant scan (for off-site borrow materials) per 1.2 D. and E. above.

1.4 Product Delivery, Storage, and Handling

A. Stockpile excavated materials and/or borrow in designated areas or in areas as approved by the ENGINEER. Do not stockpile material in the flood plain.

B. Lightly compact and slope top of stockpiles to prevent excessive erosion and ponding of water.

1.5 Protection

A. Protect trees, shrubs, lawns, and other features remaining as portion of final landscaping.

B. Protect benchmarks, existing structures, fences, roads, sidewalks and paving.

C. Protect above or below grade utilities which are to remain. Do not take existing utilities out of service without specific authorization by the OWNER. Notify OWNER at least five working days prior to taking existing utilities out of service to make connections or for removal of utility.

D. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods, as required to prevent cave-ins or loose soil from falling into excavations.

E. Underpin adjacent structures which may be damaged by excavation work, including service lines and pipe chases.

F. Notify the OWNER and ENGINEER of unexpected subsurface conditions.

G. Where damage could result from continuing work, discontinue work in area until ENGINEER notifies the CONTRACTOR of the required modifications.

H. Protect bottom of excavations and soil around and beneath foundations from frost, freezing, and excessive moisture changes.

I. Grade around excavations to prevent surface water runoff into excavated areas. During excavation, maintain grades for complete drainage. Install temporary drains or drainage ditches as needed to intercept or divert surface water and prevent interference or delay of the Work. Install groundwater pumping facilities and hoses/piping required to perform the work. The pumping of water shall be included in the appropriate lump sum bid items. No separate payment will be made for drainage control or ground water pumping.

J. Repair damage, promptly, at no cost to OWNER.

PART 2 - PRODUCTS

2.1 Materials

A. Class 1 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other materials having a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five (5) cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The material shall meet the following gradation in accordance with ASTM D448, size number 57:

Sieve Size Square Opening	Percent Passing
1-1/2 inches	100
1-inch	95 - 100
1/2-inch	25 - 60
No. 4	0 - 10
No. 8	0 - 5

B. Class 2 Aggregate Fill: Consist of durable particles of crushed or weathered limestone free of unsuitable, soft, or organic material complying with the following gradation requirements:

Sieve Size Square Opening	Percent Passing

1-inch	100
3/4-inch	90 - 100
3/8-inch	75 - 90
No. 4	40 - 75
No. 40	0 - 35
No. 200	0 - 15

C. Class 3 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other materials having a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation:

Sieve Size Square Opening	Percent Passing
1-3/4 inches	100
7/8-inch	65 - 90
3/8-inch	50 - 70
No. 4	35 - 55
No. 40	15 - 30
No. 100	0 - 12
	(Wet Sieve Method)

D. Crushed Limestone Base Material: Not used.

E. Non-Expansive Earth Fill: Consist of soil materials with a liquid limit of 35 or less, a plasticity index between 8 and 16, a minimum of 35 percent passing the No. 200 sieve, a minimum of 85 percent passing the No. 4 sieve, and which are free of organics or other deleterious materials. When compacted to the recommended moisture and density, the material shall have a maximum free swell value of 0.5 percent and a maximum hydraulic conductivity (permeability) of 1 E-05 cm/sec, as determined by laboratory testing of remolded specimens of the actual materials proposed for the non-expansive earth fill.

F. General Earth Fill: Consist of any soil materials which have a minimum plasticity index of 8, a minimum of 20 percent passing the No. 200 sieve, a minimum of 75 percent passing the No. 4 sieve, and which are free of organics or other deleterious material. On-site soils are generally suitable for use as general earth fill.

G. Select Fill:
   1. Non-organic, sandy clay or clayey sand.
   2. Liquid limit less than 30.
   3. Plasticity index ranging from 5 to 15.
   4. Sieve Analysis: Maximum percent retained on No. 4 sieve = 25 to 50 and on No. 40 sieve 50 to 75.
   5. Maximum of 70 percent passing #200 sieve.
   6. Maximum size of aggregate 1-3/4 inches.
   7. The sand and sandy clay on-site soils may be blended and utilized for select fill if the blended material complies with the select fill requirements above.

H. Sand Fill or Embedment:
   1. Granular material of uniformly graded crushed rock from 3/4-inch U.S. sieve downward.
   2. Plasticity Index: Less than 6 for material passing No. 40 Sieve.
   3. Sieve Analysis:

Sieve No.	Max. Percent Passing
1-inch	100
10	50
40	30
200	8

I. Low-Permeability Earth Fill: Consist of soil materials classified as CH or CL in accordance with ASTM D 2487, CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES. The materials also shall have a minimum liquid limit of 40, a minimum plasticity index of 20, a minimum of 50 percent passing the No. 200 sieve, and shall be free of organics or other deleterious materials. The material shall have a Percent Dispersion of less than 20 when tested in accordance with ASTM D 4221, STANDARD TEST METHOD FOR DISPERSIVE CHARACTERISTICS OF CLAY SOIL BY DOUBLE HYDROMETER. When compacted to the recommended moisture and density, the material shall have a maximum hydraulic conductivity of 1 E-07 cm/sec, as determined by laboratory testing of remolded specimens of the actual materials proposed for the low-permeability fill.

J. Unclassified Material: All material excavated from site not meeting the requirements for topsoil, or classified materials.

K. Topsoil:
   1. Topsoil excavated from site may be reused if the specified requirements are met and the material is acceptable to the OWNER. Additional topsoil (if necessary) shall be secured from an offsite location and shall be acceptable to the OWNER.
   2. Natural friable loam; free of subsoil, roots, grass, excessive amount of weeds, stone, and foreign matter; acidity range (pH) of 5.5 to 7.5; containing a minimum of 4 percent and a maximum of 25 percent organic matter per ASTM D2974 - “Standard Test Methods for Moisture, Ash and Organic Matter of Peat and Other Organic Soils”, less than 35 percent retained on a No. 4 sieve and more than 35 percent passing the No. 200 sieve.

PART 3 - EXECUTION

3.1 Preparation and Layout

A. Establish extent of site grading by area and elevation; designate and identify datum elevation.

B. Set required lines and levels.

C. Maintain benchmarks, monuments, and other reference points.

3.2 Utilities

A. Known underground utilities are indicated on the Drawings.

B. Before starting excavation, establish location and extent of underground utilities occurring in work area.

C. Notify the ENGINEER for direction for removal and/or relocation of lines which are in the way of excavation.

D. Maintain, reroute, or extend as required, existing utility lines to remain which pass through work area with the approval of the OWNER.

E. Support and protect utility services uncovered by excavation.

F. Accurately locate and record abandoned and active lines rerouted or extended, on Project Record Documents.

G. As excavation approaches utilities, hand excavate to uncover utilities.

3.3 Excavation

A. Before starting excavation, strip work area of vegetation, roots, and old construction debris (estimated depth of stripping 4 to 8-inches) and strip top soil and stockpile.

B. Excavate in accordance with lines and levels required for construction of the Work.

C. Machine slope banks.

D. Hand trim excavations and leave free from loose or organic matter.

E. Provide and maintain surface and groundwater control until backfilling is complete. Keep excavations free from standing water.

F. Correct unauthorized excavation as directed, at no cost to OWNER. Areas that are excavated to elevations below those shown on the Plans shall be backfilled and compacted with crushed rock (Class 3 Aggregate Fill) if area is under aggregate fill, pipe, or structure, and otherwise with non-expansive earth fill.

G. Excavations should not interfere with normal 45 degree bearing splay of any foundation unless sheeting and/or shoring is designed and provided for excavation.

H. Stockpile excavated material in areas designated by OWNER according to classifications given under materials portion of this section.

I. Do not disturb soil within branch spread of existing trees or shrubs that are to remain.

3.4 Compacted Fill

A. Preparation for Fill Placement:
   1. Do not start backfilling operations until structures have been inspected and backfilling authorized by OWNER's representative or resident engineer.
   2. Ensure areas to be filled are free from debris, snow, ice and water, and that ground surfaces are not in a frozen condition.
   3. Do not place fill over existing subgrade surfaces which are porous, wet or spongy.
   4. Compact existing subgrade surfaces if densities are not equal to that required for materials. Proofroll all subgrade surfaces prior to proceeding with fill placement.
   5. Cut out soft areas of existing subgrade. Backfill with Non-Expansive Earth Fill or select fill and compact to required density. Proofroll subgrade with minimum 25-ton pneumatic roller or loaded dump truck under observation of OWNER's representative.
   6. Place compacted fill to grades, contours, levels and elevations shown on Drawings. After dumping, spread the material in horizontal layers over the entire fill area. The thickness of each layer before compaction must not exceed 8 inches in loose measure.
   7. Existing hillsides or slopes which will receive fill should be loosened by scarifying or plowing to a depth of not less than 8 inches. The fill material shall be benched into the existing slope in such a manner as to provide

adequate bonding between the fill and slope, as well as to allow the fill to be placed in horizontal lifts.

8. Fills should extend a minimum of 5 feet outside of building lines and slope to natural grade.

B. Material Placement:

1. General:

a. Place fill systematically and as early as possible to allow maximum time for natural settlement and compaction. Embankment materials shall be placed on a properly prepared subgrade as recommended above. The combined excavation, placing and spreading operation shall be done in such a manner to provide that the materials, when compacted in the embankment, will have the most practicable degree of compaction and stability.

b. Place and compact fill materials in continuous layers not exceeding 8 inches loose depth. Use a method so as not to disturb or damage completed work constructed in the excavations.

c. Maintain moisture content of fill materials within specified range to attain required compaction density.

d. If the surface is too smooth and hard to bond properly with a succeeding layer, the surface should be roughened and loosened by discing before the succeeding layer is placed.

e. Where fill is to be placed next to existing fill, that fill shall be removed to unweathered, dense material. Each layer shall be benched and disced as adjoining lifts are placed. Material hauling equipment shall be so routed over the embankment surface to distribute the added compaction afforded by the rolling equipment, and to prevent the formation of ruts.

f. The surface of the fill shall be graded to drain freely and maintained throughout construction. During the dumping and spreading process, all roots and debris and all rocks greater than 4 inches in maximum dimension shall be removed. No rocks shall be allowed within the final 8 inches of subgrade.

g. Following the spreading and mixing of the soil, it shall be processed by discing or pulverizing throughout its thickness to break up and reduce clod size and provide additional blending of materials. Processing shall consist of at least five passes of a fully penetrating disc plow or three passes of a fully penetrating roto-till pulverizer. Additional passes of the processing equipment shall be performed as necessary to accomplish breaking up, reduction of clod size, and blending the fill. Each successive pass of the processing equipment shall be in a direction perpendicular to the previous pass, where working space permits. The maximum loose lift thickness prior to compaction shall be 8 inches.

h. The moisture content of the soil shall be adjusted, if necessary, by either aeration or the addition of water to bring the moisture content within the recommended range. Water required for sprinkling to bring the fill material to the proper moisture content shall be applied evenly through each layer.

i. Any layers which become damaged by weather conditions shall be processed to meet recommended requirements. The compacted surface of a layer of fill shall be lightly loosened by discing before the succeeding layer is placed.

C. Compaction:

1. Compact fill materials listed below to required percentages of maximum dry density as determined by ASTM D 698. Compaction shall be performed with a heavy tamping foot roller with fully penetrating feet (feet long enough to penetrate the previous lift) either towed by a crawler-type tractor or the self-propelled type. The tamping foot roller shall weigh no less than 2,000 pounds per linear foot of drum width. Vibratory tamping rollers are recommended for compacting sandier fill materials. A minimum of 8 passes shall be provided.
   a. Compact non-expansive earthfill in top 12 inches under paving to 95 to 100 percent at moisture contents of -2 to plus 5 percentage points of optimum.
   b. Compact non-expansive earthfill and general earthfill not under roads or in embankments and more than 1-foot beneath roads to a minimum of 95 percent of maximum dry density at moisture content of -2 to plus 5 percentage points of optimum.
   c. Minimum Frequency of Density Tests:
      1) Bearing: 1 test/200 cubic yards or minimum of 2 tests per structure.
      2) Structure Fills: 1 test/200 cubic yards, minimum 2 test per lift.
      3) Backfill: 2 test/200 cubic yards, minimum 2 tests per lift.
      4) Trench backfill: 2 test/150 lf trench per lift, minimum 2 tests per lift.
   d. The CONTRACTOR shall be responsible for the actual quality of the fill, in place. Satisfactory test results shall not be considered as the sole factor of the quality of the fill operation.
   e. The moisture content and density of all fill shall be maintained at the specified range of moisture and density. These moisture ranges represent the maximum recommended limits. It is possible that a more arrow range will be necessary to consistently achieve the recommended density
2. Compact aggregate fill material in maximum 8-inch thick lifts with a small self-propelled vibratory roller or a hand-operated vibratory plate compactor. The aggregate fill shall receive no less than 8 passes of the compaction equipment. The number of passes shall be increased, if necessary, to fully densify and interlock the aggregate particles.
   a. Aggregate fill for pipe bedding shall be compacted to a minimum of 95 percent of maximum density as determined by ASTM D 4253. The moisture content shall be in a range that will accommodate efficient placement and compaction.

3.5 Schedule

A. General Earth Fill:
   1. Use under seeded areas, backfill at depths of more than 5 feet below and 5 feet outside of roads and in embankments (except for clay liner material) unless otherwise shown on Drawings.
   2. Fill to within 4 inches of finished grade as backfill adjacent to structures.

B. Non-Expansive Earth Fill: Use as backfill for the top 5 feet depth under roads as shown on Drawings. Use to 5 feet outside the limits of roads.

C. Low Permeability Earth Fill: Use for top 2 feet of interior slope of embankments and liner for floor of lagoons.

D. Select Fill: Use as backfill against structure walls and beneath structures.

E. Class I Aggregate Fill: Use for overexcavated areas under structures and as otherwise shown on Drawings.

F. Class 2 Aggregate Fill: Use for pipe embedment and initial backfill per details in the plans.

G. Sand Fill: Use for small pipe embedment (#2-inch diameter).

H. Topsoil: Use within limits of seeded areas after substantial completion of construction and other fill has been placed.

I. Unclassified Material: Dispose of off-site as directed by the OWNER.

3.6 Tolerances

A. Site grading to conform to Plans within the following tolerances:
   1. Drainage ditches: 0.10 feet.
   2. Excavations: Plus zero to -0.10 feet.
   3. Compacted fill: 0.10 feet.

3.7 Surplus Material

A. Dispose of unclassified material, surplus fill materials and excess topsoil off-site.

B. Leave stockpile areas and entire jobsite clean and raked, ready to receive seeding.

END OF SECTION

31 10 00 SITE CLEARING

1.00 GENERAL

1.01 SUMMARY

A. Section includes: Clearing, grubbing, and stripping project site.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. United States Code of Federal Regulations (CFR):
   1. 40 – Protection of Environment.
      a. 503 – Standards for the Use or Disposal of Sewage Sludge.

1.03 DEFINITIONS

A. Clearing: Consists of removal of natural obstructions and existing foundations, buildings, fences, lumber, walls, stumps, brush, weeds, rubbish, trees, boulders, utility lines, and any other items which interferes with construction operations or are designated for removal.

B. Grubbing: Consists of the removal and disposal of wood or root matter below the ground surface remaining after clearing and includes stumps, trunks, roots, or root systems greater than 1 inch in diameter or thickness to a depth of 6 inches below the ground surface.

C. Stripping: Includes the removal and disposal of all organic sod, topsoil, grass and grass roots, and other objectionable material remaining after clearing and grubbing from the areas designated to be stripped. The depth of stripping is estimated to be 6 inches, but the required depth of stripping will be determined by the Engineer.

1.04 QUALITY ASSURANCE

A. Regulatory requirements: Verify and comply with applicable regulations regarding those governing noise, dust, nuisance, drainage and runoff, fire protection, and disposal.

B. Pre-construction conference: Meet with Engineer to discuss order and method of work.

1.05 SEQUENCING AND SCHEDULING

A. Clearing and grubbing: Perform clearing and grubbing in advance of grading operations.

2.00 PRODUCTS

Not Used.

3.00 EXECUTION

3.01 EXAMINATION

A. Verification of conditions: Examine site and verify existing conditions before beginning work.

3.02 PREPARATION

A. Protect existing improvements from damage by site preparation work.

3.03 INSTALLATION

A. Clearing:
   1. Clear areas where construction is to be performed and other areas as indicated on the Drawings, or specified in this Section, of fences, lumber, walls, stumps, brush, roots, weeds, trees, shrubs, rubbish, and other objectionable material of any kind which, if left in place, would interfere with proper performance or completion of the work, would impair its subsequent use, or form obstructions.
   2. Do not incorporate organic material from clearing and grubbing operations in fills and backfills.
   3. Contractor's temporary construction facilities: Fill or remove pits, fill, and other earthwork required for erection of facilities, upon completion of the work, and level to meet existing contours of adjacent ground.

B. Grubbing:
   1. From excavated areas: Grub stumps, roots, and other obstructions 3 inches or over in diameter to depth of not less than 18 inches below finish grade.
   2. In embankment areas or other areas to be cleared outside construction area: Do not leave stumps, roots, and other obstructions higher than the following requirements:

Height of Embankment over Stump	Depth of Clearing and Grubbing
0 feet to 2 feet	Grub stumps or roots 3 inches or over in diameter to 18 inches below original grade. Cut others flush with ground.
2 feet to 3 feet	Grub stumps 1 foot and over in diameter to 18 inches below original grade. Cut others flush with ground.
Over 3 feet	Leave no stumps higher than stump top diameter, and in no case more than 18 inches.

   3. Backfill and compact cavities left below subgrade elevation by removal of stumps or roots to density of adjacent undisturbed soil.

C. Stripping:

1. Remove soil material containing sod, grass, or other vegetation to depth of 6 inches from areas to receive fill or pavement and from area within 5 feet outside foundation walls.
2. Deposit stripped material in accordance with following requirements:
   a. At locations acceptable to Engineer.
   b. Use accepted material in top 6 inches of areas to be used for future planting.
3. Replace topsoil where disturbed and left unpaved.

END OF SECTION

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31 22 15 ROUGH AND FINAL GRADING

1.00 GENERAL

1.01 SUMMARY

A. Section includes: stockpiling, grading, shaping, leveling, and ditch work within project area as shown on plans or as directed by Engineer.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. Section 31 00 00, Site Grading and Earthwork
   3. Section 31 10 00, Site Clearing
   4. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. Geotechnical Engineering Report prepared by CMJ Engineering Inc. dated September 2023.

1.03 QUALITY ASSURANCE

A. Regulatory requirements: Verify and comply with applicable regulations regarding those governing noise, dust, nuisance, drainage and runoff, fire protection, and disposal.

1.04 SEQUENCING AND SCHEDULING

A. Perform clearing, grubbing, stripping and stockpiling in advance of grading, shaping, leveling and ditch work operations.

2.00 PRODUCTS

Not Used.

3.00 EXECUTION

3.01 EXAMINATION

A. Verification of conditions: Examine site and verify existing conditions before beginning work.

3.02 PREPARATION

A. Protect existing improvements, fences, roads, sidewalks, paving, and curbs (not scheduled for demolition) from damage by the work.

B. Eliminate uneven areas and low spots. Finish grade uniformly to maintain contours shown. Make gradual grade changes blending slopes into level areas. Create drainage swales and berms as shown on the Plans. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove subsoil contaminated with petroleum products.

C. Scarify subgrade to depth of 4 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.03 EXECUTION

A. Stockpiling:
   1. Remove and stockpile topsoil from all areas to be excavated or filled.
   2. Preserve and protect stockpile topsoil.

B. Remove subsoil as necessary to meet plan grades.

C. Excess material is property of Contractor to remove and dispose of according to State Law

D. Excavated surfaces to be uniform, smooth, and without loose earth.

E. Finish grading to be uniform to slopes and elevations shown on plans.

F. Placing topsoil:
   1. Spread stored topsoil evenly over all disturbed surfaces, unless indicated otherwise.
   2. Place topsoil in areas where seeding, sodding, plugging and planting is scheduled.
   3. Use topsoil in relatively dry state. Place during dry weather.
   4. Fine grade topsoil eliminating rough or low areas. Maintain levels, profiles, and contours of subgrade.
   5. Remove stone, roots, grass, weeds, debris, and foreign material while spreading. All stones shall be removed which would be retained on a ½-inch screen.
   6. Manually spread topsoil around trees to prevent damage.
   7. Lightly compact placed topsoil.
   8. Leave stockpile area and site clean and raked, ready to receive landscaping.

G. Uniformity of Topsoil: Plus or minus 1-inch.

H. Take all measures necessary to prevent erosion of completed work or loss of topsoil.

I. Replace any eroded areas with topsoil or replace lost topsoil.

J. Provide adequate ditch work and grading to ensure adequate drainage.

3.04 SCHEDULE OF LOCATIONS

A. The following paragraph identifies compacted topsoil thicknesses for various locations:
   1. Seeded Grass: 4 inches.

2. Sodded Grass: 4 inches in areas having greater than 5 to 1 slopes.

END OF SECTION

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31 23 19 DEWATERING

1.00 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Installation and maintenance of dewatering systems.
   2. Disposal of water entering excavation or other parts of the work.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCE

A. National Electrical Manufacturers Association (NEMA):
   1. 250 – Enclosures for Electrical Equipment (1000 V Maximum).

1.03 DEFINITIONS

A. NEMA Type 4X enclosure in accordance with NEMA 250.

1.04 SYSTEM DESCRIPTION

A. Design requirements:
   1. Keep excavations reasonably free from water. Draw down the static water level to a minimum of 3 feet below the bottom of excavations.
   2. Analysis includes the following: Evaluation of the anticipated subsurface conditions, required well spacing, diameter of wells, depth screen interval, backfill and filter pack, pump size, drawdown duration, drawdown and steady state flow rates, desilting tank, and settlements.
   3. Include water drawdown curves in dewatering calculations.
   4. Coordinate dewatering design with excavation and shoring design. Recognize the changes in groundwater conditions and earth pressures in the shoring and excavation design.
   5. Do not place concrete or masonry foundations or floors in water, nor allow water to rise over them until concrete or mortar has set at least 24 hours.
   6. Maintain operation of the dewatering system until the complete structure including walls, slabs, beams, struts, and all other structural elements have been constructed and the concrete has attained specified strength, and backfill has been completed to finish grade.
   7. Provide standby power to ensure continuous dewatering in case of power failure.

B. Recharge groundwater behind shoring to minimize settlement due to dewatering.

C. Secure written permission from the Engineer before locating wells, well points, or drain lines for purposes of dewatering within limits of structure foundation.

D. Locate dewatering facilities where they will not interfere with utilities and construction work to be performed by others.

E. Open manholes will not be allowed for discharge piping. Obtain approval of each discharge location from the Engineer.

1.05 SUBMITTALS

A. Dewatering plan:
   1. Arrangement, location, depths of system components.
   2. Type and sizes of filters.
   3. Required permits.

B. Well construction logs which include:
   1. Descriptions of actual materials encountered in accordance with Unified Soil Classification System.
   2. Construction details.
   3. Well development procedures and results.
   4. Deviations from original design.

C. Laboratory test results.

D. Identify the proposed alignment of the discharge pipe and method for the pipe to enter the manhole. Provide details of the pipe entering the manhole.

E. Qualifications:
   1. Dewatering contractor.
   2. Dewatering design engineer.
   3. Testing laboratory.

F. Control points and schedule of measurements:
   1. Location and details of control points and method and schedule of measurements.
   2. Within 24 hours of constructing control points and making measurements at such control points, submit a copy of field notes with such measurements.
   3. Deliver submittal with control point measurements within 24 hours of collection.
      a. Show the current measurement and the change in measurement from the first measurement taken.
      b. Show a graphical plot with movements.

G. Recording of flowmeter.

1.06 QUALITY ASSURANCE

A. Qualifications of a dewatering design engineer:
   1. Dewatering plan and dewatering system analysis:
      a. Prepared by a registered Civil Engineer, registered in the state where the Project is located. The Civil Engineer must have at least 8 years of experience in designing similar systems.
      b. Submit qualifications of the dewatering contractor, the Dewatering Design Engineer, sampling service, and testing laboratory.

B. Regulatory requirements:
   1. Assume responsibility for obtaining water discharge permits that are required.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Flowmeter and chart recorder: One of the following:
   1. Badger Meter Turbo Series Meter with totalizer**.**
   2. Or Approved Equal

3.00 EXECUTION

3.01 INSTALLATION

A. Provide and maintain during construction: Ample means and devices with which to promptly remove and properly dispose of water entering excavation or other parts of the work, whether water is surface water or underground water.

B. Install at least 1 groundwater level monitoring well. If more than 4 dewatering wells or well points are installed, install 1 additional monitoring well for every 4 dewatering wells or well points.
   1. Locate monitoring wells within 6 feet of the excavation and located mid-way between dewatering wells or well points.
   2. Monitoring wells: Temporary cap shall not be less than 2 inches in diameter.
   3. Protect the dewatering wells in place during the excavation.

C. Intercept and divert precipitation and surface water away from excavations through the use of dikes, curb walls, ditches, pipes, sumps, or other means.

D. Disposing of water:
   1. Dispose of water from the work in suitable manner without damage to adjacent property.
   2. Do not drain water into work built or under construction.
   3. Dispose of water in such manner as not to be menace to public health.
   4. All groundwater is assumed to be contaminated and will require discharge to the plant drain system or require periodic testing. Coordinate with the Owner for testing requirements.

E. Wells, well points, and drain lines for dewatering:
   1. Locate after receiving Engineer's written permission.
   2. Fill dewatering wells, pipes, and French drains to be left in place within structure foundation limits with Class “C” concrete as specified in Section 03 30 00 or grout as specified in Section 03 60 01.

3.02 CONSTRUCTION

A. Interface with other work:
   1. Prior to release of groundwater to its static level, ensure the following:
      a. All groundwater pressure relief devices for the structure are fully operational.

b. Construction of the structure is complete and the concrete has reached specified strength.
c. Backfill of the structure is complete.
d. Control release of groundwater to its static level to prevent disturbance of the natural foundation soils or compacted backfills and fills and to prevent flotation or movement of structures or pipelines.

3.03 FIELD QUALITY CONTROL

A. Monitoring wells:
1. Record water levels at least once a week.

END OF SECTION

31 23 33 TRENCHING, BACKFILLING, AND COMPACTING

1.00 GENERAL

1.01 WORK INCLUDED

A. Trenching for buried piping systems as well as subsequent embedment, backfill and compaction operations, necessary to install the pipe as specified.

1.02 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM D698 Moisture Density Relationship of Soils using a 5.5 lb Hammer and a 12-inch drop.
   2. ASTM C131: Resistance to Degradation of small sizes and coarse aggregates by abrasion and impact in the Los Angeles Machine.

1.03 PROTECTION

A. Protect trees, shrubs, and lawn areas to receive planting, and other features remaining as part of final landscaping.

B. Protect benchmarks, existing structures, roads, sidewalks, paving and curbs against damage from vehicular or foot traffic. Install and maintain bridging, planking and cants to provide access to Work.

C. Protect excavations by shoring, bracing, sheet piling, underpinning, or by other methods, as required to prevent cave-ins or loose dirt from falling into excavations.

D. Underpin or otherwise support adjacent structures which may be damaged by excavation work. This includes service lines and pipe chases.

E. Notify the Engineer of unexpected subsurface conditions.

F. Where damage could result from continuing work, discontinue work in area until Engineer notifies the Contractor of the required modifications.

G. Protect bottom of excavations and soil around and beneath foundations from frost and freezing.

H. Grade around trenches to prevent surface water runoff into excavated areas.

I. Protect above or below grade utilities including lateral lines, sprinkler system lines, and all other lines which are to remain. The cost of replacing damaged lines is to be borne by the Contractor.

1.04 DEFINITIONs

A. Bedding or embedment shall mean the material placed around the pipe in the pipe zone. The pipe zone is the excavated area below, around and 12 inches above the outside diameter of the pipe.

1.05 SUBMITTALS

A. Submit the following information in accordance with the Contract Documents:
   1. Shop Drawings: Submit detailed sieve analysis data on embedment and backfill material to be placed in pipe zone.
   2. Certified Test Report: Submit soil resistivity for embedment and backfill material to be placed in pipe zone.
   3. Sample: Submit sample of materials to be used in pipe zone.
   4. Test for contaminants.

2.00 PRODUCTS

2.01 BED AND FILL MATERIALS

A. Crushed Stone:

   1. Crushed stone for reinforced concrete pipe and ductile iron pipe embedment shall consist of angular, sound, durable stone material graded between the prescribed limits (ASTM C33 Size No. 67):

Sieve Size	Percent Retained
1"	0
3/4"	0 to 10
3/8"	45 to 80
No. 4	90 to 100
No. 8	95 to 100

   Crushed stone shall not contain more than one (1%) percent by weight of organic matter, loam, or clays, or more than five (5%) percent by weight of any one or combination of slate, shale, schist, or soft particles of sandstone. The percent of wear shall not exceed forty (40%) percent when tested in accordance with ASTM C131.

B. Crushed Stone for PVC, HDPE, steel and concrete cylinder embedment:
   1. Crushed stone embedment shall consist of angular, sound, durable stone material graded between the prescribed limits (ASTM C33 Size No. 8):

Sieve Size	Percent Retained
1/2"	0
3/8"	0 to 15
No. 4	70 to 90
No. 8	90 to 100
No. 16	95 to 100

   2. Crushed stone embedment shall not contain more than 1 percent by weight of organic matter, loam, or clays, or more than 5 percent by weight of any one or combination of slate, shale, schist, or soft particles of sandstone.
   3. The percent of wear shall not exceed 40 percent when tested in accordance with ASTM C131.

C. Gravel: Gravel shall consist of washed or screened gravel, 1/4-inch to 1/2-inch in size, pea gravel that is retained on 1/8 mesh but passes the 5/8 mesh, or similar

sized crushed rock or slag, free of fines. Gravel will not be allowed from bottom of trench to springline of pipe.

D. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, or organic matter; graded in accordance with ANSI/ASTM C136, within the following limits:

Sieve Size	Maximum Percent Passing
No. 10	50
No. 14	30
No. 200	15

E. Granular Backfill and Embedment:
1. Granular backfill and embedment shall be sand, hydraulically graded, crushed stone fines, mixed sand and gravel, or sandy loam. The material shall be free from lumps, stone over 1-inch in size, clay, and organic matter.
2. The plasticity index of the fraction passing the No. 40 sieve shall not exceed 10.
3. Granular backfill and embedment material may be excavated on-site or borrowed from an outside source as approved by the Owner.

F. Select Material:
1. Select materials shall be gravel, fine rock cuttings, sand, sandy loam or loam free from excessive clay.
2. Select material shall have a liquid limit less than 40 and a plasticity index less than 20 for the fraction passing the No. 40 sieve.
3. Sieve analysis: Maximum percent retained on No. 4 sieve = 25 to 50 and on No. 40 sieve 50 to 85.
4. Select material may be excavated on site or borrowed from an outside source as approved by the Owner. Maximum aggregate size of 3 inches.

G. Site Backfill: Material excavated on-site excluding large rock or borrowed from an outside source approved by the Owner.

H. Topsoil:
1. The existing topsoil on-site is considered to be that top layer of soil which contains roots, humus, organic material in general, and is usually, but not always, 6 inches in depth, distinguishable by color and texture from the underlying subsurface soil.
2. Imported topsoil shall be friable loam free from subsoil, roots, grass, weeds, stones and foreign matter.
3. Use topsoil stockpiled on-site or if quantity is not satisfactory, obtain from a source approved by the Owner.

I. Unclassified Material: All material excavated on-site, not meeting the requirements for topsoil, or fill material.

J. In addition to all other requirements, material furnished for use as backfill material in the pipe zone for ductile iron, concrete steel cylinder and steel pipe shall have a resistivity of not less than 5,000 ohms/cm^3. Any material found to have a resistivity less than that required by this specification shall be removed from the project and

disposed at the Contractor's expense. Pipe zone is defined as the zone from the bottom of the excavated trench to 1-foot above the top of the pipe.

K. Crushed Stone for Trench Foundation: Where crushed stone or coarse gravel is required for drainage of water away from the trench foundation, restorage of trench foundation, or other purposes, it shall be angular crushed stone with the following grading requirements:

Sieve Size	Percent Retained
1"	0 to 5
3/4"	40 to 75
No. 4	90 to 100
No. 8	95 to 100

L. General Earth Fill: The general earth fill may consist of any soil materials which have a minimum plasticity index of 8, a minimum of 20 percent passing the No. 200 sieve, a minimum of 85 percent passing the No. 4 sieve, and which are free of organics or other deleterious material.

M. Concrete shall conform to Section 03 30 00.

3.00 EXECUTION

3.01 PREPARATION AND LAYOUT

A. Establish extent of excavation by line and elevation. Designate and identify datum elevations.

B. Set required lines and levels. Maintain benchmarks, monuments and other reference points.

3.02 UTILITIES

A. Known underground utilities may be shown on the Drawings. Contractor is responsible for locating all underground utilities prior to excavating. Contractor will not rely solely on the Drawings to locate underground utilities.

B. Before starting excavation, establish the location and extent of underground utilities occurring in the work area.

C. As excavation approaches utilities, hand excavate to uncover utilities. Notify the Engineer for direction for removal and/or relocation of utility companies' lines which are in the way of excavation.

D. Maintain, re-route or extend as required, existing utility lines to remain which pass through work area with the approval of the Owner. Relocations are at the Contractor's cost.

E. Protect utility services uncovered by excavation.

F. Accurately locate and record abandoned and active lines rerouted or extended on Project Record Documents.

3.03 TRENCHING

A. Ensure trenching does not interfere with normal 45 degree bearing splay of any foundation.

B. Excavate in accordance with lines and grades. Excavated material shall be placed adjacent to the work to be used for backfilling as required.

C. Trench depths and grading are calculated to provide adequate cover over pipes. Notify Engineer if adequate cover is lacking and correct as directed by Engineer.

D. Cut trenches sufficiently wide to enable proper installation of services and to allow for inspection. Minimum trench width for flexible pipe shall be 18 inches wider than the pipe outside diameter. Trim and shape trench bottoms and leave free of irregularities, lumps and projections. Over excavated trench depths shall be filled to the proper grade with crushed rock at no additional cost to the Owner.

E. Trench width in the pipe zone (pipe zone designated as the zone from the trench bottom to at least 1-foot above the top of the pipe) shall be vertical. The walls of the excavation above this specifically designated pipe zone may be laid back where room permits, as necessary, and shall be constructed as required by the safety laws of OSHA, federal, state, municipal and any other agency having jurisdiction over the Work.

F. The maximum width of the trench excavation in the pipe zone shall be no more than 24 inches wider than the outside diameter of the pipe barrel. Whenever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher class of embedment as approved by the Owner, and the next higher class of pipe, at no additional cost to the Owner.

G. The minimum width of the trench excavation throughout the pipe zone shall be the outside diameter of the pipe barrel plus 16 inches (8 inches on either side of the pipe).

H. Do not disturb soil within branch spread of existing trees or shrubs that are to remain. If it is necessary to excavate through roots, perform work by hand and cut roots with a sharp axe. When complete, request the Engineer to inspect excavations. Correct unauthorized excavation as directed, at no cost to the Owner.

I. The trench shall be excavated to an even grade to permit the installation of the pipe in such a manner that the full length of the pipe barrel is supported on the proper depth of granular embedment material. The entire foundation area in the bottom of all excavations shall be firm, stable material, and material shall not be disturbed below required grade except as described in this article. Where the character of the foundation materials is such that a proper foundation cannot be obtained at the elevation indicated on the Plans, then, when directed by the Owner in writing, the Contractor shall deepen the excavation to where a satisfactory foundation can be obtained.

J. If the subgrade is soft, spongy, or disintegrated, the materials shall be removed until a firm, stable, and uniform bearing is reached and the subgrade brought back to the required grade with “rock for foundation” material (NCTCOG 2.1.8) compacted in place or with concrete. If the unsatisfactory subgrade condition is due to the Contractor’s failure to make a proper provision for adequate drainage or dewatering of excavations, the expense of replacing any unsatisfactory subgrade shall be borne by the Contractor. However, if, in the opinion of the Owner, the unsatisfactory subgrade condition is not the result of the failure of the Contractor to provide adequate drainage, bailing or pumping facilities and the Owner orders in writing that the Contractor make additional excavation and replace unsatisfactory subgrade material with “rock for foundation” material (NCTCOG 2.1.8) or Class B concrete, then compensation will be made for the additional expense incurred at the unit price provided in the Proposal.

K. Trenches shall be dry and free of standing water prior to pipe installation. No pipe shall be laid in water.

L. Unsuitable excavated subsoil including perishable, spongy material, large rock, or other material designated by the Engineer shall not be used in backfilling. Unsuitable material shall be disposed of by the Contractor in a manner approved by the Engineer.

3.04 SHEETING AND SHORING

A. In caving ground or in wet, saturated or flowing or otherwise unstable materials, the sides of all trenches and excavations shall be adequately sheeted and braced, to maintain the excavation from slides or cave-ins and to provide safety for workmen.

B. Sheeting, shoring, and bracing shall be removed unless otherwise approved by the Engineer. Removal of sheeting, shoring, and bracing shall be performed in a manner to prevent damage to new or existing structures and to avoid cave-ins or sliding of the banks. All holes and voids from the sheeting shall be immediately and completely filled and compacted with suitable materials. All costs associated with the abandonment of sheeting, shoring and bracing shall be borne by the Contractor.

3.05 DEWATERING

A. Keep trenches dry. Provide necessary equipment including pumps, piping and temporary drains.

B. Direct surface drainage away from excavated areas. Provisions shall be made for the satisfactory disposal of water pumped to prevent damage to public or private property.

C. Control the grading in and adjacent to excavations to prevent water running into excavated areas or onto adjacent properties or thoroughfares.

D. Furnish and operate suitable pumps on a 24 hour basis to keep excavations free of water until services have been placed and backfilling is completed.

3.06 BEDDING

A. Manually place and compact bedding material in layers not exceeding six inches.

B. Manually shape bedding material to conform to pipe barrel and bell or flanges such that the entire length of the pipe barrel is supported by the bedding material.

C. Granular backfill and embedment materials shall be placed as shown on the plans and compacted in six-inch layers along sides of pipe and to a minimum depth of 12 inches over the top of the pipe.

3.07 BACKFILLING

A. Do not start backfilling until services have been inspected.

B. Ensure trenches are free of building debris, snow, ice, and water and that ground surfaces are not in a frozen condition.

C. Backfill systematically and as early as possible to allow maximum time for natural settlement and compaction.

D. Place and compact backfill materials in continuous layers according to the method of compaction used. Use a method which will not disturb or damage services. No excessively large rocks or debris of any sort shall be used as backfill.

E. Maintain optimum moisture content (±2 percent) of fill materials so as to attain required compaction density.

F. Acceptable backfill from the excavation shall be placed from 12 inches over the pipe to the surface.

G. Excavated unsuitable material and excess material shall be disposed of by the Contractor in a manner approved by the Engineer.

3.08 COMPACTION

A. Compact embedment materials with hand-operated devices.

B. All embedment material, which includes material placed in trench bottom for pipe foundation, and all backfill material within the pipe zone shall be compacted to a minimum of 95 percent of maximum dry density defined by ASTM D698 or to a minimum 75 percent of relative density as determined by ASTM D4253 and D4254, whichever is applicable.

C. Outside Paved Areas: Backfill materials shall be thoroughly compacted by mechanical, or pneumatic tamping in layers not to exceed 18 inches in compacted thickness. Care must be taken to avoid pipe damage. Compact backfill material to 90 percent (minimum) standard Proctor (ASTM D698).

D. Within Paved Areas: Backfill under roads shall be mechanically or pneumatically compacted to 98 percent of maximum dry density as defined as ASTM D698 in layers not exceeding six inches of compacted thickness.

E. Compact backfill and embedment materials at moisture contents of within -2 percent to +4 percent of optimum for cohesive materials and as necessary to achieve specified density for noncohesive materials. Contractor shall provide compaction tests as deemed necessary by the Contractor to ensure adequate compaction is

being achieved. Contractor's compaction tests shall be performed at Contractor's sole expense and will be considered subsidiary to construction.

F. Compaction tests on all pipeline trenches under pavement will be required at intervals of 150 feet of trench length and vertical intervals of 5 feet of backfill depth. All other trenches, except those in the lake, will be tested at intervals of 350 feet of length per 5 feet of depth.

G. Additional compaction tests may be directed by the Owner at the Contractor's expense. If Owner provided tests determine that the embedment or backfill does not meet the required density, the Contractor shall recompact the embedment until densities are met, or shall remove all embedment and add new embedment to meet the densities.

H. The Contractor shall pay the cost of all additional retesting required by the Owner.

I. Remove and replace improperly compacted backfill material at no cost to Owner. Additional trench settlement following completion shall be restored to a level surface. Trench surfaces may be left crowned in open country.

J. Water jetting for consolidation will not be permitted.

3.09 CLEAN UP

A. Remove surplus fill materials to on-site spoil areas as directed by the Engineer.

END OF SECTION

31 23 31.1 TRENCH EXCAVATION SAFETY PROTECTION SYSTEM

1.00 GENERAL

1.01 DESCRIPTION

This item will consist of the basic requirements which the Contractor must comply with in order to provide for the safety and health of workers in a trench. The Contractor shall develop, design and implement the trench excavation safety protection system. The Contractor shall bear the sole responsibility for the adequacy of the trench safety system and providing "a safe place to work" for the workman.

1.02 GENERAL

The trench excavation safety protection system shall be used for all trench excavations deeper than five (5) feet. The Excavating and Trenching Operation Manual of the Occupational Safety and Health Administration, U.S. Department of Labor, shall be the minimum governing requirement of this item and is hereby made a part of this Specification. The Contractor shall, in addition, comply with all other applicable federal, state and local rules, regulations and ordinances. The design of the trench excavation safety protection system shall be performed by or under the supervision of a Professional Engineer licensed to practice in the State of Texas.

1.03 MEASUREMENT AND PAYMENT

A. All methods used for a trench excavation safety protection system shall be measured by the linear foot of trench and paid at the unit price in the Contractor’s schedule of values, which shall be total compensation for furnishing design, materials, tools, labor equipment, and incidentals necessary, including removal of the system.

B. Measurement for pipeline trench excavation safety protection system shall be based on the linear feet along the centerline of the pipeline trench. Measurement for structural trench excavation safety protection system shall be based on the linear feet around the outside perimeter of the structure's walls.

C. Where pipelines intersect structures, measurement for the pipeline shall begin/end at the outside of the structure's wall.

END OF SECTION

32 31 11 POWERED CANTILEVER GATES

1.00 GENERAL

1.01 WORK INCLUDED

Provide all labor, materials and incidental items required to install two powered cantilevered gates as specified and as indicated on the Plans.

1.02 REFERENCES

A. Underwriters Laboratory Gate Operator Requirements (UL 325)

B. ASTM F 2200 – Standard Specification for Automated Vehicular Gate Construction

C. ASTM F 1184 – Standard Specification for Industrial and Commercial Horizontal Slide Gates

1.03 QUALITY ASSURANCE.

A. Equipment shall be the product of a manufacturer having at least twenty U.S. installations of the type being proposed each with a minimum of five years of satisfactory service.

1.04 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 33 00.
   1. Submit drawings of gate, including details of major components.
   2. Submit details of gate construction, gate height and post spacing dimensions.
   3. Submit drawings showing connections to adjacent construction, range of travel, and all electrical and mechanical connections to the gate operator.

B. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.05 WARRANTY

A. Standard limited warranty that the cantilever slide gate system is free from defects in material and workmanship and, under normal or proper usage, will remain free from such defects for a period of two years from the date of installation complete.

2.00 PRODUCTS

2.01 MANUFACTURER

A. Slide Gate Operator shall be as manufactured by:
   1. Eagle Access Control Systems
   2. Or Approved Equal

B. Use of a manufacturer's name is for the purpose of establishing the standard of quality and general configuration desired. All listed manufacturers must meet the requirements set forth in these specifications.

2.02 MATERIALS

A. Materials shall be new and products of recognized, reputable manufacturers. Like items of materials provided hereunder shall be the end products of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement.

B. All fencing materials shall be galvanized steel.

C. Framework shall be ASTM A120; Schedule 40 steel pipe, standard weight, one piece without joints.

D. Fabric: 2 inch diamond mesh steel wire, interwoven, 9 gage thick, top selvage twisted tight, bottom selvage knuckle end closed.

2.03 COMPONENTS

A. Barbed Wire
   1. Barbed wire support arm for supporting 3 strands of barbed wire shall be set at 45-degree angles.
   2. Barbed wire shall be minimum double strand 12-1/2 gauge twisted wire with 15 gauge, 4 point round barbs, spaced on approximately 3-in centers.

B. Slide Gate
   1. Gate shall be cantilevered slide type with an opening width of 20 ft. Frame is to be welded for rigid connections and braced to eliminate any possible sagging condition.
   2. Gate shall be fabric covered with fabric and barbed wire identical to adjacent fencing.
   3. Gate frame is to be supported from a separate semi-enclosed overhead track by a minimum of two swivel type, self-aligning, four wheeled, sealed lubricant, ball-bearing truck assemblies. The bottom of each center support post shall be equipped with a 3-inch guide wheel.
   4. The gate is to be hung from 4-inch diameter galvanized steel posts, set apart as required by the gate manufacturer

C. Gate Operator
   1. Each gate shall be operated by a chain driven motor. The gate operator shall be UL325 and UL991 listed for Class IV.
   2. Gate operator shall be heavy duty, worm gear reduction type with a lever type disconnect to permit manual gate operation. A reversal switch shall be provided for operator protection, an adjustable friction clutch, adjustable limit switches, contractor-type magnetic reversing starter with overload and undervoltage protection. The operator enclosure shall be heavy duty, NEMA 12, all welded construction with a gasketed hinged cover with padlock.
   3. Gate operator shall be complete with all drive and electrical components required to move gate and control its position in both the open and close directions.

D. Motor and Drive
   1. Motor shall be continuous duty rated with integral thermal protection. Motor shall be sized by control supplier based on gate dimensions and weight. Motor shall not be overloaded under any condition of normal year round operation which includes snow and ice loads.
   2. Controller shall utilize a heavy duty right-angle oil bath gear head speed reducer. Gears shall consist of a hardened steel machine cut worm and mating bronze gear running in oil.
   3. Bearings shall be heavy duty pillow block type with grease fittings.
   4. A lever type disconnect shall be provided to operate the gate manually.
   5. A built in magnetic brake shall be furnished to prevent coasting of gate.
   6. Drive chain shall be minimum 50# roller chain.
   7. Limit switches shall be furnished to limit travel from full open and full closed positions. Switches shall be precision type and field adjustable.

E. Electrical
   1. Terminal blocks shall be provided for incoming main power and all field wiring.
   2. Provide necessary connectors for termination of vehicle loop detectors.
   3. Provide ON/OFF power switch.
   4. Within the gate cabinet, furnish 120 VAC duplex ground fault convenience outlet.

F. Environment
   1. Operating temperature: Minus 15 through 115 degrees F
   2. Humidity: 10 to 90 percent (non-condensing)
   3. Provide thermostatically controlled heater with on and off temperature setpoints as recommended by system manufacturer.

G. Controls
   1. A maximum run timer shall be furnished to protect mechanism from burnout in the event the gate is obstructed. After maximum run timer times out, motor shall be de-energized.
   2. Gate closing timer shall be plug-in type with adjustable timer logic which will allow gate to close after both safety loops have been cleared and only after a preset time has elapsed. Plug-in timer shall be similar and equal to Osco Model 2650-031.
   3. Controls shall allow for interface with a future card access control system.
   4. Provide vehicle detector frequency/sensitivity relays.
   5. Provide a gate OPEN-CLOSE-STOP pad for manual operation.
   6. Furnish soft start to ramp up and ramp down motor speed at the beginning and end of gate cycles.
   7. Electronic access controller and keypad card reader for gate operators included in scope of supply of pre-selected system integrator. Contractor shall coordinate with system integrator on access controller and keypad card reader to provide for complete and operable powered cantilevered gate systems.

H. Vehicle Detection Loop
   1. The detection loop shall consist of a single length of wire (loop wire) embedded and wound in a square or rectangular saw cut in the pavement.
   2. The system manufacturer shall provide recommendations for the optimum number of turns and burial depth of the loop wire to provide maximum

coverage and field height to detect the presence of vehicles ranging from motorcycles to automobiles to 18 wheel tractor trailers.

3. The wire shall be copper, #14 AWG stranded, XLPE or XHHW insulated as recommended by the system manufacturer.

I. Safety

1. Provide all safety hardware, equipment, wiring and signage required by UL.

2.04 ACCESSORIES

A. Each operator shall bear a 316 stainless steel manufacturer's nameplate indicating the operating characteristics of the gate.

3.00 EXECUTION

3.01 INSTALLATION

A. Install according to manufacturer's instructions.

B. Gates shall be plum in the closed position, installed to slide with an initial pull force no greater than 40 lbs.

3.02 FIELD TESTING

A. Test that gate is operating smoothly under manual conditions before use of gate operators. Do not proceed if gate is binding or not properly aligned.

B. Test gate operator through ten full cycles and adjust for operation without binding, scraping or uneven motion. Test limit switches for proper "at rest" gate position.

END OF SECTION

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32 31 13 CHAIN LINK FENCES AND GATES

1.00 GENERAL

1.01 WORK INCLUDED

Provide all labor, materials and incidental items required to install a full height fence and manual and powered gates as specified and as indicated on the Plans.

1.02 REFERENCES

A. ANSI/ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings of Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strips.

B. ANSI/ASTM F567 - Installation of Chain-Link Fence.

C. ASTM A120 - Pipe, Steel, Black and Hot-dipped Zinc-coated (Galvanized) Welded and Seamless, for Ordinary Uses.

D. ASTM C94 - Ready-mixed Concrete.

E. FS RR-F-191 - Fencing, Wire and Post, Metal.

1.03 QUALITY ASSURANCE

A. Fencing Manufacturer: Fencing company specializing in commercial quality chain link fencing with minimum five years' experience.

B. Installation: ANSI/ASTM F567.

1.04 SUBMITTALS

A. Submit record drawings and product data under provisions of Section 01 33 00.

B. Include plan layout, grid, spacing of components, accessories, fittings, hardware, anchorages, and schedule of components.

C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

2.00 PRODUCTS

2.01 MATERIALS

A. All fencing materials shall be galvanized steel.

B. Framework: ASTM A120; Schedule 40 steel pipe, standard weight, one piece without joints.

C. Fabric: FS RR-F-191 Type I

2.02 COMPONENTS

A. Line Posts: 2.38 inch diameter steel pipe.

B. Corner and Terminal Posts: 2.88 inch diameter steel pipe.

C. Gate Posts: 3.5-inch diameter steel pipe.

D. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled steel pipe.

E. Gate Frame: 1.66 inch diameter steel pipe for welded fittings and truss rod fabrication.

F. Fabric: 2 inch diamond mesh steel wire, interwoven, 9 gage thick, top selvage twisted tight, bottom selvage knuckle end closed.

G. Caps: Cast steel or malleable iron; sized to post dimension, set screw retained.

H. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings:

I. Tension Wire: 6 gage thick steel, single strand.

J. Anchorage: 8-inch long, 4.00-inch diameter steel pipe;

K. 4-inch diameter closure plate welded to pipe sleeve end.

L. Extension Arms for Full Height Fence: Cast steel to accommodate three strands of barbed wire, single arm sloped to 45 degrees.

M. Barbed Wire: Barbed wire shall be minimum double strand 12-1/2 gauge twisted wire with 15 gauge, 4 point round barbs, spaced on approximately 3-in centers.

2.03 FINISHES

A. Galvanized: ANSI/ASTM A123; 2.0 oz/sq ft coating.

B. Accessories: Same finish as framing.

3.00 EXECUTION

3.01 INSTALLATION

A. Install framework, fabric, and accessories in accordance with ANSI/ASTM F567.

B. Space line posts at intervals not exceeding 10 feet o.c.

C. Set gate and line posts plumb, in concrete footings with top of footing 2 inches above finished grade. Slope top for water runoff. Footings to be 36 inches deep minimum.

D. Stretch fabric between terminal posts and at intervals of 500 feet maximum.

E. Position bottom of fabric 2 inches above top of wall.

F. Fasten fabric to top rail, line posts, corner posts, braces, and bottom tension wire with wire ties maximum 15 inches on centers.

G. Attach fabric to end posts with tension bars and tension bar clips.

H. Install bottom tension wire stretched taut between terminal posts.

I. Provide top rail through line post tops and splice with 7 inch long rail sleeves.

J. Brace each gate and corner post back to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail, one bay from end and gate posts.

K. Install center and bottom brace rail on corner and gate leaves.

L. Install barbed wire support arms sloped outward and attach barbed wire; tension and secure.

M. Install gates with fabric and barbed wire vertical. Install three hinges per leaf, latch, catches, drop bolt foot bolts and sockets torsion spring retainer and locking clamp.

N. Provide concrete center drop to foundation depth and drop rod retainers at center of double gate openings.

END OF SECTION

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32 92 13 HYDROMULCH SEEDING AND SODDING

1.00 GENERAL

1.01 WORK INCLUDED

A. Establishment of a uniform, full-coverage of grass by hydromulch seeding is required in all disturbed areas and other areas indicated on the Plans, including at any soil stockpiles or waste areas, except where sodding is explicitly called for.

B. Hydromulch seeding includes mixing fertilizer, grass seed and mulch material with water and spraying the mixture onto tilled topsoil. Seeding includes spreading fertilizer, and grass seed onto tilled topsoil.

C. Furnish all materials, labor and equipment including watering system to establish full coverage grass where specified and to maintain the established areas for 60 days.

1.02 DEFINITIONS

A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perrenial Sorrel, and Brome Grass.

1.03 SUBMITTALS

A. Submit data on fertilizer, seed, and mulch as necessary to show compliance with these specifications. Include source of supply for materials as well as:
   1. Name, trademark, warranty, analysis, form, and coverage for fertilizer.
   2. Name, type, germination, purity, germination test results with date of test for seed.
   3. Name, type, components and coverage for mulch.

B. Submit maintenance instructions, cutting method, minimum and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.04 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.05 QUALITY ASSURANCE

A. Provide seed in containers showing name and type of seed, year of production, net weight, date of packaging, date of germination test, and location of packaging.

B. Provide fertilizer in containers bearing the name, trademark warranty of producer, the weight and analysis, and form of constituents.

C. In the designated areas for grass establishment, it shall be the sole responsibility of the CONTRACTOR to establish uniform stand of grass which is defined as not less than 150 growing plants per square foot of seeded area, regardless of adverse

climatic or other conditions. The resident engineer may stop work if unfavorable conditions are likely until favorable conditions are present.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed mixture in sealed containers. Seed in damaged, wet, or moldy packaging is not acceptable. Store in dry location.

B. Deliver fertilizer in waterproof bags. Store in dry location not in contact with runoff.

1.07 MAINTENANCE SERVICE

A. For areas where establishment is required per the Plans and Paragraph 1.06 A., maintain the hydromulched areas for 60 days beginning immediately after placement and watering as required until grass is well established and exhibits a vigorous growing condition. Coordinate water requirements with availability of water from OWNER and areas to be seeded at one time.

2.00 PRODUCTS

2.01 SEED MIXTURE

A. Seed Type: Hulled, common Bermuda (Cynodon dactylion).

B. Seed Quality:
1. All seed shall meet the requirements of the Texas Seed Law including labeling requirements for showing pure live seed (PLS = purity x germination), name and type of seed.
2. All seed shall be treated with a fungicide.
3. Seed which has become wet, moldy or otherwise damaged in transit or storage will not be acceptable.
4. Seed shall be new crop seed (harvested within 1 year prior to planting), free of other weed seed to the limits allowable under the Texas Seed Law.
5. The seed shall have a germination and purity that will produce a pure live seed content of not less than 85 percent.

2.02 FERTILIZER

A. Fertilizer shall be a commercial product uniform in composition, free flowing, and suitable for application with standard equipment. The fertilizer shall comply with the applicable State fertilizer laws and shall be delivered in bags or other convenient containers, each fully labeled and bearing the name, trademark, and warranty of the producer. Fertilizer applied during the initial planting shall have analysis ratio of 20-20-20 also containing traces of sulfur, iron and zinc. Fertilizer used in the second application shall have an analysis ratio of 12-4-8. The figures in the analysis represent the percent of nitrogen, phosphorus, and potash nutrients, respectively as determined by methods of the Association of Official Agricultural Chemists. Fifty percent or greater of the nitrogen required shall be in the form of nitrate nitrogen. The remaining nitrogen may be in the form of urea nitrogen.

B. In the event it is necessary to substitute a fertilizer of a different analysis or form, the total amount of nutrients applied per 1000 square feet shall equal or exceed that specified for each nutrient.

C. Fertilizer which has become caked or exposed to excess humidity or mixture will not be acceptable.

2.03 HYDROMULCH

A. Hydromulch material for areas requiring grass establishment shall be Second Nature Hydroseeding Mulch as manufactured by Central Fiber Corporation, or approved equivalent.

B. Mulch shall be manufactured of natural fiber stock free of plastics and foreign materials. Mulch shall have a green non-toxic dye, disperse rapidly in water to form a homogeneous slurry and shall remain in suspension. It shall have a water holding capacity of not less than 1300 gms water per 100g fiber.

2.04 MULCH

A. Furnish straw mulch free of weeds and spread at the recommended rate to adequately cover all areas which are broadcast seeded and indicated to be mulched.

2.05 SOIL MATERIALS

A. Topsoil: Refer to material requirements in Section 31 00 00

2.06 ACCESSORIES

A. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

B. Erosion Fabric: Jute matting, open weave, where shown on Plans or where slope is steeper than 3:1.

3.00 EXECUTION

3.01 INSPECTION

A. Verify that prepared soil base is ready to receive the work of this Section that topsoil has been placed and final grading is acceptable to OWNER.

B. Beginning of installation means acceptance of existing site conditions.

3.02 FINAL GRADING

A. All areas to be seeded shall have sufficient topsoil placed prior to seeding.

B. Smooth areas that have become gullied; and loosen or retill areas that have become compacted since completion of grading to a depth of 6 inches.

3.03 FERTILIZING

A. Apply initial fertilizer in accordance with manufacturer's instructions at a minimum rate of 15 lb per 1000 sf with hydromulch mixture.

B. A second application of fertilizer shall be applied to the establishment areas between 45 and 60 days from seeding, at a rate of 8 pounds per 1000 sf.

3.04 SEEDING

A. For hydromulch (grass establishment) areas, hydromulch mixture containing the seed, fertilizer, mulch and water shall be prepared in accordance with the following quantities. Mixture shall be applied to planting area using conventional "Hydromulch" equipment. For seeded areas, seed and fertilizer shall be spread with mechanical spreaders to obtain the specified rates.

Component	Rate per 1000 sf
Grass seed	2.5 pounds
Fertilizer	15 pounds
Water	As Needed
Paper Fiber Mulch	Recommended by Manufacturer

B. Planting Season:
   1. March 1 to August 31.
   2. Seeding shall not be done during periods other than listed above.

C. For areas to be established, apply water with a fine spray immediately (within 24 hours) after each area has been seeded and mulched. Saturate to 4 inches of soil. Water daily as often as necessary for 4 weeks to establish grass.

3.05 SEED PROTECTION

A. Cover seeded slopes where grade is steeper than 4 inches per foot with erosion fabric. Roll fabric onto slopes without stretching or pulling. Cover hydromulched areas as recommended to obtain establishment of grass.

B. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Provide 12-inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

C. Secure outside edges and overlaps at 36-inch intervals with stakes.

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

F. No heavy equipment shall be moved over planted area unless area is to be retilled and reseeded.

3.06 MAINTENANCE FOR HYDROMULCHED AREAS

A. The Contractor shall mow grass as required.

B. Contractor shall water as required to establish grass and to prevent grass and soil from drying out for the initial 60-day period.

C. Contractor shall control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

D. Prior to the second fertilizer application, Contractor shall reseed areas which show bare spots of 2 square feet or larger. Minimum of 95 percent coverage shall be required for Owner acceptance.

E. Contractor shall maintain grass and reseed as required to establish 95 percent coverage (within a minimum of 60 days) or 150 plants per square foot.

F. Protect seeded areas with warning signs during maintenance period, if necessary.

END OF SECTION

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40 05 00.01 COMMON WORK RESULTS FOR GENERAL PIPING

1.00 GENERAL

1.01 SUMMARY

A. Section includes: Basic piping materials and methods.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME):
   1. B16.5 – Pipe Flanges and Flanged Fittings: NPS 1/2 Through 24.
   2. B16.47 – Large Diameter Steel Flanges: NPS 26 Through NPS 60 Metric/Inch Standard.

B. American Water Work Association (AWWA):
   1. C105 – Polyethylene Encasement for Ductile-Iron Pipe Systems.
   2. C110 – Ductile-Iron and Gray-Iron Fittings
   3. C207 – Steel Pipe Flanges for Waterworks Services, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)

C. ASTM International (ASTM):
   1. A 193 – Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
   2. A 194 – Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
   3. A 307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
   4. F 37 – Standard Test Methods for Sealability of Gasket Materials.

1.03 DEFINITIONS

A. Buried pipe: Pipe that is buried in the soil or cast in a concrete pipe encasement that is buried in the soil.

B. Exposed pipe: Pipe that is located above ground, or pipe that is located inside a structure, supported by a structure, or cast into a concrete structure.

C. Underground piping: Piping actually buried in soil or cast in concrete that is buried in soil.

D. Underwater piping: Piping below tops of walls in basins or tanks containing water.

E. Wet wall: Wall with water on at least 1 side.

1.04 SUBMITTALS

A. Product data:
   1. Escutcheons.
   2. Flange bolts.
   3. Gaskets.
   4. Link -type seals.
   5. Certifications of compliance with reference standard for lead limits.

2.00 PRODUCTS

2.01 LINK TYPE SEALS

A. Characteristics:
   1. Modular mechanical type, consisting of interlocking neoprene or synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening.
   2. Assemble links solely with stainless steel bolts and nuts to form a continuous rubber belt around the pipe.
   3. Provide a nylon polymer pressure plate with Type 316 stainless steel hardware. Isolate pressure plate from contact with wall sleeve.

B. Manufacturers: One of the following or equal:
   1. Calpico, Incorporated.
   2. Pipeline Seal and Insulator, Inc., Link-Seal.

2.02 FLANGE BOLTS

A. Ductile iron pipe:
   1. Bolts and nuts for ductile iron pipe flanges shall be Type 316 stainless steel in accordance with ASTM A 193, Grade B8M for bolts and in accordance with ASTM A 194, Grade 8M for nuts.
   2. Provide a washer for each nut. Washer shall be of the same material as the nut.
   3. Nuts shall be Heavy hex-head.
   4. Cut and finish flange bolts to project a maximum of 1/4 inch beyond outside face of nut after assembly.
   5. Tap holes for cap screws or stud bolts when used.

B. Plastic pipe:
   1. Bolts and nuts for flanges on plastic pipe shall be Type 316 stainless steel in accordance with ASTM A 193, Grade B8M for bolts and in accordance with ASTM A 194, Grade 8M for nuts.
   2. Provide a washer for each nut. Washer shall be of the same material as the nut.
   3. Nuts shall be Heavy hex-head.
   4. Cut and finish flange bolts to project a maximum of 1/4 inch beyond outside face of nut after assembly.
   5. Tap holes for cap screws or stud bolts when used.

C. Steel pipe:

1. Bolts and nuts for flanges shall be Type 316 stainless steel in accordance with ASTM A 193, Grade B8M for bolts and in accordance with ASTM A 194, Grade 8M for nuts.
2. Provide a washer for each nut. Washer shall be of the same material as the nut.
3. Nuts shall be Heavy hex-head.
4. Cut and finish flange bolts to project a maximum of 1/4 inch beyond outside face of nut after assembly.
5. Tap holes for cap screws or stud bolts when used.

D. Lubricant for stainless steel bolts and nuts:
1. Chloride-free.
2. Manufacturers: One of the following or equal:
3. Huskey FG-1800.

2.03 GASKETS

A. Gaskets for non-steam cleaned ductile iron and steel piping:
1. Suitable for pressures equal to and less than 150 pounds per square inch gauge, temperatures equal to or less than 250 degrees Fahrenheit, and raw sewage service.
2. Gasket material:
a. Neoprene elastomer with minimum Shore A hardness value of 70.
b. Reinforcement: Inserted 13-ounce nylon fabric cloth for pipes 20 inch or larger.
c. Thickness: Minimum 3/32-inch thick for less than 10-inch pipe; minimum 1/8 inch thick for 10-inch and larger pipe.
3. Manufacturers: One of the following or equal:
a. Pipe less than 20 inches in diameter:
1) Garlock, Style 7797.
2) John Crane, similar product.
b. Pipe 20 inches in diameter and larger:
1) Garlock, Style 8798.
2) John Crane, similar product.

B. Gaskets for steam cleaned non glass-lined ductile iron and steel piping:
1. Suitable for pressures equal and less than 150 pounds per square inch gauge, temperatures equal or less than 360 degrees Fahrenheit, and raw sewage service.
2. Material:
a. Neoprene elastomer, compressed, non-asbestos fiber reinforcement.
3. Manufacturers: One of the following or equal:
a. Garlock, Bluegard 3300.
b. John Crane, similar product.

C. Gaskets for steam cleaned glass lined ductile iron piping:
1. Suitable for pressures equal and less than 150 pounds per square inch gauge, temperatures equal and less than 360 degrees Fahrenheit, and sludge service.
2. Material:
a. Teflon gasketing with 1/16-inch sheet thickness each side (1/8 inch total sheet thickness), filled with corrugated or perforated Type 316 stainless

steel ring and non-asbestos filler material with minimum 5/16-inch overall thickness.

3. Manufacturers: One of the following or equal:
   a. Garlock, Style HP3561.
   b. John Crane, similar product.

D. Gaskets for flanged joints in polyvinyl chloride and polyethylene piping:
   1. Suitable for pressures equal to or less than 150 pounds per square inch gauge, with low flange bolt loadings, temperatures equal and less than 120 degrees Fahrenheit, and polymer, chlorine, caustic solutions, and other chemicals, except chemicals which liberate free fluorine including fluorochemicals and gaseous fluorine.
   2. Material: 0.125-inch thick Viton rubber.
   3. Manufacturers: One of the following or equal:
      a. Garlock.
      b. John Crane, similar product.

E. Gaskets for flanged joints in low pressure air piping:
   1. Suitable for pressures equal to or less than 150 pounds per square inch gauge, temperatures equal to or less than 300 degrees Fahrenheit, and compressed air service.
   2. Material: EPDM elastomer, 1/8 inch thick, 60 Shore hardness, smooth surface.
   3. Manufacturers: One of the following or equal:
      a. Garlock, Style 8314.
      b. John Crane, similar product.

F. Gaskets for flanged joints in ductile iron or steel water piping:
   1. Suitable for hot or cold water, pressures equal to or less than 150 pounds per square inch gauge, and temperatures equal to or less than 160 degrees Fahrenheit.
   2. Material:
      a. Neoprene elastomer, compressed, with non-asbestos fiber reinforcement.
   3. Manufacturers: One of the following or equal:
      a. Garlock, Bluegard 3300.
      b. John Crane, similar product.

G. Provide gaskets suitable for the specific fluids and pressure and temperature conditions.

3.00 EXECUTION

3.01 EXAMINATION

A. Verification of existing conditions:
   1. Locate and expose existing structures, piping, conduits, and other facilities and obstructions that may affect construction of underground piping before starting excavation for new underground piping and appurtenances.
   2. Verify sizes, elevations, locations, and other relevant features of existing facilities and obstructions. Determine conflicts for the construction of the new underground piping and appurtenances.
   3. Make piping location and grade adjustments to resolve conflicts between new piping and existing facilities and obstructions.

3.02 INSTALLATION

A. General:
   1. Piping drawings:
      a. Except in details, piping is indicated diagrammatically. Not every offset and fitting, or structural difficulty that may be encountered has been indicated on the Drawings. Sizes and locations are indicated on the Drawings.
      b. Perform minor modifications to piping alignment where necessary to avoid structural, mechanical, or other type of obstructions that cannot be removed or changed.
         1) Modifications are intended to be of minor scope, not involving a change to the design concept or a change to the Contract Price or Contract Times.
   2. Piping alternatives:
      a. Provide piping as specified in this Section, unless indicated on the Drawings or specified otherwise.
      b. Alternative pipe ratings:
         1) Piping with greater pressure rating than specified may be substituted in lieu of specified piping without changes to the Contract Price.
         2) Piping of different material may not be substituted in lieu of specified piping.
      c. Valves in piping sections: Capable of withstanding specified test pressures for piping sections and fabricated with ends to fit piping.
      d. For flanged joints, where 1 of the joining flanges is raised face type, provide a matching raised face type flange for the other joining flange.
   3. Unless otherwise indicated on the Drawings, piping at pipe joints, fittings, couplings, and equipment shall be installed without rotation, angular deflection, vertical offset, or horizontal offset.

B. Wall and slab penetrations:
   1. Unless shown otherwise on the drawings, provide sleeves for piping penetrations through aboveground masonry and concrete walls, floors, ceilings, roofs, unless specified or otherwise indicated on the Drawings.
   2. For piping 1 inch in nominal diameter and larger, provide sleeves with minimum inside diameters of 1 inch plus outside diameter of piping. For piping smaller than 1 inch in nominal diameter, provide sleeve of minimum twice the outside diameter of piping.
      a. Arrange sleeves and adjacent joints so piping can be pulled out of sleeves and replaced without disturbing the structure.
      b. Cut ends of sleeves flush with surfaces of concrete, masonry, or plaster.
      c. Conceal ends of sleeves with escutcheons where piping runs through floors, walls, or ceilings of finished spaces within buildings.
      d. Seal spaces between pipes and sleeves with link-type seals when not otherwise specified or indicated on the Drawings.
      e. Seal openings around piping running through interior walls and floors of chlorine rooms and chlorine storage rooms gastight with synthetic rubber sealing compound.
   3. Provide flexibility in piping connecting to structures to accommodate movement due to soil settlement and earthquakes. Provide flexibility using details indicated on the Drawings.
   4. Core drilled openings:

a. Do not damage or cut existing reinforcing bars, electrical conduits, or other items embedded in the existing concrete without acceptance by Engineer.
b. Determine location of reinforcing bars or other obstructions with a non-destructive indicator device.
c. Remove dust and debris from hole using compressed air.

5. Where shown or noted on the plans, provide a wall fitting with an integral thrust ring.

C. Exposed piping:
1. Install exposed piping in straight runs parallel to the axes of structures, unless otherwise indicated on the Drawings:
a. Install piping runs plumb and level, unless otherwise indicated on the Drawings.
1) Slope plumbing drain piping with a minimum of 1/4 inch per foot downward in the direction of flow.
2) Slope digester gas piping to drip traps or low-point drains at a minimum of 1/2 inch per foot where condensate flows against the gas, or at a minimum of 1/4 inch per foot where condensate flows with gas.
2. Install exposed piping after installing equipment and after piping and fitting locations have been determined.
3. Do not transfer pipe loads and strain to equipment.
4. In addition to the joints indicated on the Drawings, provide unions, flexible couplings, flanged joints, flanged coupling adapters, and other types of joints or means which are compatible with and suitable for the piping system, and necessary to allow ready assembly and disassembly of the piping.
5. Assemble piping without distortion or stresses caused by misalignment:
a. Match and properly orient flanges, unions, flexible couplings, and other connections.
b. Do not subject piping to bending or other undue stresses when fitting piping.
c. Do not correct defective orientation or alignment by distorting flanged joints or subjecting flange bolts to bending or other undue stresses.
d. Flange bolts, union halves, flexible connectors, and other connection elements shall slip freely into place.
e. Alter piping assembly to fit, when proper fit is not obtained.
f. Install eccentric reducers or increasers with the top horizontal for pump suction piping.

D. Buried piping:
1. Bury piping with minimum 3-foot cover without air traps, unless otherwise indicated on the Drawings.
2. Where 2 similar services run parallel to each other, piping for such services may be laid in the same trench.
a. Lay piping with sufficient room for assembly and disassembly of joints, for other structures, and to meet separation requirements of public health authorities having jurisdiction.
3. Laying piping:
a. Lay piping in finished trenches free from water or debris. Begin at the lowest point with bell ends up slope.
b. Place piping with top or bottom markings with markings in proper position.

c. Lay piping on an unyielding foundation with uniform bearing under the full length of barrels.
d. Where joints require external grouting, banding, or pointing, provide space under and immediately in front of the bell end of each section laid with sufficient shape and size for grouting, banding, or pointing of joints.
e. At the end of each day's construction, plug open ends of piping temporarily to prevent entrance of debris or animals.

4. Concrete encase all buried pipe installed under concrete slabs or structures.

E. Venting piping under pressure:
1. Lay piping under pressure flat or at a continuous slope without air traps, unless otherwise indicated on the Drawings.
2. Install plug valves as air bleeder cocks at high points in piping.
   a. Provide 1-inch plug valves for water lines, and 2-inch plug valves for sewage and sludge lines, unless otherwise indicated on the Drawings.
3. Provide additional pipe taps with plug cocks and riser pipes along piping as required for venting during initial filling, disinfecting, and sampling.
4. Before piping is placed into service, close plug valves and install plugs. Protect plugs and plug valves from corrosion.

F. Restraining piping:
1. Restrain piping at valves and at fittings where piping changes direction, changes sizes, and at ends:
   a. When piping is underground, use mechanical restraints, or push-on restraints.
   b. When piping is aboveground or underwater, use mechanical or structural restraints.
   c. Determine thrust forces by multiplying the nominal cross sectional area of the piping by design test pressure of the piping.
2. Provide restraints with ample size to withstand thrust forces resulting from test pressures:
   a. During testing, provide suitable temporary restraints where piping does not require permanent restraints.
3. Place concrete thrust blocks against undisturbed soil.
4. Place concrete so piping joints, fittings, and other appurtenances are accessible for assembly and disassembly.
5. Provide underground mechanical restraints where specified in the Piping Schedule.

G. Connections to existing piping:
1. Expose existing piping to which connections are to be made with sufficient time to permit, where necessary, field adjustments in line, grade, or fittings:
   a. Protect domestic water/potable water supplies from contamination:
      1) Make connections between domestic water supply and other water systems in accordance with requirements of public health authorities.
      2) Provide devices approved by Owner of domestic water supply system to prevent flow from other sources into the domestic supply system.
2. Make connections to existing piping and valves after sections of new piping to be connected have been tested and found satisfactory.

3. Provide sleeves, flanges, nipples, couplings, adapters, and other fittings needed to install or attach new fittings to existing piping and to make connections to existing piping.
4. For flanged connections, provide stainless steel bolts with isolation bushings and washers, and full-face flange gaskets.

H. Connections to in-service piping:
1. Shutdown In-Service Piping as specified in Section 01 35 00:
   a. Establish procedures and timing in a conference attended by Contractor, Engineer, and Owner of the in-service piping.
2. Where operation and maintenance of existing facilities require that a shutdown be made during hours other than normal working hours, perform the related work in coordination with the hours of actual shutdown.
3. Additional provisions regarding shutdown of existing facilities are specified in Section 01 35 00.

I. Connections between ferrous and nonferrous metals:
1. Connect ferrous and nonferrous metal piping, tubing, and fittings with dielectric couplings especially designed for the prevention of chemical reactions between dissimilar metals.
2. Nonferrous metals include aluminum, copper, and copper alloys.

J. Flanged connections between dissimilar metals such as ductile iron pipe and steel pipe:
1. Provide stainless steel bolts with isolation bushings and washers, and full-face flange gaskets.

3.03 CLEANING

A. Piping cleaning:
1. Upon completion of installation, clean piping interior of foreign matter and debris.
2. Perform special cleaning when required by the Contract Documents.

B. Cleaning potable water piping:
1. Flush and disinfect potable water piping designated as potable water.

C. Cleaning air piping:
1. Perform special cleaning of filtered air piping from the intake clean air plenums to the discharge points and high-pressure air piping.
   a. Protect surfaces from contamination.
2. Special cleaning shall include wire brushing, power tool cleaning, wiping down with lint-free cloths, brooming, and vacuuming to remove rust, scale, weld spatter, dust, dirt, oil, and other matter deleterious to operation of the air system:
   a. Do not sandblast installed piping.
3. To the greatest extent possible, clean piping immediately prior to final closure of piping systems:
   a. Enter piping, clean and wipe down surfaces, and vacuum out residue.
   b. Clean surfaces not accessible to this cleaning operation after installation within 6 hours preceding installation.
4. Subsequent to cleaning, protect surfaces from contamination by dust, dirt, construction debris, and moisture, including atmospheric moisture:

a. Whether or not pipe upstream has been cleaned, temporarily seal openings in partially completed work except when installation is actively in progress.
b. When installation is actively in progress, seal openings at the end of each day's construction or when construction is temporarily stopped.

5. Suspend cleaning and seal openings when inclement weather, including dust storms, is imminent.
6. Use clean, dry air for testing the piping and other elements of the system.
7. Prior to introduction of air to the system, blow piping clean.
   a. Blow with maximum discharge rate possible for minimum 4 hours, using new blowers or compressors and filters.
8. Clean surfaces that become contaminated prior to acceptance.

3.04 TESTING

A. Hydrostatically test all liquid pipe to 125 psig unless noted otherwise.

END OF SECTION

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40 05 04 GENERAL REQUIREMENTS FOR PIPING SYSTEMS

1.00 GENERAL

1.01 WORK INCLUDED

A. All exposed, submerged and buried plant and station piping including modifications to existing systems as well as new pipe systems.

B. Potable water and raw water mains, process lines, sanitary sewers, storm drains and culverts shown on Drawings.

1.02 REFERENCES

A. ASME B31.1 (American Society of Mechanical Engineers) - Power Piping

B. ASME B31.5 (American Society of Mechanical Engineers) - Refrigeration Piping

C. ASME B31.9 (American Society of Mechanical Engineers) - Building Services Piping

D. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

E. MSS SP58 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Materials, Design and Manufacturer.

F. MSS SP69 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Selection and Application.

G. MSS SP89 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Fabrication and Installation Practices.

H. NFPA 13 (National Fire Protection Association) - Installation of Sprinkler Systems.

I. NFPA 14 (National Fire Protection Association) - Installation of Standpipe and Hose Systems

1.03 DESCRIPTION OF PIPING SYSTEMS

A. The configuration and layout of yard, process, and station piping systems are shown in the Drawings.

B. The type of pipe and joints, and embedment (if buried) to be used for each system are shown on the drawings or included in the appropriate specifications.

C. In certain locations, pipe supports, anchors, and expansion joints have been indicated on the drawings. It shall be the Contractor’s responsibility to provide a complete system of pipe supports, to provide expansion joints, and to provide restraints and anchor all piping, in accordance with the requirements set forth herein. Additional pipe supports may be required adjacent to expansion joints, couplings, or valves or to meet the spacing requirements specified.

D. Pipe and fittings shown on yard piping drawings are general in nature. Contractor shall determine exact lengths and fittings required and make field adjustments necessary to complete piping and avoid conflicts. Changes to Plans and profiles of piping shall be submitted to Engineer for approval. Pipe and fittings not incorporated into the project shall remain the property of the Contractor. Costs will not be paid by the Owner for materials not used in the project, even if shown on the drawings. Additions and deletions to the scope shall be incorporated by Change Order.

E. Provide a minimum of ½-inch clearance between the pipe jacket and all walls, ceilings or floors.

1.04 SUBMITTALS

A. Shop Drawings and Product Data:
   1. Comply with the provisions of Section 01 33 00 and the supplemental requirements below.
   2. Submit detailed layout drawings for all piping systems. Those drawings may be organized by system or by areas. Prepare drawings to scale and show the following information on them:
      a. Type of piping including material, weight, linings, and coatings. If desired, use code and key to product data sheet specified below.
      b. Location and type of joints, fittings, taps, supports, restraint systems, kickers and blocking (as applicable).
   3. Submit fabrication drawings for specials including fabricated fittings, wall pipes and wall sleeves. Show dimensions and materials of construction.
   4. Submit manufacturer's standard drawings showing dimensions, configuration and materials of construction for the following items:
      a. Joints.
      b. Flanges.
      c. Couplings.
      d. Expansion joints.
      e. Hangers, brackets and other similar accessories.
   5. Submit the following product data on all piping materials.
      a. Reference standard.
      b. Type material.
      c. Wall thickness, schedule and class as appropriate.
      d. Outside diameter.
      e. Type and thickness of lining.
      f. Type and thickness of coating.
      g. Pressure rating, if applicable.

B. Affidavits of Compliance:
   1. Submit manufacturer's affidavits of compliance with the reference standards.

C. Contractor shall mark actual flowline or top of pipe elevations and actual coordinates on record drawings when pipelines are being installed.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. General: Comply with manufacturer's instructions.

B. Delivery and Handling:

1. Do not deliver piping materials to project site prior to Engineer's approval of required submittals.
2. Unload and handle piping materials using proper materials handling equipment.
3. Do not drop, roll, skid piping materials.
4. Take such additional precautions as necessary to avoid damaging piping materials and coatings thereon.

C. Storage:
1. Store piping materials in a manner which will reduce risk of damage.
2. Block piping materials to prevent rolling.
3. Protect materials from weather and sun as recommended by the manufacturer.

2.00 PRODUCTS

2.01 GENERAL

A. See other Sections for piping materials specifications.

B. No asbestos materials shall be used in any piping materials, linings, and gaskets for this project.

C. PVC piping shall not be used beneath structures except for chlorine gas and chemical service.

D. All piping beneath slabs and to 2 feet outside of slab shall be concrete encased.

E. Gravity drain systems beneath slabs shall be ductile iron except for chemical drains, unless shown specifically on the Plans.

F. All buried potable water piping installed in this project shall have tape indicating "Potable Water Line" installed 12 inches above the pipe.

G. Install cleanouts on sludge piping so that all runs between bends may be accessed and at intervals not exceeding 250 feet on straight runs. Refer to Standard details.

H. All bolts and fasteners on buried fittings and valves shall be 304 stainless steel. Buried MJ fitting bolts may be Corten. Bolts and fasteners on submerged fittings and valves shall be 316 SS.

I. For buried pipes, provide a flexible joint (Dresser style coupling or push on or mechanical joint) within 10 feet from a structure connection to allow differential movement. Provide proper restraint on pressure systems.

3.00 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Install all piping systems in accordance with the Drawings, Technical Specifications, approved shop drawings and manufacturer's installation instructions.

B. Examine all piping materials prior to installation and replace items that are damaged or otherwise defective.

C. Thoroughly clean inside of all piping, valves, and accessories, and outside of all materials which will be exposed. Clean before installation and maintain in that condition until accepted by Owner.

D. Provide secure temporary caps or inflatable plugs at all pipe ends at the end of each day to prevent foreign material from entering the piping systems. Brace pipe to restrain from floating.

E. Do not modify structures, equipment, or piping for the purpose of installing piping unless specifically authorized by the Engineer.

F. All piping systems shall be cleaned and tested prior to making connections at structures and to existing pipe systems. Small diameter pipes shall be flushed and large diameter pipes shall have mandrels pulled or other acceptable verification furnished that pipes are clean and no construction debris remains. Temporary blocking and forms used to grout inverts and blockouts shall be removed and manholes and pipes shall be tested before payment will be approved for the last 10 percent of the respective pipe pay estimate items.

G. Contractor shall be responsible for, develop, and comply with the trench safety plan and a confined space entry plan.

3.02 INSTALLATION OF BURIED PIPING SYSTEMS

A. Line and Grade:
   1. Install piping to lines and grades shown on Drawings.
   2. Slope piping uniformly between flowline elevations shown.
   3. If centerline and flowline elevations are not shown on Drawings, install piping so that there is at least 4 feet of cover over same, except under ditches where the minimum cover is to be 24 inches. Piping less than 4-inch diameter may be installed with 3 feet of cover.
   4. Comply with requirements for minimum and maximum trench widths shown in the plans. If maximum trench width is exceeded, use next higher class of embedment at no additional cost.
   5. Refer to special detail for installation of chemical and small diameter PVC piping.

B. Dewatering:
   1. Keep trenches free of water when performing any type of work in them.
   2. Discharge groundwater from construction pumps as directed by Owner.

C. Bedding:
   1. Install bedding as shown on Drawings. Shape bedding to allow for coupling and bells and to provide support over full length of pipe section. Place embedment under haunches and on sides of pipe and compact in lifts and in a manner which does not disturb pipe from line and grade.
   2. If bedding is not called for on Drawings or Specifications, piping less than 4-inch diameter shall be installed and encased in sand or granular material. Use embedment type shown in the standard details for larger pipes.

3. Provide concrete encasement for all pipe under structures and to 2' beyond structure and as shown on drawings.
4. Provide concrete cradle (Class V) Embedment to first pipe joint at all connections to structures unless otherwise shown.

D. Laying of Pipe:
1. Do not drop or roll pipe into trench. Inspect thoroughly prior to laying and then place carefully by hand or materials handling equipment.
2. Do not lay pipe in water.
3. Lay bell and spigot type piping with bell end facing direction of laying which is normally upgrade.
4. Joint pipe as specified in piping material specifications.
5. Do not deflect pipe unless shown on Drawings or approved by Engineer.
6. When deflection of pipe is authorized, do not exceed the Manufacturer's recommended maximum deflection.
7. Shoring or other trench safety systems utilized shall be of thin cross-section such that when the sections are pulled, the embedment is not disturbed or displaced.

E. Encasement of Piping and Valves:
1. Provide polyethylene encasement for steel, RCCP, cast iron and ductile iron piping and valves.
2. Provide Class IV embedment for PVC pipe unless otherwise shown.
3. Embedment shall extend at least six inches above pipe and 3 inches below pipe.
4. Use Class C concrete or flowable fill when concrete encasement is called for on Drawings. Such encasement to extend a distance of Pipe OD/6 with a minimum of six inches from pipe in all directions unless otherwise noted on drawings.

F. Restrained Joints:
1. Use restrained joint piping, fittings and valves for all pipe that is under pressure. Joint restraint shall be provided for test pressures shown on the Plans and specified for each piping system with a safety factor of 1.5 minimum.
2. Restraining system and number of restrained joints shall be designed by pipe supplier, sealed by a Texas Licensed Professional Engineer in Texas and submitted for review. In general, restrained joints using the U.S. Pipe TR FLEX® system or approved equivalent are acceptable.
3. Restrained joint systems that use tapping or set screws perpendicular to the pipe barrel are not allowed.

G. Backfilling:
1. Comply with Section 31 23 33 and the following supplemental requirements.
2. Backfill as soon as practicable after installation of piping, valves, encasement, restraint and blocking.
3. Touch up damaged protective coatings prior to backfilling.
4. Exercise care to avoid damaging piping or protective coatings with tamping equipment.
5. When authorized by the Engineer, sheeting and bracing may be left in trench. Cut off all members so that tops of same are at least 18 inches below ground. Sheeting and bracing left in place shall be indicated on Record Drawings.

H. Connections to New Manholes:
   1. Couplings for pipe connections shall be cast into the manhole walls (FERNCO or approved equal). PVC sleeves with rubber gaskets and abrasive silica outer coating may also be utilized.
   2. All clamps shall be 316 stainless steel.
   3. Support manhole connection to first pipe joint with concrete cradle.

I. Valves:
   1. Provide restrained joints on buried valves. Flanges may be utilized for valves 12 inches and larger.

3.03 INSTALLATION OF EXPOSED PIPING SYSTEMS

A. Alignment and Elevation:
   1. Install straight runs true to line and elevation.
   2. Install vertical pipe truly plumb in all directions.
   3. Install piping parallel or perpendicular to building walls. Piping at odd angles and 45 degree runs across corners will not be accepted unless specifically shown on Drawings.
   4. Install small diameter piping generally as shown on Drawings when specific locations and elevations are not indicated. Locate such piping as required to avoid ducts, equipment, beams, etc.
   5. Install piping so that pipe, flanges, valves, and associated appurtenances are at least eight feet above finish floors, stairs, and landings unless lesser clearances are specifically dimensioned on the Drawings.
   6. Insulated pipe shall have ½" minimum clearance from the adjacent surface to the outside of the pipe jacket.
   7. Bring piping to alignment and elevation without forcing or springing pipe.
   8. For PVC or CPVC or ABS piping runs of 10 feet or longer, provide supports that accommodate expansion and contraction without bending the pipe out of alignment.

B. Joints:
   1. Joint pipe in accordance with piping material specifications and the supplemental requirements below.
   2. Wire brush flange faces and threads before jointing.
   3. Bring piping to proper alignment and elevation with permanent support system before tightening flange bolts and nuts.

C. Unions for Threaded Piping:
   1. Install unions near threaded valves and equipment to facilitate assembly and disassembly of piping, in addition to the specific locations shown on plans.
   2. Install dielectric unions wherever dissimilar metals are joined.

D. Expansion Joints:
   1. Install in accordance with Drawings, specifications for expansion joints and approved shop drawings.
   2. Use of additional couplings and adaptors to be approved by Engineer prior to installation.
   3. All expansion joints on piping shall be restrained.
   4. All expansion joints for foul air duct shall have joints on each side with the distance between the two supports no more than 10 feet.

E. Flexible Couplings and Flanged Coupling Adaptors:
   1. Install in accordance with Drawings, specifications for couplings and adaptors, and approved shop drawings.
   2. Contractor may use couplings and adaptors over and above those shown on Drawings to facilitate installation of piping. Use of additional couplings and adaptors to be approved by Engineer prior to installation.
   3. All flexible couplings and flanged coupling adapters shall be restrained.

F. Piping Supports and Restraints:
   1. General:
      a. Restrain, block, brace, support, or suspend pipe and fittings to prevent displacement, vibration, sagging, warping, deformation, or failure of piping and fittings, and to allow for expansion and contraction.
      b. Support and restrain piping so that no piping loads from weight or thrust will be imparted to pumps or other equipment. Do not support pipes from other pipes.
      c. Materials: Unless otherwise specified, all pipe supports shall comply with ANSI/MSS SP-58 and MSS SP-69. Materials of construction for fabricated steel supports are covered in the structural steel section. All pipe support materials shall be packaged as necessary to ensure delivery in satisfactory condition.
      d. Unless otherwise specified or indicated on the drawings, pipe supports shall be fabricated of manufacturer's standard materials and provided with manufacturer's standard finish.
      e. Supports shall be as manufactured by:
         1) Carpenter & Paterson Inc.
         2) Grinnell
         3) Piping Technology and Products
         4) Kellog
         5) Or Equal
      f. Except as specified herein, the use of supports which rely on stressed thermoplastic components to support the pipe will not be acceptable. PVC pipe 4 inches and smaller used for chemical storage area locations, shall be supported by pultruded vinylester channel and components as specified below:
         1) Material: Vinylester Fiberglass, Class 1 Fire Rated per ASTM E-84, Premium Grade, pultruded channel as manufactured by Entrum Industries, Strut Tech Series 200 or equal. Support system shall be as specified herein and as recommended by the manufacturer.
         2) Adjustable strap type pipe clamps are not acceptable. Any metal components, if required, for this type support system shall be Type 316 stainless steel.
      g. Contact between dissimilar metals, including contact between stainless steel and carbon steel, shall be prevented. Supports for brass or copper pipe or tubing shall be copper plated. Those portions of pipe supports which contact other dissimilar metals shall be rubber or vinyl coated.
      h. All pipe supports, fasteners, anchors and hardware in wetwells, manholes, vaults, and submerged locations shall be AISI Type 316 stainless steel. Stainless steel supports fabricated by welding shall be AISI Type 316L material.

G. Supports for Horizontal Piping and Spacing of Expansion Joints:

1. Location: Unless closer spacing is indicated on the drawings, the maximum spacing for pipe supports and expansion joints shall be:

Type of Pipe	Pipe Support Max Spacing feet	Max Run Without Expansion Joint, Loop, or Bend (Note a) feet	Expansion Joint Max Spacing (Note b) feet
Cast iron	15	80	80
Cast iron, glass-lined	12	80	80
Steel for hot water heating			
1-1/4-inch and smaller	7	30	100
1-1/2- to 4-inch	10	30	100
Over 4-inch	15	30	100
Steel for other services			
1-1/4-inch and smaller	7	30	100
1-1/2- to 4-inch	10	30	100
Over 4-inch	15	80	80
Stainless steel			
1-1/4-inch and smaller	7	30	100
1-1/2- to 4-inch	10	30	100
Over 4-inch	15	80	80
Copper for hot water			
1-inch and smaller	5	20	100
Over 1-inch	7	20	100
Copper for other services			
1-inch and smaller	5	--	--
Over 1-inch	7	50	100
CPVC, PVC, and ABS Schedule 80			
1/8- and 1/4-inch	Continuous	20	60
1/2-inch	3-1/2	20	60
3/4-inch	4	20	60
1- and 1-1/4-inch	4-1/2	20	60
1-1/2- and 2-inch	5	20	60
2-1/2-inch	5-1/2	20	60
3-inch	6-1/2	20	60
4-inch	7	20	60
6-inch	8	20	60
8-inch	9	20	60
10-inch	9-1/2	20	60
12-inch	10	20	60
PVC, Schedule 40			
1/2-inch	3-1/2	20	60
3/4- and 1-inch	4	20	60
1-1/4- and 1-1/2-inch	4-1/2	20	60
2-inch	5	20	60
2-1/2-inch	5-1/2	20	60
3-inch	6	20	60
4-inch	6-1/2	20	60
6-inch	7-1/2	20	60

8-inch 10-inch 12-inch	8 8-1/2 9-1/2	20 20 20	60 60 60
Polypropylene	6	--	--
Cast iron soil	10	--	--

NOTES:

a) Unless otherwise permitted, an expansion joint shall be provided in each straight run of pipe having an overall length between loops or bends exceeding the maximum run specified herein.
b) Unless otherwise permitted, the spacing between expansion joints in any straight pipe run shall not exceed the maximum spacing specified herein.
c) Expansion joint fittings shall be as specified in the pipe joint and expansion joints section.
d) Correction factors shall be applied to the above table as recommended by the manufacturer to adjust for fluid specific gravities other than 1.0.
e) Maximum allowable spacing for PVC pipe shall be reduced when required by manufacturer's recommendations for maximum fluid temperatures.

2. Locate hangers or supports immediately adjacent to or at any change in piping direction, on both sides of valves, couplings, and heavy fittings, and on either end of pipe sections being removed unless specifically noted otherwise on Drawings.
3. Install all hangers and supports so as not to interfere with the free expansion and contraction of the pipe.
4. When hangers are used to support insulated piping, provide shields to protect insulation.
5. Provide concrete supports as shown on Drawings, or when required to comply with these specifications. Construct in accordance with concrete specifications and details shown on Drawings.
6. Rubber hose and flexible tubing shall be provided with continuous angle or channel support, except at injector and chemical feed pump locations.
7. Unless otherwise indicated on the drawings or permitted by the Engineer, piping shall be supported approximately 1-1/2 inches out from the face of walls and at least 3 inches below ceilings.
8. Concrete inserts or L-shaped anchor bolts shall be used to support piping from new cast-in-place concrete. Capsule anchors shall be used to fasten supports to existing concrete and masonry. Design loads for inserts, brackets, clamps, and other support items shall not exceed the manufacturer's recommended loads.
9. Pipe supports shall be manufactured for the size and type of pipe to which they are applied. Strap hangers will not be acceptable. Threaded rods shall have sufficient threading to permit the maximum adjustment available in the support item.
10. Anchorage shall be provided to resist thrust due to temperature changes, changes in diameter or direction, or dead ending. Anchors shall be located as required to force expansion and contraction movement to occur at expansion joints, loops, or elbows, and as required to prevent excessive bending stresses and opening of mechanical couplings. Anchorage for temperature changes

shall be centered between elbows and mechanical joints used as expansion joints. Anchorage for bellows type expansion joints may be located adjacent to the joint.

11. Pipe guides shall be provided adjacent to bellows type expansion joints. Guides will not be required when mechanical couplings are permitted as expansion joints. Guides shall be placed on both sides of expansion joints except where anchors are adjacent to the joint. Unless otherwise indicated on the drawings, one guide shall be within four pipe diameters from the joint and a second guide within 14 pipe diameters from the first guide. Pipe supports shall allow adequate movement; pipe guides shall not be used for support. Pipe guides shall be installed as recommended by the manufacturer.

H. Drain Valves and Air Bleed Valves:
   1. Provide drain petcocks 1/4-inch diameter opening at all low points in air piping.
   2. Provide air bleed valves 1/8-inch diameter opening at all high points in force mains unless specifically indicated otherwise.

I. Supports for Vertical Piping:
   1. Support in accordance with Drawings and approved shop drawings.
   2. For piping 4 inches and smaller, install riser clamps so as to support piping at each floor sleeve.
   3. Use at least 3/4-inch of non-shrink grout in setting base elbows and tees. See SECTION 03 30 00 for non-shrink grout requirements.
   4. For piping larger than 4 inches, locate supports at change of direction, at both sides of valves and couplings, and at maximum spacing of 10 feet.

J. Piping Restraints:
   1. Provide kickers and mechanical restraint system as shown on Drawings and required herein.
   2. Use at least 3/4-inch of non-shrink grout between kickers and walls or floors and between piping supports and floors or walls unless otherwise shown on Drawings. See Division 03 for non-shrink grout requirements.

K. Supports for Valves:
   1. Provide supports for valves 16 inches and larger. Use the type of support shown on Drawings. If type is not shown, use adjustable pipe saddle type. Contractor may utilize an alternate type if acceptable to the Engineer.
   2. Install floor stands as shown on Drawings and as recommended by the manufacturer.
   3. Provide lateral restraints for extension bonnets and extension stems as shown on Drawings and as recommended by the manufacturer.
   4. Provide sleeves where operating stems pass through floor.
   5. Place approved asphalt fill in recessed areas as shown on Drawings where flush bottom sluice gates or special valve installations are indicated. Size recessed areas as recommended by valve or gate manufacturer. Compact fill after placement.
   6. Install valve boxes so that they will not transmit shock or stress to valve and will be centered and plumb over the operating nuts.

L. Wall Fittings:
   1. Wall fittings shall be as shown on the plans and the standard detail sheets.

2. Wall fittings shall match the wall thickness, pipeline diameters, and connection types specified for the applicable pipeline designation.

M. Field Painting: Comply with Section 09 90 00.
1. Buried Piping: Ductile iron, cast iron and steel coatings per individual piping specifications.
2. Exposed Piping: Paint all exposed piping, supports, fittings and valves except stainless steel and fiberglass in accordance with Section 09 90 00.

N. Pipe Testing.
1. Comply with NCTCOG and Division 01 specifications.

O. Heat Trace, Insulation and Jacketing
1. Heat trace, insulate and jacket all exposed pipes 8-inch and smaller and where specifically called for on the plans.

END OF SECTION

40 05 05 IDENTIFICATION, STENCILING, AND TAGGING

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish all labor, materials, tools, equipment, and perform all work and services for all identifications, stenciling and tagging as shown on the drawings and as specified for all items.

B. Items include but are not necessarily limited to the following areas of work:
   1. Paint and provide identification labels for all exposed piping, ductwork, and conduits in accordance with Schedule A at the end of this section. All exposed piping other than stainless steel shall be painted.
   2. Provide identification tags and stenciling for all treatment units, tanks, equipment, valves (including buried valves), instrumentation, and electrical components.
   3. Provide marking tape for all buried pipelines; non-metallic pipe shall have metallic marking tape.

C. Although such work is not specifically shown or specified, all supplementary or miscellaneous items, including connections and mounting hardware, necessary for a sound, secure, and complete installation shall be furnished and installed as part of this work.

D. Related Work and Specifications:
   1. Section 01 33 00: Submittals.
   2. Section 09 91 00: Painting.

1.02 QUALITY ASSURANCE

A. Unless otherwise specified, all treatment units, tanks, equipment and valves including mechanical, process, electrical, and instrumentation are required to be identified.

B. Unless otherwise specified, openings, accesses and related locations are required to be identified.

C. Coordination, development, and initiation of identification, marking, and tagging systems and determination of separation of subcontractor's and manufacturer's corresponding responsibilities is the sole responsibility of the SUPPLIER.

D. Referenced Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. 30 TAC 217 – Texas Commission on Environmental Quality Design Criteria for Domestic Wastewater Systems
   2. 30 TAC 290 - Texas Commission on Environmental Quality Rules and Regulations for Public Drinking Water Systems
   3. ANSI A13.1, Scheme for the Identification of Piping Systems.
   4. Great Lakes - Upper Mississippi River Board of State Sanitary Engineers (Ten States Standards). Recommended Standards of Waste Treatment Works latest edition, Recommended Color Scheme for Piping. Three Great

Lakes - Upper Mississippi River Board of State Sanitary, 1968 Edition, Addendum No. 6, Painting of Water Works Piping for Public Water Supplies.
5. OSHA 1910.144, Safety Color Code for Marking Physical Hazards.
6. SSPC Volume 2, System and Specifications, Surface Preparation Guide and Paint Application Specifications.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01 33 00, identification register acknowledging all designated or scheduled treatment units, tanks, equipment, instruments, gauges, valves, HVAC equipment, mechanical and electrical equipment. All items on register shall be tagged. Numbering system will be determined by the Owner.

B. Develop and submit full identification register acknowledging equipment, valves, instruments, mechanical equipment and electrical equipment which is not designated or scheduled in drawings and specifications. Provide identifications compatible but not conflicting with designated or scheduled equipment and related items. All items on register shall be tagged.

C. Submit assurances that subcontractors and manufacturers have been advised of register requirements.

D. Update identification register immediately prior to final acceptance of work.

E. Pipe Markers and Safety Signs:
1. Submit for approval samples of each type of marker and sign specified.
2. Submit copies of manufacturer's technical brochure including color chart and list of standard signs.

2.00 PRODUCTS

2.01 MATERIALS

A. Acceptable Manufacturers: Provide products by one of the following:
1. W. H. Brady Company.
2. Seton Identification Products.
3. Or approved equal.

B. General:
1. Pipe marker and equipment label materials shall withstand normal washing as required to remove grease, oil, chemicals, etc., without showing discoloration, loss of gloss, staining or other damage.
2. Piping markers shall be formed from laminated plastic. All printing shall be sealed with a formed butyrate plastic film. Markers for piping up to 6-inch diameter shall be pre-formed to completely wrap around the pipe requiring no adhesive. Markers for pipes over 6-inch diameter shall be performed to the contour of the pipe and attached with stainless steel spring fastener.
3. Each marker shall consist of at least one legend descriptive of the function of the pipe, as listed in Schedule A, and a directional arrow.
4. The size of lettering and marker shall conform to ANSI A13.1.
5. Location of markers:
   a. Adjacent to each valve and "T" connection.

b. At each branch and riser takeoff.
c. At each pipe passage through a wall, floor and ceiling.
d. On all horizontal and vertical pipe runs at 20-foot intervals.

6. Safety signs shall be 18 inches by 24 inches formed from semirigid butyrate or polyethylene. Signs shall be attached with 4 stainless steel screws or similar fastener for substrate.

2.02 COLORS AND FINISHES

A. Color Schedule: Paint colors will be selected by the Owner from the approved manufacturer's samples.

B. Color Coding: In general, all color coding of piping, ducts and equipment shall comply with applicable standards of TCEQ, ANSI A13.1 and OSHA 1910.144.

C. Piping and Sign Color Code: Refer to Schedule A at end of section. For items not listed, coordinate color and text with Owner.

2.03 IDENTIFICATION SYSTEMS

A. Tagging system and stenciling system may be selected by the Supplier, but shall provide the following information:
1. Valves: Include tag number, size, type, process, direction, and number of turns to open.
2. Gates: Include tag number, size, type. If manufacturer′s tag has this information, additional tag is not required. Verify that manufacturer's tag is correct for location shown in Plans.
3. Instruments: Include tag number, size of meter or pipe installed on as applicable, loop number, process. Gauges do not require labels.
4. Electrical: Label per electrical specifications. Verify tags on starters/breakers are consistent with equipment.
5. HVAC: Include tag number, size, and type of unit.
6. Equipment: Include name, tag number, process, size, and type as applicable.
7. Treatment Units: Include name and tag number and abbreviation.

B. Tagging of Equipment:
1. Yard Valves: Identify with stainless steel or bronze marking plate (minimum 1/8-inch thick) with embedment for placement in concrete.
2. Yard Gates: Provide stainless steel plates with black enamel-filled embossed lettering. Provide minimum plate of 2-1/2 inches with minimum letter height of 2 inches. Attach to gate frames at visible location on operator by stainless steel fasteners.
3. Process valves, mechanical valves, instrumentation, and mechanical and process equipment (interior/exterior):
   a. Provide minimum 2-1/2-inch stainless steel plate with black enamel filled lettering or stencil with 2-inch letters on equipment.
   b. Attach to valves by nylon strap or stainless steel nonremovable beaded chains or to equipment by stainless steel fasteners.
   c. Provide general color scheme of tagging for listed items with black letter and numbers on background as follows:

Instrumentation tags	White
Process valves and equipment tags	Red

Potable Water valves tags	Blue
Sludge valve tags	Brown
Plant Water valve tags	Purple
Mechanical valve and equipment tags	Green
Electrical equipment	Yellow

4. Electrical Equipment: Observe requirements and provisions stated in individual electrical specifications.

C. Identification of piping, treatment units, process tanks, galleries, pits, chemical liquid or solid storage tanks and silos, storage vessels, air ducts and similar items.
   1. Use Tagging Systems by W. H. Brady Company, as follows:
      a. Vinyl film cloth for interior non-insulated piping systems (Category B-500).
      b. Thin film for insulated piping systems (Category B-350).
      c. All weather film for outdoor exposed piping (Category B-350). Provide flow arrows, banding tape, and numbering and lettering of same materials for corresponding applications.
   2. Stenciling systems shall be in accordance with accepted practices and as accepted by Owner and Engineer. Stenciling shall not be used on piping smaller than 8-inch diameter.
   3. Letter and number heights shall be:
      a. Minimum 1/2-inch for piping less than 1-inch diameter.
      b. Minimum 1-1/8 inches for piping 1-inch to 3-inch diameter.
      c. Minimum 2-1/4 inches for piping greater than 3-inch diameter to 24-inch.
      d. Minimum 3-1/2 inches for piping greater than 24-inch diameter and all process tanks, treatment units, galleries, pits, chemical, liquid, or solid storage tanks, day tanks, and silos, storage vessels, mechanical heat exchangers, ducts, fans, and similar related items.
      e. Use 12-inch letters for chemical bulk storage tanks.
   4. Provide safety labels per OSHA on chemical storage tanks.

3.00 EXECUTION

3.01 INSTALLATION

A. Protected printed surfaces and adjacent work and materials by suitable covering during progress of work.

B. Ensure hardware, accessories, plates, fixtures, finished work and similar items are removed or protected.

C. Paint or apply not less than one band on any length of pipe. Follow a clean cut line around entire pipe.

D. Install piping markers and safety signs only after all painting and finish work has been completed. This does not include temporary "wet paint" or construction safety signs.

E. Provide arrows and identification at following locations:
   1. At 20'-0" maximum centers along continuous lines.
   2. At changes in direction (route), valves, risers, joints, machinery, or equipment.
   3. Where pipes, ducts pass through floor, wall, ceiling, cladding assemblies and the like obstruction on both sides of assembly.

4. Apply markers on both sides of pipe and where view is not obstructed.
5. Arrow markers must point away from pipe markers and in flow direction, if flow in both directions use double-headed arrow markers.

F. Identify piping and ductwork including interior or exterior, exposed or covered, insulated or not, including pipes and ducts in open or covered floor or ceiling ducts or spaces.

G. Apply tapes in uniform manner and parallel to piping and ducts.

H. Sample piping shall be the color of the process piping with sample labels.

Schedule A

Pipe Service & Legend	Pipe Color	Lettering Color
Sludge	Brown*	Black
Natural Gas*	Red*	Black
Potable Water*	Light Blue*	Black
Chlorine	Yellow*	Black
Sulfur Dioxide	Lime Green with Yellow Bands*	Black
Sewage	Grey*	Black
Compressed Air	Light Green*	White
Hot Water	Blue with 6-inch Red Bands spaced 30-inches apart*	Black
Power Conduit	Per NEC*	Per NEC
Reclaimed Water	Purple*	Gray
Instrument Air	Light Green with Dark Green Bands*	White
Liquid Alum	Yellow with Orange Bands*	Black
Alum (Solution)	Yellow with Green Bands*	Black
Ferric Chloride	Brown with Red Bands*	Black
Ferric Sulfate	Brown with Yellow Bands*	Black
Polymer	White with Green Bands*	Black
Ozone	Stainless Steel with White Bands*	Black
Raw Water	Tan*	Black
Effluent Water	Dark Green*	Black
Non-Potable Water	Purple*	Gray
Blower Low Pressure Air	Stainless Steel with Light Green Bands	White
Drain	Grey	Black
Grit	Tan	Black
*Denotes TCEQ Required Color		

END OF SECTION

40 05 06 PIPE COUPLINGS AND EXPANSION JOINTS

1.00 GENERAL

1.01 WORK INCLUDED

A. Flexible couplings, flange coupling adapters, expansion joints, and restraining hardware for above items.

1.02 QUALITY ASSURANCE

A. Factory Assurance:
   1. Test each item for mechanical and material defects per manufacturer's standard practice.
   2. Hydrostatically test each item to 150 percent of its maximum allowable working pressure.

1.03 SUBMITTALS

A. Shop Drawings, Product Data and Samples:
   1. Comply with the general requirements of Section 01 33 00 and supplemental requirements below.

B. Submit the following items for each type flexible coupling, flanged coupling, adaptor, and rubber expansion joint.
   1. Description and illustration of construction.
   2. List of materials.
   3. Description of factory-applied protective coatings.
   4. Dimensions.
   5. Pressure rating.
   6. For expansion joints only, the movement, force, and spring rate capabilities.
   7. Shop drawings for restraining systems such as tie bolt assemblies. Drawings to show layout, dimensions, number and size of bolts, and lug details.
   8. Manufacturer's installation instructions.

C. Product data described in the previous paragraph may be submitted in the form of catalog bulletins or other standard manufacturer literature and drawings as long as all the data specified are furnished. If catalog bulletins are submitted, they are to be marked up to show the styles, options, and other data which are applicable.

D. If Contractor elects to use more couplings and expansion joints than are shown on Drawings, submit piping layout drawings showing the location of each proposed additional unit and describing the type of each such unit.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Comply with the requirements of the General Conditions.

2.00 PRODUCTS

2.01 FLANGED COUPLING ADAPTERS

A. Flanged coupling adapters to consist of a body or sleeve with pipe flange on one end and compression-type coupling on the other end. Compression coupling to consist of follower, resilient wedge-shaped gasket, and a set of bolts to draw follower against gasket. All flanged coupling adapters shall include restraining systems. Use flanged coupling adapters in lieu of dismantling joints where needed for pipe assembly.

B. Construction:
   1. Body and follower: Carbon steel except that cast iron is acceptable in sizes 12 inches and smaller.
   2. Flange: ANSI Class 125 or 250 flat face. Match class to that of piping system. Flanges shall be suitable for a working pressure of 250 psi.
   3. Bolts and nuts:
      a. All bolts and nuts in buried and exposed applications shall be 304 stainless steel. Bolts and nuts in submerged or intermittently submerged applications shall be 316 stainless steel.
      b. Number and sized to suit specified piping system test pressure.
   4. Gasket:
      a. Resilient rubber compound suitable for air, water, and sewage service, and temperatures below 150° F. Buna-N for 240°F for air service.
      b. Wedge shaped.

C. Restraining System:
   1. Number and size for tie bolts and anchor studs or locking pins to suit specified piping system test pressure. Minimum of two diametrically opposed restraints required for restrained adapters.
   2. Wedge or lug type restraints. Restraints that use tapping or set screws to directly engage the pipe barrel are not allowed.

D. Factory Painting:
   1. Apply epoxy-type protective coating system to interior suitable for potable water contact, and exterior of adapters. Coating to be manufacturer's standard epoxy system complete with prime and finish coats.
   2. Do not paint bolts and gaskets.
   3. Coatings used on exterior of couplings which will be exposed to be compatible with specified coating system for piping so that and coupling can be painted a common color. Coating for buried couplings shall be epoxy.

E. Manufacturer and Model:
   1. All sizes:
      a. Romac Industries, Inc. RFCA.
      b. Or approved equivalent.

2.02 EXPANSION JOINTS

A. Expansion Joints for Low Pressure (Aeration) Air Service:
   1. Expansion Joints: Flexible bellows type, except as otherwise specified or indicated on the Drawings.
   2. Manufacturers:

a. Expansion Joints: One of the following or equal:
   1) Victaulic Style 240S
   2) Or approved equivalent

3. Design:
   a. Expansion Joint Rating: 25 pounds per square inch gauge, at 240 degrees Fahrenheit.
   b. Bellows: 316 stainless steel.
   c. Axial Travel of Expansion Joints: Not less than 1.50 inches.
   d. Ends: ANSI flanges, or plain suitable for welding connections, as required for piping in which installed.
   e. Provide welded lugs matching the pipe material and 316SS tie rods with hardware to prevent excessive extension and compression.

3.00 EXECUTION

3.01 INSTALLATION

A. General:
   1. Inspect each coupling, adaptor, and expansion joint for damage and defects before installation and replace defective items.
   2. Install each item in accordance with the Drawings, Technical Specifications, approved piping layout shop drawings, and approved manufacturer's installation instructions.
   3. Contractor may provide additional flexible couplings, flanged coupling adapters, and expansion joints over and above those shown on Drawings to facilitate installation of piping.
      a. Use of such additional items is to be approved by the Engineer prior to installation.
      b. Additional joints are to be at no expense to the Owner.
   4. Verify that inside diameters of flexible couplings and flanged coupling adapters are compatible with outside diameters of piping with which couplings or adapters are being used.

B. Expansion Joints:
   1. Prevent damaging stresses due to normal expansion and contraction with temperature changes in piping and connected equipment.
      a. Where anticipated expansion is greater than can be absorbed by the normal piping configuration, install loops, bends, and expansion joints as indicated on the drawings, to absorb excess expansion.
   2. Install expansion joints to allow 2-1/4-inch expansion per 100 linear feet of piping.
   3. Where possible, install expansion joints adjacent to an anchor, and provide one concentric guide on piping within 12 pipe diameters, but not more than 5 feet, from the end of the joint opposite the anchor.
      a. Locate a similar guide approximately 30 diameters but not more than 10 feet from the first.
   4. For expansion joints not installed adjacent to an anchor, provide two concentric guides similarly located at each end of the joint.

C. Field Painting:
   1. Touch up factory finishes which have been damaged.

2. Apply protective coating to bolts and nuts after tightening. Use same coating system as that specified for adjoining piping.

D. Testing:
1. Joints are tested as a part of the overall piping system.
2. Test in accordance with Section 01 40 00.

END OF SECTION

40 05 07.01 PIPE SUPPORTS

1.00 GENERAL

1.01 SUMMARY

A. Section includes: Supports for pipe, fittings, valves, and appurtenances.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME):
   1. B31.1, Power Piping.
   2. B31.3, Process Piping.

B. ANVIL International (ANVIL).

C. ASTM International (ASTM):
   1. A 36 – Standard Specification for Carbon Structural Steel.
   2. A 123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. A 276 – Standard Specification for Stainless Steel Bars and Shapes.
   4. A 380 – Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
   5. A 510 – Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
   6. A 575 – Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
   7. A 917 – Standard Specification for Steel Sheet, Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface (General Requirements).
   8. A 918 – Standard Specification for Steel Sheet, Zinc-Nickel Alloy Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.
   9. A 967 – Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts.
   10. B 633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

D. American Welding Society (AWS):
   1. D1.1, Structural Welding Code – Steel.

E. Manufacturer's Standardization Society (MSS):
   1. SP-58 – Pipe Hangers and Supports – Materials, Design, and Manufacture.
   2. SP-69 – Pipe Hangers and Supports – Selection and Application.

1.03 SUBMITTALS

A. Shop drawings: Include schedule, indicating where supports will be installed, and drawings of pipe support system components.

2.00 PRODUCTS

2.01 MATERIALS

A. General:
   1. Hot dip galvanized:
      a. Fabricate as specified in Section 05 12 00 Structural Steel.
      b. Hot dip after fabrication of support in accordance with ASTM A 123.
      c. Repair galvanized surface as specified in Section 05 12 00 Structural Steel.
   2. Stainless steel.
      a. Fabricate as specified in Section 05 12 00 Structural Steel.
      b. Finish requirements: Remove free iron, heat tint oxides, weld scale, and other impurities, and obtain a passive finished surface.
      c. At the shop, perform pickling and passivation on all surfaces inside and out in accordance with ASTM A 380 or A 967.
         1) Passivation treatments using citric acid are not allowed.
      d. Field welding is prohibited unless specifically allowed by the Owner. All field welds shall be passivated.

B. Fasteners:
   1. As specified in Section 05 12 00 Structural Steel.

2.02 PIPE SUPPORTS

A. Hanger rods: Sized to match suspended pipe hanger, or as indicated on the Drawings:
   1. Manufacturers: One of following or equal:
      a. For stainless steel piping:
         1) Bergen-Power, Figure 133.
         2) Nibco-Tolco, Figure 103.
      b. For all other piping, unless indicated on the Drawings:
         1) Anvil International, Figure 140.
         2) Bergen-Power, Figure 133.
         3) Cooper B-Line Systems, Inc., Figure B3205.

B. Hanger rods, continuously threaded: Sized to match suspended pipe hanger, or as indicated on the Drawings:
   1. Manufacturers: One of the following or equal:
      a. For stainless steel piping:
         1) Bergen-Power, Figure 94.
         2) FM Stainless Fasteners.
      b. For steel and ductile iron piping:
         1) Anvil International, Figure 146.
         2) Bergen-Power, Figure 94.

C. Eye bolts:

1. For stainless steel piping:
    a. Type 316 stainless steel, welded and rated equal to full load capacity of rod.
2. For all other piping, unless indicated on the Drawings:
    a. Welded and rated equal to full load capacity of rod.

D. Welded eyebolt rod:
1. Manufacturers: One of the following or equal:
    a. For stainless steel piping:
        1) Nibco-Tolco, Figure 101.
        2) FM Stainless Fasteners.
    b. For all other piping, unless indicated on the Drawings:
        1) Anvil International, Figure 278.
        2) Bergen-Power, Figure 93.
        3) Cooper B-Line Systems, Inc., Figure B3210.

E. Adjustable ring hangers: MSS SP-58, Type 7 or Type 9 (system dependent):
1. Manufacturers: One of the following or equal:
    a. For stainless steel piping:
        1) Nibco-Tolco, Figure 1C.I.
        2) Bergen-Power, Figure 100SS.
    b. For all other piping, unless indicated on the Drawings:
        1) Anvil International, Figure 97.
        2) Cooper B-Line Systems, Inc., Figure B3172.

F. Adjustable clevis hangers: MSS SP-58, Type 1:
1. Manufacturers: One of the following or equal:
    a. For stainless steel piping:
        1) Cooper B-Line Systems, Inc, Figure B3100 or B3102.
        2) FM Stainless Fasteners, Figure 60.
    b. For all other piping, unless indicated on the Drawings:
        1) Anvil International, Figure 260 or Figure 590.
        2) Bergen-Power, Figure 100.
        3) Cooper B-Line Systems, Inc., Figure B3100 or B3102.

G. Adjustable clevis hangers for insulated pipe: Oversize:
1. Manufacturers: One of the following or equal:
    a. For stainless steel piping:
        1) Nibco-Tolco, Figure 1A.
    b. For all other piping, unless indicated on the Drawings:
        1) Anvil International, Figure 300.
        2) Bergen-Power, Figure 100EL.
        3) Cooper B-Line Systems, Inc. Figure B3108.

H. Brackets: MSS SP-58, Type 32 with back plate; rated for 1,500 pounds:
1. Manufacturers: One of the following:
    a. For stainless steel piping:
        1) Nibco-Tolco, Figure 30M.
        2) Cooper B-Line Systems, Inc., Figure B3066.
        3) FM Stainless Fasteners, Figure 98.
    b. For all other piping, unless indicated on the Drawings:
        1) RSJK, Inc., Figure 801.

2) Cooper B-Line Systems, Inc., Figure B3066.
3) Or approved equal.

I. Brackets, heavy duty: MSS SP-58, Type 33 with back plate; rated for 3,000 pounds:
1. Manufacturers: One of following or equal:
a. RSJK, Inc., Figure 802
b. Cooper B-Line Systems, Inc., Figure B3067.
c. Or approved equal.

J. Standard U-bolt: MSS SP-58, Type 24:
1. Manufacturers: One of the following:
a. For stainless steel piping:
1) Nibco-Tolco, Figure 110.
2) Cooper B-Line Systems, Inc., Figure B3188.
3) FM Stainless Fasteners, Figure 37.
b. For all other piping, unless indicated on the Drawings:
1) Anvil International, Figure 137.
2) Bergen-Power, Figure 283.
3) Cooper B-Line Systems, Inc., Figure B3188.

K. Riser clamps: MSS SP-58, Type 8:
1. Manufacturers: One of the following:
a. For stainless steel piping:
1) Cooper B-Line Systems, Inc., Figure B3373.
2) FM Stainless Fasteners, Figure 61.
b. For all other piping, unless indicated on the Drawings:
1) Anvil International, Figure 261.
2) Bergen-Power, Figure 126.
3) Cooper B-Line Systems, Inc., Figure B3373.

L. Pipe clamps: MSS SP-58, Type 4:
1. Manufacturers: One of the following:
a. For stainless steel piping:
1) Nibco-Tolco, Figure 4.
2) Cooper B-Line Systems, Inc., Figure 3140.
b. For all other piping, unless indicated on the Drawings:
1) Anvil International, Figure 212.
2) Bergen-Power, Figure 175.
3) Cooper B-Line Systems, Inc., Figure B3140.

M. Pipe Covering Protection Saddle
1. Manufacturers:
a. Anvil International, Figure 167, Type B.

N. Welded beam attachment: MSS SP-58, Type 22:
1. Manufacturers: One of the following:
a. For stainless steel piping:
1) Nibco-Tolco, Figure 304.
2) Cooper B-Line Systems, Inc., Figure 3083.
b. For all other piping, unless indicated on the Drawings:
1) Anvil International, Figure 66.
2) Bergen-Power, Figure 113A or 113B.

3) Cooper B-Line Systems, Inc., Figure B3083.

O. Concrete Inserts for Hanger Rods:
1. Manufacturers: One of the following:
a. For continuous slots:
1) Unistrut #P1000.
b. For individual inserts:
1) Anvil International, Figure 281.
c. Anvil International Figure 52 attachment plate for precast or existing concrete.

P. Heavy pipe clamp: MSS SP-58, Type 4:
1. Manufacturers: One of the following:
a. For stainless steel piping:
1) Nibco-Tolco, Figure 4H.
b. For all other piping, unless called out otherwise on the Drawings:
1) Anvil International, Figure 216.
2) Bergen-Power, Figure 298.

Q. Anchor bolts, concrete anchors, concrete inserts, powder-actuated fasteners, and sleeve anchors: As specified in Section 05 12 00 Structural Steel.

3.00 EXECUTION

3.01 INSTALLATION

A. Properly support, suspend, or anchor exposed pipe, fittings, valves, and appurtenances to prevent sagging, overstressing, or movement of piping; and to prevent thrusts or loads on or against connected pumps, blowers, and other equipment.

B. Field verify support location, orientation, and configuration to eliminate interferences prior to fabrication of supports.

C. Carefully determine locations of inserts. Anchor to formwork prior to placing concrete.

D. Use flush shells only where indicated on the Drawings.

E. Do not use anchors relying on deformation of lead alloy.

F. Do not use powder-actuated fasteners for securing metallic conduit or steel pipe larger than 1 inch to concrete, masonry, or wood.

G. Suspend pipe hangers from hanger rods and secure with double nuts.

H. Install continuously threaded hanger rods only where indicated on the Drawings.

I. Use adjustable ring hangers or adjustable clevis hangers, for 4 inch and smaller diameter pipe.

J. Use adjustable clevis hangers for pipe larger than 4 inches in diameter.

K. Secure pipes with double nutted U-bolts or suspend pipes from hanger rods and hangers.
   1. For stainless steel piping, use stainless steel U-bolts.
   2. For all other piping, use galvanized U-bolts.

L. Support spacing:
   1. Support 2-inch and smaller piping on horizontal and vertical runs at maximum 5 feet on center, unless otherwise specified.
   2. Support larger than 2-inch piping on horizontal and vertical runs at maximum 10 feet on center, unless otherwise specified.
   3. Support exposed polyvinyl chloride and other plastic pipes at maximum 5 feet on center, regardless of size.
   4. Support tubing, PVC pipe 1-inch and smaller, copper pipe and tubing, fiber-reinforced plastic pipe or duct, and rubber hose and tubing at intervals close enough to prevent sagging greater than 1/4 inch between supports.
   5. Do not suspend or support valves, pipe and fittings from another pipe or conduit.

M. Install supports at:
   1. Any change in direction.
   2. Both sides of flexible pipe connections.
   3. Base of risers.
   4. Floor penetrations.
   5. Connections to pumps, blowers, and other equipment.
   6. Valves and appurtenances.

N. Securely anchor plastic pipe, valves, and headers to prevent movement during operation of valves.

O. Anchor plastic pipe between expansion loops and direction changes to prevent axial movement through anchors.

P. Provide elbows or tees supported from floors with base fittings where indicated on the Drawings.

Q. Support base fittings with metal supports or when indicated on the Drawings support on concrete piers.

R. Do not use chains, plumbers' straps, wire, or similar devices for permanently suspending, supporting, or restraining pipes.

S. Support plumbing drainage and vents in accordance with the latest plumbing code.

T. Supports, clamps, brackets, and portions of support system bearing against copper pipe: Copper plated, copper throughout, or isolated with neoprene or polyvinyl chloride tape.

U. Where pipe is insulated, install over-sized supports and hangers.

V. Install insulation shield in accordance with MSS SP-58, Type 40. Shield shall be galvanized steel unless otherwise specified or indicated on the Drawings.

W. Install riser clamps at floor penetrations and where indicated on the Drawings.

X. Coat support system components as specified in Section 09 91 00 Painting and Coatings.

END OF SECTION

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40 05 07.03 PREFORMED CHANNEL PIPE SUPPORT SYSTEM

1.00 GENERAL

1.01 SUMMARY

A. Section includes: Preformed channel pipe support system consisting of preformed channels, fittings, straps, and fasteners engineered to support piping.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. American Institute of Steel Construction (AISC).

B. American Iron and Steel Institute (AISI).

C. Manufacturer's Standardization Society (MSS):
   1. SP-58 – Pipe Hangers and Supports – Materials, Design, and Manufacture.
   2. SP-69 – Pipe Hangers and Supports – Selection and Application.

1.03 SYSTEM DESCRIPTION

A. Design responsibility:
   1. The manufacturer of the preformed channel pipe support system is responsible for the design of the support system.
   2. Prepare design calculations utilizing the design criteria included in these Specifications.
   3. Prepare detailed shop drawings illustrating the layout of the support system and identifying the components of the support system.

B. Design criteria:
   1. Include live, dead, and seismic loads associated with piping, valves, and appurtenances. Consider the content of the pipes in load calculations.
   2. Minimum gauge thickness: 12 gauge.
   3. Allowable stress of channels:
      a. Steel channels: The lesser of 25,000 pounds per square inch, or 0.66 times yield stress of steel.
      b. Stainless steel channels: 0.66 times the yield stress of the stainless steel alloy.
   4. Maximum deflection: 1/240 of span.
   5. Allowable column loads: As recommended by manufacturer in published instruction for column's unsupported height and "K" value for calculating effective column length of not less than 1.0.
   6. Future loads:
      a. Support systems indicated on the Drawings may include spaces intended to accommodate future pipes.

b. Assume such spaces are occupied by 6-inch diameter ductile iron pipes. Only the number of pipes that would physically fit into the space need be considered.
c. Include the weight of the pipe contents in determining future loads. Assume pipe contents are water.

7. Spacing of supports: As required to comply with design requirements but not more than 5 feet.

C. Supports below the top of walls of water bearing structures: Use Type 316 stainless steel for support system components.
1. Supports in other locations: Use hot-dipped galvanized components unless other materials are specifically indicated on the Drawings.

1.04 SUBMITTALS

A. Submit as specified in Section 01 33 00 Submittals.

B. Shop drawings: Include layout of support system including pipe loads, selected channel size, fittings, and appurtenances.

C. Structural design calculations.

1.05 QUALITY ASSURANCE

A. Design preformed channel pipe support system for loads in accordance with applicable provisions of:
1. AISC Manual of Steel Construction.
2. AISI Cold-Formed Steel Design Manual.

B. Product standards:
1. Pipe support components: In accordance with MSS SP-69.
2. Pipe support materials: In accordance with MSS SP-58.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Fabricate preformed channel pipe support system using, as a minimum, parts specified below and meeting the requirements specified under Design Criteria.
1. Manufacturers: One of the following:
a. Unistrut, Series P1000 or P1001; P5500 or P5501.
b. Allied Support Systems, Power Strut, Figure PS-200 or PS-200 2TS; PS-150 or PS-150 2TS.
c. Cooper B-Line, Channel Type B22 or B22A; B12 or B12A.

2.02 ACCESSORIES

A. Preformed channel concrete inserts: Minimum 12 inches long.
1. Manufacturers: One of the following:
a. Unistrut, Series P-3200.
b. Allied Support Systems, Figure 282.
c. Cooper B-Line, Series B32I.

B. 90-degree angle fittings:
   1. Manufacturers: One of the following or equal:
      a. Unistrut, P1026.
      b. Allied Support Systems, Power Strut, P603.

C. Pipe straps:
   1. For pipes 8 inches in diameter and smaller: Use 2-piece universal strap with slotted hex head screw and nut.
      a. Manufacturers: One of the following:
         1) Unistrut, Series P1109 through P1126.
         2) Allied Support Systems, PS1100.
         3) Cooper B-Line, Series B2000.
   2. For pipes greater than 8 inches in diameter: Unless different material is otherwise indicated on the Drawings use 1-piece 1 inch wide by 1/8 inch thick steel strap, hot-dip galvanized after fabrication.
   3. For stainless steel pipes: Use type of strap required for the pipe sizes specified above, but use Type 316 stainless steel materials.

D. Touch-up paint galvanized surfaces:
   1. Manufacturers: One of the following or equal:
      a. Galvinox, Galvo-Weld.

E. Touch-up paint for painted surfaces: Same formulation as factory paint.

2.03 FABRICATION

A. Hot-dip galvanize support system components after fabrication to required length and shape.

B. Do not galvanize or paint stainless steel components.

3.00 EXECUTION

3.01 INSTALLATION

A. Install preformed channel concrete inserts for vertical support, quantity based on manufacturer's structural design calculations.

B. Fasten preformed channel pipe supports to existing walls using Z-fittings and concrete anchors as indicated on the Drawings.

C. Fasten preformed channel pipe supports to preformed channel concrete inserts embedded in ceiling using U-shaped fittings.

D. Suspend threaded rods from concrete inserts embedded in ceiling. Support preformed channel pipe supports with threaded rods.

E. Touchup cut or damaged galvanized surfaces.

F. Prevent contact between pipes and support components of dissimilar metals. Utilize rubber coated, plastic coated, or vinyl coated components, stainless steel components, or wrap pipe with PVC or polyethylene tape.

G. Install support as near as possible to concentrated loads.

H. Install support within 2 feet of horizontal and vertical changes in pipe alignment.

I. Adjust supports or install shims to obtain specified slope or elevation.

END OF SECTION

40 05 19 DUCTILE IRON PROCESS PIPE

1.00 GENERAL

1.01 SUMMARY

A. Section includes: Ductile iron pipe, joints, fittings, gaskets, and pipe linings and coatings.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME):
   1. B16.1 – Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

B. American Water Works Association (AWWA):
   1. C105 – Polyethylene Encasement for Ductile-Iron Pipe Systems.
   2. C110 – Standard for Ductile-Iron and Gray-Iron Fittings.
   3. C111 – Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   4. C115 – Flanged Ductile Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
   5. C150 – Standard for Thickness Design of Ductile-Iron Pipe.
   6. C151 – Standard for Ductile-Iron Pipe, Centrifugally Cast.
   7. C600 – Installation of Ductile Iron Water Mains and Their Appurtenances.

C. American Welding Society (AWS):
   1. D11.2 – Guide for Welding Iron Castings.

D. ASTM International (ASTM):
   1. A 47 – Standard Specifications for Ferritic Malleable Iron Castings.
   2. A 183 – Standard Specifications for Carbon Steel Track Bolts and Nuts.
   3. A 536 – Standard Specifications for Ductile Iron Castings.
   4. C 283 – Standard Test Methods for Resistance of Porcelain Enameled Utensils to Boiling Acid.
   5. D 792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

E. Ductile Iron Pipe Research Association (DIPRA):
   1. Thrust Restraint Design Manual.

F. NACE International (NACE):
   1. SP0188 – Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

G. National Association of Pipe Fabricators, Inc. (NAPF):
   1. 500-03 – Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings.

H. Society for Protective Coatings (SSPC):
   1. PA-2 – Measurement of Dry Coating Thickness With Magnetic Gages.

1.03 SYSTEM DESCRIPTION

A. Thrust restraint system design:
   1. Design restrained joint thrust restraint system.
   2. Concrete thrust blocks for DIP restraint will only be permitted where indicated on the Drawings.
   3. Determine the length of pipe that must be restrained on each side of the focus of a thrust load in accordance with the procedures and criteria established by the DIPRA Thrust Restraint Design Manual as specified in Piping Schedule in Section 40 05 00.01 and the following additional criteria:
      a. Design pressure: 125 psig.
      b. Laying condition: Type 5 in accordance with AWWA C150.
      c. Soil designation: Silt 1 as defined by DIPRA.
      d. Unit friction resistance: Based upon polyethylene encasement of pipe.
      e. Safety factor: 1.5 (for thrust restraint calculations only).
   4. Contractor shall restrain a minimum of two joints on either side of fittings all fittings or valves.

1.04 SUBMITTALS

A. Product data: Photographs, drawings, and descriptions of fittings, gaskets, couplings, pipe linings, and coatings.

B. Shop drawings:
   1. Detailed layout drawings showing alignment of pipes, location of valves, fittings, and appurtenances, types of joints, connections to structures, and thrust restraint system layouts.
   2. Thrust restraint systems: Calculations and layout for restrained joint thrust restraint systems.

C. Design calculations:
   1. Calculations for thrust restraint system design (sealed by an Engineer licensed in the State of Texas) per DIPRA.

D. Test reports:
   1. Manufacturer's test reports for lining certifying successful performance of holiday detection tests. Refer to Section 40 05 00.01 for DIP and lining schedule.
      a. This documentation shall identify each piece by mark designation, and show the actual test results during the final inspection by the manufacturer prior to shipment.
      b. Acceptance criteria for glass lining shall be as specified under Field Quality Control.
   2. Manufacturer’s test results for glass lined pipe-certifying compliance with specified material requirements for glass lining.

3. Submit Coating Manufacturer's Technical Representative's reports.

1.05 QUALITY ASSURANCE

A. Qualifications:
   1. Lining manufacturers: For piping specified to receive glass or epoxy lining, use only a lining manufacturer having a minimum of five years' experience supplying this type of product to the wastewater and water industry.
   2. Welded on outlets: The pipe manufacturer shall have a minimum of five years' experience in the fabrication and testing of outlets of similar size and configuration similar to those used on the Project.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Block piping and associated fittings for shipment to prevent damage to coatings and linings.

B. Carefully handle piping and associated fittings during loading, unloading, and installation.
   1. Do not drop piping material from cars or trucks.
   2. Lower piping by mechanical means.
   3. Do not drop or pound pipe to fit grade.

C. Ceramic epoxy and Glass lined pipe and fittings must be handled only from the outside.
   1. No forks, chains, straps, hooks, or other lifting device shall be placed inside the pipe or fittings for lifting, positioning, or laying.

D. Protect gaskets and polyethylene encasement from long-term exposure to sunlight.

E. Store piping, fittings, and other accessories such that they do not accumulate and hold rainwater, dirt, and debris.

2.00 PRODUCTS

2.01 MANUFACTURED UNITS

A. Ductile iron piping:
   1. Above Grade:
      a. Standard: AWWA C115 & C151
      b. Pressure Class: Special Pressure Class 53
      c. Joints: Class 125 flanged as specified below.
      d. Lining: Ceramic epoxy except for grit service which shall be glass lined (both as specified below).
      e. Coating: As specified in Division 09 with factory prime coat and field applied finish coat.
   2. Buried:
      a. Standard: AWWA C115
      b. Pressure Class: Special Pressure Class 53
      c. Joints: Restrained Mechanical Joint or restrained Push-on as specified below.

d. Lining: Ceramic epoxy except for grit service which shall be glass lined (both as specified below).
e. Coating: As specified in Division 09 with factory prime coat and field applied finish coat.

B. Joints:
1. Flanged joints:
a. Screw-on flanges: Comply with the diameter, thickness, drilling, and other characteristics in accordance with ASME B16.1. In addition, comply with the following requirements:
1) Ductile iron.
2) Long hub, threaded, and specially designed for ductile iron pipe.
3) After attaching to pipe, machine flange face to make pipe end and flange even and perpendicular to the axis of the pipe.
b. Bolt holes on flanges: 2-holed and aligned at both ends of pipe.
c. Cap screw or stud bolt holes: Tapped.
d. Bolts and nuts: As specified in Section 40 05 00.01.
e. Gaskets: Standard Ethylene Propylene Diene Monomer (EPDM) unless specified otherwise in Section 40 05 00.01.
2. Mechanical joints: In accordance with AWWA C111.
3. Push-on rubber gasket joints: In accordance with AWWA C111.
4. Push-on joint restraint harnesses (Mechanically restrained push-on):
a. Manufacturers: One of the following or equal:
1) EBAA Iron, Inc., Megalug Series 1700.
2) Star Pipe Products, Split Stargrip Series 3100S.
b. Materials:
1) Restraint and backup ring: Ductile iron in accordance with ASTM A 536.
2) Wedges and wedge actuating components: Ductile iron in accordance with ASTM A 536.
a) Wedges shall be heat treated to a minimum of 370 BHN.
3) Actuating bolts and nuts: Ductile iron in accordance with ASTM A 536.
a) Provide torque-limiting twist off components to ensure proper installation.
4) Tie rods: Low alloy steel in accordance with AWWA C111.
c. Coatings:
1) Provide manufacturer applied coating system.
2) Manufacturers: One of the following or equal:
a) EBAA Iron Inc., Mega-Bond.
b) Star Pipe Products, Star-Bond.
d. Working pressure:
1) Shall include a minimum safety factor of 2:1.
2) For sizes 3- through 16-inch: 350 pounds per square inch.
3) For sizes 18- through 48-inch: 250 pounds per square inch.
e. Restraint shall consist of a backup ring behind the ductile iron bell and a restraint ring consisting of multiple gripping wedges connected with number and type of tie rods as recommended by the manufacturer.
f. Restraint shall allow post assembly deflection of a minimum of 50 percent of the deflection capability of the push-on joint.
5. Mechanical wedge action joint restraints:
a. Manufacturers: One of the following or equal:

1) EBAA Iron, Inc., Megalug Series 1100.
2) Star Pipe Products, Split Stargrip Series 3000.

b. Materials:
1) Gland body: Ductile iron in accordance with ASTM A 536.
2) Wedges and wedge actuating components: Ductile iron in accordance with ASTM A 536.
a) Wedges shall be heat treated to a minimum of 370 BHN.
3) Actuating bolts and nuts: Ductile iron in accordance with ASTM A 536.
a) Provide torque-limiting twist off components to ensure proper installation.

c. Coatings:
1) Provide manufacturer applied coating system.
2) Manufacturers: One of the following or equal:
a) EBAA Iron Inc., Mega-Bond.
b) Star Pipe Products, Star-Bond.

d. Working pressure:
1) Shall include a minimum safety factor of 2:1.
2) For sizes 3- through 16-inch: 350 pounds per square inch.
3) For sizes 18- through 48-inch: 250 pounds per square inch.

e. Restraint shall consist of multiple gripping wedges incorporated into a follower gland meeting the requirements of AWWA C111.

f. Restraint shall allow post assembly angular deflection that is a minimum of 50 percent of the angular deflection allowed by the mechanical joint.

g. Restraint must be in accordance with applicable requirements of AWWA C110 and AWWA C111 for mechanical joints.

C. Fittings:
1. Ductile iron in accordance with AWWA C110 or AWWA C153.
2. Joint type: Same as that of the associated piping as specified in Section 40 05 00.01.
3. Plain end-to-flanged joint connectors using setscrews are not acceptable.
4. Linings and coatings: As specified for pipe.

D. Pipe linings:
1. Ceramic epoxy lining:
a. Manufacturers: One of the following or equal:
1) PROTECTO 401.
2) SP-2000W.

b. Material: Amine cured Novolac epoxy containing at least 20 percent by volume of ceramic quartz pigment.

c. Minimum dry film thickness (DFT): 40 mills.

d. Application:
1) The lining shall only be applied by a manufacturer-authorized representative with no less than five years of experience in applying the specified material.
2) The application of the lining shall be preformed in accordance with manufacturer's published specifications.
3) Pipe and fittings shall be delivered to application facility with no interior lining.
4) Interior of pipe shall be abrasive blasted per manufacturer's specifications.

e. Coverage:
   1) Gasket and spigot ends-on joints: Provide 6 mils minimum and 10 mils maximum coverage using joint compound as specified by the manufacturer for the gasket area and spigot ends.
   2) Mechanical joints: Extend lining from spigot end to edge of gauging ring.
   3) Number of coats: As recommended by the lining manufacturer.
f. Source quality control:
   1) Test pipe and fitting lining with a magnetic film thickness gauge. Perform testing in accordance with the method outlined in SSPC PA-2 Film Thickness Rating.
   2) Test lining integrity of pipes using a holiday detection testing instrument set at the voltage as specified by the coating manufacturer:
      a) Repair all holidays with joint compound in accordance with the recommendations of the coating manufacturer, and re-test.
   3) Discard piping or reline piping when pinholes or discontinuities are found.

2. Glass lining:
   a. Manufacturers: One of the following or equal:
      1) Water Works Manufacturing, Ferrock MEH-32 Lining.
      2) Vitco Corporation, SG-14 Lining.
   b. Material: Special glasses and inorganic materials suited for lining of sewage, sludge, and scum piping with the following characteristics:
      1) Thickness: 0.008 to 0.012 inch.
      2) Hardness: 5 to 6 on the Mohs Scale.
      3) Density: 2.5 to 3.0 grams per cubic centimeter, measured in accordance with ASTM D 792.
      4) Thermal shock resistance: Capable of withstanding 350 degrees Fahrenheit change from 430 degrees Fahrenheit to 80 degrees Fahrenheit without crazing, blistering, or spalling.
      5) Gloss retention: Capable of retaining gloss after immersion in an 8 percent sulfuric acid solution at 148 degrees Fahrenheit for 10 minutes.
      6) Weight loss: Maximum 3 milligrams per square inch when tested in accordance with ASTM C 283.
   c. Fabrication:
      1) Use piping that is suitable for glass lining with minimum Class 53 wall thickness after application of glass lining.
      2) Machine interior of pipe. Bore or grit blast in accordance with NAPF 500-03 prior to application of glass lining.
      3) Screw factory assembled flanges on pipe, align bolt holes, and flange faces, unless otherwise specified.
      4) Apply lining to surfaces free of chemicals.
      5) Place piping in furnaces specially designed for heating piping until glass melts and fuses with an integral molecular bond to the base metal.

2.02 POLYETHYLENE ENCASEMENT

A. 2 layers of linear low-density polyethylene (LLDPE) film, minimum thickness of 8 mils in accordance with AWWA C105; or

B. Single layer of high-density, cross-laminated polyethylene (HDCLPE) film, minimum thickness of 4 mils in accordance with AWWA C105.

2.03 PUSH-ON JOINT RESTRAINT HARNESS AND MECHANICAL JOINT ENCASEMENT

A. Apply one of the following exterior coatings over the fusion-bonded factory coating and all hardware:
   1. Tapecoat Company, Inc., T.C. Mastic.
   2. Carboline Company, Inc., Bitumastic Number 50.

B. Thickness: Minimum 125 mils.

C. Single layer of heat shrink sleeves on top of the factory finish coat in accordance with AWWA C216 with one of the following:
   1. Cross-linked polyolefin wrap or sleeve with mastic sealant.
      a. 85-mils total thickness.
      b. Manufactured by Canusa, or equal.

3.00 EXECUTION

3.01 INSTALLATION

A. General:
   1. Install ductile iron piping in accordance with AWWA C600, modified as specified in Section 40 05 00.01.
   2. For underground piping, the trenching, backfill, and compaction: As specified in Section 31 23 33.

B. Polyethylene encasement:
   1. Wrap all buried ductile iron pipe and fittings in 2 layers of loose polyethylene wrap in accordance with AWWA C105.
   2. Polyethylene encasement shall be continuous and terminated neatly at connections to below grade equipment or structures.
   3. At wall penetrations, extend encasement to the wall and neatly terminate.
   4. At slab penetrations, extend encasement to 2 inches below the top of slab and neatly terminate.
   5. When rising vertically in unimproved areas, extend encasement 6 inches above existing grade and neatly terminate.
   6. Repair tears and make joints with 2 layers of plastic tape.
   7. All work shall be inspected prior to backfilling of pipe and associated items.

C. Push-on joint restraint harness encasement:
   1. Encase all buried push-on joint restraint harnesses and mechanical joints as described in this specification.
   2. Apply exterior coating over the fusion-bonded factory coating.
   3. For underground installations, after application of the required exterior coating, wrap the push-on joint restraint harnesses with heat shrink sleeves on top of the factory finish coat in accordance with AWWA C216.

D. Joints:
   1. Install types of joints as specified in the piping schedule provided in Section 40 05 00.01.

2. Mechanical joints are not acceptable in above ground applications.
3. Field closure for restrained push-on pipe:
   a. Locate field closures in areas where thrust calculations demonstrate restraint is not required.

3.02 FIELD QUALITY CONTROL

A. Testing ductile iron piping:
   1. Test as specified in Section 40 05 00.01.
   2. Do not test sections longer than 1/2 mile in total pipe length.

B. Repair damaged cement mortar lining to match quality, thickness, and bonding of original lining in accordance with AWWA C104.
   1. When lining cannot be repaired or repairs are defective, replace defective piping with undamaged piping.

C. Verify that interior surfaces of glass lined pipe and fittings have continuous coverage:
   1. Verify with low voltage wet sponge holiday detector in accordance with NACE SP0188.
   2. Discard glass lined ductile iron piping and fittings with voids or casting anomalies. that exceed the maximum non-visible pinholes allowances below:

Diameter	**Maximum Pinholes**	
	Fittings	**Pipe (per 20-foot length of pipe)**
4- to 8-inch	3-5	10-12
10- to 18-inch	5-8	18-20
20-inch and Larger	8-10	25-28

   3. Discard lined piping and fittings found to have pinholes, crazing, or fish scales, which expose the metal substrate.

END OF SECTION

40 05 23 STAINLESS STEEL PIPE AND FITTINGS

1.00 GENERAL

1.01 SCOPE

The work included in this section of the Specifications shall consist of furnishing, installing, and testing all stainless steel tubing and pipe and fittings in sizes 1/2-inch through 24-inch as shown on the Plans or described in these Specifications.

1.02 REFERENCES

A. ASTM A312/A312M - Specification for Seamless and Welded Austenitic Stainless Steel Pipe.
B. ASTM A778 - Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
C. ASTM F593 - Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
D. ASTM F594 - Specification for Stainless Steel Nuts.
E. AWWA C208 - AWWA Standard for Dimensions for Fabricated Steel Water Pipe Fittings.
F. ASTM A774/A774M - Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.

1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with the requirements of Sections 01 33 00 Submittals and 40 05 00.01 Common Work Results for General Piping, as well as affidavits of compliance with the referenced standards. Submit information on:
   1. Pipe material.
   2. Fittings.
   3. Joints.
   4. Appurtenances.
   5. Adaptors.
   6. Pipe layout drawings.
   7. All materials, thickness, coatings, and linings.
   8. Pressure classes, working and surge pressure ratings.
   9. Restraint design and details.

1.04 DELIVERY, STORAGE AND HANDLING

Comply with the requirements of Section 33 05 00 General Requirements for Plant and Station Piping Systems, and the manufacturer's recommendations.

2.00 PRODUCTS

2.01 STAINLESS STEEL PIPE IN SIZES UNDER THREE INCHES

A. Pipe:
   1. Referenced Standard: ASTM A312.
   2. Type: 316.
   3. Grades: L.

4. Size: Nominal diameters shown on the Plans.
5. Schedule: Standard weight for system working pressures required unless otherwise shown on the Plans or specified.
6. Type Ends: Threaded, unless otherwise noted.
7. Factory Finish: All pipe shall be passivated prior to shipment from the mill.

B. Fittings:
1. Referenced Standard: ANSI 16.3.
2. Type: Threaded.
3. Class: 150 lb.
4. Factory Finish: As specified above for pipe.
5. For high pressure air service, all fittings shall be Swagelok type.

C. Joints: Threaded unless otherwise specified.

2.02 STAINLESS STEEL PIPING IN SIZES THREE INCHES AND LARGER

A. Pipe:
1. Schedule 10 AISI, conforming to ASTM A312, lengths as shown on the Plans.
2. Type 304L unless otherwise specified.

B. Joints:
1. Field joints shall be flanged or utilize couplings unless otherwise specified or shown on the Plans. Shop weld sections to the largest extent practical.
2. Use plate flanges with ANSI Class 125 drilling.

C. Gaskets:
1. EPDM.
2. BUNA-N for air-piping service.

D. Fittings: Conforming to ASTM A774, dimensions per ASME B16.9.

E. Supports: Stainless steel, Type 304L unless otherwise shown.

F. Finish:
1. No. 1 Mill finish or better.
2. All stainless steel materials shall be pickled and passivated following shop operations by immersion in 10% nitric acid and 3% hydrofluoric acid at 125°F for 15 minutes, followed by a neutralizing rinse.

G. Marking: All pipe, fittings, and fabrications shall be properly marked with type, size, gauge, and heat numbers.

3.00 EXECUTION

3.01 INSTALLATION

A. General:
1. Comply with the general installation requirements for piping systems and the supplemental specifications below.
2. Do not perform any welding, cutting, or grooving of steel piping in field unless specifically called for on the Plans or authorized in writing by Engineer. This

restriction applies to attachment of lugs and brackets to pipe, as well as to jointing of pipe.

B. Jointing of Threaded Piping:
   1. Cut piping accurately and squarely.
   2. Ream inside of pipe to full diameter.
   3. Thread pipe per the referenced standard.
   4. Remove all cuttings and other foreign matter from inside of pipe before making joints.
   5. Clean rusty or dirty threads with a wire brush.
   6. Apply approved joint compound or tape to male threads before making joints.

C. Jointing of Flanged Pipe:
   1. Setting gasket:
      a. If non-graphited gaskets are used, apply graphite and water solution to gasket before placing on flange.
      b. Wire-brush flange and clean inside of pipe before placing gasket.
   2. Tightening bolts:
      a. After bringing pipe to alignment and elevation with permanent supports, place flange bolts with all heads in same direction.
      b. Tighten nuts, each in turn, at uniform rate around joint until all are tight.

3.02 FIELD TESTING

Comply with the requirements of Section 01 40 00 Quality Requirements. Low pressure air pipe shall be tested to 15 psi.

END OF SECTION

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40 05 31.13 POLYVINYL CHLORIDE (PVC) AND CHLORINATED POLYVINYL CHLORIDE (CPVC) PRESSURE PIPE

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnishing, installing, and testing of polyvinyl chloride (PVC) and chlorinated polyvinyl chloride (CPVC) pressure pipe and fittings in sizes 1/2-inch through 36-inch. Hydrostatic testing, cleaning, and disinfecting, if applicable installed pipe and fittings.

1.02 QUALITY ASSURANCE

A. Referenced Standards:
   1. ANSI/AWWA C900: American National Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm)
   2. ASTM D1785: Standard for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, 120.
   3. ASTM D2464: Standard for Threaded Polyvinyl Chloride (PVC) Plastic Pipe Fittings Schedule 80.
   4. ASTM D2466: Standard for Socket-Type Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
   5. ASTM D2467: Standard for Polyvinyl Chloride (PVC) Plastic Pipe Fittings Schedule 80.
   6. ASTM 2564: Standard for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings.
   7. ASTM D2855: Standard for Making Solvent Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.
   8. NSF Std. No. 14: National Sanitation Foundation Standard for Thermoplastic Materials, Pipe, Fittings, Valves, Traps and Joining Materials.
   9. ASTM D3139: Standards for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
   10. ASTM F441: Specification for Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe Schedule 40 and 80.
   11. ASTM F493: Specification for Solvent Cements for Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe and Fittings.
   12. ASTM 439: Specification for Socket Type Polyvinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80.
   13. ASTM D1784: Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Poly(vinyl Chloride) (CPVC) Compounds.
   14. ASTM F656: Primers for use in solvent cement joints of Polyvinyl Chloride (PVC) Plastic pipe and fittings.

B. Polyvinyl Chloride (PVC) and Chlorinated Polyvinyl Chloride (CPVC) pipe and fittings may be rejected for failure to meet any of the requirements of this specification. Pipe rejected by the Engineer shall be removed from the site.

C. Inspection: The quality of all materials, process or manufacture and the finished pipe shall be subject to the inspection and approval of the Engineer.

1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with the requirements of Section 01 33 00.

B. Submit manufacturer's installation instructions.

1.04 DELIVERY, STORAGE AND HANDLING

A. Comply with the supplemental requirements below.

B. Comply with the manufacturers' handling and storage recommendations.

C. Use nylon slings or rope to lift bundles of pipe. Do not use chains.

D. Do not drop pipe.

E. Support pipe every 4 feet.

F. Limit stacking height of pallets to prevent any undue stress or deflection in pipe materials.

2.00 PRODUCTS

2.01 GENERAL

A. Pressure pipe for potable water systems shall bear the seal of approval of the National Sanitation Foundation for use in potable water systems.

B. All PVC and CPVC pipe shall be new and shall be stamped to show the design working pressure.

C. Pressure pipe shall be as manufactured by IPEX, NAPCO, JM Eagle or approved equal.

D. The pipe shall have true section complying with the sizes specified. All pipe shall be free from cracks, holes, blisters, voids, projections, defects, roughness and chalking, sticky or tacky material.

E. All pipe and fittings furnished under this section shall be clearly marked by the manufacturer with the following information in such a manner that it will remain legible after inspection:
   1. Manufacturer's name, trademark and code which includes the date, shift, plant and extruder of manufacturer.
   2. Nominal pipe size in inches.
   3. PVC or CPVC cell classification.
   4. ASTM designation.
   5. AWWA designation and dimension ratio (for AWWA pipe).

2.02 EXPOSED PIPING

A. Pipe:

1. Above grade piping shall be CPVC.
2. Referenced Standard: ASTM F441.
3. Type: Type 1, Grade 1, unplasticized.
4. Schedule: Schedule 80 is required.

B. Joints:
1. Type: Solvent welded unless otherwise shown on Drawings or specified in Piping Schedule.
2. Referenced Standard for Solvent Cement: ASTM F493.

C. Fittings:
1. Referenced Standards: ASTM F439.
2. Type: Solvent weld unless otherwise shown on Drawings or specified in Piping Schedule.

2.03 BURIED PIPING

A. Diameter less than 1-1/2 Inches:
1. As specified above for exposed piping.

B. Diameter at least 1-1/2 Inches but less than 4 inches:
1. Pipe:
a. Referenced Standard: ASTM D 1785.
b. Type: Type 1, Grade 1, unplasticized.
c. Schedule 40.
2. Joints:
a. Type: Solvent welded unless otherwise shown on drawings or specified in pipe schedule.
b. Referenced Standard for solvent cement: ASTM D2564.
3. Fittings:
a. Referenced Standard: ASTM D2466.
b. Type: Solvent weld unless otherwise shown on drawings or specified in piping schedule.

C. Diameters from 4 inch to 12 inch (inclusive):
1. Pipe:
a. Referenced Standards: ANSI/AWWA C900.
b. Type: Bell and spigot with elastomeric gasket joint formed integral with pipe.
c. Pressure Class and Dimension Ratio: 165 psi; DR 25 if not shown on otherwise on plans.
2. Joints:
a. Referenced Standard: ASTM D 3139.
b. Gasket Type: ASTM F 477.
c. Pipe joints shall utilize mechanical joint restraint systems designed by Supplier
3. Fittings:
a. Type: Mechanical joint or push-on type, of PVC or ductile iron fittings. Ductile iron fittings shall be ceramic epoxy lined.
b. Fittings shall utilize mechanical joint restraint systems designed by Supplier. If not shown otherwise on the drawings, utilize 100 psi test pressure and 7 fps velocity for surge calculation.

c. Bolts, fasteners, and hardware for buried fittings shall be 304 stainless steel. Buried MJ fitting bolts may be Corten. Submerged bolts, fasteners, and hardware shall be 316 stainless steel.

D. Diameters from 14 Inches to 36 Inches (inclusive):
1. Pipe:
a. Referenced Standards: ANSI/AWWA C905.
b. Type: Bell and spigot with elastomeric gasket joints formed integral with pipe.
c. Pressure Class and Dimension Ratio: 165 psi; DR 25 if not shown on Plans.
2. Joints:
a. Referenced Standard: ASTM D 3139.
b. Gasket Type: ASTM F 477.
c. Pipe joints shall utilize mechanical joint restraint systems designed by Supplier.
3. Fittings:
a. Type: Mechanical joint or push-on type, of PVC or ductile iron fittings at Contractor's discretion. Ductile iron fittings shall be ceramic epoxy lined.
b. Fittings shall utilize mechanical joint restraint systems designed by Supplier. If not shown, utilize 190 psi test pressure and 7 fps velocity for surge calculation.
c. Bolts, fasteners, and hardware for buried fittings shall be 304 stainless steel. Buried MJ fitting bolts may be Corten. Submerged bolts, fasteners, and hardware shall be 316 stainless steel.

2.04 CHEMICAL PIPING

A. Single wall CPVC Piping: CPVC pipe for chemicals, vacuum and solution, shall be ASTM F441, Schedule 80 for exposed piping and Schedule 40 buried piping. Fittings shall be molded, as manufactured by Tube Turn Plastics, or equal. Pipe threads, if used, shall conform to ASA B2.1, NPT, and shall be full and cleanly cut with sharp dies.
1. If glued joints are used, cement shall be of type which welds plastic surfaces together. Cement shall be as recommended by the pipe manufacturer and shall be compatible with the chemical conveyed. Teflon tape shall be used on all threaded joints. Teflon tape shall be mil spec P-7730A or as recommended by the pipe supplier for the chemical service. Tubing connecting to piping shall utilize barbed fittings and 316 stainless steel tube clamps, two per connection. Barbed fittings shall be CPVC or other material recommended by the manufacturer rated for work pressure of 50 psi and chemical service up to 110°F.
2. Gaskets and O-rings for chlorine vacuum and solution piping shall be Viton. Gaskets and O-rings for other chemicals shall be compatible with the chemical being used.
3. Cement and primers shall be suitable for use in potable water. Cement shall be industrial grade and primer shall be purple color. Cement used shall have a manufacture date within 14 months of the date being utilized. Containers shall be kept tightly closed when not in use. Brush or swab applicators shall be appropriately sized and utilized as recommended by the manufacturer.
4. Mark pipe in accordance with ASTM D1785.

B. Dual containment piping, fittings and valves shall be Corzan CPVC by Ipex, Inc. or equal. Carrier pipe shall be Schedule 80 gray or white; Containment pipe shall be Schedule 40 or 80 gray or white. Solvent weld all joints unless noted otherwise on the drawings. rovide termination fittings to transition to single wall piping.

3.00 EXECUTION

3.01 INSTALLATION

A. General:
   1. Comply with the general requirements of Sections 31 23 33 and the supplemental requirements following.
   2. Install all piping in accordance with pipe manufacturer's instructions.
   3. Chemical piping shall be installed at uniform grades or slopes without any high points in the pipe except at the pumps.

B. Making of Joints:
   1. General:
      a. Make joints in accordance with pipe manufacturers recommendations and the supplemental specifications below.
      b. For shorter than standard pipe lengths, field cuts may be made with either hand or mechanical saws with fine tooth blade (16–18 teeth per inch) or plastic pipe cutters. Cut piping accurately and squarely within 1/8 inch and install without forcing or springing.
      c. Ream out all pipes and tubing to full inside diameter after cutting.
      d. Remove all cuttings and foreign matter from the inside of pipes and ends shall be smoothly beveled by a mechanical beveller or by hand with a rasp or file before installation. Field spigots shall be stop-marked with an adequate marker for the proper length of assembly insertion.
      e. Joints shall not be covered until approved by Engineer or his representative. Connections which are made for future use shall be properly capped.
   2. Solvent Weld Joints Only:
      a. Comply with the requirements of ASTM D2855 and F493.
      b. File end of PVC or CPVC Pipe to form a 10 to 15 degree bevel 1/16-inch to 3/32-inch wide on the exterior of the pipe end.
      c. The pipe and fittings shall be cleaned of all loose dirt and moisture and then lightly roughened with emery cloth over the entire surfaces to be glued, after cutting pipe and removing all burrs and prior to applying the primer.
      d. Apply primer to the female end, then the male end and then reapply to female end, keeping the surface wet with primer over 5- to 15-second period.
      e. Apply solvent cement to pipe end and socket and then apply a second coat to pipe end using a brush one-half of the diameter of the pipe. Hold for 30 seconds.
      f. Immediately insert pipe end in socket and wipe off excess cement.
      g. Rotate pipe under 6 inches about one-quarter turn after inserting in socket.
      h. Completed glue joints shall not have any gaps or voids in the glue between the pipe and the fitting.

i. Do not perform solvent welding operations when temperature is below 40°F or above 90°F, or when rain or drizzle is present. Do not move or disturb the glued joints for 3 minutes after completion. Joints shall not have any pressure or deflection applied for at least 1 hour after completing the joint. Allow all joints to set 24 hours prior to performing pressure test on system.
j. All joints shall be checked for leakage 48 hours and again 15 days after placing them in service with the proposed chemical. Joints which show signs of leaking or signs of salt buildup shall be replaced and system retested and checked again 48 hours and 15 days after repair until satisfactory results are obtained.
k. Small diameter pipes shall be checked for excess glue after the joints have set. Joints with more than one-half of the pipe area blocked shall be drilled or reamed out.
l. All pipe systems shall be flushed at velocity greater than 5 fps for a minimum of 5 minutes and longer for pipes larger than 300 feet.

3. Threaded Joints Only:
   a. Use liquid lubricant for permanent joints.
   b. Use tape lubricant at valves and equipment where piping may have to be disconnected for maintenance.
4. Gasketed Joints Only:
   a. Thoroughly clean pipe ends and gaskets before installation.
   b. Apply lubricant recommended by manufacturer.
5. Plastic to Metal Connections:
   a. Make all plastic to metal connections by means of PVC adapters.
   b. Do not cut threads on PVC Pipe.

C. Buried Piping:
1. All excavation shall be done in an approved manner to the elevations and grades shown on the Plans or specified. The trench bottom shall be free of sharp rocks and large clods of dirt.
2. Embedment for PVC pipe (larger than 2-inch) shall be as shown on the plans or as specified in Section 31 23 33. All bedding and granular backfill material shall be consolidated to 85 percent standard proctor density. Utilize Class IV embedment if not called out on the Plans.
3. Backfill shall be placed according to Section 31 23 33.
4. Sand or granular embedment material shall be used for PVC pipe 2 inches and smaller.

D. Exposed Piping:
1. Where required PVC piping shall be installed in the locations indicated with hangers, brackets, supports, etc., at spacings required by Section 40 050 04 General Requirements for Piping Systems and as recommended by the pipe manufacturer.
2. Flexible connections shall be required at locations where pipe passes through a concrete wall.
3. All exposed PVC piping shall be painted.

E. Restrained Joints
1. Buried pressure pipe systems shall utilize mechanical restrained joint systems.
   a. PVC Pipe to PVC Pipe restraint shall be EBAA Iron 2500 or equal.

b. PVC Pipe to Ductile Iron MJ Fittings shall be EBAA Iron 2000/2200 or equal.
c. Mechanical restraints that use tapping or set screws to directly engage the pipe barrel are not allowed.

2. Exposed PVC shall be solvent weld joints or flanges.
3. Mechanical restraint system design shall be the responsibility of the Contractor.
   a. Systems shall be designed such that the working pressure rating of the restraint system is greater than or equal to the test pressure times 1.5 or the working pressure plus the surge pressure as shown on the drawings.
   b. Backwash supply, potable water and service water piping restraint shall be based on the working pressure plus 350 psi surge allowance.
4. Contractor shall determine length of pipe from fittings necessary to resist the thrust forces and provide/install required retainer fittings at joints.
5. Submit restraint systems, details and design, and lengths of pipe joint restraint required sealed by a Licensed Professional Engineer in Texas.
6. Wrap all MJ and joint restraint fittings.
7. Costs for design of restraint systems shall be in the Base Bid and included in the Schedule of Values with the appropriate pipes.

3.02 FIELD TESTING

A. Comply with the requirements of Sections 40 05 00.01 Common Work Results for General Piping and 40 05 04 General Requirements for Piping Systems.

END OF SECTION

40 05 51 COMMON WORK RESULTS FOR VALVES

1.00 GENERAL

1.01 SUMMARY

A. Section includes: Basic requirements for valves.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. American Water Works Association (AWWA):
   1. C111– Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   2. C550 – Protective Interior Coatings for Valves and Hydrants.

B. ASTM International (ASTM):
   1. A 126 – Standard Specification for Gray Iron Casting for Valves, Flanges, and Pipe Fittings.
   2. A 167 – Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   3. A 536 – Standard Specification for Ductile Iron Castings.

C. NSF International (NSF):
   1. 61 – Drinking Water System Components – Health Effects.

D. Society for Protective Coatings (SSPC):
   1. SP 7 – Brush-Off Blast Cleaning.
   2. SP 10 – Near-White Blast Cleaning.

1.03 DESIGN REQUIREMENTS

A. Pressure rating:
   1. Suitable for service under minimum working pressures of 150 pounds per square inch gauge.
   2. When a piping system is specified in Section 40 05 00.01 to be tested at a pressure greater than 150 pounds per square inch gauge, provide valves for that piping system with design working pressure which is sufficient to withstand the test pressure.

B. Above ground valve to piping connections:
   1. Valves 3 inch nominal size and larger: Flanged ends.
   2. Valves less than 3 inch nominal size: Screwed ends.
   3. Plastic valves in plastic piping:
      a. Up to 2.5 inches: Provide solvent or heat welded unions.
      b. 3 inches and above: Provide solvent or heat welded flanges.

4. Underground valve to piping connections:
    a. Provide underground valves with flanged, mechanical, or other type of joint required for the type of pipe to which the valve is to be connected.
    b. Coating and wrapping:
        1) Prior to installation, coat buried valves in accordance with Section 09 91 00 Painting and Coatings.
        2) After installation, encase valves in 2 layers of polyethylene wrap as specified for ductile iron piping in Section 40 05 19.
            a) Ascertain that polyethylene wrapping does not affect operation of valve.

1.04 SUBMITTALS

A. Submit as specified in Section 01 33 00.

B. Product data:
1. Submit the following information for each valve:
    a. Valve type, size, pressure rating, Cv factor.
    b. Coatings.
    c. Power valve actuators:
        1) Information on valve actuator including size, manufacturer, model number, limit switches, mounting; and motor enclosure, seating and unseating torque coefficient, dynamic torque, and bearing friction for calculation of maximum operating torque.
        2) Complete wiring diagrams and control system schematics.
    d. Manual valve actuators:
        1) Information on valve actuator including size, manufacturer, model number.
    e. Certified drawings with description of component parts, dimensions, weights, and materials of construction.
    f. Certifications of reference standard compliance:
        1) Submit certification that the valves and coatings are suitable in potable water applications in accordance with NSF 61, if applicable.
    g. Clearly mark submittal information to show specific items, materials, and accessories or options being furnished.
    h. Factory test data.

C. Operation and maintenance data:
1. See Section 01 78 23 Operation and Maintenance Data which contains information and requirements for manual content.
2. Furnish installation, operation, and maintenance instructions for each type of manual valve 4 inch in nominal size and larger, and each type of actuated valve for any valve size. Include information on valve operators in operation and maintenance instruction manual.

1.05 QUALITY ASSURANCE

A. Manufacturer qualifications:
1. Valve manufacturer shall demonstrate a minimum of five years of experience in similar applications for sizes of valves being furnished. References shall be furnished upon request.

B. Each valve shall have a stainless steel manufacturer's nameplate showing the pressure rating, serial and model numbers, valve tag number, and year manufactured at a minimum.

1.06 DELIVERY STORAGE AND HANDLING

A. Protect valves and protective coatings from damage during handling and installation; repair coating where damaged.

B. Store valves in accordance with manufacturer's recommendations.

2.00 PRODUCTS

2.01 MATERIALS

A. Refer to individual valve Specification Section.

B. Stainless steel: In accordance with ASTM A 167, Type 316, or Type 304, UNS Alloy S31600 or S30400.

C. Valve and operator bolts, nuts, and washers:
   1. Fabricated of stainless steel for the following installation conditions:
      a. Submerged in sewage or water.
      b. In an enclosed space above sewage or water.
      c. In structures containing sewage or water, below top of walls.
      d. At openings in concrete or metal decks.
   2. Exposed: Zinc or cadmium-plated.
   3. Where dissimilar metals are being bolted, use stainless steel bolts with isolation bushings and washers.
   4. Underground bolts: Low-alloy steel in accordance with AWWA C111/A21.11.

D. Bronze alloys: Use bronze alloys with not more than 6 percent zinc and not more than 2 percent aluminum in the manufacture of valve parts; UNS Alloy C83600 or C92200 unless specified otherwise.

E. Valve bodies: Cast iron in accordance with ASTM A 126, Class 30 minimum or ductile iron in accordance with ASTM A 536, Grade 65-45-12 minimum unless specified otherwise.

2.02 VALVE BOXES

A. Provide cast-iron valve boxes at each buried valve to access valve and valve operators.

B. Do not support boxes on valve, valve operator, or pipe.

C. Boxes:
   1. 2-piece, fabricated of cast iron; provide cover, with asphalt varnish or enamel protective coating.
   2. Adjustable to grade, install centered around the upper portions of the valve and valve operator.

D. Manufacturers: One of the following or equal:
   1. Tyler Pipe Industries, Inc.
   2. Neenah Foundry Company.

2.03 VALVE OPERATORS

A. Provide actuators as shown on drawings or per individual valve sections.

B. Valve Actuators – General
   1. Valve operator "Open" direction: Open counterclockwise direction as viewed from the top.
   2. Direction of opening and the word OPEN to be cast in handwheel or valve bonnet.
   3. Size actuator to produce required torque with a maximum pull of 80 pounds at the maximum pressure rating of the valve provided and withstand without damage a pull of 200 pounds on handwheel or chainwheel or 300 foot-pounds on the operating nut.
   4. Unless otherwise specified, actuators for valves to be buried, submerged or installed in vaults or manholes shall be sealed to withstand at least 20 feet of submergence.
   5. Provide valves located below operating level or deck with extension stems. Extension stems shall be solid steel with actuator key and nut, diameter nut less than stem of valve actuator shaft. All stem connections shall be pinned and centered in valve box or grating opening with guide bushing.
   6. All manual valve actuators shall conform to AWWA C504.
   7. Manual valve actuator shall be equipped with a totally enclosed worm gearing. Gears shall be permanently lubricated.
   8. Manual valve actuators shall have a position indicator.
   9. Operator force requirements shall not exceed 40 pounds under any operating condition, including valve seating and unseating conditions. Provide additional mechanical advantage through gear reduction or increased lever arm length, as appropriate.
   10. Operators shall be self-locking type or equipped with self-locking device.
   11. Position indicators shall be provided on all quarter-turn and non-rising stem valves.
   12. Worm gearbox type operators shall be factory lubricated and shall consist of a high strength alloy steel input worm gear mated to an output spur gear or yoke nut driven output yoke, as applicable. Spur gears shall be of alloy bronze or ductile iron construction. Yoke nuts shall be of ductile iron construction with stainless steel yoke nut bearings and alloy steel yokes. Worm gearboxes shall include adjustable stops of either the traveling nut or stud screw variety, as applicable. Worm gearboxes shall include gasketed access covers and shaft seals designed to provide weathertight or submersible duty service, as required, and include a mechanically driven valve position indicator. All trim and fastening hardware shall be of stainless steel construction.
   13. Lever type operators shall include lever actuator of appropriate length and locking mechanism capable of locking the valve securely in a minimum of 10 positions from fully open to fully closed. Levers shall be of galvanized steel or ductile iron construction. Locking mechanism and hardware shall be of stainless steel construction.
   14. Handwheels for direct or gearbox driven valve actuation shall be appropriately sized to limit operator force requirements to that specified. Handwheels used

in conjunction with any type of gearbox shall include bearing mounted hand crank of stainless steel or composite, non-metallic, construction.

C. Buried Valve Actuator:
   1. Provide screw or slide type adjustable cast iron valve box, 5 inches minimum diameter, 3/16-inch minimum thickness, and identifying cast iron cover rated for traffic load.
   2. Box base to enclose buried valve gear box or bonnet.
   3. Provide 2 inch standard actuator nut complying with AWWA C500.
   4. Provide at least two (2) tee handle keys for actuator nuts, with 5 foot extension between key and handle.
   5. Extension Stem:
      a. Provide for buried valves greater than 4 foot below finish grade.
      b. Extend to within 6 inches of finish grade.
   6. Provide concrete pad encasement of valve box as shown on drawings for all buried valves unless indicated otherwise.

D. Exposed Valve Manual Actuator:
   1. Provide for all exposed valves not having electric or cylinder actuators.
   2. Provide handwheels for gate and globe valves.
      a. Size handwheels in accordance with AWWA C500.
   3. Provide lever actuators for plug valves, butterfly valves and ball valves 3 inches in diameter and smaller.
      a. Lever actuators for butterfly valves shall have a minimum of 5 intermediate lock positions between full open and full close.
   4. Gear actuators required for plug valves, butterfly valves, and ball valves four inches in diameter and larger.
   5. Provide gearing for gate valves 20 inches and larger in accordance with AWWA C500.
   6. Gear actuators to be totally enclosed, permanently lubricated and with sealed bearings.
   7. Provide manually operated valves located not more than 6 feet above the operating level with tee handles, wrenches, or handwheels.
      a. Make the valve operator more conveniently accessible by rolling valves, located more than 5 feet but less than 6 feet above the operating level, toward the operating side.
      b. Secure tee handles and wrenches to the valve head or stem, except where a handle or wrench so secured constitutes a hazard to personnel; in which case, stow handle or wrench immediately adjacent to the valve on or in a suitable hanger, bracket, or receptacle.
   8. Provide chain actuators for valves 6 foot or higher from finish floor to valve centerline.
      a. Cadmium-plated chain looped to within 3 feet of finished floor.
      b. Equip chain wheels with chain guides to permit rapid operation with reasonable side pull without “gagging” the wheel.
      c. Where chains constitute a nuisance or hazard to operating personnel, provide holdbacks or other means for keeping the chains out of the way.
   9. Provide valve with extended stem when valve and connected piping is to be insulated to permit proper insulation application without interference from handle.

E. Electric Motor Operators

1. See 40 05 57.25 Electric Actuators and electrical and instrumentation specifications and drawings.

2.04 COATING

A. Shop and field coat all valves in accordance with Section 09 91 00 Painting and Coatings.

3.00 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install valves accessible for operation, inspection and maintenance.

C. Provide incidental work and materials necessary for installation of valves including flange gaskets, flange bolts and nuts, valve boxes and covers, concrete bases, blocking, and protective coating.

D. Support exposed valves and piping adjacent to valves independently to eliminate pipe loads being transferred to valve and valve loads being transferred to the piping.

E. Install electric or cylinder actuators above or horizontally adjacent to valve and gear box to optimize access to controls and external handwheel.

F. Install valves with their stems in vertical position above the pipe, except as follows:
   1. Butterfly valves, gate valves aboveground, globe valves, ball valves, and angle valves may be installed with their stems in the horizontal position.
   2. Install buried plug valves with geared operators with their stems in a horizontal position.

G. Install valves so that handles clear obstructions when the valves are operated from fully open to fully closed.

H. Place top of valve boxes flush with finished grade or as otherwise indicated on the Drawings.

I. Valves with threaded connections:
   1. Install valves by applying wrench on end of valve nearest the joint to prevent distortion of the valve body.
   2. Apply pipe joint compound or Teflon tape on external (male) threads to prevent forcing compound into valve seat area.

J. Valves with flanged connections:
   1. Align flanges and gasket carefully before tightening flange bolts.
   2. When flanges are aligned, install bolts and hand tighten.
   3. Tighten nuts opposite each other with equal tension before moving to next pair of nuts.

K. Valves with soldered connections:

1. Do not overheat connection to prevent damage to resilient seats and metal seat rings.
2. Position valves in full open position before starting soldering procedure.
3. Apply heat to piping rather than to valve body.

L. Adjust valves, actuators and appurtenant equipment to comply with Section 01 75 00. Operate valves, open and close at system pressure and same duration as the piping system they are in.

END OF SECTION

40 05 57.25 ELECTRIC ACTUATORS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: This section includes materials and installation of motorized gate and valve actuators for wastewater service.

1.02 QUALITY ASSURANCE

A. Qualifications:

1. The specified equipment shall be the standard product of manufacturers who regularly engage in the production of this type of equipment and who are fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed, delivered, and installed in accordance with the best practices and methods and shall be specifically designed for wastewater service, as appropriate.

2. Each component and ancillary equipment item furnished under this specification shall be new and unused, and the product of manufacturer having a successful record of operation, manufacturing and servicing the equipment for a minimum of five (5) years.

B. All electric actuators shall be the product of a single manufacturer.

1.03 SUBMITTALS

A. Materials and Shop Drawings:

1. Furnish, as prescribed under the General Requirements, shop drawings covering the items included under this section of the work.

2. Specifically, include the following information:
   a. Catalog information, descriptive literature, diagrams, and drawings on all components.
   b. Submit a description of the actuator function and proposed settings of all actuator components.

B. Operation and Maintenance Manuals:

1. For each device assemble the updated submittal information and all service manuals for the referenced equipment.

PART 2 - PRODUCTS

2.01 EQUIPMENT REQUIREMENTS

A. Acceptable Manufacturers

a. EIM Controls, Inc.
b. Flowserve-Limitorque
c. Rotork Controls, Ltd.
d. Auma

B. Actuators shall be suitable for use on a nominal 480-volt, 3 phase, 60 Hertz power supply and are to incorporate motor, integral reversing starter, local control facilities, and terminals for remote control and indication connections.

2.02 ACTUATOR SIZING

A. The actuator shall be sized to guarantee closure at the specified torque and/or thrust requirements as indicated by the gate or valve manufacturer. The actuator must be adequately sized to provide the torque required at 90 percent (90%) of the nominal voltage with the option of operation at up to -30 percent (-30%) under-voltage conditions. Actuator size shall cover the torque range, to avoid over sizing and unnecessary weight load on the stem, flange and yoke.

B. The operating speed shall provide gate valve closing and opening at approximately 12 inches per minute.

2.03 ENVIRONMENTAL

A. Actuators shall be suitable for indoor and outdoor use. The actuator shall be capable of functioning in an ambient temperature ranging from -13°F to +160°F (-25°C to +70°C), up to 100 percent (100%) relative humidity.

2.04 ENCLOSURE

A. Actuators shall be O-ring sealed, watertight to NEMA 4X/6. Enclosure must allow for temporary site storage without the need for electrical supply connection. All external fasteners shall be of stainless steel. Gear case call be cast iron. To prevent condensation, a heater must be installed inside the actuator, suitable for continuous operation. Actuator must provide an alarm signal in case of failure of anti-condensation heater.

2.05 MOTOR

A. The electric motor shall be Class F insulated, with a duty rating of at least fifteen (15) minutes at 104°F (40°C) ambient temperature at an average load of at least 35 percent (35%) of rated actuator torque. Motor shall be specifically designed and built by the actuator manufacturer for electric actuator service characterized by high starting torque, low stall torque, and low inertial. Electrical disconnection of the motor shall be by means of a plug and socket and motor removal shall be possible without loss of lubricant. The actuator must include a device to ensure that the motor runs with the correct rotation for the required direction of travel regardless of the connection sequence of the power supply.

2.06 MOTOR PROTECTION

A. The following criteria shall be provided for motor protection:

1. The motor shall be de-energized without damage in the event of a stall condition when attempting to move a jammed gate or valve.

2. The motor shall be de-energized in the event of an over-torque condition.

3. Thermal devices (one for each phase of power) shall be imbedded in the motor windings to de-energize the motor in case of overheating.

4. Lost phase protection.

2.07 GEARING

A. The actuator gearing shall be totally enclosed in a grease-filled cast iron gearcase suitable for operation in any orientation. Oil lubrication is not permitted. The gearcase shall contain sensors capable of continuously recording temperatures and vibration within the actuator. Actuator gearing shall be hardened steel with alloy bronze worm wheel. Where required per application, electric actuators will be provided with worm gearboxes. The worm gearboxes shall be supplied with full 360-degree bronze or ductile iron worm wheels and end-of-travel mechanical stops.

2.08 MANUAL OPERATION

A. Manual operator shall not rotate during motor operation. Handwheel declutch mechanism shall include an output contact to indicate actuator manual operation. Manual operation shall utilize the worm shaft/worm wheel to maintain self-locking gearing and to facilitate changeover from motor to manual operation when the actuator is under load. The declutching from motor operation shall be at the motor shaft to minimize declutching effort. Return from manual to electric mode of operation will be automatic upon motor operation. A seized or inoperable motor shall not prevent manual operation.

2.09 DRIVE NUT AND THRUST BASE ASSEMBLY

A. For multi-turn rising stem applications, the drive nut shall be installed in a detachable thrust base. The design shall allow actuator removal from the thrust base, leaving the thrust base attached to the valve to retain position. Thrust bearings shall be lubricated by means of an easily accessible grease fitting.

2.10 POSITION AND TORQUE CALIBRATION

A. Position and torque shall be sensed by absolute encoder using Hall effect sensors. Incremental encoders requiring batteries to retain settings upon loss of power shall not be accepted. Position and torque settings will be stored in permanent non-volatile memory.

B. Torque and travel adjustment parameters are to be as follows:

1. Position setting range 1 to 500 or 10 to 5,000 turns, with resolution of 2.81 degrees and accuracy to 5.0 degrees of actuator output.

2. Torque setting: 40 percent (40%) to 100 percent (100%) of rated torque.

C. Torque switches bypass to be provided for the torque sensing system to inhibit torque switch trip during unseating or during starting in mid-travel against high inertia loads.

2.11 ELECTRIC ACTUATOR CONTROL

A. Actuator status indication.

1. Six (6) contacts shall be provided. The contacts shall have a minimum rating of 5A, 250VAC

a) One (1) contact dedicated for collective fault (phase failure, motor protection tripped, torque fault) or one (1) of eight (8) other fault groups.
b) Five (5) additional indication contacts selectable from a list of at least 45 parameters including, but not limited to: end position CLOSED, end position OPEN, selector switch in REMOTE mode, torque fault in CLOSED direction, and torque fault in OPEN direction.

B. Local indication.

1. The actuator shall include a digital position indicator with a display from fully open to fully closed in one percent (1%) increments.

2. Six (6) indicating lights shall be included. Five (5) of which are programmable local indicating lights to indicate functions including, but not limited to: end position CLOSED, end position OPEN, selector switch in REMOTE mode, and actuator moving. The sixth light shall indicate Bluetooth® interface connectivity.

C. Actuator shall provide torque feedback signal corresponding to required valve torque for diagnostics and preventive maintenance.

D. Integral starter and transformer.

1. The starter shall be suitable for up to 60 starts per hour for open/close service. The applicable number of starts per hour depends on actuator size and output speed.

2. A removable plug and socket controls housing containing LCD operations and diagnostics display, Bluetooth® interface, reversing starters or thyristors, power supply/control transformer and local controls capable of:

a) Being mounted integrally with the actuator and capable of being re-oriented at 90-degree increments, so that push buttons and indication lights will face the operator.
b) Being wall mounted remotely up to 330 feet (100 meters) where required by application conditions.

E. Integral local controls and control mode selector.

1. The actuator shall include local Open/Stop/Close/Reset pushbuttons and a Local/Off/Remote selector switch lockable in any of the three (3) positions. The Reset pushbutton shall be provided to facilitate actuator commissioning. It shall be possible to select maintained or non-maintained control independently for either the local or remote modes. It shall be possible to program the output direction of the actuator (clockwise or counterclockwise to close) without removal an any covers. It shall be possible to re-orient local pushbutton controls in 90-degree increments.

F. Controls

1. The following control capabilities must be available:

a) Incorporate the following features: automatic end position settings, adaptive behavior (automatic setting of dead band), programmable dead band time, programmable tolerance for open/close end positions, programmable behavior on loss of signal, split range operation.
b) Programmable electronic torque switch bypass initialized in end and intermediate positions, settable from zero to five (0-5) seconds, or separate open and close direction pulse timer (stepping mode) circuits capable of initializing at any position (Open, Close, or Intermediate)
c) It shall be possible to reverse travel without the necessity of stopping the actuator. The starter contactors shall be protected from excessive current surges during travel reversal by an automatic time delay on energization of the contactor coils.
d) Programmable emergency input for fail to any intermediate or end of travel positions when required.
e) The internal circuits associated with the remote control and monitoring functions are to be designed to withstand simulate lightning impulses of up to 1.5 kV.

G. Monitoring facilities.

1. Facilities shall be provided for monitoring actuator operation and availability as follows:

a) Liquid Crystal Display (LCD) – minimum four (4) lines back-lit for setting menu showing status indication and diagnostic information.
b) Monitoring capability via Bluetooth® connection.
c) Remote monitoring capability via network system.
d) Retrievable (lifetime and re-settable) data logs including:

1) Motor run time.
2) Total number of cycles.
3) Number of torque trips in each direction of travel.
4) Number of limit switch trips at each end of travel.
5) Total torque trip faults.
6) Motor thermal overloads.

e) Diagnostic capability, which will store and enable download of historical actuator operation, torque data to permit analysis of actuator, in-service performance, and status signals according to NAMUR recommendation NE 107 via local display. Data download shall be carried out without removing any covers and all shall be available locally at the actuator or accessible via laptop computer.

f) Actuators installed in critical applications, shall be optionally equipped with a sensor package, consisting or torque, temperature, and vibration diagnosis. In this case, actuators shall also have a real-time clock for event recording to support asset management functions and life cycle analysis.

H. Wiring and terminals

1. Internal wiring shall be tropical grade insulated stranded cable of appropriate size for the control and main power.

2. All external wiring shall terminate in a removable plug and socket head, which allows easy disconnection of all power and control voltages.

3. Actuators furnished without plug and socket terminal connections must have power and control disconnect switches for ease of maintenance and safety.

PART 3 - EXECUTION

3.01 ELECTRIC ACTUATOR COMMISSIONING AND TEST REPORTS

A. Commissioning.

1. Each actuator will be provided with a commissioning kit consisting of a wiring diagram and installation and operation manual. No special commissioning tools or parts will be required for start-up. To prevent loss of screws during commissioning or maintenance, all covers shall be fixed with captive screws. In order to minimize the amount of spare parts required, parts such as covers, plug and sockets, parts must be interchangeable throughout all model sizes.

B. Performance Test Documentation.

1. Each actuator shall be performance tested. Test documentation can be provided if requested indicating the following:
   a) Torque sensing tripping points in both the open and closed directions of travel.
   b) Current at the maximum torque tripping point.
   c) Actuator output speed.
   d) High voltage test.

C. Non-intrusive capability.

1. To maintain the integrity of the enclosure, setting of all actuator parameters including the torque levels, position limits, configuration of the indication contracts and positioner functionality shall be accomplished without removing covers from the actuator control assemblies or housing.

2. Settings shall be made by entering the set-up mode and following menu prompts appearing in the LCD window. Set-up shall be accomplished by using the actuator integral selector switch and pushbuttons without the need for a hand-held setting device. Actuator parameters may also be set by means of laptop computer via a two-way information infrared interface or laptop or PDA via Bluetooth® interface. No special setting tools or devices are acceptable.

3.02 FIELD SERVICE

A. One eight (8) hour day of field service from a factory trained technician for start-up and field calibration.

TABLE 40 05 57.25-1 ACTUATOR SCHEDULE

Area	**Electrically Actuated Gates**	**Electrically Actuated Valves ****
03 Headworks	Four Channel Isolation Slide Gates, Open/Closed One Wet Well Isolation Slide Gate, Open Closed	None
04 Aeration Basins	Two Inlet Weir Gates, Modulating	None
05 Clarifiers	None	Two Inlet Isolation 24” Valves, Open/Closed
06 Filters	None	Two Inlet Isolation 18” Valves (one for each filter), Open/Closed One Bypass 24” Valve, Open/Closed
07 UV Disinfection	Two Channel Isolation Slide Gates, Open Closed	None
Total Number	**9**	**5 ****

** Valves controlled by Manufacturer Provided Control Panels not included.

40 05 59 HYDRAULIC GATES

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to install slide gates and downward opening weir gates as shown in the drawings with operators, gate stems, frames, gate guides, wall thimbles and other related appurtenances.

1.02 QUALITY ASSURANCE

A. The fully assembled gates shall be shop inspected, tested for operation and leakage, and adjusted before shipping. Manufacturer shall provide test certificates for gates that seals at the top, sides and bottom to show that they meet the leakage rate required in this specification. There shall be no assembling or adjusting on the job site other than for the lifting mechanism. Refer to AWWA C-561.

B. The gate manufacturer shall be ISO 9001 certified and compliant or have an approved Quality Assurance Policy.

C. The equipment supplier shall have at least 10 years' experience in the design, application and supply of stainless steel fabricated gates in wastewater service. The equipment supplier shall submit a list of not less than 10 operating installations in the United States with similar size gate as scheduled, as evidence of meeting the experience requirement. Installation list shall be submitted with the shop drawings.

1.03 REFERENCES

A. The applicable provisions of the following standard shall apply as if written here in its entirety:
   1. American Water Works Association (AWWA) Standards:
      a. AWWA C561: Fabricated Stainless-Steel Slide Gates
      b. AWWA C562: Fabricated Aluminum Slide Gates

1.04 SUBMITTALS

A. See Section 01 33 00, Submittals for the mechanics and administration of the submittal process.

B. Shop Drawings:
   1. Product Technical Data including:
      a. Complete catalog information, descriptive literature, performance specifications, and identification of materials of construction.
      b. Material storage and handling.
      c. Dimensional drawings (in English units)
      d. Factory finish system and/or shop painting.

e. Recommend Spare Parts List with pricing.
f. List of special tools required to perform preventative maintenance and repairs with pricing.

C. Operation and Maintenance Manuals:
1. See Section 01 78 33 for the content, mechanics and administration of the submittal process.

D. Quality Control Submittals:
1. Quality assurance policy.
2. Warranty information.
3. Special shipping, storage and protection, and handling instructions.
4. Manufacturer's printed installation instructions.
5. Manufacturer's Certificate of Proper Installation.

1.05 WARRANTY

Manufacturer shall warrant that the complete system shall be free from defective material and workmanship for a period of two years from date of owner acceptance.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Where a manufacturer's standard equipment name and/or model number is listed, the equipment system shall be provided as modified to conform to the performance, functions, features, and materials of construction as specified herein.

B. Equipment furnished and installed under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with drawings, specifications, engineering data, and instructions and recommendations of the equipment manufacturer unless exceptions are noted by the Engineer.

C. Acceptable Manufacturers:
1. Hydro Gate
2. Fontaine Gates
3. Golden Harvest
4. Whipps
5. Waterman
6. RW Gate

2.02 MATERIALS

A. Materials in fabricated gates and appurtenances shall conform to the requirements of the applicable specifications listed below for the alloy,

grade, type, or class of material and the condition and finish appropriate to the structural and operational requirements:

1. Stainless Steel: Type 316
2. Bronze Bars, Shapes, Rods: ASTM B21 or ASTM B98
3. Cast Bronze: ASTM B584
4. Rubber for Gaskets and Seals: ASTM D2000, Grade R-62
5. UHMWPE: ASTM D4020

2.03 GATE DEFINITIONS

A. Slide gates are defined as fabricated gates with bottom and side seals. Slide gates are typically used for open channel isolation and diversion. The top of slide gates is typically above the maximum water surface elevation. Slide gates are not suitable for submerged orifice applications.

B. Weir gates are defined as fabricated gates with bottom and side seals. Weir gates are typically used as overflow downward opening adjustable weirs. The top of weir gates is typically submerged and set at the desired overflow elevation. Weir gates are mounted flush to the wall surface at the weir opening in the structural wall.

C. Stop gates and stop logs are defined as hydraulic control gates where their use is more permanent and requires infrequent opening and closing. Stop gates and stop logs are used to provide a permanent flow control across an opening and operate similar to an adjustable weir gate. Stop gates typically consist of a single continuous slide while stop logs consist of several smaller equal size “logs” that can be installed or removed as needed to change the height of gate.

2.04 FABRICATED GATES

A. GENERAL

1. Gates shall be as specified herein and have the characteristics and dimensions shown on the contract documents.
2. Leakage for fabricated gates shall not exceed 0.10 GPM/FT of wetted seal perimeter in seating and unseating head conditions.
3. The maximum allowable leakage for stop gates and stop logs shall be 0.40 GPM/LF of wetted seal perimeter in seating and unseating head conditions.
4. The gate seal design shall meet the latest applicable AWWA standards.
5. All structural components of the frame and slide shall be constructed of fabricated stainless steel having a minimum thickness of ¼ inch and shall have adequate strength to prevent distortion during normal handling, during installation and while in service.
6. All welding shall be performed by welders with AWS certification and be completed in the manufacturing facility. No welding is allowed in the field during installation.
7. Materials:

Components	Materials
Frame Assembly and Retainers	316 stainless steel
Slide and Stiffeners	316 stainless steel
Stem	316 stainless steel
Fasteners, Nuts and Bolts	316 Stainless steel
Invert Seal (Upward Opening Gates only)	Neoprene
Seat/Seals and Facing	UHMWPE
Lift Nuts	Bronze
Pedestal and Wall Brackets	316 stainless steel
Operator Housing	316 stainless steel

B. FRAMES

1. Frame shall be formed or extruded construction consisting of guides and invert members and top member where top closure is required. Suitable reinforcements will be provided to resist all operating loads.
2. The structural portion of the frame that incorporates the seat/seals shall be formed into a one-piece shape for rigidity. Guide members that consist of two or more bolted structural members are acceptable but shall provide the required rigidity based on the application. Guide member designs where water loads are transferred through the assembly bolts are acceptable.
3. On self-contained gates, a yoke shall be provided across the top of the frame. The yoke shall be formed by two structural members affixed to the top of the side frame members to provide a one-piece rigid assembly. The yoke shall be designed to allow removal of the slide. The maximum deflection of the yoke shall be 1/360 of the gate's span.
4. A rigid stainless steel invert member shall be provided across the bottom of the opening. The invert member shall be of the flush bottom type on upward opening gates. Flush bottom seal shall incorporate an embedded frame channel gate for new construction or an existing channel gate mount for existing channels.
5. A rigid stainless steel top seal member shall be provided across the top of the opening on gates designed to cover submerged openings.

C. SLIDES AND GUIDES

1. The slide and reinforcing stiffeners shall be constructed of stainless steel plate. All structural components shall have a minimum thickness of 1/4 inch.
2. The gate slide deflection shall not exceed 1/360th of gate width at maximum design head or 1/16" at seal points, whichever is less.
3. Reinforcing stiffeners shall be welded to the slide and mounted horizontally. Vertical stiffeners shall be welded on the outside of the horizontal stiffeners for additional reinforcement.

4. The stem connector shall be constructed of two angles or plates. The stem connector shall be welded to the slide. A minimum of two bolts shall connect the stem to the stem connector.
5. The gate guides shall be designed for maximum rigidity, having a weight of not less than 2-1/2 pounds per foot for aluminum stop gates, 5 pounds per foot for aluminum slide gates, and 7 pounds per foot for stainless steel The guides shall be of sufficient length to support 2/3 of the height of the slide when the gate is fully open. On self-contained gates, where the guides extend above the operating floor, they shall be strong enough so that no further reinforcing shall be required.
6. Downward opening weir gates shall have a self-containing frame that extends beyond the weir elevation so that the top of gate slide elevation is lower than the weir elevation when fully open.

D. GATE STEM AND LIFT
1. Stems shall be of suitable length with minimum 1.5-inch diameter, and ample strength for the intended service. The operating stem shall be rising stem. The stem diameter shall be capable of withstanding twice the rated output of the operator at 40 pounds crank pull and shall be capable of moving the gate slide with the specified seating and unseating head against the gate.
2. The stem shall be furnished in sections as necessary to permit reasonable ease in installation. Couplings shall be machine-cut ACME of sufficient length to completely open the gate. The threads shall be smooth and of uniform lead and cross-section, such that the nut can travel the full length without binding or excessive friction. The stem shall be threaded for connection to the stem block or thrust nut on the gate slide. The entire stem shall be of solid stainless steel material and the threaded portion of the stem shall have a rolled or cut ACME threads. Stem extension pipes are not acceptable unless approved prior to installation by the Engineer.
3. Stem guides shall be fabricated with UHMWPE bushed collars. Stem guide spacing shall be as recommended by the manufacturer but shall not exceed slenderness ratio l/r ratio of 200.
4. An adjustable bronze stop collar shall be provided to limit both upward and downward travel of the fabricated gate.
5. Provision shall be made to prevent stem rotation within the thrust nut at the connection with the gate slide.

E. SEALS
1. Neoprene ASTM D2000 Grade AA625 seal shall be attached to the bottom of the disc of the frame provide a flush bottom closure.
2. Either of the following sealing systems will be acceptable:

F. The side and top double bulb seals or J-seals will be neoprene and will be of a design to seal in both the seating and unseating directions. The side and top seals shall be a double hollow bulb or J-seal design. The double hollow bulb seal or J-seal shall be attached to the gate with ultra-high molecular

weight polyethylene grommets secured by stainless steel fasteners. All seals shall be replaceable without dewatering the gate. Plastic or polyethylene is not acceptable as a seal material for this system.

G. Side and top seals shall be made of UHMWPE (ultra-high molecular weight polyethylene) of the self-adjusting type. A compression cord shall ensure contact between the UHMWPE guide and the gate in all positions. The sealing system shall maintain sealing in any position of the slide and allow the water to flow only in the opened part of the gate.

1. The seat/seals shall extend to accommodate the 2/3 the height of the slide when the slide is in the fully closed or fully opened position.
2. All upward opening gates shall be provided with a resilient seal to seal the bottom portion of the gate. The seal shall be attached to the invert member or the bottom of the slide and it shall be held in place with stainless steel attachment hardware or attached to the invert member of the frame and be mechanically retained.
3. The seal system shall be a continuous single strand, durable and shall be designed to accommodate high velocities and frequent cycling without loosening or suffering damage.
4. All seals must be bolted or otherwise mechanically fastened to the frame or slide and shall be field replaceable without the need to remove the gate assembly. Arrangement with seals that are force fit or held in place with adhesives are unacceptable.
5. The seals shall be mounted so as not to obstruct the gate opening.
6. The seal system shall be factory tested to confirm negligible wear (less than 0.01”) and proper sealing.

H. MANUAL OPERATORS

All gates shall be operable by a manual crank-operated gearbox. The operator shall be mounted on the yoke of self-contained gates or on the pedestal of non-self-contained gates.

1. The gate manufacturer shall select the proper gear ratio to ensure that the gate can be operated with no more than a 40-lb effort when the gate is in the closed position and experiencing the maximum operating head.
2. An arrow with the word "OPEN" shall be permanently attached or cast onto the operator to indicate the direction or rotation to open the gate.
3. Manufacturer shall provide the appropriate operator crank-operated gearbox at 36-inch above operating floor unless noted otherwise in the schedule or the Contract Drawings.
4. Crank-operated gearboxes shall be fully enclosed and shall have a stainless steel housing.
   a. Gearboxes shall have single gear reduction.
   b. Gearboxes shall be provided with a threaded cast bronze lift nut to engage the operating stem.
   c. Bearings shall be provided above and below the flange on the operating nut to support both opening and closing thrusts.

d. Gears shall be steel with machined cut teeth designed for smooth operation.
e. The pinion shaft shall be stainless steel and shall be supported on ball or tapered roller bearings.
f. Positive mechanical seals shall be provided on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
g. The crank shall be cast aluminum with a revolving nylon grip.
h. The crank shall be removable**.** Provide a minimum of 1 crank for every gate unless otherwise approved by the Engineer.

5. All gates having widths greater than twice their height shall be provided with two gearboxes connected by an interconnecting shaft for simultaneous operation.
   a. Interconnecting shafting shall be constructed of stainless steel**.**
   b. Flexible couplings shall be provided at each end of the interconnecting shaft.
   c. One crank shall be provided to mount on the pinion shaft of one of the gearboxes.
6. An extended geared operator system utilizing chain and sprockets shall be furnished by the manufacturer when the centerline of the handwheel, on a non-geared operator, is located over 36-inches above the operating floor unless approved by the Engineer. As an alternative to chain and sprockets, a motor actuator drive design is acceptable.
   a. A removable stainless steel or aluminum cover shall be provided to enclose chain and sprockets.
   b. The extended operator system shall either lower or raise the centerline of the pinion shaft to 36-in above the operating floor.
7. Pedestals shall be constructed of stainless steel. Aluminum pedestals are not acceptable.
   a. Wall brackets shall be used to support floor stands where shown on the Drawings and shall be constructed of stainless steel.
   b. Wall brackets shall be reinforced to withstand in compression at least two times the rated output of the operator with a 40 lb. effort on the crank.
   c. The design and detail of the brackets and anchor bolts shall be provided by the gate manufacturer and shall be approved by the ENGINEER. The gate manufacturer shall supply the bracket, anchor bolts and accessories as part of the gate assembly.
8. Operators shall be equipped with fracture-resistant clear butyrate or lexan plastic stem covers.
   a. The top of the stem cover shall be closed.
   b. The bottom end of the stem cover shall be mounted in a housing or adapter for easy field mounting.
   c. Stem covers shall be complete with indicator markings to indicate gate position.
   d. Vent holes shall be provided to prevent condensation.
   e. Cover shall not become brittle or discolored when subjected to local weather conditions for a minimum of five (5) years after installation. Replacement of covers less than 5 year after installation shall be provided under warranty.

3.00 EXECUTION

3.01 INSTALLATION

A. Fabricated gates shall be installed in accordance with the recommendations of the gate manufacturer. The bottom of the fabricated gate structure shall be embedded flush bottom, unless otherwise indicated.

B. Install the gates in a manner that will prevent leakage around the seats and binding of the gates during operation.

C. Keep surfaces where metal and the concrete placed come in contact free from oil, grease, loose mill scale, loose paint, surface rust, and other debris or objectionable coatings.

D. Secure anchor bolts, thimbles and spigot frames in true position in the forms and hold in alignment during the placement of the concrete.

E. Finish surfaces to provide a smooth and uniform contact surface where concrete and rubber seals come in contact and where flat frames or plates are installed. When a flat frame is installed against concrete, the contractor shall either install using double-nuts and a grout pad or a minimum 1/2 inch EPDM shall be placed between the gate and the concrete.

F. When the gate is attached to a thimble, apply or a resilient gasket material with a minimum of 60 durometer hardness between the gate frame and the thimble.

G. Carefully align gate stems, stem guides and gate lifts so the stem is parallel to the guide bars or angles on the gate frame after installation.

3.02 FIELD QUALITY CONTROL

A. Prior to final acceptance by the Owner, the slide gates shall be tested in the presence of the Engineer. A seating head corresponding to the maximum water level shall be placed on the slide gate and the gate examined for leakage. The maximum allowable leakage for fabricated gates shall be per paragraph 2.04 A.2 and A.3. Manufacturer shall provide test certificates to show that they meet the leakage rate required in this specification.

B. The slide gate shall be opened from the fully closed position under maximum seating head and closed from the fully open position under average flow conditions to verify that the gate lift is operational and in satisfactory working order.

3.03 CLEAN AND ADJUST

A. After installation, clean, lubricate, and otherwise service the gate and lift in accordance with the manufacturer’s instructions.

3.04 MANUFACTURER'S SERVICES

A. A manufacturer's representative for the equipment specified herein shall be present at the job site for the minimum person-days listed in Section 01 75 00 Starting and Adjusting.

B. An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation and shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of the Engineer.

C. All costs for these services shall be included in the contract price for the number of days and round trips to the site as required.

D. Manufacturer representative is to train OWNER's personnel in the routine operation, maintenance and troubleshooting procedures. This period shall consist of a maximum of one eight-hour day. CONTRACTOR shall coordinate the scheduling of training with OWNER's personnel.

E. Manufacturer's representative shall:
   1. Approve installation before operation.
   2. Test and operate system in presence of ENGINEER and OWNER and provided certified field test reports.
   3. Verify conformance to the specification.

3.05 GATE SCHEDULE

A. Slide and weir gates shall be supplied in accordance with the following schedule: The required gates and certain pertinent data are given below. This list is given to facilitate description of the various gates and as an aid to plan take-off and is not guaranteed to be complete.

Gate Schedule

Gate No.	Invert Elevation	Gate Dimensions W x H	Mounting	Configuration	Top of Wall Elevation
Screens					
SDG-1	649.75 (1)	36" (2) x 72"	Side Wall Anchored	Self-Contained	661.75
SDG-2	649.75 (1)	36" (2) x 72"	Side Wall Anchored	Self-Contained	661.75
SDG-3	649.75 (1)	36" (2) x 72"	Side Wall Anchored	Self-Contained	661.75
SDG-4	649.75 (1)	36" (2) x 72"	Side Wall Anchored	Self-Contained	661.75
Influent Pump Station					
SDG-5	646.00 (1)	48” x 48”	Face Wall Anchored	Self-Contained	661.75
Aeration Basin Inlet Box					
WRG-1	670.85	72” x 72”	Face Wall Anchored	Self-Contained	677.35
WRG-2	670.85	72” x 72”	Face Wall Anchored	Self-Contained	677.35
UV Disinfection					
SDG-6	657.24 (1)	38.98" (2) x 60"	Side Wall Anchored	Self-Contained	663.47
SDG-7	657.24 (1)	38.98" (2) x 60"	Side Wall Anchored	Self-Contained	663.47

1. Finished floor elevation at gate noted in table. Minimize invert elevation anchoring from finished floor without embedding gate into concrete floor.
2. Channel width at gate noted in table. Maximize gate width using side wall anchoring without embedding gate into concrete channels.

40 05 62 PLUG VALVES

1.00 GENERAL

1.01 WORK INCLUDED

The CONTRACTOR shall furnish and install plug valves, operators and appurtenances, complete as shown on the drawings and specified herein.

1.02 Related Sections include but are not necessarily limited to:

A. Division 00 – Bidding Requirements, Contract Forms and Conditions of the Contract

B. Division 01 – General Requirements

C. Section 09 91 00 – Painting and Coatings

D. 40 05 00.01 Common Work Results for General Piping

E. 40 05 51 Common Work Results for Valves

1.03 SUBMITTALS

A. Shop Drawings and Product Data:
   1. Comply with the general requirements of Section 01 33 00 Submittals for the mechanics and administration of the submittal process.
   2. Submit one drawing or illustration showing unit construction for each type and size valve used.
   3. Submit the following information for each valve:
      a. Specific application in plant expressed in terms of service and contract drawing number where shown.
      b. Description including type of valve, type of operator and accessories included.
      c. Size and end connections.
      d. Maximum non-shock working pressure for which valve is designed.
      e. Materials of construction and coatings for valves, operators and accessories.
      f. K or Cv value.
      g. Manufacturers' make and model.
   4. Submit the following information for geared operators:
      a. Type of gearing.
      b. Type of lubrication.
      c. Size of handwheel, lever or crank.
      d. Input torque required to develop required output torque.
      e. Orientation and dimensions of operator.
      f. Manufacturers' make and model.
   5. If catalog bulletins are used to communicate above information, mark out inapplicable information.

B. Operation and Maintenance Data:

1. Comply with the requirements of Section 01 78 23 Operation and Maintenance Data.

1.04 DELIVERY, STORAGE AND HANDLING

A. Comply with the requirements of the General Conditions and manufacturers' recommendations.

2.00 PRODUCTS

2.01 NON-LUBRICATED ECCENTRIC PLUG VALVES (SEWAGE APPLICATION)

A. Acceptable manufacturers:
1. DeZurik, Figure 118.
2. Valmatic Series 5000.
3. J&S Valve PV 4800

B. Valve construction:
1. Body: Cast iron. (In accordance with AWWA C-504 or C509).
2. Plug facing: Grease and/or petroleum-resistant resilient Neoprene or Buna-N compound, 70 Type A durameter hardness per ASTM D 2240.
3. Plug: Cast iron, neoprene faced. (In accordance with AWWA C-504).
4. Bearings: Oil impregnated stainless steel and Teflon.
5. Shaft seal: Nitrile-butadiene chevron packing, bronze cartridge with O-rings or V-type.
6. Body seat: Nickel steel machined.
7. Furnish grit seats in upper and lower journals.
8. Interior coating: 4 - 6 mil of 2-part hi-build epoxy.
9. Bolts: Type 316 stainless steel.
10. Packing: NBR.

2.02 NON-LUBRICATED ECCENTRIC PLUG VALVES

A. Acceptable manufacturers:
1. DeZurik, Figure 499.
2. Milliken, Series 603.
3. Or approved equal

B. Valve construction:
1. Body: Cast iron. (In accordance with AWWA C-504 or C509).
2. Plug: Bronze or nickel plated cast iron.
3. Bearings: Bronze or nickel.
4. Plug seal: Isobutene-isoprene (250°F)

2.03 ACCESSORIES

A. Refer to Sections 40 05 51 and 40 05 57.25 Electric Actuators for actuator requirements. Furnish actuator integral with valve.

2.04 DESIGN REQUIREMENTS

A. Non-Lubricated Eccentric Plug Valve (Sewage Application)
   1. Port Area:
      a. Valves 4 inch through 20 inches: Equal to or exceed 80 percent of full pipe area
      b. Values greater than 20 inches: 100 percent equivalent full pipe area
   2. Valve Body: Fitted with bolted bonnet.
   3. End connections: See Section 40 05 51.
   4. Stem Seal: Adjustable and replaceable without disassembling valve or bonnet.
   5. Designed for seating drip tight in any flow direction.
   6. Rating:
      a. ½ through 12 inches: 175 psi working pressure
      b. 14 through 36 inches: 150 psi working pressure
      c. Three way valves: 125 psi working pressure
   7. Actuators:
      a. See Sections 40 05 51 and 40 05 57.25 Electric Actuators
      b. Actuator gearing in enclosure suitable for running in oil with seals on shaft to prevent entry of dirt and water.
      c. Adjustable stop to set closing torque.

B. Non-Lubricated Eccentric Plug Valves (HVAC Application):
   1. Port Area:
      a. Valves 1/2 inch through 2-1/2 inches: Equal to 100 percent of full pipe area
   2. Valve Body: Fitted with threaded or bolted bonnet.
   3. End connections:
      a. Flanges: In full accordance with ASME B16.1, Class 125 including facing, drilling and thickness.
      b. Threaded: In full accordance with NPT.
   4. Stem Seal: Self-adjusting U-cups or multiple O-ring seals.
   5. Designed for seating drip tight at full rated pressure.

3.00 EXECUTION

3.01 INSTALLATION

A. Install all valves, floor stands, and appurtenances in complete accordance with the plans, approved shop drawings and manufacturers' instructions and recommendations.

B. Install valves and valve operators:
   1. to provide for ease of access and operation
   2. with valve stem horizontal
   3. with plug seat on inlet side and with plug rotating up into the open position for valves in horizontal lines
   4. with actuator above pipe or plug centerline

D. Install buried valves by carefully lowering into position in such a manner to prevent damage to any part of the valve. Buried valves shall be placed in proper position and shall be securely held until all connections have been made. All buried pipe

and appurtenances shall be wrapped in polyethylene encasement in accordance with AWWA C105.

END OF SECTION

40 05 64 BUTTERFLY VALVES

1.00 GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish and install butterfly valves, operators and appurtenances, complete as shown on the drawings and specified herein.

1.02 RELATED WORK

A. Related Sections include but are not necessarily limited to:
   1. Division 00 – Bidding Requirements, Contract Forms and Conditions of the Contract
   2. Division 01 – General Requirements
   3. Section 09 91 00 – Painting and Coatings
   4. Section 40 05 00 – Common Work Results for General Piping
   5. Section 40 05 51 – Common Work Results for Valves

1.03 SUBMITTALS

A. Shop Drawings and Product Data:
   1. Comply with the general requirements of Section 01 33 00 for the mechanics and administration of the submittal process.
   2. See Section 40 05 51.
   3. Manufacturer's literature, illustrations, specifications, detailed drawings, data and descriptive literature on all valves and appurtenances.
   4. Submittal data for each valve, operator, and actuator.
   5. Deviations from the Contract Documents.
   6. Engineering data including dimensions, materials, size and weight.
   7. Fabrication, assembly, installation and wiring diagrams.
   8. Shop drawings shall also include seat, seal, and stem details including machining tolerances.
   9. Submit the following information for geared operators:
      a. Type of gearing
      b. Type of lubrication
      c. Size of handwheel, lever or crank
      d. Input torque required to develop required output torque
   10. If catalog bulletins are used to communicate above information, mark out inapplicable information.

B. Operation and Maintenance Data: See Section 01 78 23 Operation and Maintenance Data for the content of Operation and Maintenance manuals.

C. Manufacturer’s installation instructions.

D. Shop Tests:
   1. Test motor operated valves before shipment to ensure that the mechanisms can close the valves in the specified time limit, and for proper seating.
   2. Hydrostatic tests shall be performed, when required by the valve specifications included herein.

E. Certificates:
   1. For valves 8-inch and larger, furnish “Affidavit of Compliance” with Owner in accordance with AWWA C504.

1.04 REFERENCE STANDARDS
   1. American Water Works Association (AWWA):
      a. C504: Standard for Rubber-Seated Butterfly Valves.
      b. C540: Power-Actuating Devices for Valves and Sluice Gates.

2.00 PRODUCTS

2.01 BUTTERFLY VALVES FOR LOW PRESSURE AIR SERVICE

A. High-Performance Wafer Butterfly Valves
   1. Butterfly valves for air systems shall be specifically designed for this service and meet or exceed the design, strength, performance, and testing standards of ANSI/AWWA C 504 – Rubber Seated Butterfly Valves. They shall be suitable for pressures from vacuum to 125 psi, and temperatures from minus 40 degrees F to 250 degrees F.
   2. The valve body shall be of cast iron conforming to ASTM A126 – Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fitting, Class B, with either wafer, lug, or flanged design as indicated, drilled to ANSI B16.1 – Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800, Class 125.
   3. The disc shall be of ductile iron conforming the ASTM A536 – Specification for Iron Castings, or cast iron conforming to ASTM A 48 – Specification for Gray Iron Castings, or ASTM A 126 – Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings with an edge of monel, Type 316 stainless steel, or nickel. The disc shall be designed with the air-profile or other suitable shape. Sprayed or plated disc edges are not acceptable.
   4. The elastomer seat shall be in the body. It shall be field-replaceable without special tools. Except for use with petroleum-base fluid, the seat material shall be Ethylene-Propylene-Diene Monomer (EPDM), or other suitable material, to provide a tight shut-off at the above-mentioned temperatures.
   5. The valve shaft shall be of Type 316 or 304 stainless steel, with sufficient strength to allow for the increased torque for air service.
   6. All shaft bearings shall be of the self-lubricating corrosion resistant sleeve type.
   7. The packing shall be of the adjustable or self adjustable (O-ring) type, suitable for the temperature and service conditions.
   8. All valve actuators shall be sized for air service applications, with the torque condition after three years of service. Manual actuators shall allow for positive throttling and locking in any position from open to closed.
   9. Acceptable Manufacturers:
      a. Henry Pratt
      b. Dezurik
      c. Clow
      d. Keystone
      e. Bray
      f. Approved Equal

2.02 VALVE OPERATORS

A. See Section 40 05 51.

3.00 EXECUTION

3.01 INSTALLATION

A. All valves and appurtenances shall be installed by the Contractor in the locations shown, true to alignment and rigidly supported.

B. After installation, all valves and appurtenances shall be tested at the same duration and pressure as the piping system they are in.

3.02 INSPECTION AND TESTING

A. See Section 40 05 51.

END OF SECTION

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40 05 65 CHECK VALVES

1.00 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Center guide (silent).
   2. Swing.
   3. Cushioned swing.
   4. Flapper type.
   5. High-pressure gas.
   6. Slanting disc.
   7. Plastic ball check valves.

Related Sections include but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms and Conditions of the Contract
2. Division 01 – General Requirements
3. Section 09 91 00 – Painting and Coatings
4. 40 05 00.01 Common Work Results for General Piping
5. 40 05 51 Common Work Results for Valves

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME):
   1. B16.1 – Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   2. B16.5 – Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 inch Standard.

B. American Water Works Association (AWWA):
   1. C508 – Swing-Check Valves for Waterworks Service, 2-In. Through 48-In. (50-mm Through 1,200-mm) NPS.

C. ASTM International (ASTM):
   1. A 126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   2. A 313 – Standard Specification for Stainless Steel Spring Wire.
   3. A 536 – Standard Specification for Ductile Iron Castings.
   4. B 582 – Standard Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Plate, Sheet, and Strip.
   5. B 584 – Standard Specification for Copper Alloy Sand Castings for General Applications.

D. NSF International (NSF):
   1. 61 – Drinking Water System Components – Health Effects.

1.03 SYSTEM DESCRIPTION

A. Design requirements:

1. Check valves: When not otherwise specified as indicated on the Drawings, provide check valves suitable for service as follows:
    a. In either horizontal or vertical position.
    b. Suitable for service working pressures up to 150 pounds per square inch gauge.

1.04 SUBMITTALS

A. Submit the following information as specified in Section 01 33 00:
    1. Product data.
    2. Certificates:
        a. General purpose AWWA check valves:
            1) Affidavit of compliance attesting valves provided comply with all provisions in accordance with AWWA C508.
    3. Operation and maintenance data, per Section 01 78 23

2.00 PRODUCTS

2.01 CENTER GUIDE (SILENT) CHECK VALVES

A. Valve design:
    1. Center guided, spring-loaded plug.
    2. Replaceable seat and plug.
    3. Shaft guide bushing.
    4. Non-slam, silent shut-off.
    5. Flanged body.

B. Materials:
    1. Body: Cast iron, ASTM A 126 Grade B, or Type 316 stainless steel, ASTM A 313.
    2. Plug and seat: Bronze, ASTM B 584 C83600.
    3. Spring: Stainless steel, ASTM A 313 Type 316.
    4. Shaft and bushing: Bronze, ASTM B 584 C83600.
    5. Seat: Buna-N or EPDM.

C. Acceptable Manufacturers:
    1. APCO, Model Number 600
    2. Crispin, Series GC

2.02 SWING CHECK VALVES

A. Valves 1/4 inch through 3 inch:
    1. Valve design:
        a. Threaded joints.
        b. Y-pattern body with integral seat.
        c. Hinged disc.
        d. Access to valve seat for regrinding without disassembly of piping.
    2. Materials:
        a. Body, cap, hinge, and disc: Bronze.
    3. Acceptable Manufacturers:
        a. Crane Company, Number 36
        b. Cincinnati Valve Company, Lunkenheimer, Figure 554Y

B. Valves 4 inch through 24 inch:
   1. Valve design:
      a. In accordance with AWWA C508.
      b. Constructed to permit top entry and removal of internal components without removing the valve.
      c. Equipped with outside lever and weight.
   2. Materials:
      a. Body: Cast iron, ASTM A 126 Class B or ASTM A 536 Gr. 65-45-12 Ductile Iron.
      b. Disc:
         1) 4-inch valves: Bronze or stainless steel.
         2) 6 inches and larger valves: Bronze faced or stainless steel.
         3) Rubber seat Buna-N or EPDM.
      c. Hinge pins: Stainless steel.
   3. Acceptable Manufacturers:
      a. Milliken, Series 9001
      b. APCO Model 250
      c. Crispin SWL Series

2.03 OIL CUSHIONED SWING CHECK VALVES

A. Acceptable Manufacturers:
   1. Crispin, Series SWC-BB
   2. APCO, Swing-Check, Series 6000B
   3. Milliken, Series 9001

B. Valve design 8 inches to 66 inches:
   1. Counter-weighted.
      a. Single counterweight on sizes 8 inches to 12 inches (right side)
      b. Dual counterweights on sizes 14 inches and larger
   2. Rubber seated and drip tight.
   3. Totally enclosed oil dampening chambers with adjustment for closing speed.
   4. Bottom mounted hydraulic oil cushion system:
      a. System shall permit free open, but positive non-slam controlled closure of the disc.
         1) Hydraulic cushion shall make contact with the disc during the last 10 percent of closure to control the disc until shutoff.
      b. System shall be externally adjustable to suit operating conditions.
      c. System shall be totally enclosed and removable without need to remove the entire valve.
         1) Oil system shall be totally independent from the main line to prevent corrosion or contamination to the process water.
   5. Materials:
      a. Valve body, cover, and disc: Ductile Iron ASTM A 536 Class 65-45-12.
      b. Disc seat: Bolted in replaceable seat, EPDM.
         1) Disc attachment design.
            a) Single top shaft disc mount with machined pin, (no bolts & nuts attachments on the disc are acceptable)
            b) Dual device hinge pinning on linkage arm to disc pinning, (no bolts & nuts attachments on the disc are acceptable)
         2) Shaft: Stainless steel: T303 high strength stainless steel.

a) Shaft shall have large pin shaft design for full rating of the valve fully extended though valve cast on each end of body casting
(1) Shaft minimum sizing is:

Valve Size (per inch	8	10	12	14	16	18	20	24	30	36
Shaft Size (per inch)	1.75	2.125	2.5	3 10	3.5	3.75	4	3	3.75	4

c. Oil Cushion bottom mounted cylinder:
1) Corrosion resistant metal with stainless steel control rod to slow closing function of the valve not connected to the disc.
2) Side mounted oil reservoir to be oriented in the vertical position after valve installation.

d. Shaft packing seals: Shaft packing seals on both ends of body casting or O-rings.
e. Disc ring seat: Bronze or stainless steel.
f. Seat pins and lock screws: Stainless steel.

6. Pressure rating:
a. Swing check valve shall be rated for minimum 150 pounds per square inch differential pressure.

2.04 FLAPPER TYPE CHECK VALVES

A. Acceptable Manufacturers:
1. Crane Company
2. Techno Corporation
3. APCO Model 9000

B. Valve design:
1. Spring-assisted dual valve plates with metal hinge. Springs designed to close valve plates upon flow reversal.
2. Replaceable elastomeric seal secured to valve plates with clamp plates and fasteners.
3. Valve seats integral with valve body. Eliminate leakage when valve plates are fully closed with elastomeric seal in full contact with valve seat.
4. Flanged ASME Class 125 end connections.
5. Stops on valve shaft which prevent valve plates from opening more than 90 degrees from closed position.

C. Valve design:
1. Dual valve plates with replaceable elastomeric member which acts as both a hinge and a seal.
2. Elastomeric member secured to valve plates with clamping plates and fasteners.
3. Full port, seatless design. Eliminate leakage when valve plates are fully closed with elastomeric member in full contact with interior surface of valve port.
4. Flanged ASME Class 125 body.

D. Materials:
1. Body: Cast iron.
2. Valve plates: Type 316 stainless steel, stainless faced iron casting not acceptable.
3. Seal: EPDM.

4. Trim: Type 316 stainless steel.
5. Spring: Type 316 stainless steel.

2.05 PLASTIC BALL CHECK VALVES

A. Acceptable Manufacturers:
1. Chemtrol
2. Georg Fischer
3. Plast-O-Matic Valves

B. Valves: Ball type:
1. Material: Polyvinyl chloride.
2. End connection: Double or single union-type.
3. Seals: Viton.

C. Valve body material:
1. Polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), Polypropylene (PP) or polyvinylidene fluoride (PVDF), as best suited for each individual service condition.

D. Union connections material:
1. NPT or socket ends conforming to ASME B16.5 pipe flanges and flange fittings, class 150.

E. Seats and seals material:
1. EPDM, Buna-N, or Viton.

F. Maximum inlet pressure rating:
1. PVC, CPVC or PVDF: 150 pound per square inch at 77 degrees Fahrenheit.
2. PP: 100 pounds per square inch at 77 degrees Fahrenheit.

2.06 COATING

A. Coat valves as specified in Section 09 91 00 Painting and Coatings.

3.00 EXECUTION

3.01 INSTALLATION

A. Install valves as specified and according to manufacturer's instructions.

B. Flapper type check valves:
1. Install with proper orientation of flow direction arrow on valve body.
2. When installed in horizontal pipelines, mount with shaft on vertical locations.
3. When mounted in a vertical pipeline, directly downstream of an elbow, mount with the shaft perpendicular to the outermost portion of the elbow.
4. Mount on downstream side of discharge silencer when used on positive displacement and centrifugal blowers.

3.02 ADJUSTING

A. Adjust cushioned swing check valves in the field by means of external adjustment devices to minimize pressure surges.

B. Adjust weight on swing check valves to affect proper closing action on equipment shutdown.

END OF SECTION

40 42 13 PIPE INSULATION AND JACKETING

1.00 GENERAL

1.01 SCOPE

A. This Section includes the furnishing and the installation of pipe insulation, jackets, and accessories for water piping, sludge piping, and piping subject to condensation and freeze conditions.

B. Types of mechanical insulation specified in this section include the following:
   1. Piping System Insulation:
      a. Preformed split type polyurethane foam pipe and fitting insulation.
      b. Preformed Aluminum pipe and fitting jackets.
   2. Insulate all outdoor piping as shown on the drawings, including all water and recirculation piping associated with the odor control systems.

C. For piping subject to freeze conditions, coordinate insulation with installation of heat tracing.

1.02 REFERENCES

A. ASTM International, (ASTM):
   1. B-209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   2. C-177 - Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
   3. C-208 – Specification for Cellulosic Fiber Insulating Board.
   4. C-209 – Test Method for Cellulosic Fiber Insulating Board.
   5. C-335 - Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
   6. C-518 - Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   7. C-534 - Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
   8. C-585 - Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
   9. C-591 - Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
   10. C-921 - Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
   11. D-2842 - Test Method for Water Absorption of Rigid Cellular Plastics.
   12. E-84 - Test Method for Surface Burning Characteristics of Building Materials.
   13. E-96 - Test Method for Water Vapor Transmission of Materials.

B. National Fire Protection Association, (NFPA):
   1. 255 - Test of Surface Burning Characteristics of Building Materials.

C. Underwriters Laboratories (UL):
   1. 723 - Surface Burning Characteristics of Building Materials.

D. Building Codes: Comply with applicable requirements of all governing authorities.

1.03 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation and jacket in accordance with Section 01 33 00 Submittals. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation. Submit information on insulation and jacket properties, UV inhibitors and associated expected life.

B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.04 DELIVERY, STORAGE, AND HANDLING:

A. Deliver insulation, coverings, cements, adhesive, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Insulation for piping subject to freeze conditions
   1. Dow Trymer 2000 Brand Polyisocyanurate Foam Insulation with applicable jacket and sealing system.
   2. Nomaco Polymer Foam Insulation with applicable jacket and sealing system.
   3. Approved Equal

B. Aluminum Jacketing
   1. ITW Insulation Systems/Pabco-Childers Metals Preformed Aluminum Jacketing
   2. Approved equal

2.02 MATERIALS

A. Insulation for piping subject to freeze conditions
   1. Type: Heavy density, preformed, one-piece insulation sections of polyurethane or polyisocyanurate foam.
   2. Thermal performance: Maximum K-factor of 75°F = 0.25 Btu in/hr – ft^{2} -^{o}F.
   3. Flame/Smoke Rating: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 450 or less, as tested by ASTM E84 (NFPA) 255) method, with the following exceptions:
      a. Outdoor mechanical insulation may have flame spread index of 75 or less and smoke developed index of 450 or less.
      b. Industrial mechanical insulation that will not affect life safety egress of building may have flame spread index of 75 or less and smoke development index of 450 or less.
   4. Temperature range: 0° to 200°F.

5. Moisture absorption per ASTM C553: Less than 0.2 percent by volume.
6. Shrinkage per ASTM C356: Negligible.
7. Corrosivity: Does not accelerate corrosion to steel or alum or copper.
8. Resistance to bacteria and fungi: Does not breed or promote.

B. Aluminum Jacket
1. Type: Aluminum jacketing shall be 0.02" (0.5 mm) minimum with moisture barrier, secured in accordance with the jacket manufacturer's recommendations. Joints shall be applied so they will shed water and shall be sealed completely.
2. Fittings shall be jacketed with preformed fitting covers matching outer jacketing used on straight pipe sections, with all joints weather sealed.

C. Accessories:
1. Sealants: Silicone and Weatherban sealants as recommended by the manufacturer.
2. Tapes supplied with products per manufacturers recommendations.
3. Metal Jacket Bands: 3/8 inch wide 0.015 inch thick stainless steel or aluminum.

D. Insulation Thickness Schedule for Water and Sludge Piping:

Pipe size, in.	Insulation thickness, in.
1/2 or less	3/4
3/4	1
1	1
1-1/4	1
1-1/2	1
2	1-1/2
2-1/2	1-1/2
3	1-1/2
4	1-1/2
6	2
8	2
10	2
12	2
>12	2

E. Heat Trace:
1. Size insulation to accommodate heat tracing cable.

3.00 EXECUTION

A. General:
1. Install system piping system insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
2. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.

3. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scrapes abutting each other.
4. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
5. Maintain integrity of vapor-barrier jackets on pipe insulation and protect to prevent puncture or other damage.
6. Cover valves, fittings, flanges and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
7. Extend piping insulation without interruption through wall sleeves, hanger sleeves and similar piping penetrations, except where otherwise indicated.

B. Preformed pipe insulation:
1. Pipe insulation shall be cut to proper length as required, installed around the pipe, and sealed into position.
2. All butt joints shall be finished with butt strips and sealants.
3. All fitting covers shall be sealed with sealant then taped in place using pressure sensitive tape.
4. All installation shall be performed in compliance with the directions of the manufacturer.
5. All fittings, valves, flanges, etc., shall be insulated with equal thickness as piping and finished with factory preformed jackets.
6. All designated equipment shall be insulated with 2-inch thick and finished with field fabricated jackets.

3.02 PROTECTION AND REPLACEMENT:

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

CITY OF AUBREY, TEXAS

SPECIFICATIONS AND CONTRACT DOCUMENTS
WASTEWATER TREATMENT PLANT EXPANSION TO 2.25 MGD

VOLUME 3
SECTION 40 61 00 TO DIVISION 46

May 2024

BID SET for **INTERNAL REVIEW**

Mead&Hunt
TBPELS FIRM NO. F-9593

In Association with:

MBROH ENGINEERING
TBPE FIRM NO. 9439

JQ Infrastructure
TBPELS Firm F-7986

rawls·culver
ARCHITECTS, LP

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SECTION 40 61 00 INSTRUMENTATION AND CONTROL – GENERAL PROVISIONS

PART 1 GENERAL

1.01 SUMMARY

A. The General Contractor shall procure the services of a Process Control System Supplier (PCSS) to furnish, install, calibrate, test, configure, program and place in operation all instrumentation and control system equipment necessary to perform the specified functions in accordance with the requirements of the Specification Sections listed below, and in related drawings, except for those services and materials specifically noted.

1. Section 40 72 13 Level Measurement Ultrasonic
2. Section 40 71 13 Flow Measurement Magnetic Flowmeter
3. Section 40 71 76 Flow Measurement Thermal Mass
4. Section 40 72 76 Level Measurement Switches
5. Section 40 73 63 Pressure Vacuum Measurement Diaphragm and Annular Seals
6. Section 40 91 04 Pressure Vacuum Measurement Instrument Valves
7. Section 40 73 36 Pressure Vacuum Measurement Switches
8. Section 40 91 06 Pressure Vacuum Measurement Gauges
9. Section 40 91 07 Pressure Vacuum Measurement Direct
10. Section 40 91 08 Analyzers Dissolved Oxygen (DO)
11. Section 40 66 00 Network Materials and Equipment
12. Section 40 67 63 Uninterruptible Power Supplies 10 KVA & Below
13. Section 40 78 00 Process Control Panels and Hardware
14. Section 40 61 96 Control Description
15. Section 40 80 00 Testing, Calibration, & Commissioning

B. The PCSS shall provide primary sensor/transducers, field instruments, sensor cables, and associated mounting hardware as shown on the drawings and specifications.

C. The PCSS shall provide PLC control panels and RIO control panels as shown in the P&ID and system architecture drawings. The PLC/RIO control panels shall be fully factory tested before installation.

D. The Application Engineering System Supplier (AESS) shall be responsible for programming the Programmable Logic Controllers (PLC) and configuring the SCADA Human Machine Interface (HMI) in the SCADA control panel OIT and control room HMI (Geo Scada) including graphic,

trend, operation faceplate, PID tuning, historical data logging and alarming as required. Some of vendor LCPs have pass through their PLC data to HMI server for control & monitor. The following is a general list of control system which require programming and configuration.

1. Lift Pump Station PLC (PLC-0300)

2. Electrical Building No. 1 PLC (PLC-1410)

3. Chemical Dosing PLC (PLC-1100)

4. Clarifiers & RAS/WAS Pump PLC (PLC-0510)

5. Electrical Building No. 2 PLC (PLC-1420)

E. The AESS shall provide all programming configuration and related service for the controls system equipment provided by the PCSS and control and monitor from LCP to HMI.

F. To ensure that all control systems and equipment are properly coordinated and will function in accordance with the intent of these Specifications, the Contractor shall retain ultimate responsibility under this Contract for control system and equipment coordination, installation, operation, and warranty.

G. The PCSS shall furnish and install all labor, equipment, materials, appurtenances, specialty items and services required for complete and operable control systems. The vendor package control system (such as Filter, LCP-0610) and scope of work are in a separate specification.

H. The PCSS and Manufacturers of the equipment specified herein shall be required to re-view and satisfy all relevant requirements of other sections of the Contract Documents.

I. The control layer is ring topology with fault-tolerant, which means that even if one PLC fails, the remainder of the network will continue to function, and this is accomplished by using specific ring switch model such as Schneider Electric MCSESM063F2CU0. A ring topology is a network configuration where each networked device is connected to two other devices on either side of it to form a circular “ring” data path. When data is transferred in a ring topology, the data is sent in one direction along the single continuous pathway. If a network switch fails, the backup ring immediately activates, allowing data to continuously flow across the counter-rotating ring—resulting in extremely short failover recovery times.

J. PCSS shall provide all the network hardware for ring topology including ring switch, patch cables, adaptor, and FOPP etc. AESS should configure this fault-tolerant capacity through one assigned switch (ring manager). Refer to MCSESM, MCSESM-E, MCSESP Managed Switch Configuration User Manual for detail.

K. AESS should provide OPC driver for Ethernet/IP, Modbus or others protocol and configure/mapping in the Geo SCADA.

L. Using the table to represent the plant control and monitoring is not allowed unless approved by the owner. Design the operation graphics format like P&IDs should be used.

M. AESS should configure and demonstrate main server (Geo Scada) and standby server (Geo Scada) fail over test.

N. AESS should configure Cisco L3 switch and firewall (server room) together with IT team with City of Aubrey. The IP address listed in the control description should be assigned by the IT team of City of Aubrey.

1.2 QUALITY ASSURANCE

A. The Contractor shall furnish the services of a single PCSS who shall assume responsibility for providing a complete and integrated system. Applicable parts of Section 40 61 00, such as shop drawings, record drawings, and Operations and Maintenance Manuals shall be provided by the PCSS.

B. All equipment, components, and materials required shall be furnished by the single supplier who shall assume responsibility for adequacy and performance of all items.

C. The Contractor shall require the supplier to identify those system components which are not off-the-self components or not of his manufacture/production.

D. The Contractor shall supply to the Owner's Representative the PCSS's quality assurance plan, and for components which are not off-the-self components or not of their manufacture, the component manufacturer's quality assurance plan. The plans shall include but not necessarily be limited to: method of testing, raw material criteria, methods of documentation, station control, "Burn-In", the final tests, serialization coding, and packaging.

E. PCSS Qualifications:

1. Shall be a financially sound firm having at least five years continuous experience in designing, implementing, supplying, and supporting instrumentation and control systems which are comparable to the instrumentation system in terms of hardware, software, cost, and complexity.

2. Shall have in existence at the time of bid advertisement, an experienced engineering, and technical staff capable of designing, implementing, supplying, and supporting the instrumentation system and handling the submittal, testing, and training requirements throughout the project to the end.

3. Shall have a thorough working knowledge of wastewater treatment processes and control philosophy in accordance with standard practices of the wastewater treatment industries.

4. Shall have a demonstrated record of prompt positive response to field failures.

5. Shall have a record of prompt shipments in accordance with contract obligations required for previous projects.

6. Shall have a demonstrated experience record of successful instrumentation and control system equipment installations, including experience with the installation, startup, and commissioning of Plant Control System (PCS) as required in this project.

7. Shall have been the contractor on a minimum of three wastewater projects, each with complexity equal to or greater than that of the city of Aubrey WWTP location. PCSS shall provide a list of qualifying installations, including the name and telephone numbers of the plant superintendent at each facility.

8. The Owner has pre-approved the following PCSSs for this project. No others are allowed without approval from the owner
   a. WHECO Controls
      8501 Jacksboro Highway
      Fort Worth, Texas 76135Attn: Kent Meyerhoeffer
      Phone 817-244-6660
      Kent@whecocontrols.com
      www.whecocontrols.com

F. AESS Qualifications:

1. Shall be a financially sound firm having at least five years continuous experience in designing, implementing, supplying, and supporting PLC / SCADA HMI programming and software development including ScadaPack 474 RTU, expansion I/O, ring fault-tolerant network configuration, and Geo-Scada (redundancy server) HMI.

2. Shall have in existence at the time of bid advertisement, an experienced engineering, and technical staff capable of designing, implementing, supplying, and supporting the SCADA PLC / HMI system and handling the submittal, testing, and training requirements throughout the project to the end.

3. Shall have a thorough working knowledge of wastewater treatment processes and control philosophy in accordance with standard practices of the wastewater treatment industries.

4. Shall have a demonstrated record of prompt positive response to field failures.

5. Shall have a record of prompt shipments in accordance with contract obligations required for previous projects.

6. The AESS shall maintain a permanent, fully staffed and equipped service facility within 200 miles of the Project Site with full time, capable employees during the warranty of the Project. At a minimum, the AESS shall be capable of responding to on-site problems within 12 hours of notice. Provide an on-site response within 4 hours of notification starting two months before scheduled start up to two months after startup completion.

7. Shall have been the contractor on a minimum of three wastewater projects, each with complexity equal to or greater than that of the City of Aubrey WWTP location. AESS shall provide a list of qualifying installations, including the name and telephone numbers of the plant superintendent at each facility.

8. The Owner has pre-approved the following AESSs for this project. No others are allowed without approval from the owner
   a. WHECO Controls
      8501 Jacksboro Highway
      Fort Worth, Texas 76135Attn: Kent Meyerhoeffer
      Phone 817-244-6660
      Kent@whecocontrols.com
      www.whecocontrols.com

9. Include lists of five installations that have been operating satisfactorily for a period of five years from the suppliers of each of the following major equipment items:
   a. Control Panels.
   b. Programmable Logic Controllers.
   c. HMI

G. PCSS's Responsibility:

1. Detailed design, fabrication, assembly, wiring, integration, testing, and debugging of the instrumentation and control system in accordance with the Contract Documents, the reviewed submittal drawings, and all referenced standards and codes.

2. Preparation, assembly, submission, and correction of all instrumentation and control system submittals in accordance with the Contract Documents.

3. Proper integration, configuration and interfacing of the instrumentation and control and network system hardware, field devices, and panels including required interfacing with package control systems furnished by other equipment suppliers, with existing equipment, and with the electrical system.

4. Supervision of the installation of the instrumentation and control system, instruments, panels, consoles, cabinets, wiring, and other components required.

5. Field Calibration Verification, testing, and startup of the instrumentation (new or existing) and control system.

6. Handling of all warranty obligations for the control system components.

H. AESS Responsibility:

1. Provide configuration of new PLCs for all equipment shown on the Drawings, except for controls equipment shown being provided as part of a vendor package system.

2. Provide configuration of the existing plant Process Control System (PCS) HMI Software system for all new and modified or replaced equipment shown on the Drawings, including communications with equipment provided by vendor package systems.

3. Provide configuration of the existing SCADA Historian Software. Existing tags for the equipment modified under this Contract shall be identified in the Historian and submitted for review. The new tags shall be configured and linked to the existing tags.

4. Test communications and functionality between all connected devices (such as PLCs) and the HMI software packages that are affected during this project, including devices supplied by others such as vendor-supplied package equipment, as depicted on the system architecture drawings in order to provide a comprehensive working system of data collection and storage.

5. All work shall be coordinated with plant operating personnel to minimize impacts on daily operation. Delays caused for any reason shall be noted and formally submitted to the Engineer and the Owner in the form of a letter.

6. Any temporary application engineering services required to keep the plant in service, whether specifically indicated in contract documents or not, shall be included in the Contractor Agreement.

7. The AESS shall adhere to the requirements of the Procedures as applicable for the project and meet the overall intent outlined in the Specifications.

8. During construction, the modified PLC with monitoring and controls functionality fully tested on plant HMI and the affected screens, displays and databases shall be revised as per any updates, reviewed by the Owner and be made fully functional.

9. Provide all programming, configuration, and related services required to achieve a fully integrated and operational system as specified herein.

10. Provide configuration of the SCADA Historian Software.

11. Provide configuration of system reports using the Reporting Software provided.

12. Provide test communications and functionality between all connected devices (such as PLCs) and the HMI software packages, including devices supplied by others, as depicted on the system architecture drawings in order to provide a comprehensive working system of data collection, storage and reporting.

I. Reference Standards:

1. The following organizations have generated standards that are to be used as guides in assuring quality and reliability of components and systems; govern nomenclature; define parameters of configuration and construction, in addition to specific details in this Specification and the Contract Drawings:
   a. ISA, Instrument Society of America.
   b. API, American Petroleum Institute.
   c. UL 508A, Underwriters Laboratories, Industrial Control Panels
   d. NEMA, National Electrical Manufacturers Association.
   e. OSHA, Occupational Safety and Health Administration.
   f. ANSI, American National Standards Institute.
   g. NFPA 79, Electrical Standard for Industrial Machinery.
   h. IEEE, Institute of Electrical and Electronic.
   i. NEC, National Electrical Code.
   j. FM, Factory Mutual.

1.3 COORDINATION AND PROGRESS MEETINGS

A. Contractor shall be responsible for scheduling and coordinating the system installation with regard to all other work on the site and in accordance with the provisions of Division 1 General Requirements. All related activities shall be included and shall be documented on the project schedule.

B. Routine progress and coordination meetings will be scheduled by the Engineer. Contractor shall be required to provide the services of a representative to attend a minimum of (24) meetings.

C. The purpose of the meetings shall be to review the progress of the work involving the instrumentation and control system and provide coordination for installation of the equipment to ensure construction schedules are met and conflicts with other projects are addressed.

D. Representatives at the meetings shall have the competence and authority to make any and all necessary decisions. Decisions and statements made at the meetings shall commit the Contractor and system supplier to agreed procedures and schedules.

E. A project Kickoff coordination meeting within two weeks after submitting the project plan. The purpose of the meeting will be to discuss the PCSS's Project plan, to summarize the PCSS's understanding of the project, discuss a forum to coordinate hardware and software testing and delivery deadlines date; and request any additional information required from the Owner.

F. A submittal review coordination meeting after the Hardware, Panel Drawing, and Loop Drawing Submittal package has been reviewed by the Engineer and returned to the PCSS. The purpose of this meeting is to review comments made on the submittal package; to refine scheduled deadline dates; coordinate equipment installation activities; and provide a forum for any further required coordination between the PCSS and AESS.

G. Schedule and conduct a standards and conventions workshop. The purpose of this workshop shall be to review the standards, conventions and methodologies that will be used to program and develop the programs (i.e. HMI and PLC database, HMI graphics, and PLC programming, etc.).

H. The AESS shall conduct a minimum of one eight-hour workshop to review proposed SCADA HMI for content including graphics standards, alarming, trending, and reporting. The workshop shall include the AESS, I&C Engineer, Process Mechanical Engineer and the City.

I. All final coordination meeting and workshops shall be between the City, PCSS, Engineer and AESS to ensure all work done complies as specified and operates as stated.

1.4 PCSS PROJECT PERSONNEL

A. The PCSS shall provide the following project personnel:

1. Project Manager:
   a. The project manager shall coordinate and schedule all work and assure that the project schedule is met.
   b. The project manager shall act as the liaison with the Contractor for the installation of the instrumentation and control system equipment and shall assist in all matters required for proper coordination and interfacing of the equipment and processes.

2. Field Engineer:
   a. The Field Engineer shall have the responsibilities as follows:
      1) Provide advice and technical consultation relative to installation techniques and procedures for equipment furnished.
      2) Provide installed system checkout, calibration, adjustment, and startup including tuning of every control loop.
      3) Provide maintenance services during the field test as specified.
      4) Have involvement in the on-site system training of plant personnel.

5) Provide resolution of control problems encountered during initial startup and testing of all instrumentation and control equipment.

b. The Field Engineer shall have a minimum of five years' experience in systems engineering and startup and shall have a thorough working knowledge of the hardware supplied for the instrumentation and control system.

1.5 AESS PROJECT PERSONNEL

A. The AESS shall provide the following project personnel:

1. Project Manager:
   a. The project manager shall coordinate and schedule all work and assure that the project schedule is met.
   b. The project manager shall act as the liaison with the Contractor for the programming and shall assist in all matters required for proper coordination and interfacing of the equipment and processes.

2. Field Engineer:
   a. The Field Engineer shall have the responsibilities as follows:
      1) Provide advice and technical consultation relative to programing of all equipment
      2) Provide installed system checkout, calibration, adjustment, and startup including tuning of every control loop.
      3) Have involvement in the on-site system training of plant personnel.
      4) Provide resolution of control problems encountered during initial startup and testing of all instrumentation and control equipment.
   b. The Field Engineer shall have a minimum of five years' experience in systems engineering and startup and shall have a thorough working knowledge of the hardware supplied for the instrumentation and control system.

1.6 RELATED WORK

A. All instrumentation work provided under any Division of the Specifications shall fully comply with the requirements of Division 26.

1.7 SUBMITTALS

A. Pre-Submittal Conference:

1. Contractor shall arrange and conduct a pre-submittal conference on the control system within 45 days after the Notice to Proceed of the general construction contract.

2. The pre-submittal conference shall be attended by representatives of PCSS and AESS. The Owner and Owner's Representative will also attend. The meeting shall be held at the Owner's facility.

3. The purpose of the pre-submittal conference shall be to informally review and conceptually accept the manner in which the control system supplier intends to respond to the Contract requirements before any submittals are prepared.

4. Contractor shall prepare the items listed below for presentation at the pre-submittal conference. The information shall be submitted to the Owner's Representative one week prior to the date of the conference:
    a. A description of the qualifications of Contractor, including references.
    b. A list of equipment and materials required for the control system and the brand (manufacturer) which the Contractor proposes to use for each item.
    c. A list of proposed exceptions to the Contract Documents along with a brief explanation of each. Approval shall be subject to a formal submittal.
    d. A flow chart showing the steps to be taken in preparing and coordinating each control system submittal to the Owner's Representative.
    e. A bar chart type schedule for all instrumentation and control system related activities from the pre-submittal conference through startup and training. Particular emphasis shall be given to dates relative to submittals, design, fabrication, factory testing, deliveries, installation, field testing, commissioning, and training. The schedule shall be subdivided to show activities relative to each major item or group of items when everything in a given group is on the same schedule. Incorporate time constraints for AESS activities as defined in this specification.
    f. A general outline of the type of tests to be performed to verify that all sensors/transducers, instruments, and control equipment are functioning properly.
    g. List of all graphics intended to be created for this Project
    h. List of all PLC programs that will be created or modified for this Project

B. Shop Drawings:

1. General:
    a. Make shop drawing submittals in accordance with the requirements of the Contract Documents, including Section 01 33 00, Submittals. Submit all substitutions (products by manufacturers other than those specifically named) in accordance with the requirements of Section 01 33 00, Submittals.
    b. Preparation of shop drawings shall not commence until after the pre-submittal conference.
    c. Manufacturing of the instrumentation and control system shall not commence until related submittals have been approved by Owner's Representative.
    d. Shop drawings shall be submitted by specification section number, as generally outlined in Paragraph 1.7.C, Submittal Requirements, listed below.
    e. Review of shop drawings by OWNER'S REPRESENTATIVE will be for conformance with Contract Documents and with regard to functions specified to be provided.
    f. All shop drawings and diagrams shall be developed using AutoCAD. One hard copy for the city and a digital copy shall be submitted for review. Record Drawings and Final O&M Manuals shall include all AutoCAD Drawing Files (softcopy) as well as the hard copies and PDF files of the drawings and diagrams. The Contractor's retainage shall not be paid until the Record Drawings and O&M Manuals have been furnished to the Owner/Owner's representative.

C. Submittal Requirements:

1. Product information for all sensors/transducers and field instruments. Include the following:
    a. Manufacturer's product name, standard catalog product data and complete model number.

b. Instrument tag number from Contract Documents.
c. Description of construction features, including housing material and NEMA rating.
d. Performance and operation data.
e. Dimensioned installation and mounting details, instructions, and recommendations that is specific to this project.
f. Identification of all wiring interconnections and points of connection.
g. Service requirements.
h. Calibration information.
i. A list of ranges and set points that includes each device.
j. Any instrument not listing a range in Division 40 shall be coordinated during the submittal review process. Ranges that are specified may be changed due to the actual sizes, flow and pressure of equipment provided. This will be at no extra cost to the Owner/Owner's Representative during the submittal review and approval process.

D. Programmable Controller System Information:

1. System Description:
   a. Detailed block diagram showing system hardware configuration and identifying manufacturers and model numbers of system components.
   b. Software language and organization.
   c. List of spare parts and test equipment.

2. Equipment Hardware:
   a. Manufacturer's standard catalog product data for all system components. Layout drawings showing front, rear, end, and plan views to scale of all processing equipment, I/O components, power supplies, and peripheral devices.
   b. Construction details, features, and procedures.
   c. Interconnection diagrams including termination details, cable identification lists, and cable lengths.
   d. Plans showing equipment layout in control panels.
   e. Installation requirements, instructions, and/or recommendations.

3. Software Description:
   a. Standard technical documentation covering all aspects of the programmable controller software functions and capabilities, including instruction set description and programming procedures related to control, monitoring, logging, and alarming functions.
   b. Documentation describing memory type, size and structure, listing, I/O, Data Table memory, and size of memory available for programs.

E. System Standards and Conventions Submittal (AESS)

1. The existing standards and conventions currently in use at the City of Aubrey WWTP will be used for developing/modifying required graphics. And the standards and conventions used at the City main SCADA shall be used to develop/modify the graphics. Following the standards and conventions workshop, submit the standards and conventions that will be used on this project. The submittal shall define, at a minimum:
   a. Graphic display standards, including color conventions, equipment symbols, display format, equipment control pop-up displays, trend displays, and display navigation. Include samples of each proposed type of graphic display (i.e., overview, detail, diagnostic, tabular, etc.)

b. System naming conventions, such as graphic displays naming, database naming, tag names, and computer naming.
c. System configuration, including network addressing and PLC/RTU addressing.
d. Alarm configuration standards, including priorities and logging.
e. Security configuration standards, including user groups and privileges.
f. PLC/RTU standard programming modules, including analog input scaling, flow totalization, equipment runtime, motor start/stop, valve open/close, and any other standard logic planned to be used.

2. To facilitate the Owner's future operation and maintenance, the submitted standards and conventions shall be used as the basis for programming and configuration of the system. System programming and configuration shall not begin prior to the System Standards and Conventions Submittal.

F. Operator Interface (AESS)

1. All Process graphics display shall be developed/modified as per existing City of Aubrey standard and convention.

2. Following the approval of the standards and conventions submittal, submit a draft of all proposed graphic displays, examples of each type of pop-up (faceplate) displays, and examples of trends. For those graphics which will be duplicated more than once for similar type of equipment, submit the graphics for the first equipment only.

3. Following the draft graphics review workshop and prior to the factory test, submit a ready-for testing version of all graphic displays. These graphics should be finished other than the incorporation of comments and changes resulting from testing.

4. Submitted graphic displays and trends shall be no less than 8.5 inches by 11 inches and in full color.

G. Historical Data Management (AESS)

1. All Historical Data Management shall include the plant equipment number of the associated device as per City of Aubrey WWTP historian standard.

2. Submit all aspects of the historical data management system and shall include as a minimum the following:
a. A complete listing of all signals to be collected and stored. This listing shall include data sampling rate and duration for which the data will be immediately accessible.
b. Data reduction methods, rates, and duration data will be immediately accessible.
c. Storage space requirements and supporting calculations.
d. Description of historical database design, including data flow diagram, table definitions, procedures used, and queries used. Method of accumulating and displaying run times and flow totals shall be described. Method of interfacing to the reporting system shall be defined. Methods of handling Data Quality Flags shall be defined. Method of storing and displaying trending information shall be defined.
e. Description of methodology for restoring data collected locally during times that the historical data management system is not available. Description of database failure and recovery, including data correction.

f. Description of selecting only the active real-time data source for systems that are utilizing redundant data acquisition nodes.
g. List of data source interfaces to be used with the system (for example, OPC, file collection, historian-historian collector, HMI applications, etc.)

3. Control System Operation and Maintenance Manuals:
   a. Furnish O&M manuals for the instrumentation and control system in accordance with the requirements of Section 01 78 23, Operation and Maintenance Data, and the supplemental requirements below.
      1) O&M manual Shall be developed and submitted in Phases to match the overall construction sequence to ensure the City does not have to operate some facilities without a manual (before the entire project is complete) with one final complete O&M manual submitted at the end of the project.
   b. The O&M manuals shall include the following:
      1) Name, address, and telephone number of the control system supplier's local service representative.
      2) Complete list of supplied system hardware parts with full model numbers referred to system part designations, including spare parts and test equipment provided.
      3) Copy of all approved submittal information and system shop drawings as specified herein with corrections made to reflect the actual system as tested and delivered to the site for installation. Half-size black line reproductions shall be provided for all shop drawings larger than 11x17 inches.
      4) Manufacturer's Original Copies of Hardware, Installation, Assembly, Programming, and Operations Manuals for all control system components. Manuals shall include the following information:
         a) General descriptive information covering the basic features of the equipment.
         b) Physical description covering layout and installation requirements and all environmental constraints.
         c) Standard technical documentation covering the procedures for programming, start-up, and shutdown of the PLC equipment including instruction set descriptions and programming procedures.
         d) Principles of operation explaining the logic of operation; provide information covering operation to a component level.
         e) Maintenance procedures covering checkout, troubleshooting, and servicing; checkout procedures shall provide the means to verify the satisfactory operation of equipment, troubleshooting procedures shall serve as a guide in determining faulty components, and servicing procedures shall cover requirements and recommended time scheduled for calibration, cleaning, lubrication, and other housekeeping and preventive maintenance procedures.
         f) Wiring, schematic, and logic diagrams.
         g) Safety considerations relating to operation and maintenance procedures.
         h) Manufacturer’s recommended spare parts list with model numbers.
      5) A detailed description of the operation of the HMI including all appropriate displays. Including a screenshot of each HMI display screen and annotating each function in text is an acceptable format for presenting this information.
      6) Step-by-step procedures for starting up or shutting down an individual component of the control system and also of the entire system.
      7) Login / logout procedures.
      8) Complete, step-by-step procedures for printing reports and entering manual data.

9) Complete, step-by-step procedures for performing system or selected file backup and restoration including archiving historical data. Include recommended archiving schedule for historical data.
10) Operational description for operating HMI computer equipment and peripherals including printers, CD-ROMs, removable bulk storage devices, UPS, etc. Description shall include procedures for typical maintenance and troubleshooting tasks.
11) A complete glossary of terms and definitions of acronyms.
12) List of personnel to be contacted for warranty and emergency services, including name, address, telephone number, pager or cell phone number, fax number, and email address.
13) All O&M Manuals shall be tailored for the project by indicating all options or accessories provided and/or deleting or crossing out non-applicable options or information.
14) The O&M Manuals shall be printed on heavy, first quality paper. Large manuals shall be submitted in D ring type (1 ½" max) binders with a table of contents and index tabs to identify the various devices. The table of contents shall reference the applicable Specification Section(s) for each item and shall be included in each volume of multi-volume manuals. Comply with the requirements of Section 01 78 33, Operation and Maintenance Data.

4. Record Drawings and Documentation:
   a. Contractor and system supplier shall revise all system shop drawings and submittals to reflect as-built conditions in accordance with the requirements of Section 01 33 00 – Submittals, and the Contract Documents.

1.8 REFERENCE STANDARDS

A. Instrumentation equipment, materials and installation shall comply with the National Electrical Code NEC and with the latest edition of the following codes and standards:

1. National Electrical Safety Code (NESC)

2. Occupational Safety and Health Administration (OSHA)

3. National Fire Protection Association (NFPA)

4. National Electrical Manufacturers Association (NEMA)

5. American National Standards Institute (ANSI)

6. Insulated Cable Engineers Association (ICEA)

7. Instrument Society of America (ISA)

8. Underwriters Laboratories (UL)

9. Factory Mutual (FM)

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

C. All material and equipment for which a UL standard exists, shall bear a UL label. No such material or equipment shall be brought onsite without the UL label affixed. All the Surge Protective devices (SPD) provided under this contract shall comply with UL 1449 third edition.

D. If the issue of priority is due to a conflict or discrepancy between the provisions of these Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents will take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization, or association, or between Laws and Regulations, the higher performance requirement shall be binding on the Contractor, unless otherwise directed by the Owner/Owner's Representative.

E. In accordance with the intent of the Contract Documents, the Contractor accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time nor limit in any way the Contractor's responsibility to comply with all Laws and Regulations at all times.

1.9 HAZARDOUS AREAS

A. Equipment, materials, and installation in areas designated as hazardous on the Drawings shall comply with NEC Articles 500, 501, 502 and 503.

B. Equipment and materials installed in hazardous areas shall be UL listed for the appropriate hazardous area classification.

C. Unless otherwise specified herein or shown on the Drawings, enclosures and associated installations shall have the following ratings:

1. NEMA 12 for dry, non-process indoor above grade locations (i.e. administration areas, laboratories, control rooms, storage rooms).

2. NEMA 7 (and listed for use in the area classifications shown) for "Class I Div. 1 Group D" and "Class I Div. 2 Group D" hazardous locations shown on the Drawings.

3. NEMA 4X 304 Stainless steel enclosures shall be provided where specifically designated herein or specifically shown on the Drawings.

4. NEMA 4X 316 Stainless Steel enclosures shall be provided for all other locations on the project.

1.10 CODES, INSPECTION AND FEES

A. Equipment, materials, and installation shall comply with the requirements of the local authority having jurisdiction.

B. Contractor shall obtain all necessary permits and pay all fees required for permits and inspections.

1.11 TESTS AND SETTINGS

A. Test systems and equipment furnished under Division 40 and repair or replace all defective work. Make adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

B. Prior to energizing electrical equipment, control panels, or field instruments, make all tests as required by the individual specification sections, and submit the required test reports and data to the Owner/Owner’s Representative for approval.

C. Mechanical inspection shall be performed, including testing, and setting of circuit breakers. Prior to operation.

D. Check interlocking, control, and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by schematic and wiring diagrams.

E. Testing shall be scheduled and coordinated with the Owner/Owner’s Representative at least two weeks in advance. Provide qualified test personnel, instruments, and test equipment.

F. Refer to the individual equipment sections for additional specific testing requirements.

G. Make adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

H. Testing and training to be provided in phases as various process areas are brought online.

1.12 SIZE OF EQUIPMENT

A. Investigate each space in the structure through which equipment must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.

B. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to ensure that the tilting does not impair the functional integrity of the equipment.

1.13 RECORD DRAWINGS

A. As the work progresses, legibly record all field changes on a set of Project Contract drawings, hereinafter called the "Record Drawings". The Record Drawings and Specifications shall be kept up to date throughout the project.

B. Record Drawings shall accurately show the installed condition of the following items:

1. Equipment and devices.

2. Control Panels.

3. Pumps and valves.

C. Submit a typical example of a schedule of control wiring raceways and wire numbers, including the following information:

1. Circuit origin, destination, and wire numbers.

2. Field wiring terminal strip names and numbers.

D. As an alternate, submit a typical example of point-to-point connection diagrams showing the same information, may be submitted in place of the schedule of control wiring raceways and wire numbers.

E. Submit the record drawings and the schedule of control wiring raceways and wire numbers (or the point-to-point connection diagram) to the Owner/Owner's Representative.

F. The Contractor's retainage shall not be paid until the point-to-point connection diagrams have been furnished to the Owner/Owner's Representative.

1.14 EQUIPMENT INTERCONNECTIONS

A. Review shop drawings of equipment furnished under other related Divisions and prepare coordinated wiring interconnection diagrams or wiring tables. Submit copies of wiring diagrams or tables with Record Drawings.

B. Furnish and install all equipment interconnections.

1.15 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new.

B. Material and equipment of the same type shall be the product of one manufacturer and shall be UL listed.

C. All hardware for mounting boxes and equipment, such as racks, brackets, washers, springs, nuts, etc., shall be of 316 stainless steel.

D. The Contractor shall be responsible for all material, product, equipment, and workmanship being furnished for the duration of the project. The Contractor shall replace any furnished equipment if it does not meet the Contract Documents.

E. Warrant all equipment furnished under Division 40 in accordance with Division 1. Refer to individual equipment sections for additional warranty items. Unless otherwise specified, the Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 3 years from date of final acceptance of the equipment by Owner. Within such period of warranty, the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the Manufacturer at no expense to the Owner.

1.16 DELIVERY, STORAGE AND HANDLING

A. Equipment and materials shall be handled and stored in accordance with the manufacturer's instructions, and as specified in the individual Specification Sections.

1.17 EQUIPMENT IDENTIFICATION

A. Identify equipment (disconnect switches, control stations, etc.) furnished under Division 40 with the name of the equipment it serves. Control Panels, Instruments, Junction or Terminal boxes, etc., shall have nameplate designations as shown on the Drawings.

B. Nameplates shall be engraved, laminated impact acrylic, black lettering on a white background, matte finish, not less than 1/16-in thick by 3/4-in by 2-1/2-in, Rowmark 322402. Nameplates shall be 316 SS screw mounted to all enclosures except for NEMA 4 and 4X.

C. Nameplates for NEMA 4 and 4X enclosures shall be attached with double faced adhesive strips, TESA TUFF TAPE 4970, .009 x ½", no equal. Prior to installing the nameplates, the metal surface shall be thoroughly cleaned with 70% alcohol until the metal surface residue has been removed. Epoxy adhesive or foam tape is not acceptable.

PART 2 PRODUCTS

2.1 GENERAL

A. All instrumentation and electronic equipment shall be of the manufacturer's latest design, utilizing printed circuitry and epoxy or equal coating to prevent contamination by dust, moisture, and fungus. The field mounted equipment and system components shall be de-signed for installation in dusty, humid, and slightly corrosive service conditions.

B. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks unless otherwise noted. Fasteners for securing control panels and enclosures to walls and floors shall be either hot-dipped galvanized after fabrication or stainless steel. Provide stainless steel fasteners only in corrosive areas rated NEMA 4X on the plan drawings. Provide minimum size anchor of 3/8-inch.

C. All indicators shall be linear in process units, unless otherwise noted. All transmitters shall be provided with indicators in process units, accurate to two percent or better.

D. All equipment, cabinets and devices furnished shall be heavy-duty type, designed for continuous industrial service. The system shall contain similar products of a single manufacturer, and shall consist of equipment models, which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.

E. All electronic/digital equipment shall be provided with radio frequency interference protection.

F. Electrical:

1. Equipment shall operate on a 60 Hertz alternating current power source at a nominal 120 volts, plus or minus 10 percent, except where specifically noted. Regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

2. With the exception for field device network connected devices, all electronic instrumentation shall utilize linear transmission signals of isolated 4 to 20 mA VDC (milliampere direct current) capable of driving a load up to 750 ohms, unless specified

otherwise. However, signals between instruments within the same panel or cabinet may be 1-5 VDC (volts direct current).

3. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero-based signals will be allowed.

4. All switches shall have double-pole, double-throw contacts rated at a minimum of 600 VA, unless noted otherwise.

5. Switches and/or signals indicating an alarm, failure or upset condition shall be wired in a fail-safe manner. A fail-safe condition is an open circuit when in an alarm state.

6. Materials and equipment shall be UL approved whenever such approved equipment and materials are available.

7. All equipment furnished shall be designed and constructed so that in the event of power interruption, the systems specified herein shall go through an orderly shutdown with no loss of memory and shall resume normal operation without manual resetting when power is restored, unless otherwise noted.

2.2 ELECTRICAL SURGE PROTECTION

A. General - Surge protection shall be provided to protect the electronic instrumentation system from induced surges propagating along the signal and power supply lines from lightning, utility, or the plant electrical system. The protection systems shall be such that the protective level shall not interfere with normal operation but shall be lower than the instrument surge withstand level. Protection shall be maintenance free and self-restoring. Devices shall have a response time of less than 50 nanoseconds and be capable of handling a discharge surge current (at an 8x20µs impulse waveform) of at least 8 kA. Ground wires for all instrumentation device surge protectors shall be connected to a low resistance ground in accordance with specification section 25 05 26.

B. Provide protection of all analog signal (4-20 mA) circuits where any part of the circuit is outside of the building envelope. Circuits shall be protected at both the transmitter and the control system end of the circuit. Protection devices located near the transmitter shall be mounted in a separate NEMA 4X 316 stainless steel enclosure with quarter turn latch (plastic is not acceptable) or conduit mounted; and shall be Phoenix Contact PT Series, MTL Surge Technologies (Telematic) TP48, Citel TSP-10 series, EDCO or equal. Substitution of a single device to protect both 120 VAC and 4-20 mA wires to an instrument is acceptable. Protection devices in control panels shall be MTL Surge Technologies (Telematic) SD Series, Phoenix Contact PT Series, Citel DLA series, or equal.

C. Provide protection of all 120 VAC power feeds into control panels, instruments, and control room equipment. Surge arresters shall be Transtector ACP-100BW Series, Phoenix Contact "Mains-PlugTrab", MCG Surge Protection 400 Series, Citel DS40 series, or equal.

D. Inductive Loads – Provide coil surge suppression devices, such as varistors or interposing relays, on all process controller outputs or switches rated 120 VA or less that drive solenoid, coil, or motor loads.

PART 3 EXECUTION

3.1 EQUIPMENT PADS AND SUPPORTS

A. Instrumentation equipment pads and supports, of concrete or steel, are shown on the Structural Drawings.

3.2 INSTALLATION

A. Any work not installed according to the Drawings and this Section shall be subject to change as directed by the Owner/Owner's Representative. No extra compensation will be allowed for making these changes.

B. Instrumentation equipment shall be protected at all times against mechanical injury or damage by water. Instrumentation equipment shall not be stored outdoors. Instrumentation equipment shall be stored in dry permanent shelters. Do not install instrumentation equipment in its permanent location until structures are weather-tight. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and tested as directed by the Owner/Owner's Representative or shall be replaced at no additional cost at the Owner/Owner's Representative's direction.

C. Equipment that has been damaged shall be replaced or repaired by the equipment manufacturer, at the Owner/Owner's Representative's direction.

D. Repaint any damage to the factory applied paint finish using touch-up paint furnished by the equipment manufacturer. If the metallic portion of the panel or section is damaged, the entire panel or section shall be replaced, at no additional cost to the Owner.

3.3 MANUFACTURER'S SERVICE

A. Provide manufacturer's services for testing and start-up of the equipment as listed in each individual Specification Section.

B. Testing and startup shall not be combined with training. Testing and start-up time shall not be used for manufacturer's warranty repairs.

3.4 TESTING - GENERAL

A. Results of testing shall be tracked on a project specific status sign off form or similar document. The PCSS shall be responsible for maintaining the sheet.

B. Tests the PCSS, AESS and Equipment Vendor is required to perform are as follows:

1. Factory Testing:
   a. Unwitnessed Factory Testing (UFT)
   b. Witnessed Factory Test (WFT)

2. Field Testing:
   a. Operational Readiness Test (ORT).
   b. Functional Demonstration Test (FDT).
   c. 30-Day Site Acceptance Tests (SAT)

C. Field testing shall be performed when a specific process area has been completely installed, including, but not limited to, process equipment, MCC, instrumentation, local control panels, SCADA PLC/RIO control panel, and associated SCADA HMI screens. The following process areas shall be tested as a whole. Further test consolidation may be possible based on construction progress:

1. Lift Pump Station & Grit Removal-LCP-0330 (PLC-0300)

2. Electrical Building No. 1 PLC for Generator, Bar Screen (LCP-0300 & LCP-0310), and Aeration blower (PLC-1410)

3. Chemical Dosing (PLC-1100)

4. Clarifier No. 1 & No. 2 & RAS/WAS Pump (PLC-0510)

5. Electrical Building No. 2 PLC for UV disinfection (ICA-200) and Sludge Blower (PLC-1420)

6. Screw Press No.1 (LCP-1001)

7. Screw Press No. 2 (LCP-1002)

8. Fiter No. 1 (LCP-0610)

9. Filter No. 2 (LCP-0620)

D. The Engineer and City representative shall be given the option of witnessing each test. Testing shall be coordinated to be executed for multiple pieces of equipment in a given process area at the same time.

E. Each test shall be in the cause-and-effect format. The person conducting the test shall initiate an input (cause) and, upon the system's or subsystem's producing the correct result (effect), the specific test requirement shall be satisfied.

F. All tests shall be conducted in accordance with prior Owner’s Representative approved procedures, forms, and check lists. Each specific test shall be described and followed by a section for sign off by the appropriate party after its satisfactory completion.

G. Copies of these sign off test procedures, forms, and check lists will constitute the required test documentation.

H. The PCSS shall provide all special testing materials and equipment. Wherever possible, perform tests using actual process variables, equipment, and data. Where it is not practical to test with real process variables, equipment, and data, provides suitable means of simulation. Define these simulation techniques in the test procedures.

I. The General Contractor shall require the PCSS to coordinate all testing with the Owner’s Representative, all affected Subcontractors, and the Owner.

J. The Owner’s Representative reserves the right to test or retest all specified functions whether or not explicitly stated in the prior approved Test Procedures.

K. The Owner's Representative's decision shall be final regarding the acceptability and completeness of all testing.

L. No equipment shall be shipped until the Owner's Representative has received all the test results and approved the system is ready for shipment.

M. The PCSS shall furnish the services of servicemen, all special calibration and test equipment and labor to perform the field tests.

N. Correction of Deficiencies

1. All deficiencies in workmanship and/or items not meeting specified testing requirements shall be corrected to meet specification requirements at no additional cost to the Owner.

2. Testing, as specified herein, shall be repeated after correction of deficiencies is made until the specified requirements are met. This work shall be performed at no additional cost to the Owner.

3.5 UNWITNESSED FACTORY TEST (UFT)

A. The purpose of UFT is for PCSS and AESS to check system prior to Engineer and/or Owner attending factory testing. This type of testing is part of any quality firm's internal QA/QC procedures.

B. Temporary network connections are required to confirm the network configuration. Temporary wiring of primary elements, final control elements, and field-mounted transmitters is not required.

C. Hardware to be tested includes all control system devices shown on System Architecture drawings and provided by PCSS.

D. Perform these test but not limited to the following. Address each of these rest in the Test procedure Submittal.

1) All panels and enclosures provided to undergo a thorough inspection to verify integrity of cabinet enclosures, frame structures, paint work and finish, etc. Review panel drawings to ensure they accurately reflect panel layout and wiring.

2) Perform a system audit to verify all components have been staged for test and have been documented properly with correct model numbers, serial numbers, etc. Prove documentation of audit at factory test and submit as part of O&M Manual Documentation:

a) For each workstation and server, list of all software installed (including the operating system), with software revision number, software improvement modules or patches installed, license number and owner registration information, warranty period, vendor and local distributor names and contacts.

b) For each microprocessor-based component connected to control communication backbone in system (PLCs, managed switches, protocol converters, communication cards on final field devices, radios, etc.), list firmware revision, vendor and local distributor information, and system, warranty information, configuration parameters (e.g., communication settings, fail position settings, etc.)

3) Perform panel wire pull tests to ensure all wiring has been connected with appropriate torque to prevent wires from coming loose.
4) Test UPS to verify UPS switch power correctly while keeping all UPS powered loads online. Perform testing of UPS to determine if they have been sized correctly to maintain specified run time during field testing.
5) Perform a 100 percent I/O point checkout to verify proper operation of input/output points from panel terminations to HMI nodes. At a minimum, I/O checkout consists of four steps.
    a) Jumper discrete input signals at field terminal blocks in control panels to verify proper status in HMI nodes.
    b) Connect analog input signals to a signal generator at field terminal blocks in control panels to verify proper status in HMI nodes and verify signals are at zero percent, 50 percent, and 100 percent of full scale.
    c) Test discrete output signals by switching equipment to manual control at HMI nodes and turning the output on or other means to turn the output on. Then verify the output is on by connecting a digital multimeter to measure continuity at terminations, thus verifying command from PLC has properly executed contact closure.
    d) Test analog output signals by switching the equipment to manual control at HMI nodes and turning output on or other means to turn the output on. Then verify output by utilizing a digital multimeter to measure current or voltage generated at termination points.
6) Verify all control strategies using simulation or other means to verify logic performs as expected. Verify faults and logical failure conditions for control strategies such instrument failures, equipment failures, loss of communication between HMI Server and PLC, loss of peer-to-peer communication, out of range testing (over and under scale) for analog inputs, and all other strategies specified in control strategy document.
7) For each hardware enclosure, include with inspection, but not be limited to, cabinet enclosures, frame structure, paint work and finish, dimensions, and hardware operability (i.e., fans, door hinges, keylocks, etc.).
8) For each subpanel, include with inspection, but not be limited to, I/O subsystem physical layout, power supply sizing and mounting, cable routing, wire runs across hinges properly installed, fans and blowers unobstructed and mounted to maximize air flow, power conditioning correctly installed, and overall layout and installation of components meets manufacturer's recommendations and standard industry accepted practices.
9) All other control panel circuitry.
10) Perform the following systems tests:
    a) Demonstrate ability to share data between operator workstations and servers.
    b) Demonstrate ability of each workstation to print reports on all designated report printers.
    c) Demonstrate ability for each workstation to read and write designated files from servers and other workstations on the network.
    d) Demonstrate operability of all back-up and mass storage equipment.
    e) Demonstrate communication failure and recovering self-healing ring testing.
    f) Demonstrate total power failure and recovery. Remove the UPS for this test.
    g) Demonstrate capabilities of the historical server.
    h) Demonstrate failover capabilities of the redundant HMI servers.

E. Upon successful completion of UFT, PCSS to submit a record copy of test results as specified in PART 1. As part of this test results submittal, notify Engineer and Owner in writing that system is ready for WFT. No other notice of Factory test will be accepted. Engineer and/or Owner to schedule a test date within 30 days of receipt of this submittal.

3.6 WITNESSED FACTORY TEST (WFT)

A. Before scheduling the Witnessed Factory Test, the PCSS must determine through his own test and quality assurance program that the equipment is ready for shipment to the jobsite.

B. All system tests specified for the Unwitnessed Factory Test shall be repeated. The WFT will be conducted at the PCSS's facility with the Engineer and City personnel present.

C. After receiving Unwitnessed Factory Test approval, the PCSS shall notify the Engineer and Owner in writing that the system is ready for the Witnessed Factory Test. The Engineer and/or Owner shall schedule a test date within 30 days of receipt of the "Ready to Test" letter. At the time of notification, the PCSS shall submit any revisions to the detailed test procedure previously approved by the Engineer.

D. The purpose of the test shall be to verify the functionality, performance, and stability of the hardware and software. The system must operate continuously for 100 hours without failure before the test shall be judged successful. Successful completion of this test, as determined by the Engineer, shall be the basis for approval of the system to be shipped to the site.

E. The various tests performed during the Witnessed Factory Test shall be designed to demonstrate that hardware and software fulfill all the requirements of the Specifications and Contract drawings. The test conditions shall resemble, as closely as possible, the actual installed conditions. Any additional hardware or software that may be required to successfully verify system operation shall be supplied at no cost to the Owner.

F. Tests to be performed shall include, but not be limited to, the following:

1. Demonstrate operability of all equipment.

2. Demonstrate operability of the control data communication network under anticipated full load conditions.

3. 100 percent point check of I/O, including wiring.

4. Demonstrate the ability to monitor and change all digital and analog data in each PLC/RIO from the HMI software at all operator workstations.

5. Demonstrate the ability to share data between operator workstations and servers

6. Demonstrate the ability for each workstation to read and write to and from designated files from other workstations on the LAN.

7. Demonstrate the operability of all mass storage equipment.

8. Demonstrate communication failure and system restart.

9. Demonstrate total power failure and recovery. NOTE: The UPS shall be removed for this test.

10. Demonstrate a catastrophic failure and recovery of a server, workstation, and PLC.

11. Demonstrate procedure for backing up the computer system (including PC and PLC); reload using a backup; and completely restoring a PC and/or PLC from a backup.

12. Demonstrate the ability of each workstation to print alarm/events on the local printer.

G. During the test the Engineer's and/or Owner's representative shall have unrestricted access to the system with supervision/demonstration by the PCSS.

H. All analog control panels shall be included in these tests.

I. All deficiencies identified during these tests shall be corrected and retested prior to completing the Witnessed Factory Test as determined by the Owner/Engineer.

J. The following documentation shall be made available to the Engineer at the test site both before and during the Witnessed Factory Test:

1. All Contract Drawings and Specifications, addenda, and change orders.

2. Master copy of the test procedure.

3. List of the equipment to be tested including make, model, and serial number.

4. Design-related hardware submittal applicable to the equipment being tested.

5. Software license.

K. The daily schedule during these tests shall be as follows:

1. Morning meeting to review the day's test schedule.

2. Scheduled tests and signoffs.

3. Evening meetings to review the day's test results and to review or revise the next day's test schedule.

4. Unstructured testing period by the witnesses.

L. All test data and procedures followed during testing shall be logged and certified copies of the logs shall be provided to the Engineer and Owner.

M. All costs associated with the Factory Testing, including travel, lodging, car rental, and food for two of the Engineer's and/or Owner's representatives, shall be the responsibility of the Contractor and shall be included in the contract price. Travel for the Engineer and owner shall be via non-stop flight, originating and terminating at the Dallas/Fort Worth International Airport in Dallas, Texas.

3.7 FIELD TESTING - OPERATIONAL READINESS TEST (ORT)

A. Prior to startup and the Functional Demonstration Test, the entire system shall be certified (inspected, tested, and documented) that it is READY for operation. The PCSS shall conduct an Operational Readiness Test (ORT) including coordination with the Contractor.

B. Loop/Component Inspections and Tests: The entire system shall be checked for proper installation, calibrated, and adjusted on a loop-by-loop and component-by-component basis to ensure that it is in conformance with related submittals and these Specifications. Signal generated during ORT shall be from the initiating device, control panel, PLC, or LCP as appropriate, without jumping wires, lifting wires, or inducing signals using signal generators. Simulation of signals will be allowed only when the initiating component cannot be physically testing without being subjected to the designed process conditions. Examples include RTD within motor windings and vibration sensors.

1. The PCSS shall conduct the Loop/Component Inspections and Tests using Owner's Representative approved forms and check lists.
   a. Each loop shall have a Loop Status Report to organize and track its inspection, adjustment, and calibration. These reports shall include the following information and check off items with space for sign off by the Integration Subcontractor:
      1) Project Name
      2) Loop Number
      3) Tag Number for each component
      4) Check offs/sign offs for each component
   b. Tag/identification.
   c. Installation.
   d. Termination – wiring.
   e. Termination – tubing.
   f. Calibration/adjustment – Check offs/sign offs for the loop.
   g. Panel interface terminations.
   h. I/O interface terminations.
   i. I/O signal operation.
   j. Inputs/outputs operational: received/sent, processed, and adjusted.
   k. Total loop operation – Provide space for comments.
   l. Each active Analog Subsystem element and each I/O module shall have a Component Calibration Sheet. These sheets shall have the following information, spaces for data entry, and a space for sign off by the Integration Subcontractor:
      1) Project Name
      2) Loop Number
      3) Component Tag Number of I/O Module Number
      4) Component Code Number Analog System
      5) Manufacturer (for Analog system element)
      6) Model Number/Serial Number (for Analog system)
      7) Summary of Functional Requirements:
         a) Indicators and Recorders: Scale and chart ranges
         b) Transmitters/Converters: Scale and chart ranges
         c) Computing Elements: Function
         d) Controllers: Action (direct/reverse) control Modes (PID)
         e) Switching Elements: Unit range, differential
         f) (FIXED/ADJUSTABLE), Preset (AUTO/MANUAL)
         g) I/O Modules: Input or output

2. The PCSS shall perform all calibrations:
   a. Analog Devices: Required and actual inputs and outputs at 0, 50, and 100 percent of span, rising and falling.
   b. Discrete Devices: Required and actual trip points and reset points
   c. Controllers: Mode settings (PID)
   d. I/O Modules: Required an actual inputs or outputs for 0, 50, and 100 percent of span, rising and falling.
      1) Provide space for comments.
      2) Space for sign off by the Integration Subcontractor.

3. The General Contractor shall require the PCSS to maintain the Loop Status Reports and Component Calibration Sheets at the jobsite and make them available to the Owner's Representative/Owner at any time.

4. The Engineer and City representative shall be given the option of witnessing the testing. The Engineer and Owner's Representative shall review and initial all Loop Status Sheets and Component Calibration Sheets and spot-check their entries periodically and upon completion of the Operational Readiness Test. Any deficiencies found shall be corrected.

5. Finalization of the ORT will take place during the FDT. Each process area sub system shall have an ORT performed to be ready for the FDT. The Items that will be not be able to be tested during the construction will be communicated or interconnecting values from other process areas.

3.8 FUNCTIONAL DEMONSTRATION TEST (FDT)

A. Prior to startup and the 30-Day Test, the entire installed instrument and control system shall be certified that it is ready for operation. All preliminary testing, inspection, and calibration shall be complete as defined in the Operational Readiness Tests. The FDT will be a joint test by the PCSS, AESS, Equipment Suppliers, Engineer and City representative.

B. Once the facility has been started up and is operating, a witnessed Functional Demonstration Test shall be performed on the complete system to demonstrate that it is operating and in compliance with these specifications. Each specified function shall be demonstrated on a paragraph-by-paragraph, loop-by-loop, and site-by-site basis.

C. Loop-specific and non-loop-specific tests shall be the same as specified under Functional Demonstration Tests except that the entire process area shall be tested and all functionality demonstrated.

D. Updated versions of the documentation specified to be provided for during the factory tests shall be made available to the Owner's Representative at the job-site both before and during the tests. In addition, one (1) copy of all O&M Manuals shall be made available to the Owner's Representative at the job-site both before and during testing.

E. The daily schedule specified to be followed during the factory tests shall also be followed during the Functional Demonstration Test.

F. The system shall operate for 100 continuous hours without failure before this test shall be considered successful.

G. Demonstrate communication failure and recovery for the process area.

3.9 30-DAY SITE ACCEPTANCE TEST (SAT)

A. After completion of the Operational Readiness, startup and Functional Demonstration Tests, the City shall be responsible for operation of the entire process area (for example Pretreatment) for a period of 30 consecutive days, under conditions of process area operation, without a single non-field repairable malfunction. The AESS/PCSS required to complete final PID Tuning at the commencement of the SAT test/startup of process flow.

B. The 30 day SAT and 7 day Acceptance Test shall start at the same time. The SAT shall continue after completion of the Acceptance Test, until the full 30 days is complete.

C. While the 30 day SAT is in progress, construction for other process areas shall continue based on the approved construction schedule requirements.

D. Partial Substantial Completion milestone shall be granted after completion of SAT.

E. During this test, plant operating and PCSS personnel shall be present as required. For this test, the PCSS is expected to provide personnel who have an intimate knowledge of the system hardware and software.

F. While this test is proceeding, the Owner shall have full use of the system. Only plant operating personnel shall be allowed to operate equipment associated with live plant processes.

G. Any malfunction during the tests shall be analyzed and corrected by the Integration Sub-contractor. The Owner and/or Owner's Representative will determine whether any such malfunctions are sufficiently serious to warrant a repeat of this test.

H. During this 30 consecutive day test period, any malfunction which cannot be corrected within 24 hours of occurrence by Integration Subcontractor personnel, or more than two similar failures of any duration, will be considered a non-field-repairable malfunction.

I. Upon completion of repairs by the Integration Subcontractor, the test shall be repeated as specified herein.

J. In the event of rejection of any part or function, the Integration Subcontractor shall per-form repairs or replacement within 90 days.

K. The total availability of the system shall be greater than 99.5 percent (99.5%) during this test period. Availability shall be defined as:

L. Availability = (Total Testing Time - Down Time) / Total Testing Time

M. Down times due to power outages or other factors outside the normal protection devices or back-up power supplies provided shall not contribute to the availability test times above.

CALIBRATION CERTIFICATE SAMPLE

Tag Number/Loop Number: _____
Loop Description: _____

Instrument Location: _____
Manufacturer: _____
Model Number: _____
Adjustable Range: _____
Calibrated Range: _____
Remarks: _____

Installation Per Manufacturer's Requirements? Yes No
Installation Per Contract Documents? Yes No
If "No", explain: _____

Calibration Test:

Input (Units)	Output (Units)		Accuracy
0%	_____	_____	_____
25%	_____	_____	_____
50%	_____	_____	_____
75%	_____	_____	_____
100%	_____	_____	_____

Switch Test:

	Switch Point Setting	Deadband	Upscale	Switch Point Downscale
Setpoint 1	_____	_____	_____	_____
Setpoint 2	_____	_____	_____	_____
Setpoint 3	_____	_____	_____	_____

I hereby certify that the above information is correct and accurate, to the best of my knowledge, and that the instrument indicated above has been supplied, installed, calibrated, and tested in accordance with the manufacturer's recommendations and the Contract Documents, unless otherwise noted.

Receipt of this Calibration Certification shall in no way imply acceptance of any work or instrument supplied as a part of this Contract.

Contractor's Signature: _____ Date: _____

PART 4 TRAINING

4.1 GENERAL

A. The cost of the training programs shall be included in the Contract price. The training and instruction shall be directly related to the system being supplied. The training program shall represent a comprehensive program covering all aspects of the operation and maintenance of the system.

B. All training schedules shall be coordinated with and at the convenience of the OWNER. Shift training may be required to correspond to the OWNER'S working schedule.

C. All onsite instructors must be intimately familiar with the operation and control of the OWNER'S facilities.

D. Provide detailed training manuals to supplement the training courses. The manuals shall include specific details of equipment supplied and operations specific to the project. The manuals shall be provided in hardcopy for each student. Provide electronic copy of each training manual in PDF format for OWNER'S future use.

E. The trainer shall make use of teaching aids, manuals, slide/video presentations, etc. After the training services, all training materials shall be delivered to the OWNER.

4.2 TRAINING SUMMARY

A. The following training courses listed in the summary table shall, as a minimum, be provided by the PCSS in phases to account for phased startup.:

Description	Minimum Course Duration (hours)	Number of Times Course to be Given	Intended Audience
Lift Pump Station (PLC-0300) - SCADA Instruments and Control Panel hardware	2	1	Maintenance
Chemical Dosing (PLC-1100)- SCADA Instruments and PLC Control Panel hardware	2	1	Maintenance
Generator, Bar Screen, and Aeration Blower (PLC-1410)- SCADA Instruments and PLC Control Panel hardware	2	1	Maintenance
Clarifier No. 1 & No. 2 & RAS/WAS Pump (PLC-0510) -SCADA Instruments and PLC Control Panel hardware	2	1	Maintenance
Electrical Building No. 2 PLC for UV Disinfection and Sludge Blower (PLC-1420) - SCADA Instruments and PLC Control Panel hardware	2	1	Maintenance

B. The following training courses listed in the summary table shall, as a minimum, be provided by the AESS in phases to account for phase starts:

Description	Minimum Course Duration (hours)	Number of Times Course to be Given	Intended Audience
SCADA HMI – Operator Screens functions, Screenshots, Alarming, Historian, and	8	1	Operations

functionality of SCADA PLCs for all process areas			

C. Definitions of audience roles

1. Maintenance - personnel responsible for maintaining the PCS and instrumentation system.

2. Operations - personnel responsible for daily plant operations.

4.3 ONSITE TRAINING

A. Training personnel shall be intimately familiar with the control system equipment, its manipulation, and configuration. Training personnel shall command knowledge of system debugging, program modification, troubleshooting, maintenance procedure, system operation, networking equipment, and programming, and shall be capable of transferring this knowledge in an orderly fashion to technically oriented personnel.

B. The OWNER shall have the option of scheduling training for a specific process area with both the PCSS and vendor equipment suppliers during the same or successive training sessions. The PCSS shall coordinate with the OWNER and vendor equipment suppliers on available schedule and training agenda.

C. Installed Control System Training

1. Training and instruction shall be specific to the system that is being supplied.

2. Training shall consist of classroom instructions and hands-on instruction utilizing the OWNER'S system.

3. Detailed training shall be provided on the actual configuration and implementation for this Contract. Training shall cover all aspects of the system that will allow the OWNER'S personnel to maintain, modify, troubleshoot, and develop future additions/deletions to the system. The training shall cover the following subjects, as a minimum:
   a. System overview.
   b. System hardware components and specific equipment arrangements.
   c. Control strategies, sequence of operation, alarming.
   d. Periodic maintenance.
   e. Troubleshooting and diagnosis.
   f. Network configuration, communications, and operation.
   g. TCP/IP addressing procedures for all Ethernet devices.

D. Instrument Manufacturer and Familiarity Training

1. Manufacturer instrument training shall be provided for those instruments where specifically indicated in the Instruments section. This shall be on-site training provided by an authorized representative of the manufacturer. The manufacturer's representative shall be fully knowledgeable in the operation and maintenance of the equipment.

2. Manufacturer and PCSS shall provide operator level instruction on the use of the field and panel instrumentation for the OWNER'S operations staff. This training shall take place at the OWNER'S facility. Include hands on demonstration of the information each transmitter

indicates, and the method used to retrieve any operator information from the transmitter, including use of pushbuttons and interpretation of international graphic symbols used on the instruments

E. Instrument Training

1. The PCSS shall Provide instruction on the maintenance of the field and panel instrumentation for the OWNER'S instrumentation technicians. This training shall be conducted before the FDT, but no more than 1 month before and at a time suitable to the OWNER. This training shall take place at the OWNER'S facility. As a minimum the following shall be included:
   a. Training in standard hardware maintenance for the instruments provided.
   b. Specific training for the actual instrumentation configuration to provide a detailed understanding of how the equipment and components are arranged, connected, and set up for this Contract.
   c. Test, adjustment, and calibration procedures.
   d. Troubleshooting and diagnosis.
   e. Periodic maintenance.

END OF SECTION

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SECTION 40 66 00 NETWORK MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Materials and equipment used in process control and LAN networks including:
   a. Network switches.
   b. Media converters.
   c. Routers.
   d. Patch panels and other data network hardware.
   e. Fiber Optic Cables
   f. Related accessories.

B. Related sections:

1. The Contract Documents are complementary; what is called for by one is as binding as if called by all.

2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. As specified in Section 40 61 00.

B. Institute of Electrical and Electronics Engineers (IEEE):

1. 802.3 - Ethernet.

2. 802.11 - Wireless LANs.

1.03 DEFINITIONS

A. As specified in Section 40 61 00.

1.04 SYSTEM DESCRIPTION

A. Provide all network equipment identified in the Contract Documents.

1.05 SUBMITTALS

A. Furnish submittals as specified in Sections 01 33 00 and 40 61 00.

B. Product data:

1. Include information on all test equipment.

2. Manufacturer's operation and installation instructions.

C. Shop drawings:

1. Complete set of drawings including but not limited to:
   a. System block diagram showing relationship and connections between devices provided under this Contract and existing equipment. Include manufacturer and model information, and address settings.
   b. Network riser diagram.
   c. Network port diagram, which physically locates all ports within the facility, and identifies their patch panel and switch port.
   d. Construction drawings for all equipment cabinets, including dimensions, identification of all components, preparation and finish data, and nameplates.
   e. Electrical connection diagrams.
   f. Complete grounding requirements.

2. Furnish data sheets for each component together with a technical product brochure or bulletin:
   a. Manufacturer's model number.
   b. Project equipment tag.

3. Complete and detailed bills of materials broken up by each cabinet. Each bill of material item will include the following:
   a. Quantity.
   b. Description.
   c. Manufacturer.
   d. Part numbers.

D. Test reports:

1. As specified in Section 40 61 00 and noted in this Section.

2. Signed test results as described in this Section.

3. Test results shall include:
   a. Narrative describing the test procedures followed.
   b. Block diagram of test set up.
   c. Manufacturer’s information on test equipment used.
   d. Detailed test results.
   e. A narrative summarizing the results of the testing and identifying any further action required.

E. Operating manuals:

1. Complete installation, operation, calibration, and testing manuals as specified in Section 40 61 00.

F. Record drawings:

1. As specified in Section 40 61 00.

2. Electrical connection diagrams shall be revised to reflect any changes made in the field and submitted as record drawings.

1.06 QUALITY ASSURANCE

A. As specified in Section 40 61 00.

1.07 DELIVERY, STORAGE, AND HANDLING

A. As specified in Section 40 61 00.

1.08 PROJECT OR SITE CONDITIONS

A. As specified in Section 40 61 00.

1.09 WARRANTY

A. As specified in Section 40 61 00.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A. Network Switches

1. Layer 2/3 Managed Network Switch for IT Server Room
   a. Manufacturers:
      1) Cisco Systems industrial ethernet switch 4010 Series (IE-4010-4S24P or equal)
   b. Layer 2/3 Managed Network Switch shall provide switching and routing of packets between VLANs
      1) Rack mounted chassis
      2) Allows IP-based Supervisory Control and Data Acquisition (SCADA) connectivity.
      3) Extended operational temperature range (-40 to 75C).
      4) Layer 3, modular uplink
      5) Ports:
         a) Ethernet: 24 X PoE+ 10/100/1000 RJ-45 ports minimum, 10% spare ports
         b) Uplink Module: 4 X SFP 10G ports, minimum
      6) Power Supply (PWR-RGD-AC-DC-250 or equal):
         a) Input Voltage: 100-240 VAC, 50/60 hertz
         b) Power supply shall provide sufficient power for 100% PoE+ port usage.
         c) 250 watts, minimum
      7) Options/Accessories:
         a) Enhanced Limited Lifetime hardware Warranty.

2. Secure Firewall
   a. Manufacturers:
      1) Cisco Firepower 1000 Series (FPR-1120 or equal)
   b. Layer 2 Managed Network Switch shall provide switching between subnets
      1) Rack mounted chassis
      2) Firewall (FW) + Application Visibility and Control (AVC)
      3) Intrusion Prevention System (IPS)

4) Transport Layer Security (TLS)
5) Threat Defense Manager
6) Ports:
   a) Ethernet: 8X RJ-45 ports minimum, 10% spare ports
   b) Uplink Module: 4XSFP 1G ports, minimum
7) Power Supply:
   a) Input Voltage: 100-240 VAC, 50/60 hertz
   b) Power supply shall provide sufficient power for 100% PoE+ port usage
   c) 100 watts, minimum
8) Options/Accessories:
   a) Enhanced Limited Lifetime Hardware Warranty

B. Patch panels:

1. General:
   a. Fiber:
      1) All optical fibers shall be provided with strain relief and terminated at a fiber patch panel. Final connections between the patch panel and the fiber optic network equipment shall be made via fiber optic patch cords.
      2) All fibers, active and dark, shall be terminated at the patch panels.
      3) Interconnect and patch panel housings shall provide space for excess fiber and provide strain relief for the fiber cable.
      4) Fiber cables shall be installed such that the outer sheath of the cable is carried into the interconnect enclosure or patch panels before breaking out buffer tubes.
   b. Copper:
      1) All copper cables (including patch cords) shall meet the specifications of IEEE 802.3ab for CAT6 cables.
      2) Final connections between the patch panel and network equipment shall be by patch cords.
      3) All premises cables shall be terminated at the patch panels.
      4) Cables shall be installed such that the outer sheath of the cable is carried into the interconnect enclosure or patch panels before breaking out conductors.
      5) Maintain twist of broken out conductors per EIA/TIA standards.

2. Cabinet style fiber patch panels:
   a. Wall mounted interconnect:
      1) Use for the termination of a single cable outside of cabinets, in small enclosures or as indicated on the plans.
      2) Wall mounted fiber interconnects shall be provided as complete units including the housing, the connector panels, and the fiber connectors.
      3) Wall mounted fiber interconnects shall provide physical protection for both the incoming cable and the outgoing patch cords.
      4) Capacity:
         a) As shown on the plans, there are a minimum of 6 connections.
      5) Accessories:
         a) Door lock.
         b) Blanks for unused connector panels.
      6) Manufacturers: The following or equal:

a) Corning Cable Systems, Wall-Mountable Interconnect Center.

C. Fiber Optic Cable

1. Provide tight buffered cables, plenum rated, OFNP, OM3 10 Gigabit rated, that are gel filled and are suitable for indoor/outdoor applications. These cables shall be flame retardant for indoor applications, and water and fungus resistant for outdoor applications. The fiber optic cable shall support the LAN resident components, but as a minimum, shall meet the following requirements:
   a. Fiber type: Multimode, graded index, outside plant
   b. Core Diameter: 50 microns.
   c. Cladding Diameter: 125 microns.
   d. Coating Diameter: 250 microns.
   e. Maximum Attenuation: 2.5 dB/km @ 850 nm.; 0.8 dB/km @ 1300 nm.
   f. Minimum OFL Bandwidth: 1500/500 MHz-km
   g. Numerical Aperture: 0.200 ± 0.015
   h. Buffer Type: Loose tube, Waterblock Gel
   i. Number of Fibers: 12
   j. Inner Strength Members: Epoxy Reinforced Glass Rods/PVC.
   k. Outer Strength Member: Aramid Yarn Fibers
   l. Inner Jacket: Black PVC - .022" Nominal Wall.
   m. Outer Jacket: Aqua, UV & Moisture Resistant; Polyethylene 0.045" Nominal Wall.
   n. Tensile Load: 1620 lbf (7200N) max. - installation, 135 lbf (600N) max. - in-service.
   o. Operating Temp. Range: -40 to +70 deg. C.
   p. Crush Resistance: 500 lbf/inch - maximum.

2. Fibers within the cable shall be color-coded so each fiber may be identified. The color sequence suggested is as follows: blue, orange, green, brown, slate, white, red, black, yellow, and violet. Dashed versions of the same colors may be used to continue the sequence, depending on the cable structure and fiber count.

3. The outer jackets of the cable shall be continuous, free from holes, splits, blisters, or inclusions. The same requirement holds for any inner jackets within a given cable structure as well as for fiber coatings.

4. Materials used for fiber optic cable shall present no environmental or toxicological hazards as defined by current industry standards and shall comply with OSHA and EPA standards or applicable federal or state laws or regulations.

5. Outer polyethylene jacket materials shall meet the tensile strength and elongation minimum requirements for unaged and aged samples as follows:

6. Tensile Strength at Break: 2800 psi (unaged), 2100 psi (aged).
   a. Elongation at rupture: 400% (unaged), 375% (aged).

7. Accessories
   a. Provide all accessories required to furnish a complete PLC control system to accomplish the requirements of the Drawings and Specifications.

2.02 ACCESSORIES

A. Provide duplex patch cords to connect the interface cards provided with the associated patch panels.

PART 3 EXECUTION

3.01 INSTALLATION

A. As specified in Section 40 61 00.

1. Refer to SCADA block diagrams for all new network connections.

2. Provide configuration for Plant PLC communication cards, such that there is isolation of the following networks:
   a. Field and PLC I/O network: This includes the connections between the Plant PLC and:
      1) Plant PLC expansion racks.
      2) Plant PLC remote I/O (RIO) racks.
      3) Field Networks.
      4) HMI(s) part of a Plant PLC.
      5) Vendor furnished Ethernet network components.
   b. Valve Actuator network: This includes the connections between the Plant PLC and the valve master stations.
   c. SCADA network: This includes the connections between the various SCADA equipment including but not limited to servers (existing), workstations and printers.

B. All racks shall be level and plumb.

C. Install Velcro wrap on all cable bundles within the network rack/enclosure.

D. All cables and equipment shall be installed in strict conformance with the manufacturer's recommendations:

1. Cables shall be installed to avoid sharp bends.

2. Install cable using lubricant designed for cable pulling.

3. Cable ties or other cable supports shall be installed without crimping the LAN cables.

4. Install LAN cables without splices.

5. Installed bend radii shall be a minimum of 4 times the cable diameter.

6. Terminated all pairs at the jack and the patch panel.

E. Install cables a minimum of 40 inches away from electrical motors and transformers.

F. Install cables a minimum of 12 inches away from fluorescent lighting.

G. Individual pairs will be untwisted less than 1/2 inch at termination points.

H. Each data port shall be individually labeled with its patch panel/switch port ID:

I. Labeling must be printed - no handwritten labels will be allowed.

J. At the completion of the wiring installation, provide the following documentation:

1. A plan-view of the premise(s) showing the jack numbering scheme.

2. A printed certification report for the entire wiring installation showing compliance with all EIA/TIA specifications for data cable.

3. Reports such as those generated by Fluke DSP cable certification equipment meet this requirement.

4. Each device with a unique IP address shall be individually labeled with its IP address. The labeling must be printed; handwritten labels will not be allowed.

3.02 ADJUSTING

A. Perform all firmware installations, configuration and other set up, as required, to place the network into proper operation.

3.03 CLEANING

A. As specified in Section 01 33 00 Submittals.

3.04 DEMONSTRATION AND TRAINING

A. As specified in Section 01 33 00 Submittals.

B. After completion of the cable system tests and before placing the system in operation, power up all devices installed on the LAN and verify communication between the devices.

C. Verify that all equipment is operable on the network simultaneously. Confirm that all network device communications settings are properly configured.

END OF SECTION

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SECTION 40 67 63 UNINTERRUPTIBLE POWER SUPPLIES 10 KVA AND BELOW

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Single-phase double conversion uninterruptible power supplies rated 10 kilovolt-amperes and below.

2. Uninterruptible power supplies rated 10 kilovolt-amperes and below.

B. Related sections:

1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. As specified in Sections 40 61 00.

B. Federal Communications Commission (FCC):

1. FCC Part 15, Class A.

2. FCC Part 15, Class B.

C. Institute of Electrical and Electronic Engineers (IEEE):

1. 519 - IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.

2. 1184 - IEEE Guide for Batteries for Uninterruptible Power Supply Systems.

3. C62.41 - IEEE Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

D. Underwriters Laboratories, Inc. (UL):

1. UL 1778 - Standard for Uninterruptible Power Supply Systems and Equipment.

1.03 DEFINITIONS

A. As specified in Sections 40 61 00.

B. Specific definitions:

1. Critical load: Load supplied by the UPS.

2. MOV: Metal oxide varistor.

1.04 SYSTEM DESCRIPTION

A. Provide complete, factory-assembled, wired, and tested, true on-line double conversion UPS equipment including, but not limited to:

1. Rectifier and battery charger

2. Inverter.

3. Sealed maintenance-free batteries and batteries disconnect switch,

4. Automatic bypass switch

5. External make-before-break maintenance bypass switch

6. Integral control and monitoring panel

7. Accessories needed for installation and electrical connections.

8. Other features as described in this specification and as indicated in the Drawings.

B. Furnish the following UPS and battery systems associated with SCADA PLC, network, and Vendor PLC enclosures as noted. Exact sizing shall be calculated by the PCSS or equipment vendor and calculations shall be submitted to the ENGINEER for review and approval prior to equipment procurement.

C. One UPS (10KVA) is located inside of electrical building no.1 and provides UPS power to nearby lighting panel LP-1410. One UPS (10KVA) is located inside of electrical building no.2 and provides UPS power to nearby lighting panel LP-1420.

PLC/RIO	Runtime Capacity	Input Power Connection	Capacity	Supplied By	Location
PLC-1410	30 min @ Actual Load x 1.5 Safety Factor	120VAC	2.0 KVA	PCSS	MCC-1 PLC for bar screen, aeration blower etc.
PLC-0300	30 min @ Actual Load x 1.5 Safety	120VAC	2.0 KVA	PCSS	PLC for lift pump station
PLC-1420	30 min @ Actual Load x 1.5 Safety	120VAC	3.0 KVA	PCSS	MCC-2 PLC for UV disinfection and sludge

PLC-1100	30 min @ Actual Load x 1.5 Safety	120VAC	2.0 KVA	PCSS	PLC for chemical dosing
ICA-200	30 min @ Actual Load x 1.5 Safety	120VAC	2.4 KVA	EQUIPMENT VENDOR	LCP for UV disinfection

1.05 SUBMITTALS

A. Furnish submittals as specified in Sections 01 33 00 and 40 61 00.

B. Product data:

1. Manufacturer and model number.

2. Catalog data.

3. Dimensions:
   a. Height.
   b. Width.
   c. Depth.
   d. Weight.

4. Ratings:
   a. Input voltage.
   b. Output voltage.
   c. Input/output power factor.
   d. Efficiency.
   e. Harmonic distortion.
   f. Runtime.

5. Noise specifications.

6. Heat dissipation.

7. Warranties and maintenance contracts:
   a. Documentation to demonstrate conformance to specifications noted in this Section.
   b. Descriptive package of offerings of preventative and full-service maintenance contracts for both UPS system and batteries.
   c. Extended warranty options available.

8. All communications requirements such as software, cards, etc.

9. Alarms and status available for remote monitoring and system health.

C. Shop drawings:

1. Power distribution block diagrams.

2. Front and rear views of equipment enclosures:
   a. Front elevation including all control and indicating devices.

3. Support points and weight of overall equipment.

4. Schematic and control wiring diagrams including, but not limited to:
   a. Line and load terminals.
   b. Alarm and status terminals.
   c. Manual maintenance bypass switch terminals.
   d. External wiring requirements for all communication signals.

5. Switching and overcurrent protective devices.

D. Calculations:

1. Include derating for temperature and elevation as necessary.

2. UPS sizing computation:
   a. Apply 1.5 safety factor .
   b. Provide itemized list of critical loads, including individual VA and watt ratings.

3. Battery time calculation based on specified runtime.

4. The Contractor shall submit load calculations with a chart or graph of runtime versus load in watts.

5. Total battery recharge time as a function of capacity utilized.

E. Record documents:

1. Provide Record Drawings of installed unit(s) including layout and wiring.

F. Manufacturer's field reports.

G. Operation and maintenance manuals:

1. System instruction manuals that describe troubleshooting, installation, operations, and safety procedures.

2. Recommendations for maintenance procedures and intervals.

3. Battery data / replacement information.

4. Parts list.

1.06 QUALITY ASSURANCE

A. Manufacturer qualifications:

1. A minimum of 10 years' experience in the design, manufacture, and testing of solid-state UPS systems.

2. ISO 9001 certified.

B. Regulatory requirements for complete UPS system:

1. UL listed per UL Standard 1778

2. IEEE C62.41, Categories A & B.

3. FCC 15:
   a. Greater than 2,000 VA - Class A.
   b. Less than 2,000 VA - Class B.

1.07 DELIVERY, STORAGE, AND HANDLING

A. As specified in Section 40 61 00.

1.08 PROJECT OR SITE CONDITIONS

A. As specified in Section 40 61 00.

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY

A. As specified in Section 40 61 00.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Double-conversion true-online UPS manufacturers, one of the following or equal:

1. Rack-mounted (Network Cabinet) or Tower (PLC) UPS, 700-5,000 VA:
   a. APC Smart UPS SRT (700 - 5,000 VA).
   b. Eaton Corporation - 9SX (700 - 5,000 VA).

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS (NOT USED)

2.04 MANUFACTURED UNITS

A. Double conversion true on-line UPS system requirements:

1. System characteristics:
   a. Provide rack-mount or free-standing UPS as specified and as indicated on the Drawings.

b. The minimum VA rating of the UPS shall be greater than or equal to the safety factor (as indicated in the UPS schedule) times the connected load or 700 VA, whichever is greater.
c. The UPS shall provide uninterrupted conditioned power under fully loaded conditions times 1.5 safety factor for a minimum of 30 minutes. The Contractor shall submit load calculations with a chart or graph of runtime versus load in watts, for engineer to confirm the correct sizing.
d. Efficiency greater than 85 percent AC-AC, all modes.
e. Acoustical noise:
    1) Less than 55 dBA at 5 feet.
f. Output connections:
    1) Receptacles:
        a) 700-2,500 VA units:
            (1) Provide a minimum of four NEMA Type 5-15R or Type 5-20R receptacles.
        b) 3,000 VA units:
            (1) Provide a minimum of four NEMA Type 5-20R receptacles.
            (2) Provide at least one NEMA Type L5-30R receptacle.
        c) Greater than 3,000 VA units:
            (1) Provide a minimum of four NEMA Type 5-20R receptacles.
            (2) Provide at least one NEMA Type L14-30R receptacle.
    2) Provide indirect hardwired connections as indicated on the Drawings. Each interconnecting load device shall be fed from a circuit breaker located in a dedicated UPS power panel.
g. Protection:
    1) Undervoltage:
        a) Operate on battery power if incoming source voltage goes below UPS system limits of operation.
    2) Overvoltage:
        a) Operate on battery power if incoming source voltage exceeds UPS system limits of operation.
    3) Overcurrent:
        a) Provide input and output current-limiting protection to ensure adequate overcurrent protection for UPS.
    4) Surge protection:
        a) MOV-based.

2. Electrical characteristics:
    a. AC input:
        1) Single phase.

        2) Voltage as indicated in the UPS schedule.
            a) Fully functional within +10 percent, -15 percent of nominal voltage at full load without depleting battery.
            b) 120 V input:
                (1) 2-wire plus ground.
            c) 208/120 V or 240/120 input:
                (1) 3-wire plus ground.
        3) Current:

a) Reflected total harmonic distortion (THD) less than 25 percent at rated load.

4) Frequency range of operation:

a) 57-63 Hz.

5) Power factor:

a) Not less than 0.95 lagging at rated load.

b. AC output:

1) Single phase.

2) Voltage:

a) Regulation:

(1) 3 percent for 3,000 VA rating and below.

(2) 5 percent for greater than 3,000 VA rating - static load.

(3) 10 percent for greater than 3,000 VA rating - dynamic load.

b) Total harmonic distortion (THD) when operating on incoming power:

(1) Not more than 3 percent for linear loads with a crest factor of 3:1.

(2) Not more than 5 percent for non-linear loads with a crest factor of 3:1.

c) Transient response:

(1) Within 7 percent for a 20-100 percent step load.

(2) Transient recovery time to nominal voltage within 166 milliseconds.

3) Load power factor:

a) UPS shall be capable of supporting the critical loads for all power factors experienced for their full range of operation.

4) Frequency regulation:

a) Within 3.5 Hz when on utility power.

b) Within 1.0 Hz when on UPS power.

3. Environmental requirements:

a. Operating ambient temperature:

1) UPS module: 50 degrees Fahrenheit to 104 degrees Fahrenheit (10 degrees Celsius to 40 degrees Celsius).

2) Battery: 68 degrees Fahrenheit to 86 degrees Fahrenheit (20 degrees Celsius to 30 degrees Celsius).

b. Operating altitude:

1) Project site conditions as specified in Sections 40 61 00

4. System components:

a. Surge protective devices:

1) MOV-supplied protection.

b. Inverter:

1) Pulse-width modulated AC output signal.

2) Overload withstand minimum time without transferring to bypass:

a) 101 to 110 percent for 2 minutes.

b) 111 to 125 percent for 10 seconds.

c) 126 to 150 percent for 1 second.

d) Greater than 150 percent for 96 milliseconds.

3) Transfer load to bypass when overload capacity is exceeded.

c. Battery rectifier/charger:

1) Recharge batteries to 90 percent in 6 hours or less.

d. Batteries:
   1) VRLA (valve regulated lead acid), sealed, maintenance free.
   2) Minimum 3-year float service life at 25 degrees Celsius.
   3) Integral to UPS enclosure or housed in a matching enclosure. All expansion battery modules shall be connected via modular plug to permit a change without lifting wires.
   4) Less than and including 6,000 VA: Hot-swappable.
   5) Automatically perform routine battery health monitoring and provide visual, audible, and/or serial warnings if abnormal battery conditions exist.

e. Automatic bypass switch:
   1) Integral to UPS system.
   2) Sense UPS overload, inverter failure, or overtemperature, and automatically transfer loads to source power.
   3) Maximum detect and transfer time of 4-6 milliseconds.
   4) Automatic re-transfer without power interruption to critical load.
   5) Input shall match output in phase, voltage, frequency, and grounding.
   6) Rated to carry the full input current of the UPS.

f. UPS chassis:
   1) Electrically isolated from AC output neutral.
   2) Include an equipment ground terminal.

g. Cooling:
   1) Forced air cooled.

h. Locally displayed system indicators:
   1) Audible alarms during abnormal conditions:
      a) UPS fault or overload condition.
      b) Battery on.
      c) Low battery.
      d) Automatic bypass on/off.
      e) Input power on.
      f) Battery testing mode.

i. Controls:
   1) Front-panel pushbuttons:
      a) UPS start-up, shutdown, and manual bypass (for automatic bypass).
      b) Testing.
      c) Visual/audible alarms reset.
   2) Applicable controls as specified in Communications Requirements.

j. Alarm contacts:
   1) Provide relay interface card and required interposing relays for 120 VAC discrete input status signals:
      a) Low battery.
      b) UPS alarm.
      c) On UPS power.

k. Communications requirements:
   1) RS-232 or USB.
   2) Ethernet via SNMP - allow remote indication of all alarms and status signals present in the UPS:
      a) Provide manufacturer’s software as required.

2.05 EXECUTION

2.06 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Do not utilize extension cords, adapters, or other electrical connectors for UPS input.

2.07 FIELD QUALITY CONTROL

A. Perform inspections and test procedures before UPS startup:

1. Inspect equipment for signs of damage.

2. Verify installation as indicated on the Drawings and specified in the Specifications.

3. Inspect cabinets for foreign objects.

4. Verify neutral and ground conductors are properly sized and terminated.

5. Inspect battery cases.

6. Inspect batteries for proper polarity.

7. Check power and control wiring for tightness.

8. Check terminal connectors for tightness.

9. Assure connection and voltage of the battery string(s).

2.08 CLEANING

A. As specified in Section 40 61 00.

2.09 PROTECTION

A. As specified in Section 40 61 00.

END OF SECTION

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SECTION 40 71 13 FLOW MEASUREMENT: MAGNETIC FLOWMETERS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
1. Full-body magnetic flowmeters that will operate with zero upstream and downstream piping requirements while maintaining a flow meter performance of ±2.0% of flow rate or +- 0.20% with five upstream and 3 downstream with manufacturers standard mag meters.

B. Related sections:
1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. As specified in Section 40 61 00.

B. NSF International (NSF).

1.03 DEFINITIONS

A. As specified in Section 40 61 00.

1.04 SUBMITTALS

A. Furnish submittals as specified in Section 40 61 00.

1.05 QUALITY ASSURANCE

A. As specified in Section 40 61 00.

B. Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:
1. Process conditions: Fluids, pressures, temperatures, flows, materials, etc.
2. Physical conditions:
a. Installation and mounting requirements.
b. Location within the process.
c. Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

C. Notify the Engineer if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

1.06 DELIVERY, STORAGE, AND HANDLING

A. As specified in Section 40 61 00

1.07 PROJECT OR SITE CONDITIONS

A. As specified in Section 40 61 00.

1.08 WARRANTY

A. As specified in Section 40 61 00.

1.09 MAINTENANCE

A. As specified in Section 40 61 00.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. One of the following or approved equal:
   1. Siemens Mag 5100W/6000
   2. Endress+Hauser. Promag W400

2.02 MANUFACTURED UNITS

A. Magnetic flowmeter:
   1. General:
      a. Magnetic flowmeters obtain the flow velocity by measuring the changes of induced voltage of the conductive fluid passing across a controlled magnetic field.
      b. Complete zero stability shall be an inherent characteristic of the flowmeter system.
      c. Include for each magnetic flow metering system:
         1) A metering tube with electrodes (sensor).
         2) Signal cable.
         3) Transmitter integral or remote as indicated on the Drawings.
         4) Flowmeter grounding rings.
   2. Performance requirements:
      a. Accuracy:
         1) 0.25 percent of flow rate from 10 to 100 percent of full scale for velocities ranging between 1.9 to 10 feet per second.
      b. Repeatability:
         1) 0.25 percent of rate.
   3. Element:
      a. Metering tube:
         1) Constructed of carbon steel or Type 304 stainless steel (unless specifically noted otherwise in the instrument data sheets) with flanged connections to match with piping material.
         2) Liner material in conformance with:
            a) Manufacturer’s recommendations for the intended service.
            b) NSF certified for all drinking water applications.
         3) Electrodes type and material in conformance with:
            a) Manufacturer’s recommendations for the intended service.
            b) Utilize a minimum of 4, self-cleaning electrodes.

4) Meter terminal housing NEMA Type 4X unless specifically noted otherwise in the instrument data sheets.
5) Meter coating consisting of epoxy painted finish.
6) Components:
a) 2 grounding rings:
(1) Which are in conformance with the manufacturer's bore and material recommendation for the meter's intended service.
(2) Designed to protect and shield from abrasion of the liner's edge interface at the meter's end.

4. Transmitter:
a. Power supply:
1) 120 VAC.
2) Power consumption: 60 VA maximum.
b. Outputs:
1) As noted in the instrument data sheets.
2) For all instruments with 4 to 20 mA HART or digital bus protocol, provide a Device Type Manager (DTM) certification by FDT group.
c. Microprocessor-based signal converter/transmitter.
d. Utilize DC pulse technique to drive flux-producing coils.
e. Contains a 6-digit display for flow rate, percent of span, and totalizer.
f. Operator keypad interface.
g. Integral zero return to provide consistent zero output signals in response to an external dry contact closure.
h. Integral low flow cut-off zero return.
i. Programmable parameters including:
1) Meter size.
2) Full-scale flow rate.
3) Magnetic field frequency.
4) Time constant.
j. Data retention for a minimum of 5 years without auxiliary main or battery power.
k. Self-diagnostics, NAMUR NE107 status signal description for easy operator servicing, on-board flow meter verification, and automatic data checking.
l. Protected terminals and fuses in a separate compartment which isolates field connection from electronics.
m. Ambient operating temperature limits of -5 to 140 degrees Fahrenheit (-20 to 60 degrees Celsius).

2.03 ACCESSORIES

A. Stainless steel tag labeled as specified in the Contract Documents.

B. Provide sunshades for all transmitters located outdoors.

C. Provide galvanic isolation gaskets, nylon/Teflon flange bolt insulation bushings and nylon washers on all meters installed on pipes with cathodic protection.

D. Provide remote mount kit for all transmitters that are not mounted integral to flow tube.

E. Provide flow tube rated at IP68 Submergence Rating for all meters installed below grade.

F. Provide Manufacturers suggested cabling for all remote mounted instillations. The proper length of cables to be confirmed in the field or from drawings by contractor.

2.04 **SOURCE QUALITY CONTROL**

A. As specified in Section 40 90 00.

B. Factory calibrate each flow metering system at a facility that is traceable to the NIST.

C. A real-time computer-generated printout of the actual calibration date indication actual velocities and as read values of the flow tube.
   1. Flow calibration report of the manufacturers flow lab calibration procedure shall be shipped with the meter system.
   2. Minimum calibration shall be a 3-point calibration including 1, 3, and 10 feet per second velocities for every meter and transmitter system.
   3. The manufacturer shall archive all calibration reports for future reference.

PART 3 EXECUTION

3.01 INSTALLATION

A. As specified in Section 40 61 00.

3.02 FIELD QUALITY CONTROL

A. As specified in Section 40 61 00.

B. Provide local authorized manufacturer’s representative services to perform installation inspection.

3.03 ADJUSTING

A. Have local authorized manufacturer’s representative performs a flow meter verification of all instruments in accordance with the manufacturer’s instructions and submit a report of all flow meter verification that is traced to an independent, third-part test lab:
   1. Return factory calibrated devices to the factory if they do not meet the field verification requirements for calibration.

3.04 CLEANING

A. As specified in Section 40 61 00.

3.05 DEMONSTRATION AND TRAINING

A. As specified in Section 40 61 00.instruments to the Engineer before commissioning.

3.06 PROTECTION

A. As specified in Section 40 61 00.SCHEDULES

B. Instrument Data Sheets included in this Section.

C. The provided information does not necessarily include all required instruments.

D. Provide all instruments identified in the Contract Documents:
   1. Instruments may be indicated on the Drawings, specified in the Specifications, or both.

END OF SECTION

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SECTION 40 71 76 FLOW MEASUREMENT: THERMAL MASS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
1. Thermal mass flow measurement.

B. Related sections:
1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. As specified in Section 40 61 00.

1.03 DEFINITIONS

A. As specified in Section 40 61 00.

B. Specific definitions:
1. Surface mount technology: The practice and method of attaching leaded and non-leaded electrical components to the surface of a conductive pattern that does not utilize leads in feed-through holes. This technology reduces power requirements for the thermal flow instruments.
2. Retract mechanism: A device that holds the sensor probe in place for the flow measurement. This device also includes a mechanism that enables the plant maintenance staff to remove the probe easily for cleaning and other maintenance needed. This device also enables the plant maintenance staff to re-insert the sensor probe back into its original position without leakage for measurement service again.

1.04 SUBMITTALS

A. Furnish submittals as specified in Sections 40 61 00.

B. Design calculations:
1. Flow modeling.

C. Provide complete documentation covering the traceability of all calibration instruments.

1.05 QUALITY ASSURANCE

A. As specified in Section 40 61 00.

B. Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:
   1. Process conditions: Fluids, pressures, temperatures, flows, materials etc.
   2. Physical conditions:
      a. Installation and mounting requirements.
      b. Location within the process.
      c. Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

C. Notify the Engineer if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

D. Provide instruments manufactured at facilities certified to the quality standards of ISO 9001.

1.06 DELIVERY, STORAGE, AND HANDLING

A. As specified in Section 40 61 00.

1.07 PROJECT OR SITE CONDITIONS

A. Project environmental conditions as specified in Section 40 61 00.
   1. Provide instruments suitable for the installed site conditions including, but not limited to, material compatibility, site altitude, site seismic conditions, humidity, and process and ambient temperatures.

1.08 WARRANTY

A. As specified in Section 40 61 00.

1.09 MAINTENANCE

A. Furnish all parts, materials, fluids, etc. necessary for operation, maintenance, and calibration purposes throughout the warranty period. Deliver all of these supplies before project substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermal mass flowmeters:
   1. One of the following or equal:
      a. Fluid Components International (FCI®) - Model No. ST-100 with thermal dispersion flow element, remote transmitter, and probe sensor.
      b. Kurz Instruments, Inc. - Model No. 454 series with thermal mass flow element, remote transmitter, and probe sensor.
      c. Sierra Instruments, Inc. - Model No. 640S thermal mass flow sensor; remote transmitter, and probe sensor.

2.02 MANUFACTURED UNITS

A. Thermal mass flowmeter:

1. General:
    a. Thermal mass flowmeters measure airflow, industrial, and process gas mass flows by detecting the heat transfer from a heated RTD sensor referenced to the temperature of the ambient gas stream sensor.
    b. The electronic circuitry shall either maintain a constant differential temperature between the gas temperature and the heated element or a constant power.
    c. The electronic circuitry shall deliver a linear signal 4 to 20 mA DC output proportional to the process fluid flow.
2. Performance requirements:
    a. Accuracy:
        1) 1.5 percent of full scale for velocities over 2 feet per second.
    b. Repeatability:
        1) 0.5 percent of full scale.
3. Element:
    a. Sensor with terminal enclosure:
    b. Utilize a sensor with 3/4-inch male NPT process connection.
    c. No overheating at zero flow.
4. Transmitter:
    a. Microprocessor-based.
    b. Enclosure: NEMA Type 4X.
    c. Power supply:
        1) 120 VAC.
        2) Power consumption: 50 VA maximum.
    d. Outputs:
        1) Isolated 4 to 20 mA DC with HART communication protocol.
    e. Alphanumeric display for flow rate.
    f. Ambient operating temperature limits: 0 to 150 degrees Fahrenheit.
5. Components:
    a. Signal cable between insertion probe and transmitter:
        1) Abrasive-resistant, polyurethane jacket.
        2) Sensor cable permanently bonded to sensor.
        3) Provide enough length of cable to allow removal and inspection of insertion element.

2.03 ACCESSORIES

A. Provide a balance retract mechanism (hot tap) for insertion and retraction of the probe sensor assembly.

B. Software (if available as either a standard or an option) for fully validation on instrument performances.

C. Provide sunshade for outdoor installations.

2.04 SOURCE QUALITY CONTROL

A. As specified in Section 40 61 00.

B. Factory calibrate each instrument with a minimum 3-point calibration or according to Manufacturer’s standard at a facility that is traceable to the NIST.
    1. Submit calibration data sheets to the Engineer at least 30 days before shipment of the instruments to the project site.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the installation location for the instrument and verify that the instrument will work properly when installed.
   1. Notify the Engineer promptly if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. As specified in Section 40 61 00.

B. Install digester gas flowmeters 45 degrees below the horizontal to prevent condensation from building up on the tip.

3.04 FIELD QUALITY CONTROL

A. As specified in Section 40 61 00.

B. Provide manufacturer's services to perform installation inspection services.

3.05 ADJUSTING

A. As specified in Section 40 61 00.

3.06 CLEANING

A. As specified in Section 40 61 00.

3.07 DEMONSTRATION AND TRAINING

A. As specified in Section 40 61 00.

3.08 PROTECTION

A. As specified in Section 40 61 00.

END OF SECTION

SECTION 40 72 13 LEVEL MEASUREMENT: ULTRASONIC

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
1. Ultrasonic level instruments.

B. Related sections:
1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. As specified in Section 40 61 00.

1.03 DEFINITIONS

A. As specified in Section 40 61 00.

B. Specific definitions:
1. FDT: Field Device Tool.
2. DTM: Device Type Manager.

1.04 SUBMITTALS

A. Furnish submittals as specified in Sections 40 61 00.

B. Provide complete documentation covering the traceability of all calibration instruments.

C. QUALITY ASSURANCE

D. As specified in Section 40 61 00.

E. Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:
1. Process conditions: Fluids, pressures, temperatures, flows, materials, etc.
2. Physical conditions:
a. Installation and mounting requirements.
b. Location within the process.
c. Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

F. Notify the Engineer if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

G. Provide instruments manufactured at facilities certified to the quality standards of ISO 9001.

1.05 DELIVERY, STORAGE, AND HANDLING

A. As specified in Section 40 61 00.

1.06 PROJECT OR SITE CONDITIONS

A. Project environmental conditions as specified in Section 40 61 00.
1. Provide instruments suitable for the installed site conditions including, but not limited to, material compatibility, site altitude, site seismic conditions, humidity, and process and ambient temperatures.

1.07 WARRANTY

A. As specified in Section 40 61 00.

1.08 MAINTENANCE

A. Furnish all parts, materials, fluids, etc. necessary for operation, maintenance, and calibration purposes throughout the warranty period. Deliver all of these supplies before project substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. One of the following or equal:
1. Ultrasonic Level sensor with 4-wire remote transmitter:
   a. Ametek Drexelbrook: USonic-R Series.
   b. Endress+Hauser: Prosonic S FDU Series Sensor with FMU Series Transmitter.
   c. Magnetrol: Echomaster 384 Series Sensor with Echotel 344 Series Transmitter.
   d. Siemens: Echomax Series sensor with HydroRanger 200 Series Transmitter.
2. Ultrasonic Level sensor with 2-wire integral transmitter:
   a. Siemens: SITRANS Probe.
   b. Endress+Hauser: Prosonic M FMU Series.
   c. Magnetrol: Echotel Model 355.
   d. Ametek Drexelbrook: USonic Series.

2.02 MANUFACTURED UNITS

A. Ultrasonic level measurement with 4-wire remote transmitter:
1. General:
   a. Continuous non-contact level measurement device with remote transmitter using ultrasonic echo sensing. The transducer generates an ultrasonic pulse in the range of 12 to 50 kHz and measures the time required for the pulse to travel to the process surface and return. The

distance is calculated from the send and receive times. Each 4-wire level transmitter system includes, but is not limited to:
1) Ultrasonic Transducer.
2) Signal cable.
3) Transmitter.

2. Performance requirements:
   a. Accuracy:
      1) 0.25 percent of range.
   b. Repeatability:
      1) 0.1 percent of range.
3. Ultrasonic transducer:
   a. Encapsulated in chemical and corrosion-resistant material as indicated on the Instrument Data Sheet or Instrument index.
   b. Class I, Division 1 for transducer only.
   c. Operating temperature range: -5 to 122 degrees Fahrenheit (-20 to 50 degrees Celsius).
   d. Operating relative humidity range: 5 to 95 percent.
   e. Functions:
      1) Temperature compensation.
   f. Mounting: As indicated in the Contract Documents.
4. Transmitter:
   a. Level indicating transmitter:
      1) Indicator: Liquid crystal display with approximately 0.50-inch display scaled to read in engineering units.
      2) Sensitivity: Able to ignore momentary level spikes or momentary loss of echo and indicate loss of echo condition on indicating transmitter unit.
      3) Ability to allow for signal profiles and echo mapping:
         a) Provide manufacturers software for re-mapping the signal.
   b. Functions:
      1) Level measurement.
      2) Tank volume.
      3) Flow measurement.
   c. Power supply:
      1) 120 VAC.
      2) Power consumption: 36 VA maximum.
   d. Outputs:
      1) Isolated 4 to 20 milliamperes DC with HART communication protocol.
      2) Relay outputs:
         a) 3 Form A or Form C contacts.
         b) Rated 5 amps at 250 VAC.
         c) Programmable.
      3) Enclosure: NEMA Type 4X
      4) Mounting: As indicated in the Contract Documents.
      5) Operating temperature ranges from -5 to 122 degrees Fahrenheit (-20 to 50 degrees Celsius), relative humidity of 10 to 100 percent.

B. Ultrasonic Level measurement with 2-wire integral transmitter:
1. General:
   a. Continuous non-contact level measurement device with integral transmitter using ultrasonic echo sensing.

b. The transducer generates an ultrasonic pulse in the range of 12 to 60 kHz and measures the time required for the pulse to travel to the process surface and return. The level is measured based on constant velocity of sound in air with temperature compensation to adjust for velocity changes relative to temperature.

c. Each 2- or 3-wire level transmitter system includes, but is not limited to:

1) Ultrasonic transducer with integral transmitter.

2. Performance requirements:

a. Accuracy:

1) 0.25 percent of range.

b. Repeatability:

1) 0.1 percent of range.

3. Transducer (Integral):

a. Encapsulated in chemical and corrosion-resistant material as indicated on the Instrument Data Sheet or Instrument index.

b. Operating temperature range: -5 to 122 degrees Fahrenheit (-20 to 50 degrees Celsius).

c. Operating relative humidity range: 5 to 95 percent.

4. Transmitter:

a. Functions:

1) Single Level measurement.

2) Programmable for:

a) Level.

b) Tank volume.

b. Power supply:

1) 24 VDC - 2-wire loop powered.

2) Power consumption: 6 VA maximum.

c. Outputs:

1) Isolated 4 to 20 milliamperes DC with HART communication protocol.

d. Indicator: Liquid Crystal Display with approximately 0.50-inch display scaled to read in engineering units.

e. Sensitivity: Able to ignore momentary level spikes or momentary loss of echo and indicate loss of echo condition on indicating transmitter unit.

f. Enclosure:

1) NEMA Type 4X.

g. Mounting: As indicated in the Contract documents.

2.03 ACCESSORIES

A. Mounting brackets: As indicated on the Drawings.

B. Provide sunshades for outdoor installations.

C. Provide handheld programmers for all transmitters.

2.04 SOURCE QUALITY CONTROL

A. As specified in Section 40 61 00.

B. Factory calibrate each instrument with a minimum 3-point calibration or according to Manufacturer's standard at a facility that is traceable to the NIST.

1. Submit calibration data sheets to the Engineer at least 30 days before shipment of the instruments to the project site.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the installation location for the instrument and verify that the instrument will work properly when installed.
   1. Notify the Engineer promptly if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. As specified in Section 40 61 00.

B. Coordinate the installation with all trades to ensure that the mechanical system has all necessary appurtenances including weld-o-lets, valves, etc. for proper installation of instruments.

3.04 FIELD QUALITY CONTROL

A. As specified in Section 40 61 00.

3.05 ADJUSTING

A. As specified in Section 01 75 00

3.06 CLEANING

A. As specified in Section 40 61 00.

3.07 DEMONSTRATION AND TRAINING

A. As specified in Section 40 61 00.

3.08 PROTECTION

A. As specified in Section 40 61 00.

END OF SECTION

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SECTION 40 72 76 LEVEL MEASUREMENT: SWITCHES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Conductivity level switch.

2. Capacitance level switch.

3. Ball float level switch.

4. Displacement float level switch.

5. Vibrating rod level switch

B. Related sections:

1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

C. Provide all instruments identified in the Contract Documents.

1.02 REFERENCES

A. As specified in Section 40 61 00.

1.03 DEFINITIONS

A. As specified in Section 40 61 00.

1.04 SUBMITTALS

A. Furnish submittals as specified in Sections 40 61 00.

B. Provide complete documentation covering the traceability of all calibration instruments.

1.05 QUALITY ASSURANCE

A. As specified in Section 40 61 00.

B. Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:

1. Process conditions: Fluids, pressures, temperatures, flows, materials etc.

2. Physical conditions:
   a. Installation and mounting requirements.
   b. Location within the process.
   c. Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

C. Notify the Engineer if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

1.06 DELIVERY, STORAGE, AND HANDLING

A. As specified in Section 40 61 00.

1.07 PROJECT OR SITE CONDITIONS

A. Project environmental conditions as specified in Section 40 61 00.

1. Provide instruments suitable for the installed site conditions including, but not limited to, material compatibility, site altitude, site seismic conditions, humidity, and process and ambient temperatures.

1.08 WARRANTY

A. As specified in Section 40 61 00.

1.09 MAINTENANCE

A. Furnish all parts, materials, fluids, etc. necessary for operation, maintenance, and calibration purposes throughout the warranty period. Deliver all of these supplies before project substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. One of the following or approved equal:

1. Conductivity level switch:
   a. Gems Sensors and Controls/Warrick series.
   b. Ametek B/W Controls 6013 electrode series.
   c. E+H liquiphant T FTW31

2. Capacitance level switch:
   a. E+H Liquicap M FTI51/FTI52.

3. Tuning fork level switch:(Vibrating level switch)
   a. E+H Liquiphant. FTL51B
   b. Drexelbrook TF-100 Series.
   c. Siemens Sitrans LVL200 Series Switch.

4. Ball float level switch:
   a. Siemens Water Technologies Corp 9G-EF.
   b. ITT Flygt Model ENM-10.
   c. Anchor Scientific Incorporated Ecofloat/Solofloat.
   d. E+H Liquiphant. FTS20

5. Displacement float level switch:
   a. Gems Sensors and Controls Series LS-3.
   b. B/W Unifloat.

2.02 MANUFACTURED UNITS

A. Conductivity level switch:

1. General:
   a. Probe type conductivity level switches integrating a control relay, control and reference electrode probes as required, and electrode probe holder. Unless otherwise specified in the ISA data sheets, electrode probes shall be rigid stainless steel and probe holder pressure-tight.
   b. All components provided by the same manufacturer.

2. Element:
   a. Rigid type: For probe lengths of 6 feet and less provide Type 316 stainless steel rigid probes unless otherwise specified in the instrument schedule ISA Data Sheets. Electrode probe shall be threaded at one end to fit electrode holder threads and insulated with 1/32 inch PVC sheath down to 1 inch from the other end.
   b. Electrode probe holder.
   c. Suspended probes: For probe lengths longer than 6 feet, provide wire suspended probes within a protective plastic shield suspended and PVC insulated wires. Provide suitable adapters for fastening upper end to electrode fitting.

3. Switch: The control relay senses the liquid level by conductance through electrode probes and the process liquid:
   a. Provide a solid-state general-purpose control relay designed for single level or differential control.
   b. Electrical connection: One 1/2 inch NPT conduit entry.
   c. Power supply:
      1) 120 VAC.
      2) Power consumption: 10 VA maximum.
   d. SPDT contacts rated 5 amps resistive at 120 VAC.
   e. Secondary voltage (applied to electrodes): 12 VAC, 1.5 mA maximum.
   f. Enclosure: NEMA Type 4X.

4. Components:
   a. Adjustable time delay on increasing or decreasing level.
   b. Manufacturers: One of the following or equal:
      1) Standard applications:
         a) Warrick Controls Model or 16 VM.

b) B/W Control High Sensitivity Series 5200.
2) Intrinsically Safe:
a) Warrick Controls Model 27.
b) B/W Control High Sensitivity Series 5200 N7

B. Capacitance level switch:

1. General: Capacitance type level switches shall be made up of a control relay, mechanically rigid and rugged non-metallic probe and probe housing.

2. Switch:
a. Provide a rigid, non-metallic element.
b. The control relay senses the liquid level by capacitance measurement between the electrode probe, the process liquid, and the equipment ground:
1) Power supply:
a) 120 VAC.
b) Power consumption: 10 VA maximum.
2) Outputs:
a) Relay outputs:
(1) 1 Form C contact.
(2) Rated at 6 amperes at 120 VAC.
(3) Programmable.
c. Electrical connection: One 1/2-inch NPT conduit entry.
d. Enclosure: NEMA Type 4X.

C. Ball float level switch:

1. General:
a. Free hanging, encapsulated body with a switch to determine position of float.

2. Element:
a. Mechanical switch encapsulated in waterproof floating ball of nominal diameter, supported by flexible PVC cable and jacket or heavy neoprene.
b. The length of the PVC cable shall be, at a minimum, equal to sump depth plus 5 feet.
c. Float: Provide Type 316 stainless steel or polypropylene, minimum 3 inches in diameter.
d. An operating temperature rating: -30 degrees Fahrenheit to +150 degrees Fahrenheit.
e. Mercury switches are not acceptable.
f. Lead wires: Mounted in flexible waterproof PVC cable from switch to junction box terminals without splices.

3. Switch:
a. Single pole double throw contacts rated 10 amps resistive at 120 VAC.
b. Provide the number of floats per level system as indicated on the Drawings.
c. Suspend ball float and adjust for level setpoint as required.

4. Components:

a. Floats shall include Type 316 stainless steel clamp and brackets and 1/4 inch cable to allow testing of the float without entering the basin or wet well.
b. Provide strain relief at both ends of the float cable.

D. Displacement float level switch:

1. General: Float with a permanent magnet encircles a stationary stem. A hermetically sealed magnetically operated latching reed switch(es) mounted in the stem:
   a. Mercury switches are not acceptable.

2. Lead wires: Mounted in flexible waterproof PVC cable from switch to junction box terminals without splices.

3. Switch:
   a. Single pole single throw (SPST).

4. The number of floats per level system shall be as indicated on the Drawings.

E. Vibration level switch:

1. General:
   a. Designed using the principal of tuning fork. The frequency of the vibrating fork sensor changes depending on the medium.

2. Element:
   a. Sensor length approximately 19 ft

3. Switch:
   a. Double pole Double throw (DPDT)

4. Components:
   a. Main wetted parts 316L Alloy
   b. Housing material body:304 SST
   c. ¾ in NPT conduit entry

F.

2.03 ACCESSORIES

A. Provide sunshades for outdoor installation.

2.04 SOURCE QUALITY CONTROL

A. As specified in Section 40 61 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the installation location for the instrument and verify that the instrument will work properly when installed.

1. Notify the Engineer promptly if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. As specified in Section 40 61 00.

3.04 FIELD QUALITY CONTROL

A. As specified in Section 40 61 00.

3.05 ADJUSTING

A. As specified in Section 40 61 00.

3.06 CLEANING

A. As specified in Section 40 61 00.

3.07 DEMONSTRATION AND TRAINING

A. As specified in Section 40 61 00.

3.08 PROTECTION

A. As specified in Section 40 61 00.

3.09 SCHEDULES

A. The provided information does not necessarily include all required instruments. Provide all instruments identified in the Contract Documents:

1. Instruments may be as indicated on the Drawings, as specified in the Specifications or both.

END OF SECTION

SECTION 40 73 36 PRESSURE/VACUUM MEASUREMENT: SWITCHES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Pressure/vacuum switches.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

C. Provide all instruments specified in the Contract Documents.

1.02 REFERENCES

A. As specified in Section 40 61 00.

1.03 DEFINITIONS

A. As specified in Section 40 61 00.

1.04 SUBMITTALS

A. Furnish submittals as specified in Section 40 61 00.

B. Additional requirements:
   1. Product data:
      a. Accessories such as diaphragm seals, valve manifold, snubbers, and pulsation dampeners.

1.05 QUALITY ASSURANCE

A. As specified in Section 40 61 00.

B. Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:
   1. Process conditions: Fluids, pressures, temperatures, flows, materials, etc.
   2. Physical conditions:
      a. Installation and mounting requirements.
      b. Location within the process.
      c. Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

C. Notify the Engineer if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

1.06 DELIVERY, STORAGE, AND HANDLING

A. As specified in Section 40 61 00.

1.07 PROJECT OR SITE CONDITIONS

A. Project environmental conditions as specified in Section 40 61 00.
   1. Provide instruments suitable for the installed site conditions including, but not limited to, material compatibility, site altitude, site seismic conditions, humidity, and process and ambient temperatures.

1.08 WARRANTY

A. As specified in Section 40 61 00.

1.09 MAINTENANCE

A. Furnish all parts, materials, fluids, etc. necessary for operation, maintenance, and calibration purposes throughout the warranty period. Deliver all of these supplies before project substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mechanical type pressure switch: One of the following or equal:
   1. Ashcroft B Series**.**
   2. United Electric Controls Series.
   3. ASCO S-Series.

B. Electronic type pressure switch: One of the following or equal:
   1. Ashcroft N Series.
   2. United Electric Series One.
   3. Noshok Series 800.

2.02 MANUFACTURED UNITS

A. Mechanical type pressure switches:
   1. General:
      a. Pressure switch shall be diaphragm or diaphragm-sealed piston type.
   2. Performance requirements:
      a. Pressure range:
         1) As specified in instrument list or schedule.
      b. Accuracy:
         1) Within 1.0 percent of range.
      c. Repeatability:
         1) Within 1.0 percent of range.
   3. Element:
      a. Type: Diaphragm, diaphragm-sealed piston, or bourdon tube.
      b. Overpressure:
         1) Minimum 130 percent of maximum range pressure without damage to switch or sensing element.

2) Minimum 400 percent of nominal range without leakage or rupture.

c. Sensing element shall not require ambient temperature compensation.

d. Wetted materials: Stainless steel.

e. Setpoint:

1) Dual.

2) Switch shall activate at setpoint on increasing pressure for high-pressure alarm applications and on decreasing pressure for low-pressure alarm applications.

f. Adjustable deadband.

g. Switch elements:

1) Snap acting.

2) Single pole-double throw (SPDT)

Options	Hermetically Sealed	Maximum Contact Rating @ 120 VAC	Automatic Reset Type	Manual Reset Type	Manufacturer and Model	Rating
Option 1	X	5 A	X		Ashcroft Type 400, B Series	Class I Div 2
Option 2		15 A	X		Ashcroft Type 400, B Series	Unclassified
Option 3	Check with Manufacturer	15 A		X	Ashcroft Type 400, B Series	Check with Manufacturer
Option 4	X	15A	X		Ashcroft Type 700, B Series	Class I Div 1 & 2
Option 5	X	15A		X	Ashcroft Type 700, B Series	Class I Div 1 & 2
Option 6	X	1 A	X		Asco S-Series	See Note 1 (above)
Option 7		15 A	X		Asco S-Series	See Note 1 (above)
Option 8	Check with Manufacturer	Check with Manufacturer		X	Asco S-Series	See Note 1 (above)
Option 9		15 A	X		United Electric Controls Series 400	Unclassified
Option 10		15 A		X	United Electric Controls Series 400	Unclassified
Option 11	X	11 A	X		United Electric Controls Series 120	Class I Div 1 & 2
Option 12	Check with Manufacturer	Check with Manufacturer		X	United Electric Controls Series 120	Class I Div 1 & 2

3) Hermetically sealed.

4) Rated at 5 A, 125/250 VAC.

5) Automatic reset type.

h. Enclosure: Epoxy coated:
    1) NEMA Type 4.
    2) NEMA Type 4X.
    3) NEMA Type 7.
i. Switch mounting:
    1) Process connection: 1/2-inch NPT.

4. Components:
    a. Provide all necessary hardware for pressure switch mounting.

B. Electronic indicating type pressure switches:
1. General:
    a. Pressure switch shall utilize ceramic or polysilicon thin film pressure transducer.
2. Performance requirements:
    a. Pressure range:
        1) As specified in data sheets
    b. Accuracy:
        1) Within 1.0 percent of range.
    c. Repeatability:
        1) Within 1.0 percent of range.
3. Element:
    a. Type: Ceramic or polysilicon thin film.
    b. Overpressure:
        1) Minimum 130 percent of maximum range pressure without damage to switch or sensing element.
        2) Minimum 400 percent of nominal range without leakage or rupture.
    c. Sensing element shall not require ambient temperature compensation.
    d. Wetted materials: Stainless steel.
4. Transmitter:
    a. Setpoint:
        1) Dual.
        2) Switch shall activate at setpoint on increasing pressure for high-pressure alarm applications and on decreasing pressure for low-pressure alarm applications.
    b. Adjustable deadband.
    c. Switch elements:
        1) Snap acting.
        2) Single pole-double throw (SPDT).
        3) Automatic reset
    d. Enclosure: Epoxy coated
        1) NEMA Type 4X.
    e. Local display:
        1) 4-digit LCD or LED.
        2) Scaled in engineering units.
    f. Switch mounting:
        1) Process connection: 1/2-inch NPT.
    g. Power supply:
        1) 120 VAC.
        2) Power consumption: 3 VA maximum.
    h. Outputs:
        1) Isolated 4 to 20 milliamperes DC with HART communication protocol.
    i. Relay outputs:

1) Form C contacts: 2.

j. Rated 5 amps at 120 VAC.

k. Components:

1) Provide all necessary hardware for pressure switch mounting.

2) Provide sun shield for outdoor installations.

2.03 ACCESSORIES

A. Pulsation dampeners and snubbers:

1. Provide pulsation dampener or snubber with each pressure switch installed on discharge of positive displacement type pump.
2. Materials: Stainless steel.
3. Mount pulsation dampener or snubber integrally to the pressure switch.
4. Connection: 1/2-inch NPT.

B. Provide diaphragm seals as specified in data sheets or as indicated on the Drawings:

1. Diaphragm seal and pressure switch shall be assembled by manufacturer and shipped as an assembly.

C. Furnish block and bleed valves as specified in Section 40 91 04.

D. Furnish gauge valves as specified in Section 40 91 04.

2.04 SOURCE QUALITY CONTROL

A. As specified in Section 40 61 00.

B. Factory calibrate each instrument with a minimum 3-point calibration or according to Manufacturer's standard at a facility that is traceable to the NIST.

1. Submit calibration data sheets to the Engineer at least 30 days before shipment of the instruments to the project site.

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. As specified in Section 40 61 00.

B. Coordinate the installation with all trades to ensure that the mechanical system has all necessary appurtenances including weld-o-lets, valves, etc. for proper installation of instruments.

3.04 FIELD QUALITY CONTROL

A. As specified in Section 40 61 00.

3.05 ADJUSTING

A. Verify factory calibration of all instruments in accordance with the manufacturer's instructions:
   1. Return factory calibrated devices to the factory if they do not meet the field verification requirements for calibration.

3.06 CLEANING

A. As specified in Section 40 61 00.

3.07 DEMONSTRATION AND TRAINING

A. As specified in Section 40 61 00.

3.08 PROTECTION

A. As specified in Section 40 61 00.

3.09 SCHEDULES

A. The provided information does not necessarily include all required instruments. Provide all instruments specified in the Contract Documents:
   1. Instruments may be indicated on the Drawings, specified in the Specifications or both.

END OF SECTION

SECTION 40 73 63 PRESSURE/VACUUM MEASUREMENT: DIAPHRAGM AND ANNULAR SEALS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
1. Diaphragm seals.
2. Annular seals.

B. Related sections:
1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. As specified in Section 40 61 00.

1.03 DEFINITIONS

A. As specified in Section 40 61 00.

1.04 SUBMITTALS

A. Furnish submittals as specified in Section 40 61 00.

B. Additional requirements:
1. Product data:
a. Manufacturer's installation instructions.
b. Seal type.
c. Body materials.
d. Diaphragm material.
e. Fill fluid type.
f. Seal size.
g. Options.
h. Process connection.

1.05 QUALITY ASSURANCE

A. As specified in Section 40 61 00.

B. Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:
1. Process conditions: Fluids, pressures, temperatures, flows, materials, etc.
2. Physical conditions:
a. Installation and mounting requirements.
b. Location within the process.

c. Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

C. Notify the Engineer if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

1.06 DELIVERY, STORAGE, AND HANDLING

A. As specified in Section 40 61 00.

1.07 PROJECT OR SITE CONDITIONS

A. As specified in Section 40 61 00.

1.08 WARRANTY

A. As specified in Section 40 61 00.

1.09 MAINTENANCE

A. As specified in Section 40 61 00.

B. Provide spare annular seal for every size indicated in the project.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Diaphragm seals:
1. For chemical applications, liquids containing solids, and liquids with pulsating flow having pressures less than or equal to 15 pounds per square inch gauge: One of the following or equal:
a. Ashcroft:
1) Flushing connection: Type 741.
2) Without flushing connection: Type 740.
b. Mansfield and Green:
1) Flushing connection: Type SGT.
2) Without flushing connection: Type SBT.
c. Wika, Type L990.40.
d. Rosemount.

B. Annular seals:
1. One of the following or equal:
a. Ashcroft Iso-Ring.
b. Onyx Valve.
c. Red Valve.

2.02 MANUFACTURED UNITS

A. Diaphragm seals:
1. General:

a. Diaphragm seal and pressure instrument shall be assembled by pressure instrument manufacturer and shipped as an assembly.

2. Requirements:
   a. Seal type:
      1) Metallic diaphragm: Welded to upper housing.
      2) Elastomer diaphragm: Bonded to upper housing.
   b. Instrument connection: 1/2 inch NPT.
   c. Material Construction: Type 316 Stainless Steel
   d. Provide 1/4-inch flushing connection in diaphragm lower housing or provide flushing ring.
   e. Flush port plug: Same material of construction as diaphragm lower housing.
   f. Provide fill/bleed connection.
   g. Mounting: As indicated in the Contract Documents.
   h. Provide Type 316 stainless steel armored capillary for all remote installations.
   i. Nuts and bolts: Type 316 stainless steel.
   j. Materials of construction:
      1) Sewage, sludge, liquids containing solids, and liquids with pulsating flow having pressures less than or equal to 15 pounds per square inch:
         a) Diaphragm: Type 316 stainless steel.
         b) Lower housing: Type 316 stainless steel.
         c) Upper housing: Manufacturer's standard.
         d) Fill fluid: Silicon oil.
      2) Sewage, sludge, liquids containing solids, and liquids with pulsating flow having pressures greater than 15 pounds per square inch:
         a) Diaphragm: Type 316 stainless steel.
         b) Lower housing: Type 316 stainless steel.
         c) Upper housing: Manufacturer's standard.
         d) Fill fluid: Silicon oil.
      3) Chlorine:
         a) Diaphragm: Tantalum.
         b) Lower housing: Hastelloy C.
         c) Upper housing: Manufacturer's standard.
         d) Fill fluid: Halocarbon.
      4) Ferric chloride:
         a) Diaphragm: PTFE or tantalum.
         b) Lower housing: PVC or titanium.
         c) Upper housing: Manufacturer's standard.
         d) Fill fluid: Silicon oil.
      5) Fluorosilicic acid:
         a) Diaphragm: Viton.
         b) Lower housing: PVC.
         c) Upper housing: Manufacturer's standard.
         d) Fill fluid: Silicon oil.
      6) Hydrochloric acid:
         a) Diaphragm: PVDF or tantalum.
         b) Lower housing: Hastelloy B2.
         c) Upper housing: Manufacturer's Standard.
         d) Fill fluid: Fluorolube.
      7) Ozone:

a) Diaphragm: Type 316 stainless steel.
b) Lower housing: Type 316 stainless steel.
c) Upper housing: Manufacturer's standard.
d) Fill fluid: Halocarbon.

8) Potassium permanganate:
a) Diaphragm: PTFE or tantalum.
b) Lower housing: PVDF or titanium.
c) Upper housing: Manufacturer's standard.
d) Fill fluid: Halocarbon.

9) Sodium permanganate:
a) Diaphragm: PTFE.
b) Lower housing: PVDF.
c) Upper housing: Manufacturer's standard.
d) Fill fluid: Halocarbon.

10) Sodium bisulfite:
a) Diaphragm: Tantalum.
b) Lower housing: Titanium.
c) Upper housing: Manufacturer's standard.
d) Fill fluid: Silicon oil.

11) Sodium hydroxide:
a) Diaphragm: Monel.
b) Lower housing: Monel.
c) Upper housing: Manufacturer's standard.
d) Fill fluid: Silicon oil.

12) Sodium hypochlorite:
a) Diaphragm: Tantalum.
b) Lower Housing: Titanium.
c) Upper Housing: Manufacturer's standard.
d) Fill Fluid: Halocarbon.

13) Sulfur dioxide:
a) Diaphragm: PTFE or tantalum.
b) Lower housing: PVDF or titanium.
c) Upper housing: Manufacturer's standard.
d) Fill fluid: Halocarbon.

14) Sulfuric acid:
a) Diaphragm: PTFE or tantalum.
b) Lower housing: Hastelloy B2.
c) Upper housing: Manufacturer's Standard.
d) Fill fluid: Halocarbon.

15) Sodium Hypochlorite:
a) Diaphragm: Tantalum.
b) Lower Housing: Titanium.
c) Upper Housing: Manufacturer's standard.
d) Fill Fluid: Halocarbon.

16) Sodium Bisulfite:
a) Diaphragm: Tantalum.
b) Lower Housing: Titanium.
c) Upper Housing: Manufacturer's standard.
d) Fill Fluid: Halocarbon.

17) Engineer's approval.

B. Annular seals:

1. General:
    a. Inside diameter of annular seal shall provide uninterrupted flow:
        1) There shall be no dead ends or crevices.
        2) Process flow shall be sufficient to make the annular seal self-cleaning.
    b. The pressure sensing flexible cylinder shall measure pressure around the full inside circumference of the pipeline.
2. Requirements:
    a. Pressure rating: Equivalent to the ANSI flanges.
    b. Materials of construction:
        1) Inner flexible cylinder: Manufacturer's standard.
        2) Body:
            a) Carbon Steel with epoxy coating
            b) Type 316 Stainless Steel.
        3) Assembly flanges: To match adjacent piping.
        4) Fill fluid: Silicon oil.
    c. Nominal pipe size: As indicated on the Drawings.
    d. Process connection: Wafer
    e. Instrument connection: 1/2 inch NPT.
    f. Provide isolating needle valve between annular seal and pressure instrument.

2.03 ACCESSORIES

A. Provide field fill kits.

2.04 SOURCE QUALITY CONTROL

A. As specified in Section 40 61 00.

PART 3 EXECUTION

3.01 INSTALLATION

A. As specified in Section 40 61 00.

B. Coordinate the installation with all trades to ensure that the mechanical system has all necessary appurtenances including weld-o-lets, valves, etc. for proper installation of instruments.

C. Do not use Teflon thread seal tape on pressure instruments with silicon oil fill fluid.

3.02 FIELD QUALITY CONTROL

A. As specified in Section 40 61 00.

3.03 CLEANING

A. As specified in Section 40 61 00.

3.04 DEMONSTRATION AND TRAINING

A. As specified in Section 40 61 00.

3.05 PROTECTION

A. As specified in Section 40 61 00.

3.06 SCHEDULES

A. The provided information does not necessarily include all required instruments. Provide all instruments identified in the Contract Documents:
   1. Instruments may be indicated on the Drawings, in the Specifications or both.

END OF SECTION

SECTION 40 78 00 PROCESS CONTROL PANELS AND HARDWARE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Design, fabrication and assembly of all instrumentation enclosures, control panels and components provided under this contract, including but not limited to:
   a. Custom built instrumentation and control panels, including all enclosures for hand stations controllers, low voltage power distribution and marshalling panels.
   b. Control panels furnished as part of equipment systems specified in other Divisions, such as vendor control panels (VCPs) and chemical feed panels.
   c. SCADA PLC control panels.
   d. Control components.
   e. Control panel installation.

B. Related sections:

1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

C. Provide all instruments identified in Contract Documents.

D. Furnish the following panels and consoles.

PANEL SCHEDULE (Vendor provided control panels not included)

Panel Designation	Enclosure Rating & Type
PLC-0300 and OIT (Lift Pump Station)	NEMA Type 12, painted-mild steel construction, wall & flange mounting bracket, continuous hinged door, front access only, hasp and staple for padlocking, data pocket etc. Type 12 hinged windows kit for OIT.
PLC-1410 and OIT (Aeration Blowers, Bar screens, generator)	NEMA Type 12, painted-mild steel construction, wall & flange mounting bracket, continuous hinged door, front access only, hasp and staple for padlocking, data pocket etc. Type 12 hinged windows kit for OIT.

PLC-0510 (secondary clarifier no. 1 & 2, RAS &WAS pump)	NEMA Type 4X, 14-gauge type 316L stainless steel bodies and doors, wall & flange mounting bracket, continuous hinged door, front access only, hasp and staple for padlocking, data pocket etc.
PLC-1100 (coagulant & hypochlorite dosing)	NEMA Type 4X, fiberglass reinforced material (chemical resistance) enclosure construction, wall & flange mounting bracket, with quick release latch, type 316L SS padlocking, front access only, data pocket etc.
PLC-1420 and OIT (UV disinfection, sludge blower)	NEMA Type 12, painted-mild steel construction, wall & flange mounting bracket, continuous hinged door, front access only, hasp and staple for padlocking, data pocket etc. Type 12 hinged windows kit for OIT.

1.02 REFERENCES

A. As specified in Section 40 61 00.

B. Institute of Electrical and Electronics Engineers (IEEE):

1. C62.41.1 - Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits.

C. Underwriters Laboratories Inc. (UL):

1. 508C - Standard for Industrial Control Equipment.

2. 1283 - Standard for Electromagnetic Interference Filters.

3. 1449 - Standard for Surge Protective Devices.

1.03 DEFINITIONS

A. As specified in Section 40 61 00.

B. Specific definitions:

1. The term “panel” in this Section is interchangeable with the term “enclosure.”

1.04 SYSTEM DESCRIPTION

A. Panel dimensions:

1. Minimum dimensions are scalable from or as indicated on the Drawings and are based upon manufacturer's non-certified information. It is the responsibility of the Contractor or manufacturer to design and size all panels:
    a. Size panels to provide space for all equipment, wiring, terminations, and other items in the panel, including space for future build out.
    b. Panel sizes that substantially deviate (within 3 inches in any dimension) from the sizes indicated on the Drawings must be approved by the Engineer.
    c. Maximum panel depth: 30 inches, unless otherwise indicated.

B. Structural design:

1. Completed and installed panel work shall safely withstand seismic requirements at the project site. Enclosures and internal equipment shall be braced to prevent damage from specified forces.

1.05 SUBMITTALS

A. Provide submittals as specified in Sections 01 33 00 and 40 61 00.

B. Provide a control panel hardware submittal for each control panel and enclosure being provided on this project, including but not limited to:

1. Product data:
    a. Enclosure construction details and NEMA type.
    b. Manufacturer's literature and specification data sheets for each type of equipment to be installed within or on the panel or enclosure.

2. Shop drawings:
    a. Scaled, detailed exterior panel (front and side views) and interior panel layout showing equipment arrangement and dimensional information:
        1) Provide draft for review and approval by Engineer. The Engineer has the authority to substantially alter initial panel layouts.
    b. Provide a layout of the defined conduit area(s) and indicate preferred entry by voltage level.
    c. Complete nameplate engraving schedule.
    d. Structural details of fabricated panels.

3. Calculations:
    a. Provide installation details based on calculated shear and tension forces:
        1) Calculations shall be signed and sealed by a Professional Engineer licensed in the state where the cabinets and panels will be installed.
    b. For assembled enclosures and other equipment with a weight of 200 pounds or more, provide calculations for:
        1) Weight including panel internal components.
        2) Seismic forces and overturning moments.
        3) Shear and tension forces in connections.
    c. Cooling calculations, including but not limited to:
        1) Highest expected ambient temperature for the enclosure's location.
        2) Internal heat load.
        3) Exposure to direct sunlight.
        4) Dimensions of the enclosure in inches.

5) Maximum allowable temperature inside the enclosure, based on the lowest operating temperature limit of the installed components.

1.06 QUALITY ASSURANCE

A. As specified in Section 40 61 00.

B. Assemble panels, enclosures, and rack systems along with all internal and external devices, wiring, equipment, and materials in a facility that is recognized by UL to assemble and certify UL-labeled control panels:

1. Provide all components and equipment with UL 508 listing.

2. All control panels shall be UL 508A labeled, unless the equipment in the panel and the design in the contract documents cannot be reasonably modified to meet the requirements for UL 508A labeling:
   a. Non-listed, complex, and unique equipment may be evaluated and approved by a third-party testing agency, with prior approval by the Owner. Provide report documenting the testing standard, specification, method of testing, and that the equipment and materials meet appropriate designated standards or have been tested and found suitable for use in a specified manner.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Project environmental conditions as specified in Section 40 61 00.

1. Provide instruments suitable for the installed site conditions including, but not limited to, material compatibility, site altitude, site seismic conditions, humidity, and process and ambient temperatures.

1.08 PROJECT OR SITE CONDITIONS

A. As specified in Section 40 61 00.

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY

A. As specified in Section 40 61 00.

1.12 SYSTEM START-UP (NOT USED)

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 COMMISSIONING (NOT USED)

1.15 MAINTENANCE (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. As listed below in the individual component paragraphs.

B. Provide instruments and other components performing similar functions of the same type, model, or class, and from 1 manufacturer.

2.02 EXISTING PRODUCTS

A. Provide labor and materials for complete modifications to existing panels as required.

B. Field cut and refinish existing panel faces to original condition to accommodate installation of new instruments, removal of existing instruments, and fitting of blanks to suit new layouts. New instrument supports shall be provided as required for complete installation.

2.03 MATERIALS

A. Construct and finish enclosures using materials capable of withstanding the mechanical, electrical, and thermal stresses, as well as the effects of humidity and corrosion that are likely to be encountered in normal service:

1. Enclosures shall have the following properties:
   a. NEMA Type 1: Steel.
   b. NEMA Type 3R: Steel
   c. NEMA Type 4: Steel
   d. NEMA Type 4X: Type 316 stainless steel (unless Type 304 is indicated on the Drawings).
   e. NEMA Type 4X: Polycarbonate or fiberglass reinforced polyester (FRP) in corrosive areas where stainless steel is incompatible.
   f. NEMA Type 12: Steel
   g. NEMA Type 7: Cast aluminum.

B. Bolting material:

1. Commercial quality 1/2-inch diameter, stainless steel hex-head Grade 5 bolts, nuts, and washers, with unified coarse (UNC) threads.

2. Carriage bolts for attaching end plates.

3. All other bolted joints shall have S.A.E. standard lock washers.

2.04 MANUFACTURED UNITS

A. Panels/enclosures:

1. Manufacturer: One of the following or equal:
   a. Rittal.
   b. Pentair (formerly Hoffman Engineering).
   c. Saginaw Control & Engineering.

2. Panel assembly:

a. General guidelines for panel fabrication include:
   1) Continuous welds ground smooth.
   2) Exposed surfaces free of burrs and sharp edges.
   3) Base formed of heavy channel iron, either galvanized or powder coated, minimum 1/2-inch holes at 12-inch spacing to accommodate anchoring of freestanding enclosures to floor.
b. Construct enclosure and mounting panel using stretcher-level quality sheet metal having minimum thickness not less than the following sizes (U.S. Standard Gauge):

Enclosure Height (inches)	Minimum Enclosure Steel Thickness (gauge)	Minimum Back Mounting Panel Thickness (gauge)
Wall-mounted up to 48	**14**	14
Up to 57	12	12
57 - 69	12	10
69 - 82	12, except 10 on back	10
82 or more	10	10

   1) Use heavier sheet metal to meet seismic requirements at the project site or when required due to equipment requirements.
c. Construct supporting frame structure with angled, channeled, or folded rigid section of sheet metal, rigidly attached to and having essentially the same outer dimensions as the enclosure surface and having sufficient torsional rigidity to resist the bending moments applied via the enclosure surface when it is deflected.
d. Provide stiffeners for back mounting panels in enclosures larger than 4 feet. In addition, secure the panels in place by collar studs welded to the enclosure.
e. Door construction:
   1) Turned-back edges suitably braced and supported to maintain alignment and rigidity without sagging.
   2) Sufficient width to permit door opening without interference with rear projection of flush-mounted instruments.
   3) Heavy-gauge piano-type continuous stainless steel hinges.
   4) For NEMA Type 12, Type 4, and Type 4X, provide oil-resistant neoprene sealing gasket and adhesive to seal cover to enclosure.
   5) Gasket installed to seal against roll lip on the enclosure opening.
f. Latches:
   1) For panels, provide each door with a 3-point latching mechanism and locking handle with rollers on the ends of the latch rods. Latch rods shall be connected to a common door handle, hold doors securely, and form a compressed seal between door and gasket, at the top, side, and bottom.
      a) Provide padlock for each enclosure with padlock provisions.
   2) Include an oil-tight key-locking, 3-point latching mechanism on each door:
      a) Provide 2 keys per panel.
      b) All locks keyed alike.
   3) For large NEMA Type 4 and NEMA Type 4X cabinets not available with 3-point latching hardware, provide multiple clips and padlock hasps.

g. Panel cut-outs:
   1) Cut, punch, or drill cutouts for instruments, devices, and windows. Smoothly finish with rounded edges.
   2) Allow a minimum of 3-inch envelope around all displays, controllers, and monitors.
   3) Reinforce around cut-outs with steel angles or flat bars for the following:
      a) Large panel cutouts; for example, openings for local operator interfaces.
      b) Pilot device groupings, where the removed metal exceeds 50 percent of the available metal.

3. In addition to the requirements specified above, the following requirements for NEMA Type 4X stainless steel enclosures apply:
   a. Minimum 14-gauge, Type 304 stainless steel.
   b. Captive stainless steel cover screws threaded into sealed wells.
   c. Inside finish: White polyester powder coating on internal panels.
   d. Specifically designed for use with flange-mounted disconnect handles where required or as indicated on the Drawings.

4. Outdoor panels. Supplementary requirements for panels located outdoors are as follows:
   a. All enclosures located outdoors shall be explicitly designed and rated for outdoor service by the manufacturer.
   b. Door hardware: Stainless steel.
   c. Provide factory installed rain canopy and sun shield for all enclosures with operator interface panels.
   d. Bases: Heavy channel, gasketed stainless steel bases, flanges up, for anchoring to pad.

5. Require install type 12 hinged windows kit for the PLC panel with OIT (operator interface terminal) touch panel to protect sensitive touch screen.

B. Arrangement of components:

1. Arrange panel internal components for external conduit and piping to enter into panel either from above or below.
   a. Provide a layout of the defined conduit area(s) and indicate preferred entry by voltage level.

2. Arrange panel instruments and control devices in a logical configuration, associating pushbutton and selector switches with related readout devices, or as indicated on the Drawings.

3. Mount internal control components on an internal back panel. Devices may be mounted on the side panel only by special permission from the Engineer.
   a. Spacing between wireways and termination points shall not be less than 1.5”, no exceptions.
   b. Used elevated DIN rails or DIN rails on elevated standoffs.

4. All control-panel-mounted operator interface devices shall be mounted between 3 feet and 5 feet above finished floor.

C. Overcurrent protection:

1. Main overcurrent device:
   a. Where the electrical power supply voltage to the control panel is more than 120 VAC, provide the panel with a flange-mounted disconnect handle operating a molded-case circuit breaker and provide a control power transformer for 120-VAC circuits:
      1) Door-mounted disconnect handles are not acceptable.
      2) Mechanically interlock the disconnect switch with the control enclosure doors so that no door can be opened unless the power is disconnected, and the disconnect switch cannot be closed until all doors are closed.
      3) Provide means to defeat the interlock.
      4) Lockable in the off position.
   b. Control panels supplied with 120 VAC:
      1) Provide an internal breaker with the line side terminals covered by a barrier.
      2) Provide a nameplate prominently positioned on the control panel identifying the location of the power source and a warning statement requiring the source to be disconnected before opening the door to the enclosure.

2. Provide circuit breakers as specified in Section 26 28 16.

3. Selection and ratings of protective devices:
   a. Interrupting ratings: Not less than the system maximum available fault current at the point of application.
   b. Voltage rating: Not less than the voltage of the application.
   c. Select current rating and trip characteristics to be suitable for:
      1) Maximum normal operating current.
      2) Inrush characteristics.
      3) Coordination of the protective devices to each other and to the source breaker feeding the panel.

4. Provide a separate protective device for each powered electrical device:
   a. An individual circuit breaker for each 120-VAC instrument installed within its respective control panel and clearly identified for function.
   b. An individual fuse for each PLC discrete output. Provide with individual blown fuse indication external of the I/O card:
      1) Size external fuse to open before any I/O-card-mounted fuses.
   c. An individual 5-ampere fuse for each discrete input loop.
   d. An individual 1/2-ampere fuse for each 4 to 20 milliamperes analog loop powered from the control panel.
   e. Install protective devices on the back mounting panel and identify by a service nameplate in accordance with the wiring diagrams.

5. Fuses for 4 to 20 milliamperes signals:
   a. Provide durable, readily visible label for each fuse, clearly indicating the correct type, size, and ratings of replacement fuse:
      1) Label shall not cover or interfere with equipment manufacturer's instructions.

b. Provide fuses rated for the voltage and available short-circuit current at which they are applied.
c. Manufacturer: One of the following or equal:
1) Ferraz Shawmut.
2) Littelfuse.
3) Bussmann.

6. Fuse holders:
a. Modular type:
1) DIN rail mounting on 35-millimeter rail.
2) Touch-safe design: All connection terminals to be protected against accidental touch.
3) Incorporates blown-fuse indicator.
b. Provide nameplate identifying each fuse:
1) As specified in UL 508A
c. Manufacturer: One of the following or equal:
1) Phoenix Contact.
2) Allen-Bradley 1492-FB Series B.

7. Control circuit breakers:
a. DIN rail mounting on 35-millimeter rail.
b. Manual OPEN-CLOSE toggle switch.
c. Rated for 250 VAC.
d. Interrupting rating: 10 kiloampere (kA) or available fault current at the line terminal, whichever is higher.
e. Current ratings: As indicated on the Drawings or as required for the application.
f. Provide nameplate identifying each circuit breaker:
1) As specified in UL508A
g. Manufacturer: One of the following or equal:
1) Schneider Electric.
2) Phoenix Contact.
3) ABB.
4) Allen-Bradley.
5) Square D.

D. Conductors and cables:

1. Power and control wiring:
a. Materials: Stranded, soft annealed copper.
b. Insulation: 600 volts type MTW.
c. Minimum sizes:
1) Primary power distribution: 12 AWG.
2) Secondary power distribution: 14 AWG.
3) Control: 16 AWG.
d. Color:
1) AC power (line and load): Black.
2) AC power (neutral): White.
3) AC control: Red.
4) DC power and control (ungrounded): Blue.
5) DC power and control (grounded): White with Blue stripe.

6) Ground: Green.

2. Signal cables:
   a. Materials: Stranded, soft annealed copper.
   b. Insulation: 600 volts, PVC outer jacket.
   c. Minimum size: 18 AWG paired or triad.
   d. Overall aluminum shield (tape) mylar coated.
   e. Drain wire, 20AWG minimum.
   f. Color:
      1) 2-Conductor:
         a) Positive (+): Black.
         b) Negative (-): White or red.
      2) 3-Conductor:
         a) Positive (+): Black.
         b) Negative (-): Red.
         c) Signal: White.
   g. Insulate the foil shielding and exposed drain wire for each signal cable with heat- shrink tubing.

E. Conductor identification:

1. Identify each conductor and cable with unique wire numbers as specified in Section 26 05 19.

2. Readily identified without twisting the conductor.

F. General wiring requirements:

1. Wiring methods: Wiring methods and materials for panels shall be in accordance with the NEC requirements for General Purpose (no open wiring) unless otherwise specified.

2. Install all components in accordance with the manufacturer's instructions included in the listing and labeling.

3. Provide a nameplate on the cover of the control panel identifying all sources of power supply and foreign voltages within the control panel.

4. Provide transformers, protective devices, and power supplies required to convert the supply voltage to the needed utilization voltage.

5. Provide power surge protection for all control panels.

6. Provide signal surge protection within control panels for each analog I/O, discrete I/O, and data line (Copper Ethernet, Coax, Fieldbus signals) that originates from outdoor devices.

7. Provide non-metallic ducts for routing and organization of conductors and cables:
   a. Provide wiring separation plan.
   b. Size ducts for ultimate build-out of the panel, or for 20-percent spare, whichever is greater.

c. Provide separate ducts for signal and low-voltage wiring from power and 120-VAC control wiring:
   1) 120 VAC: Grey colored ducts.
   2) 24 VDC: White colored ducts.

8. Cables shall be fastened with cable-mounting clamps or with cable ties supported by any of the following methods:
   a. Screw-on cable tie mounts.
   b. Hammer-on cable-tie mounting clips.
   c. Fingers of the nonmetallic duct.

9. Wire Ties:
   a. No wire ties inside wire duct.
   b. Use Panduit Cable tie installation tool, with tension control/cutoff.
   c. Verify cut ends are cut flush filed smooth after installed.

10. Provide supports at the ends of cables to prevent mechanical stresses at the termination of conductors.

11. Support panel conductors where necessary to keep them in place.

12. Wiring to rear terminals on panel-mount instruments shall be run in nonmetallic duct secured to horizontal brackets run adjacent to the instruments.

13. Conductors and cables shall be run from terminal to terminal without splice or joints. Exceptions:
    a. Factory-applied connectors molded onto cables shall be permitted. Such connectors shall not be considered as splices or joints.

14. The control panel shall be the source of power for all 120-VAC devices interconnected with the control panel including, but not limited to:
    a. Solenoid valves.
    b. Instruments both mounted in the control panel and remotely connected to the control panel.

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS

A. Thermal management:

1. General:
   a. Provide heating, cooling, and dehumidifying devices in order to maintain all instrumentation and control devices to within a range as specified in Section 40 61 00.
   b. Installation of thermal management devices along with all required gaskets shall maintain the enclosure NEMA rating and shall have the same NEMA rating.

2. Air conditioner:

a. Provide solid-state cabinet coolers or air conditioning units on all outdoor panels containing electronic components such as local operator interface (LOI) units, panel instruments, programmable logic controllers, or remote I/O.
b. Provide filters on intake and exhaust openings.
c. Increase panel sizes as needed to accommodate cooling units.
d. Manufacturer: The following or equal:
   1) Kooltronic Integrity Series 21.

3. Heating:
   a. Provide all panels located in areas that are not climate controlled with thermostatically controlled strip heaters, except where all of the following conditions apply:
      1) The panel is not supplied with 120 VAC power.
      2) There are no electronics or moisture-sensitive devices in the enclosure.
      3) The panel is smaller than 38 inches high.

4. Heat exchanger:
   a. Closed-loop design ensuring separation of ambient air and clean air inside the cabinet.
   b. Filterless design to facilitate easy cleaning of the core.
   c. Mounting: As indicated on the Drawings.
   d. Manufacturer: The following or equal:
      1) Noren CC Series.

5. Enclosure temperature sensor as indicated on the Drawings:
   a. Provide wall-mounted RTD transmitter (to measure internal cabinet temperature) in all enclosures containing electrical components such as PLCs, RTUs, RIO, and VFDs.
   b. Platinum RTD.
   c. 4-20 mA 24 VDC output.
   d. Sensor and electronic enclosure.
   e. Accuracy: Within 2 degrees Fahrenheit.
   f. Manufacturer: One of the following or equal:
      1) Omega EWS Series.
      2) TCS Basys Controls TS Series as indicated on the Drawings.

6. Enclosure temperature switch:
   a. Provide wall-mounted bimetallic switch transmitter (to measure internal cabinet temperature in all enclosures) containing electrical components such as PLCs, RTUs, RIO, and VFDs.
   b. Sensor and electronic enclosure.
   c. Accuracy: Within 2 degrees Fahrenheit.
   d. Manufacturer: The following or equal:
      1) Hoffman ATEMNC.
      2) Pfannenberg FLZ.

7. Fan ventilation:
   a. Provide Hoffman fan speed control:
      1) Provide 2 door/cabinet-mounted vent fans for every 72 inches of cabinet width.
      2) Provide finger-guard kit.

3) Filter kit with 2 spare filters for each intake fan.
4) Provide bezel and gasket kit.
5) Provide fan shroud
6) Automatically adjust fan speed depending on remote temperature sensor input.
7) 120 VAC, 60 Hertz.
8) NEMA Type 5-15R cord connections.

B. Panel meters:

1. Pointer type:
   a. Suitable for panel mounting.
   b. Minimum scale length: 3 inches.
   c. Calibrated in engineering units.
   d. Accuracy: Within 2 percent of span.
   e. NEMA Type 4/IP65 sealed front metal bezel.
   f. Manufacturer: The following or equal:
      1) Yokogawa.
      2) Red Lion.

2. Digital process indicators:
   a. General:
      1) Integral provisions for scaling.
      2) Scale to process engineering units.
      3) Switch-programmable decimal points.
      4) NEMA Type 4/IP65 sealed front bezel.
   b. Current and voltage indicators:
      1) 3-1/2-digit minimum.
      2) Minimum character height: 0.5 inches.
      3) Accuracy:
         a) AC/DC volts: Within 0.1 percent of reading plus 2 digits.
         b) DC current: 4 to 20 milliamperes; within 0.1 percent of reading plus 1 digit.
         c) DC voltage: 0 to 10 volts; within 0.1 percent of reading plus 1 digit.
   c. Operating voltage: 120 VAC.
   d. Operating temperature: 0 to 60 degrees Celsius.
      1) Manufacturer: One of the following or equal:
         a) Red Lion.
         b) Action Instruments Visipak.

3. Digital bar graph meter:
   a. Self-contained instruments that display process signals directly in engineering units, both in decimal format and as a bar graph display.
   b. Suitable for panel mounting.
   c. LED display:
      1) Not less than 3 decimal digits.
      2) Not less than a 101-segment LED bar graph.
   d. Input signal:
      1) All conventional current loops and voltage control signals.
   e. Minimum sample rate of once per second.
   f. Provisions for field-adjustable scaling and/or offset.

g. Accuracy shall be within 1 least-significant digit.
h. Manufacturer: One of the following or equal:
1) Ametek Dixson.
2) Yokogawa.
3) Weschler Instruments.

4. Counters:
a. 6 digits.
b. Switch-selectable inputs:
1) Switch contacts.
2) CMOS.
3) TTL.
4) Magnetic pickup.
5) RLC sensors.
c. Selectable up/down control via external signal.
d. Remote reset.
e. Remote inhibit to prevent accumulating counts.
f. Programmable to enable or disable front panel reset.
g. Non-volatile memory to retain all data upon loss of supply power.
h. Sunlight readable.
i. Operating temperature: 0 to 50 degrees Celsius.
j. Manufacturer: The following or equal:
1) Red Lion PAX Series.

C. Pilot devices:

1. General:
a. Provide operator pushbuttons, switches, and pilot lights, from a single manufacturer.
b. Size:
1) 30.5 millimeters.
c. Heavy duty.
d. Pushbuttons:
1) Contacts rated:
a) NEMA Type A600.
2) Furnish 1 spare normally open contact and normally closed contact with each switch.
e. Selector switches:
1) Contacts rated:
a) NEMA Type A600.
b) Knob type.
2) Furnish 1 spare normally open contact and normally closed contact with each switch.
3) Provisions for locking in the OFF position where lockout provisions are indicated on the Drawings.
f. Pilot lights:
1) Type:
a) LED for interior installations.
2) Push to test.
3) Lamp color:
a) On/Running/Start: Green.

b) Off/Stop: Red.
c) Power: White.
d) Alarm: Amber.
e) Status or normal condition: White.
f) Opened: Green.
g) Closed: Red.
h) Failure: Red.

2. Indoor and outdoor areas:
   a. NEMA Type 4/13.
   b. Manufacturer: One of the following or equal:
      1) Schneider Electric Type 9001K.
      2) Allen-Bradley Type 800T.
      3) Square D Class 9001, Type K.
      4) General Electric Type CR104P.
      5) IDEC TWTD Series.

3. Corrosive areas:
   a. NEMA Type 4X.
   b. Corrosion resistant.
   c. Exterior parts of high-impact strength fiberglass-reinforced polyester or multiple-layer epoxy-coated zinc.
   d. Manufacturer: One of the following or equal:
      1) Schneider Electric Type 9001SK.
      2) Cutler Hammer Type E34.
      3) Square D Class 9001, Type SK.
      4) Allen-Bradley Type 800H.
      5) IDEC TWTD Series.

4. Hazardous (Classified) Areas/Class I Division 2:
   a. NEMA Type 4X.
   b. Corrosion resistant.
   c. Exterior parts of high-impact strength fiberglass-reinforced polyester or multiple-layer epoxy-coated zinc:
      1) All contacts contained within a hermetically sealed chamber:
         a) Pushbuttons.
         b) Selector switches.
         c) Push-to-test contacts on pilot lights.
      2) UL listed and labeled for Class I Division 2 areas.
   d. Manufacturer: One of the following or equal:
      1) Schneider Electric Type 9001SK.
      2) Cutler Hammer Type E34.
      3) Allen-Bradley Type 800H.

D. Potentiometer and slidewire transmitters:

1. Provide a DC output in proportion to a potentiometer input.

2. Potentiometer input:
   a. 100 ohms to 100 K ohms.
   b. Impedance Greater or equal to 1 M ohms.

c. Zero turn-up: 80 percent of full-scale input.
d. Span turn-down: 80 percent of full-scale input.

3. Field-configurable output:
   a. Voltage and current: All conventional current loops and voltage control signals.

4. Accuracy including linearity and hysteresis within 0.1 percent maximum at 25 degrees Celsius.

5. Operating temperature: 0 to 55 degrees Celsius.

6. Supply power: 9 to 30 VDC.

7. Manufacturer: The following or equal:
   a. Phoenix Contact.

E. Signal isolators and converters:

1. Furnish signal isolators that provide complete isolation of input, output, and power input:
   a. Minimum isolation level: 1.5 kilovolts AC/50 Hertz for at least 1 minute.
   b. Adjustable span and zero.
   c. Accuracy: Within 1.0 percent of span.
   d. Ambient temperature range: -20 to +65 degrees Celsius.

2. Manufacturer: One of the following or equal:
   a. Phoenix Contact MCR Series.
   b. Acromag 1500, 600T, 800T, Flat Pack, or ACR Series.
   c. Action Instruments Q500 Series or Ultra SlimPakII.
   d. AGM Electronics Model TA-4000.

F. Relays:

1. General:
   a. For all types of 120-VAC relays, provide surge protection across the coil of each relay.
   b. For all types of 24-VDC relays, provide a free-wheeling diode across the coil of each relay.

2. General purpose:
   a. Magnetic control relays.
   b. NEMA Type A300 rated:
      1) 300 volts.
      2) 8 Amps continuous (minimum).
      3) 7,200 volt-amperes make.
      4) 720 volt-amperes break.
   c. Plug-in type.
   d. LED indication for energization status.
   e. Coil voltages: As required for the application.
   f. Minimum poles: DPDT.

g. Touch-safe design: All connection terminals to be protected against accidental touch.
h. Enclose each relay in a clear plastic heat and shock-resistant dust cover.
i. Quantity and type of contact shall be as indicated on the Drawings or as needed for system compatibility.
j. Relays with screw-type socket terminals.
k. Provide additional (slave/interposing) relays when the following occurs:
    1) The number or type of contacts shown exceeds the contact capacity of the specified relays.
    2) Higher contact rating is required in order to interface with starter circuits or other equipment.
l. DIN rail mounting on 35-millimeter rail.
m. Ice-cube-type relays with retainer clips to secure relay in socket.
n. Integrated label holder for device labeling.
o. Manufacturer: One of the following or equal:
    1) Phoenix Contact PLC Series.
    2) Potter and Brumfield Type KRP or KUP.
    3) IDEC R* Series (* = H, J, R, S, U).
    4) Allen-Bradley Type 700 HC.
    5) Square D Type K.

3. Latching:
    a. Magnetic-latching control relays.
    b. NEMA Type B300 rated:
        1) 300 volts.
        2) 10 Amps continuous.
        3) 3,600 volt-amperes make.
        4) 320 volt-amperes break.
    c. Plug-in type.
    d. DIN rail mounting on 35-millimeter rail.
    e. Coil voltage: As required for the application.
    f. Minimum poles: 2 PDT; as required for the application. Plus 1 spare pole.
    g. Touch-safe design: All connection terminals to be protected against accidental touch.
    h. Clear cover for visual inspection.
    i. Provide retainer clip to secure relay in socket.
    j. Manufacturer: One of the following or equal:
        1) Square D 8501, Type K.
        2) IDEC TWTD Series.

4. Time delay:
    a. Provide time-delay relays to control contact transition time.
    b. Contact rating:
        1) 240 volts.
        2) 10 Amps continuous.
        3) 3,600 volt-amperes make.
        4) 360 volt-amperes break.
    c. Coil voltage: As required for the application.

d. Provide pneumatic or electronic type with on-delay, off-delay, and on/off-delay:
   1) For off-delay, use true power-off time-delay relays. Where the required timing range exceeds capability of the off-delay relay use, signal off-delay where power loss will not cause undesirable operation or pneumatic time-delay relays.
e. Minimum poles: 2 PDT.
f. Units include adjustable dial with graduated scale covering the time range in each case.
g. Minimum timing range: 0.1 seconds to 10 minutes, or as required for the application.
h. Manufacturer: One of the following or equal:
   1) IDEC RTE Series.
   2) Agastat Series 7000 (pneumatic).
   3) Allen-Bradley Type 700-HR.

G. Terminal blocks:

1. DIN rail mounting on 35-millimeter rail.

2. Suitable for specified AWG wire.

3. Rated for 15 amperes at 600 volts.

4. Screw terminal type.

5. Provide mechanism to prevent wire connection from loosening in environments where vibration is present. This mechanism shall not cause permanent deformation to the metal body.

6. Touch-safe protection for all terminals for conductors.

7. Construction: Polyamide insulation material capable of withstanding temperature extremes from - 40 to 105 degrees Celsius.

8. Terminals: Plainly identified to correspond with markings on the diagrams:
   a. Permanent machine-printed terminal identification.

9. Disconnect-type field signal conductor terminals with socket/screw for testing.

10. Identify terminals suitable for use with more than 1 conductor.

11. Position:
    a. So that the internal and external wiring does not cross.
    b. To provide unobstructed access to the terminals and their conductors.

12. Provide minimum 25-percent spare terminals.

13. Manufacturer: One of the following or equal:
    a. Phoenix Contact UK5 Series.
    b. Allen-Bradley 1492 Series.

H. Wire duct:

1. Provide flame retardant plastic wiring duct, slotted with dust cover.

2. Type:
   a. Wide slot.
   b. Narrow slot.
   c. Round hole.

3. Manufacturer: The following or equal:
   a. Panduit.

I. Din Rail

1. Perforated Steel.

2. 35mm width.

3. 15mm deep.

4. Provide 2 inch offset using one of the following:
   a. Offset brackets
   b. Preformed standoff Din Rail Channel

J. Surge protection devices:

1. Control panel power:
   a. 120-volt control power source: Non-UPS powered:
      1) Provide surge protection device (SPD) for panel power entrances:
         a) Nominal 120-VAC with a nominal clamping voltage of 200 volts.
         b) Non-faulting and non-interrupting design.
         c) A response time of not more than 5 nanoseconds.
      2) Control panel power system level protection, non-UPS powered:
         a) Designed to withstand a maximum 10-kA test current of a 8/20 µs waveform according to IEEE C62.41.1 Category C Area.
         b) For panels receiving power at 120 VAC, provide surge protection at secondary of main circuit breaker.
         c) Provide both normal mode noise protection (line to neutral) and common mode (neutral to ground) surge protection.
         d) DIN rail mounting.
         e) Attach wiring to the SPD by means of a screw-type cable-clamping terminal block:
            (1) Gas-tight connections.
            (2) The terminal block: Fabricated of non-ferrous, non-corrosive materials.
         f) Visual status indication of MOV status on the input and output circuits.
         g) Dry contact rated for at least 250 VAC, 1 Amp for remote status indication.
         h) Meeting the following requirements:
            (1) Response time: Less than or equal to 100 ns.

(2) Attenuation: Greater than or equal to -40 dB at 100 kilovolt-Hertz as determined by a standard 50-ohm insertion test.
(3) Safety approvals:
(a) UL 1283 (EMI/RFI Filter).
(b) UL 1449 2nd Edition.
3) Manufacturer: One of the following or equal:
a) Phoenix Contact Type SFP TVSS/Filter.
b) Liebert Accuvar Series.
c) Islatrol.

b. 120-volt control power source: UPS powered.
1) Provide surge protection on the control power source at each panel containing power supplies, or electronic components including PLCs, I/O, HMI, and digital meters.
2) Location:
a) For panels with a UPS, install surge protection ahead of UPS and maintenance bypass switch.
(1) Surge protection is not required for 120-VAC circuits that are only used for panel lights and receptacles.
b) For panels receiving power at 480 VAC, provide surge protection on the 120-VAC control power transformer secondary.
3) MCOV: 150 VAC.
4) Surge capability (8/20 µs wave): 10 kA.
5) Peak let-through: 620V L-N, 850V L-G.
6) Manufacturer: One of the following or equal:
a) Phoenix Contact Plugtrab PT Series.
b) MTL Surge Technologies MA15 Series.

2. Instrument, data, and signal line protectors (traditional I/O) – panel mounted:
a. Surge protection minimum requirements: Withstand a 10-kA test current of a 8/20 µs waveform in accordance with IEEE C62.41.1 Category C Area.
b. DIN rail mounting on 35-millimeter rail (except field-mounted SPDs).
c. SPDs consisting of 2 parts:
1) A base terminal block.
2) A plug protection module:
a) Replacing a plug shall not require the removal of any wires nor interrupt the signal.
b) Base and plug coded to accept only the correct voltage plug.
d. SPD manufacturer: One of the following or equal:
1) Phoenix Contact Plugtrab Series.
2) Bournes Series 1800.

3. Instrument, data, and signal line protectors (traditional I/O) – field mounted:
a. Surge protection minimum requirements: Withstand a minimum 10-kA test current of a 8/20 µs waveform in accordance with IEEE C62.41.1 Category C Area.
b. Manufacturer: One of the following or equal:
1) Plugtrab PT Series.
2) MTL TP48 Series.

4. Fieldbus network protectors: Panel mounted.
   a. DeviceNet network surge protectors:
      1) Manufacturer: One of the following or equal:
         a) Phoenix Contact Trabtech MCR-Plugtrab PT PE/S+1x2-BE header with PT PE/S+1x2-24-ST plug.
         b) Transtector Systems Inc. DN-24 Series.
      2) Nominal operating voltage: 24 VDC.
      3) Maximum continuous operating voltage: 35 VDC.
      4) Shall withstand a surge current (8/20 µs combination wave) of 700 amperes.
      5) Operating temperature range: -40 to 85 degrees Celsius.
   b. Profibus surge protectors:
      1) Profibus DP:
         a) Manufacturer: The following or equal:
            (1) Phoenix Contact PT 1x2+F-BE series base module with PT 3-PB Series protection module.
         b) Nominal voltage: 5 VDC.
         c) Maximum continuous operating voltage: 5.2 VDC.
         d) Nominal current: 450 milliamperes.
         e) Nominal discharge surge current: 10 kA.
         f) Voltage protection level at 1 kilovolt per micro-second: 55 volts.
         g) Shall withstand a maximum discharge surge current (8/20 micro second combination wave) of 10 kA.
         h) Operating temperature range: -40 to 85 degrees Celsius.
      2) Profibus PA:
         a) Manufacturer: One of the following or equal:
            (1) Pepperl-Fuchs DP-LBF Series base and protection modules.
            (2) ABB NGV210 Series base module with NGV211 Series protection module.
         b) Line-line voltage protection level at 1 kilovolt per micro-second: 50 volts.
         c) Nominal discharge surge current: 10 kA.
         d) Shall withstand a maximum surge current (8/20 micro second combination wave) of 20 kA.
         e) Operating temperature range: -40 to 80 degrees Celsius.
   c. Foundation Fieldbus H1 surge protectors:
      1) Manufacturer: One of the following or equal:
         a) Pepperl-Fuchs DP-LBF Series base and protection modules.
         b) ABB NGV210 Series base module with NGV211 Series protection module.
      2) Line-line voltage protection level at 1 kilovolt per micro-second: 50 volts.
      3) Nominal discharge surge current: 10 kA.
      4) Shall withstand a maximum surge current (8/20 micro second combination wave) of 20 kA.
      5) Operating temperature range: -40 to 80 degrees Celsius.

5. Fieldbus instrument protectors - field mounted.
   a. Profibus PA instruments:
      1) Manufacturer: One of the following or equal:
         a) Pepperl-Fuchs F*-LBF Series.

b) ABB NGV220 Series.
2) Nominal discharge surge current: 10 kA.
3) Line-line voltage protection level at 1 kilovolt per micro-second: 50 volts.
4) Operating temperature range: -40 to 80 degrees Celsius.

b. Foundation Fieldbus H1 instruments:
1) Manufacturer: One of the following or equal:
a) Pepperl-Fuchs F*-LBF Series.
b) ABB NGV220 Series.
2) Nominal discharge surge current: 10 kA.
3) Line-line voltage protection level at 1 kilovolt per micro-second: 50 volts.
4) Operating temperature range: -40 to 80 degrees Celsius.

K. Beacons:

1. Manufacturer: One of the following or equal:
a. Federal Signal Corp Starfire Series.
b. Allen-Bradley 855 B *-* 10 Series.
c. Edwards 102 Series.

L. Horns:

1. Electromechanical:
a. Manufacturer: One of the following or equal:
1) Federal Signal 350 or 31X Series.
2) Edwards 878EX or 879EX Series.

2. Electronic:
a. Manufacturer: One of the following or equal:
1) Federal Signal 300GCX or 300X Series.
2) Allen-Bradley 855H or 855XH Series.
3) Edwards 5530M or 5533MD Series.

3. Rated for 80 dB minimum at 10 feet.

M. Power supplies:

1. Design power supply systems so that either the primary or backup supply can be removed, repaired, and returned to service without disrupting the system operation.

2. Convert 120 VAC to 24 volt DC or other DC voltages required or as required for the application.

3. Provide backup 24 VDC power supply units to automatically supply the load upon failure of the primary supply.

4. Provide power supply arrangement that is configured with several modules to supply adequate power in the event of a single module failure:
a. Provide automatic switchover upon module failure.
b. Alarm contacts monitored by the PLC.

5. Sized to provide 40-percent excess rated capacity.

6. UL 508C listed to allow full rated output without de-rating.

7. Provide fuse or short-circuit protection.

8. Provide a minimum of 1 set of dry contacts configured to change state on failure for monitoring and signaling purposes.

9. Output regulation: Within 0.05 percent for a 10-percent line change or a 50-percent load change:
   a. With remote voltage sensing.

10. Operating temperature range: 0 to 50 degrees Celsius.

11. Touch-safe design: All connection terminals to be protected against accidental touch.

12. DIN rail mounting on 35-millimeter rail.

13. Provide self-protecting power supplies with a means of limiting DC current in case of short circuit.

14. Manufacturer: One of the following or equal:
    a. Fully redundant:
       1) Phoenix Contact Quint Power Supply with SFB technology
          a) Phoenix Contact Quint - O-ring redundancy module
       2) IDEC PS5R Series.
          a) Wit redundancy Diode
    b. Sola.
    c. Acopian.
    d. PULS.

N. Intrinsic safety barriers:

1. Transformer isolated barrier:
   a. Containing a transformer to provide complete:
      1) Isolation between the safe and hazardous areas for loop-powered devices.
      2) 3-way isolation between the safe area, hazardous area, and power supply powered devices.
   b. Resistor for current limitation.
   c. Fuses for short-circuit protection.
   d. Provide barriers with pluggable connectors that are coded for easy replacement.
   e. Transmission error shall be less than or equal to 0.1 percent of full scale.
   f. DIN rail mounting on 35-millimeter rail.
   g. Approvals:
      1) FM.
      2) UL 913.

2. Types:
   a. Switch isolators:
      1) Designed and approved for use with discrete inputs.
      2) Supply power: 20 to 30 VDC.
      3) Output to track input.
      4) LED in the cover to indicate the status of the input.
      5) Selector switch to change the logic of the input.
      6) Input: Dry contact.
      7) Output: SPDT relay.
   b. Transmitter and converters for use with 4- to 20-milliampere signals without Hart® communications capability:
      1) Designed and approved for use with 4- to 20-milliampere analog signals.
      2) Designed for powering 2- and/or 3-wire transmitters in hazardous locations and repeating and/or generating the current to the safe area.
      3) Supply voltage: 20 to 30 VDC.
   c. Transmitter and converters for use with 4- to 20–milliampere signals with Hart® communications capability:
      1) Designed and approved for use with 4- to 20-milliampere analog signals.
      2) Designed for powering 2- and/or 3-wire transmitters in hazardous locations and repeating and/or generating the current to the safe area.
      3) Transfer digital signals from the hazardous area to the safe area.
      4) Complete bi-directional communication between a smart transmitter located in the field and the suitable equipment located in the safe area.
      5) Supply voltage: 20 to 30 VDC.

3. Manufacturer: One of the following or equal:
   a. Phoenix Contact ME Series.
   b. Pepperl + Fuchs.

O. Limit switches:

1. NEMA Type 4X.

2. AC contact rating 120 volts, 10 A.

3. DC contact rating 125 volts, 0.4 A.

4. Provide robust actuation mechanism not prone to degradation.

5. Provide complete actuator mechanism with all required hardware.

6. Allows for contact opening even during contact weld condition.

7. UL approved.

8. Operating temperature range: -18 to +110 degrees Celsius (0 to 230 degrees Fahrenheit).

9. Manufacturer: One of the following or equal:
   a. Schneider Electric Type XC.

b. Allen-Bradley 802 Series.
c. Honeywell HDLS Series.
d. Omron D4 Series.
e. Eaton E47, E49, E50.
f. ABB.

P. Current switches:

1. Operate from 120-VAC supply voltage.

2. 1 normally open and normally closed contacts.

3. Adjustable current setting.

4. Manufacturer:
   a. Zelio® RM35.

2.07 ACCESSORIES

A. As specified in Section 40 61 00.

B. Provide panels with an inside protective pocket to hold the panel drawings. Ship panels with 1 copy of accepted Shop Drawings including, but not limited to, schematic diagram, connection diagram, and layout drawing of control wiring and components in a sealed plastic bag stored in the panel drawing pocket.

C. Provide 15-inch floor stands or legs where needed or as indicated on the Drawings.

D. Provide a folding shelf for enclosures that contain programmable controllers. The shelf shall be mounted on the inside surface of the door, capable of supporting a laptop computer.

E. Provide nameplate to each panel as indicated on the Drawings:

1. Provide a nameplate with the following markings that is plainly visible after installation:
   a. Manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the panel can be identified.
   b. Supply voltage, phase, frequency, and full-load current.
   c. Power source or circuit ID.
   d. Short-circuit current rating of the panel based on one of the following:
      1) Short-circuit current rating of a listed and labeled assembly.
      2) Short-circuit current rating established utilizing an approved method.

2. Provide enclosures with a flange-mounted disconnect that is interlocked with the doors.

F. Provide a window kit where indicated on the Drawings or where a transmitter with display is mounted inside a control panel. The window shall meet the following requirements:

1. Safety plate glass.

2. Secured by rubber locking seal.

3. Allow full viewing of devices issuing visual process data or diagnostics.

G. Lighting:

1. Provide 1 luminaire for each section, on the interior of the panel, spaced evenly along the top-front of the enclosure door opening(s):
   a. Covered or guarded.
   b. Provide On-Off door-activated switches where indicated on the Drawings.
   c. 120-volt, single-phase, 15-amp style plug.
   d. Provide 4,000 K, 900 Lumens – LED fixture.
      1) Provide additional fixtures for every 36 inches of width.

H. Receptacles:

1. Provide 1 duplex receptacle located every 4 feet of enclosure width, spaced evenly along the back mounting panels.

2. GFCI, 120-volt, single-phase, 15-amp style plug.

3. Provide circuit breaker or fuse to limit receptacle draw to 5 amperes.

I. Grounding:

1. Provide the following:
   a. Grounding strap between enclosure doors and the enclosure.
   b. Equipment grounding conductor terminals.
   c. Provide equipment ground bus with lugs for connection of all equipment grounding wires.
   d. Bond multi-section panels together with an equipment grounding conductor or an equivalent grounding bus.

2. Identify equipment grounding conductor terminals with the word “GROUND,” the letters “GND,” the letter “G,” or the color green.

3. Signal (24 VDC) grounding: Terminate each drain wire of a signal (shielded) cable to a unique grounding terminal block, or common ground bus at the end of the cable as shown on the Loop Drawings.

4. Ensure the continuity of the equipment grounding system by effective connections through conductors or structural members.

5. Design so that removing a device does not interrupt the continuity of the equipment- grounding circuit.

6. Provide an equipment-grounding terminal for each incoming power circuit, near the phase conductor terminal.

7. Size ground wires in accordance with NEC and UL Standards, unless noted otherwise.

8. Connect all exposed, noncurrent-carrying conductive parts, devices, and equipment to the equipment-grounding circuit.

9. Connect the door stud on the enclosures to an equipment-grounding terminal within the enclosure using an equipment-bonding jumper.

10. Bond together all remote and local control panels, processor racks, and conductive enclosures of power supplies and connect to the equipment-grounding circuit to provide a common ground reference.

J. Provide sunshades and insulation for all outdoor installations.

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES

A. Finishes:

1. Metallic (non-stainless):
   a. Metal surfaces of panels shall be prepared by chemical cleaning and mechanical abrasion in accordance with the finish manufacturer's recommendations to achieve a smooth, well-finished surface.
   b. Scratches or blemishes shall be filled before finishing. One coat of zinc phosphate shall be applied per the manufacturer's recommended dry-film thickness and allowed to dry before applying the finish coat.
   c. Finish coat shall be a baked polyester-urethane powder, aliphatic air-dry polyurethane, or epoxy enamel to meet NEMA rating specified application.
   d. Exterior of enclosures located outdoors shall be UV-resistant polyester powder coating. Total dry film thickness shall be 3 mils, minimum.

2. Stainless steel:
   a. Stainless enclosures shall be provided with a Number 4 brushed finish - not painted.

B. Colors:

1. Exterior color of panels mounted indoors shall be manufacturer's standard light gray.

2. Exterior of panels mounted outdoors shall be manufacturer's standard white.

3. Panel interiors shall be manufacturer's standard white.

2.11 SOURCE QUALITY CONTROL

A. As specified in 40 61 00.

B. Factory calibrate each instrument with a minimum 3-point calibration or according to manufacturer's standard at a facility that is traceable to the NIST.

1. Submit calibration data sheets to the Engineer at least 30 days before shipment of the instruments to the project site.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the installation location for the instrument and verify that the instrument will work properly when installed.

1. Notify the Engineer promptly if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. Install enclosures so that their surfaces are plumb and level within 1/8 inch over the entire surface of the panel; anchor securely to wall and structural supports at each corner, minimum. Direct attachment to drywall is not permitted.

B. Install the enclosure per guidelines and submitted installation instructions to meet the seismic requirements at the project site.

C. Provide floor stand kits for wall-mounted enclosures larger than 48 inches high.

D. Provide 3-1/2-inch high concrete housekeeping pads for freestanding enclosures.

E. Install gasket and sealing material under panels with floor slab cutouts for conduit:

1. Undercoat floor-mounted panels.

F. Provide a full-size equipment-grounding conductor in accordance with NEC included with the power feeder. Terminate to the incoming power circuit-grounding terminal.

G. All holes for field conduits, etc. shall be cut in the field. There shall be no additional holes, factory cut holes, or hole closers allowed. Incorrect holes, additional holes, or mis-cut holes shall require that the entire enclosure be replaced.

H. Control panels that are adjacent to motor control centers shall be fully wired to the motor control centers using wireways integral to the motor control center or additional conduits as needed. These interconnections are not shown or reflected on the Conduit Schedule, but shall be shown on the Loop Drawings prepared by the Contractor.

I. Provide individually fused analog input module points with blown-fuse indicator lights, mounted external of the module on the output terminal strip.

J. Side Panels:

1. Side panels shall be kept free off all control equipment and devices. Any deviation must be sent to the engineer in writing asking for a deviation.

3.04 ERECTION, INSTALLATION, APPLICATION, AND CONSTRUCTION (NOT USED)

3.05 REPAIRS/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 FIELD QUALITY CONTROL

A. As specified in Section 40 61 00.

3.08 ADJUSTING (NOT USED)

3.09 CLEANING

A. As specified in Section 40 61 00.

3.10 DEMONSTRATION AND TRAINING (NOT USED)

3.11 PROTECTION

A. As specified in Section 04 61 00.

3.12 SCHEDULES (NOT USED)

END OF SECTION

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SECTION 40 80 00 TESTING, CALIBRATION, AND COMMISSIONING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
1. Testing requirements that apply to process control and instrumentation systems for the entire Project.

B. Related sections:
1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. As specified in Primary Control Devices Section 40 61 00.

B. United States Environment Protection Agency (EIA).

C. Telecommunications Industry Association (TIA).

1.03 DEFINITIONS

A. As specified in Section 40 61 00.

B. Specific definitions:
1. PTO: Profibus Trade Organization.

1.04 SYSTEM DESCRIPTION (NOT USED)

1.05 SUBMITTALS

A. Furnish submittals as specified in Section 01 33 00.

B. General:
1. Reference additional detailed test submittal scheduling and prerequisite requirements as specified in the Sequencing article of Section 40 61 00.
2. Develop the PCIS system test submittals in consultation and cooperation with all applicable subcontractors.
3. Develop and submit an overall testing plan for the PCIS. The overall test plan to be reviewed and approved by the Engineer before detailed test plans, procedures, and forms will be reviewed.
4. Describe the test phases as they apply specifically to this Project and each process system.
5. Provide a preliminary testing schedule to show the sequence of tests and commissioning as they apply to each process system and each PLC.

6. Provide a description of factory tests. Describe what equipment will be included, what testing equipment will be used, and the simulator that will be used.

C. Test procedures:
1. Develop and submit detailed test procedures to show that the integrated SCADA system hardware and software is fully operational and in compliance with the requirements specified in the Contract Documents.
2. Provide a statement of test objectives for each test.
3. Prepare specific procedures for each process system.
4. Describe sequentially the steps to be followed in verifying the correct operation of each process system, including all features described in the loop descriptions, control strategies, and shown in the P&IDs. Implied or generic test procedures are not acceptable.
5. Specify who will perform the tests, specifically what testing equipment will be used (including serial numbers and NIST-traceable calibration), and how the testing equipment will be used.
6. Describe the expected role of the Engineer, as well as any requirements for assistance from Owner's staff.
7. Provide the forms and checklists to be used.

D. Test forms:
1. Provide test and calibration forms and checklists for each of the following:
   a. Calibration.
   b. Factory acceptance tests (FAT).
   c. Loop validation tests.
   d. Installation tests.
   e. Functional tests.
   f. Instrumentation and Controls Performance test.
   g. Communication Testing including all digital bus and all forms of Ethernet.
2. Test forms shall include the detailed test procedures, or shall include clear references to separate pages containing the complete test procedure applicable to each form. If references to procedures are used, the complete procedure shall be included with each test binder.
3. Every page of each test form shall include project name, date, time, name of person conducting the test, signature of person conducting the test, and for witnessed tests, place for signature of person (Engineer and Owner) witnessing the test.
4. Some sample test forms are included at the end of this Section. These test forms show the minimum required test form content. They are not complete, and have not been customized for this Project. The Contractor is to develop and submit test forms customized for the Project and meeting all of the specified test and submittal requirements.

E. Testing binders:
1. Sub-system to be tested, provide and submit a test binder containing all test procedures and individual test forms for the test. References to other documents for test procedures and requirements are not acceptable.
2. Fill out in advance headings and all other information known before the test.
3. Include applicable test plan information, as well as a list of all test prerequisites, test personnel, and equipment.
4. Include or list reference material and provide separately at the time of the test.

5. Record test results and verify that all test requirements and conditions have been met.

F. FAT procedure additional minimal requirements:
1. Prepare and submit a FAT procedure which includes:
a. Control system testing block diagram.
b. Estimated test duration.
c. Details on the simulator construction, components, and operation.

G. Test reports:
1. At the conclusion of each test, submit a complete test report, including all test results and certifications.
2. Include all completed test binders, forms, and checklists.
3. Submission, review, and acceptance of each test report is required before the start of the sub-system.

1.06 QUALITY ASSURANCE

A. Test personnel:
1. Furnish qualified technical personnel to perform all calibration, testing, and verification. The test personnel are required to be familiar with this Project and the equipment, software, and systems before being assigned to the test program.

1.07 SCHEDULING

A. As specified in Primary Controll Devices Section 40 61 00.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 INSTALLATION

A. As specified in Section 40 61 00.

B. Installation supervision:
1. Provide as specified in Primary Controll Devices Section 40 61 00.

3.02 COMMISSIONING AND PROCESS START-UP

A. Source Testing:
1. Provide manufacturer services as specified in the table below.

Section Number	Section Title	Source Testing (Witnessed or Non-witnessed)
40 78 00	Control Systems - Panels, Enclosures, and Panel Components	Witnessed
40 80 00	Testing, Calibration, and Commissioning of Process Systems	Witnessed

2. FAT - general:
    a. Performed during the Commissioning Phase, source testing activity.
    b. Before shipment to the Project Site, the complete PCIS system including all operator stations, servers, network equipment, printers, PCMs, PLCs, RTUs, LCPs, peripherals, communications equipment, and other SCADA equipment, shall be assembled, connected, and all software loaded for a fully functional FAT of the integrated system.
    c. Perform tests to show that the integrated system hardware and software is fully operational and in compliance with the requirements specified in the Contract Documents.
    d. Additional factory tests are specified in other sections of the Instrumentation and Control Specifications.
    e. The FAT will be witnessed.
    f. Right of observation: The Owner retains the right to observe all factory test activities including any and all subsystem preparation, pretests, troubleshooting, retests, warm-up, and software modification and/or update.
    g. The Owner reserves the right to test any specified function, whether or not explicitly stated in the test submittal.
    h. Correction of deficiencies: Any deficiencies observed during the test shall be corrected and retested before completion of the test.
    i. Any changes and/or corrections shall be noted on the test forms. Engineer shall witness the revisions and/or corrections prior to leaving the test site.
    j. If the corrections and/or revisions are too extensive to be made while the Engineer is scheduled to be at the FAT test site, the FAT shall be, at the Engineer's sole discretion, considered failed, and the test shall be restarted at a later date. All costs for the re-test shall be borne by the Contractor.
3. Testing simulation:
    a. The FAT shall make use of hardware simulators that contain switches, pilot lights, variable analog signal generators, and analog signal level displays, which shall be connected to the I/O points within the SCADA system. All inputs and outputs shall be simulated, and proper control and system operation shall be validated.
    b. The use of jumper wires, terminal block mounted pilot lights, and loose meters to act as or supply the functionality of a simulator shall not be allowed.
    c. The hardware simulator may consist of a PLC, operating under a SCADA software package, or other approved software that has its I/O points wired to PLC's I/O points. Software operating on a PC may then act as the switches, pilot lights, variable analog signal generators, and analog signal level displays.
4. Preliminary FAT:
    a. A complete preliminary FAT (pre-FAT) shall be conducted utilizing test procedures approved by the Engineer. The pre-FAT test procedure shall be a subset of the full FAT.
    b. The purpose of the pre-FAT is to provide assurance to the Engineer that the SCADA system is ready for the full, witnessed FAT, in terms of both stability and functionality. Debugging of software and troubleshooting of hardware shall occur during and before the pre-FAT, not during the FAT.

The Contractor shall fully test the SCADA system and fix all deficiencies found before the full FAT.

c. The Owner shall have the right to witness any or all the pre-FAT testing and shall be notified in writing 20 days before the start of the pre-FAT.

d. The pre-FAT test results submittal shall include a letter, signed by the Contractor's project manager or company officer, certifying that the system is complete, has been tested successfully, and is fully ready for the full, witnessed FAT. The submittal shall include completed pre-FAT test forms, signed by the Contractor's staff, and shall be submitted for review before the start of the FAT.

5. Panel inspections:
   a. The Engineer will inspect each control panel for completeness, workmanship, fit and finish, and compliance with the Contract Documents and the accepted shop drawings.
   b. Provide panel inspection forms as part of the FAT procedures submittal.
   c. Inspection to include, as a minimum: Layout, mounting, wire and data cable routing, wire tags, power supply, components and wiring, I/O components layout (including terminals, wiring and relays), device layout on doors and front panels, and proper ventilation operation.
   d. A sample FAT control panel form has been provided at the end of this Section.
6. I/O test:
   a. Verify that I/O is properly wired to field terminals and is properly mapped into the PLC and the rest of the SCADA system, including all operator interface devices.
   b. Test methodology:
      1) Discrete inputs: Apply appropriate input at panel terminal, observe input card indicator, observe data value at each indicated data address, observe data received on all operator interface displays (SCADA workstations and local operator interface (LOI) displays).
      2) Discrete outputs: Issue commands from operator interface screen, verify output card indicator light and measure response at field wiring terminals.
      3) Analog inputs: Apply appropriate analog input signal at panel terminals, observe data value at each indicated data address, and observe data properly received at each operator screen. Check each point at 0 percent, 50 percent, and 100 percent of scale.
      4) Analog outputs: Enter scaled values in the output buffer file, observe the output data file value, and measure appropriate response at panel wiring terminals.
   c. Test forms to include, but not be limited to:
      1) PLC and panel number.
      2) I/O type.
      3) I/O tag name.
      4) Panel terminal block numbers.
      5) Rack/slot/number of I/O point.
      6) Check-off for correct response for each I/O point.
      7) Space for comments.
      8) Initials of individual performing test.
      9) Date test was performed.
      10) Witness' signature lines.
7. System configuration test:

a. Demonstrate and test the setup and configuration of all operator stations, servers, development stations, and peripherals.
b. Demonstrate all utility software and functions, such as virus protection, backup, optical drive burning, network monitoring, etc.
c. Demonstrate the proper operation of all peripheral hardware.
d. Demonstrate all general SCADA functions.
e. Demonstrate proper operation of log-on and other access security functions.
f. Demonstrate the proper operation of all historical data storage, trend, display, backup, and report functions.
g. Test automatic fail over of redundant equipment.
h. Demonstrate the proper operation of the alarm display and acknowledgement functions.
i. Test forms:
    1) For each test, list the specification page and paragraph of the function demonstrated, and provide a description of the function.
    2) List the specific tests and steps to be conducted.
    3) For each function, list all of the different sub-functions or ways the function can be used, and provide a test check-off for each:
        a) Include signature and date lines.

8. Control logic test:
    a. The purpose of this test is to verify that all software functions and logic work as specified, along with any hardwired logic or functions in the tested control panels.
    b. Testing requirements:
        1) Demonstrate in detail how each function operates under a variety of operating scenarios. Test to verify the application of each general control strategy function to each specific control strategy or loop description.
        2) Demonstrate the proper operation of the programming and configuration for each control strategy or loop description. Test each strategy or loop description on a sentence by sentence and function by function basis. Loops with similar or identical logic must each be tested individually.
        3) Demonstrate the proper operation of all digital communication links and networks. Verify each digital communication I/O point.
        4) Failure testing: In addition to demonstrating correct operation of all specified features, special effort shall be made to demonstrate how the system responds to and recovers from abnormal conditions including, but not limited to: equipment failure, operator error, communications subsystem error, communications failures, simulated/forced software lockups, power failure (both utility power and power to SCADA hardware), process equipment failure, and high system loading conditions.
    c. Test forms:
        1) Include the fully revised and approved control strategy for the loop being tested.
        2) Identify the cause and effect as each I/O point is toggled through the simulator. Check boxes shall be provided to track proper and/or improper operation of the loop.
        3) Any deficiencies or operational changes shall be noted on the forms for correction and documentation:

a) Include signature and date lines.

B. Owner Training:
1. Complete Owner training as specified in Section 40 90 00.

C. Installation Testing:
1. General:
a. The Owner reserves the right to test any specified function, whether or not explicitly stated in the test submittals.
b. Failure testing:
1) In addition to demonstrating correct operation of all specified features, demonstrate how the system reacts and recovers from abnormal conditions including, but not limited to:
a) Equipment failure.
b) Operator error.
c) Communications sub-system error.
d) Power failure.
e) Process equipment failure.
f) High system loading conditions.
c. Conduct testing Monday through Friday during normal working hours for no more than 8 hours per day.
1) Testing at other times requires approval of the Engineer.
2. Sequencing:
a. See additional requirements specified in the Sequencing article of Section 40 90 00.
3. Calibration:
a. After installation but before starting other tests, calibrate and adjust all instruments, devices, valves, and systems, in conformance with the component manufacturer's instructions and as specified in these Contract Documents.
b. Components having adjustable features are to be set carefully for the specific conditions and applications of this installation. Test and verify that components and/or systems are within the specified limits of accuracy.
c. Replace either individually or within a system, defective elements that cannot achieve proper calibration or accuracy.
d. Calibration points:
1) Calibrate each analog instrument at 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of span, using test instruments with accuracies traceable to NIST.
e. Field verify calibration of instruments that have been factory-calibrated to determine whether any of the calibrations are in need of adjustment.
f. Analyzer calibration:
1) Calibrate and test each analyzer system as a workable system after installation. Follow the testing procedures directed by the manufacturers' technical representatives.
g. Complete instrument calibration sheets for every field instrument and analyzer.
h. Calibration tags:
1) Attach a calibration and testing tag to each instrument, piece of equipment, or system.
2) Sign the tag when calibration is complete.
4. LAN cable post-testing:

a. After installing the cable and connectors, test all cables using the LAN certification to confirm the installation meets the requirements of the specification.
b. Provide test documentation that includes the cable number, total length of cable, a permanent hard copy, as well as a-USB or CD copy of all traces.
    1) After installing connectors:
    2) Perform cable end-to-end testing on all installed cables from both ends of the cable. Test shall include cable system performance tests and confirm the absence of wiring errors.
    3) Submit a signed test report presenting the results of the cable testing.
    4) Repair or replace any portions of the system not meeting ANSI/TIA/EIA standards for a Category 6 installation. Repaired sections shall be retested.
c. Submit 3 copies of all final documentation (including traces), using the approved test form, to the Engineer upon successful completion of the testing.

5. Ultrasonic and radar check out:
    a. Check response under all operating conditions.
    b. Track all responses through trend charts in the SCADA system.
    c. Provide Echo Transmission and signal quality on all level transmitters including guided and unguided units.
        1) Provide printout of the actual transmission and all parameters.
6. Loop check/validation:
    a. Check all control loops under simulated operating conditions by causing a range of input signals at the primary control elements and observing appropriate responses of the respective control and monitoring elements, final control elements, and the graphic displays associated with the SCADA system. Issue commands from the SCADA system and verify proper responses of field devices. Use actual process inputs wherever available.
    b. Provide “end-to-end” tests:
        1) Test SCADA system inputs from field device to SCADA system operator workstations.
        2) Test SCADA system outputs from SCADA operator workstations to field devices and equipment.
        3) Observe and record responses at all intermediate devices.
        4) Test and record operator commands and signal readouts to each operator device where there is more than one operator interface point.
        5) For each signal, perform separate tests for SCADA computer screens, local operator interface (LOI) screens, and local control panels.
    c. Retest any loop following any necessary corrections.
    d. Apply simulated sensor inputs corresponding to 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of span for networks that incorporate analog elements and monitor the resulting outputs to verify compliance to accuracy tolerance requirements.
    e. Apply continuously variable up and down analog inputs to verify the proper operation and setting of discrete devices (signal trips, etc.).
    f. Apply provisional settings on controllers and alarm setpoints.
    g. Record all analog loop test data on test forms.

h. Exercise each field device requiring an analog command signal, through the SCADA system. Vary, during the validation process, the output from the PLC SCADA system and measure the end device position, speed, etc. to confirm the proper operation of the device for the supplied analog signal. Manually set the output from the SCADA screen at 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent and measure the response at the final device and at any intermediate devices.

i. Exercise each field device providing a discrete input to the SCADA system in the field and observe the proper operation shall be observed at the operator workstation:
   1) Test limit switches, set limits mechanically, and observe proper operation at the operator workstation.
   2) Exercise starters, relay contacts, switch contacts, and observe proper operation.
   3) Calibrate and test instruments supplying discrete inputs, and observe proper operation.

j. Test each device accepting a discrete output signal from the SCADA. Perform the appropriate operator action at the SCADA operator stations (including LOIs, if present) and confirm the proper operation of the field device:
   1) Stroke valves through outputs from the SCADA system and confirm proper directional operation. Confirm travel limits and any feedback signals to the SCADA system.
   2) Exercise motors starters from the SCADA system and verify proper operation through direct field observation.
   3) Exercise solenoids and other field devices from the SCADA system and verify proper operation through direct field observation.

k. Include in the test forms:
   1) Analog input devices:
      a) Calibration range.
      b) Calibration data: Input, output, and error at each test value.
      c) Analog input associated PLC register address.
      d) Value in PLC register at each test point.
      e) Value displayed at each operator interface station (local operator interface displays and SCADA workstations).
   2) Analog output devices:
      a) Calibration range.
      b) Test value at each test point.
      c) Analog output associated PLC register address.
      d) Control variable value at field device at each test point.
      e) Physical device response at each test point:
         (1) Response to be actual valve position, or motor speed, etc.
   3) Discrete instrument input devices:
      a) Switch setting, contact action, and dead band.
      b) Valve position switches:
         (1) Response in the PLC as the valve is stroked from the PLC.
         (2) Field observed actual valve position, and valve indicator position as the valve is stroked from the PLC.
      c) Operator interface switches (control stations and other pilot devices) and associated response.
      d) Starter and drive auxiliary device contact response.
      e) Response of all other discrete inputs to the PLC.

4) Discrete output devices:
   a) Observed response of field device to the discrete output from the PLC.
   b) Observe the proper operation of Open, Close, Start, Stop, On, Off, etc.
5) Test equipment used and associated serial numbers.

D. Functional Testing:
1. General:
   a. Commence Functional tests after completion of all loop check/validation tests:
      1) As specified in Section 40 90 00, Sequencing and Scheduling article.
   b. Functional to demonstrate proper operation of all systems with process equipment operating over full operating ranges under conditions as closely resembling actual operating conditions as possible.
   c. Additional tests are specified in other Instrumentation and Control Sections.
   d. Follow approved detailed test procedures and check lists for Functional Test activities.
2. Control logic operational validation:
   a. The purpose of control logic validation is to field test the operation of the complete control system, including all parts of the SCADA system, all control panels (including vendor control panels), all control circuits, all control stations, all monitored/controlled equipment, and final control elements.
   b. Demonstrate all control functionalities shown on the P&IDs, control schematics, and other drawings, and specified in the loop descriptions, control strategies, Electrical Specifications, and Mechanical Equipment Specifications.
   c. Test in detail on a function-by-function and sentence-by-sentence basis.
   d. Thoroughly test all hardware and software functions:
      1) Including all hardwired and software control circuit interlocks and alarms.
   e. Test final control elements, controlled equipment, control panels, and ancillary equipment under startup, shut down, and steady-state operating conditions to verify all logic and control is achieved.
   f. Control logic validation tests to include, but not limited to: a repeat of all control logic tests from the FAT, modified and expanded to include all field instruments, control panels, circuits, and equipment.
3. Loop tuning:
   a. Optimally tune all electronic control stations and software control logic incorporating proportional, integral, or derivative control. Apply control signal disturbances at various process variable levels and adjusting the gain, reset, or rate settings as required to achieve proper response.
   b. Verify the transient stability of final control elements operating over the full range of operating conditions, by applying control signal disturbances, monitoring the amplitude and decay rate of control parameter oscillations and making necessary controller adjustments as required to eliminate excessive oscillatory amplitudes and decay rates. As a minimum, achieve 1/4 wave amplitude decay ratio damping (subsidence ratio of 4) under the full range of operating conditions.

c. If excessive oscillations or system instability occur, as determined by the Engineer, continue tuning and parameter adjustments, or develop and implement any additional control algorithms needed to achieve satisfactory control loop operation.

4. Functional validation sheets:
   a. Document each Functional test on an approved test form.
   b. Document loop tuning with a report for each loop, including two-pen chart recordings showing the responses to step disturbance at a minimum of 3 setpoints or process rates approved by the Engineer. Show tuning parameters on the charts, along with time, date, and sign-off by Contractor and Engineer.
   c. Include on the form, functions which can be demonstrated on a loop-by-loop basis:
      1) Loop number and P&ID number.
      2) Control strategy, or reference to specification tested.
      3) Test procedures: Where applicable, use the FAT function-by-function, sentence-by-sentence loop test checklist forms modified to meet the requirements of the Functional test. Otherwise, create new forms.
   d. For functions that cannot be demonstrated on a loop-by-loop basis (such as overall plant power failure), include on the test form a listing of the specific steps and tests to be conducted. Include with each test description the following information:
      1) Specification page and paragraph of function demonstrated.
      2) Description of function and/or text from specification.
      3) Test procedures: use the FAT loop test checklist forms modified to meet the specific testing conditions of the Functional test.
5. Functional certification:
   a. Provide Manufacturer's Certificate of Installation and Functionality Compliance as specified in Section 01 70 00
      1) Including all test forms with test data entered, submitted to the Engineer with a clear and unequivocal statement that all Functional test requirements have been satisfied.

E. Instrumentation and Controls Performance Testing:
   1. After the Process Operational Period, test PCIS system for additional 60 days as specified in this Section to identify issues and make corrections, as needed.
   2. General:
      a. The performance test is part of the Work that must be completed as a condition of substantial completion and final completion for the entire Project.
      b. The complete PLC control and SCADA system must run continuously for the duration of the performance test.
      c. Test and use the entire process control system under standard operating conditions.
      d. Exercise all system functions.
      e. Log failure, any system interruption and accompanying component, subsystem, or program failure including time of occurrence, duration of each failure, failure classification, and cause.
         1) Provide a competently trained technician or programmer on call for the Project Site during all normal working days and hours from the start of the performance test until final acceptance of the system.

a) Response time to the Project Site: 24 hours or less, for a major failure.

3. SCADA system testing:
   a. Exercise each system function, e.g., status report, alarms, logs, and display several times at a minimum, and in a manner that approximates "normal" system operation.
   b. Failure of the SCADA system during testing shall be considered as indicating that the programs and operating system do not meet the requirements of the specifications.
      1) Corrective action is required before restarting the performance test.
4. Failures:
   a. Classify failures as either major or minor.
      1) Minor failure:
         a) A small and non-critical component failure or software problem that can be corrected by the Owner's operators.
         b) Log this occurrence but this is not a reason for stopping the test and is not grounds for non-acceptance.
         c) Should the same or similar component failure occur repeatedly, this may be considered as grounds for non-acceptance.
         d) Failure of one printer or operator station is considered a minor failure providing all functions can be provided by backup equipment, i.e., alternate printers and operator station, and repairs can be made, and equipment returned to service within 3 working days.
      2) Major failure:
         a) Considered to have occurred when a component, subsystem, software control, or program fault causes a halt in or improper operation of the system and/or when a technician's work is required to make a repair or to re-initiate operation of the system.
         b) Cause termination of the performance test.
         c) Start a new acceptance test when the causes of a major failure have been corrected.
         d) A failure is also considered major when failure of any control system that results in an overflow, underflow, overdose, or underdose condition occurs.
5. Technician report:
   a. Each time a technician is required to respond to a system malfunction, they must complete a report, which includes details concerning the nature of the complaint or malfunction and the resulting repair action required and taken.
   b. If a malfunction occurs which clears itself or which the operator on duty is able to correct, no report is required or logged as specified above.
   c. If a technician has performed work but no report is written, then a major failure is considered to have occurred.
   d. Each report shall be submitted within 24 hours to the Engineer and the Owner, or its representative.

3.03 SCHEDULES

A. Example test forms:

1. Example test forms are attached at the end of this Section. They may be used as a starting point for the development of Project-specific test forms for this Project.
2. The example test forms are not intended to be complete or comprehensive. Edit and supplement the forms to meet the requirements for testing and test forms specified in this Section and other Contract Documents.

END OF SECTION

	FACTORY ACCEPTANCE TEST – CONTROL PANELS	

1. GENERAL INSPECTION

A. Structural Inspection

- ☐ Verify Lifting Lugs Installed
- ☐ Verity enclosure has lock and lock is functional
- ☐ Confirm that seismic bracing components are provided per manufacturer's installation instructions

B. Exterior Inspection

- ☐ Cabinet exterior is clean, scratch, and dent free
- ☐ Inspect externally for corrosion and damage
- ☐ Verify enclosure door opens and closes easily
- ☐ Verify enclosure has a 3-point latch
- ☐ Verify enclosure has a flange mounted disconnect (where voltages greater than 120 VAC enter the cabinet)
- ☐ Verify enclosure has the appropriate NEMA rating (1, 1G, 12, 3R, 4, 4X, etc)
- ☐ Verify enclosure is the appropriate size (not grossly larger than design, and will still fit in the plant)

Nameplates

- ☐ Cabinet has identification nameplate
- ☐ All door labels are straight, spelled correctly, and match the tagging defined in the Contract
- ☐ Cabinet has a nameplate that includes the following:
  - ☐ Power source(s)
  - ☐ Integrator's Logo
  - ☐ Circuit ID(s)
  - ☐ Short Circuit KAIC ratings
- ☐ If labels are screwed to door, silicone was utilized to cover screw holes (Labels screwed to the door of a NEMA 4/4X panel technically violates the NEMA rating.)

Door Devices

- ☐ All devices penetrating the outside of panel have gaskets, silicone or both
- ☐ All door devices are installed (HMIs, Pilot Devices, etc)
- ☐ Door mounted equipment is mounted straight and square
- ☐ All exterior or door mounted equipment present and accounted for, installed and securely fastened
- ☐ NEMA classification has not been violated due to penetrations
- ☐ Door mounted equipment has the same NEMA rating as the panel
- ☐ All door mounted equipment installed at the correct height
- ☐ All door mounted equipment installed in the correct positions and order (layout of door mounted equipment is grouped properly and in a logical manner)
- ☐ Doors with multiple penetrations have adequate bracing (if needed)
- ☐ Visually check condition of indicators, controllers and annunciators
- ☐ Check that pilot lights illuminate correctly
- ☐ Check the Push-To-Test function
- ☐ Ensure correct pilot light color

Peripheral Devices

- ☐ Horn / Beacon is installed (where required)
- ☐ Silence and Reset pushbutton

PROJECT NAME:	_____	TEST DATE:	_____
FACILITY NAME:	_____	TESTED BY:	_____
PROCESS AREA:	_____	COMPANY:	_____
NETWORK ID:	_____	PAGE:	_____
WITNESSED BY:	_____	SIGNATURE:	_____

1. GENERAL INSPECTION (continued)

C. Interior Inspection

- ☐ Cabinet is cleaned of marks and dirt
- ☐ Inspect internally for corrosion and damage
- ☐ Back panel is clean of marks and dirt
- ☐ Interior of panel vacuumed and shall be free of all debris
- ☐ Check that the panel roof is clean and clear of foreign materials
- ☐ Bottom of panel has been cut out (where bottom entry is required), with angle iron welded around the bottom perimeter Re-painting has been performed
- ☐ If internal light door limit switch is provided, ensure the light automatically turns "on" when the doors are open
- ☐ Intrusion alarms (where required)

Interior Labeling

- ☐ All panel mounted equipment has identification labeling, by using either a Brothers or Phenolic type tags
- ☐ Verify that door mounted components are mounted square and symmetrical
- ☐ Verify that nameplates are straight, legible, and spelled correctly
- ☐ All terminal blocks are identified/labeled with permanent labels including tight end blocks & caps
- ☐ All wiring shrink labeled and or phased correctly to the specifications
- ☐ All wire labels shrunk completely rotated and aligned alike for easy identification
- ☐ All fuses and circuit breakers are labeled with ID and current rating
- ☐ System Integrator's label or labels installed on door
- ☐ Panel manufacturer model/serial number tag is present
- ☐ All required safety/warning tags installed and straight
- ☐ Correct UL (typically UL 508) or cUL tag installed and registered and all other associated tags installed and straight (the UL tag might not be installed in the panel at the factory test. If the panel is modified due to changes during the factory test or a punch list generated from the factory test, the UL labeling would need to be re-applied. Some UL shops do not apply the UL label until the panel is released to be shipped.)

Wireways

- ☐ Plastic wire way covers installed properly
- ☐ Plastic wireways have no sharp edges
- ☐ No wire Ties inside the wireways
- ☐ No sharp edges on wire ties
- ☐ Separation: White duct is used for DC voltages, Gray duct is used for AC voltages
- ☐ Ensure wiring duct is not over-full, includes provision for 20% more wiring and the cover may easily be installed Panduit recommends 50% duct fill, but 40% is a better practice

PROJECT NAME:	_____	TEST DATE:	_____
FACILITY NAME:	_____	TESTED BY:	_____
PROCESS AREA:	_____	COMPANY:	_____
NETWORK ID:	_____	PAGE:	_____
WITNESSED BY:	_____	SIGNATURE:	_____

1. GENERAL INSPECTION (continued)

C. Interior Inspection (continued)

Wiring

- ☐ Visually check terminals and condition of internal wirings
- ☐ Verify that the control panel has been assembled and wired as designed
- ☐ Verify that all components are operational and perform the functions intended
- ☐ Verify that all components are sized appropriately for the application
- ☐ Verify that equipment control circuits function as intended
- ☐ Back of door wiring is labeled and neatly formed
- ☐ Back panel to door wiring has sufficient bending radius with spiral wrap
- ☐ Wire connection has been verified wired to correct points within the panel
- ☐ Individual wires have been given a pull test to verify a good terminal connection
- ☐ Wire and cable minimum bending radius have not been violated
- ☐ All equipment installed straight and square to back panel
- ☐ Wire colors are correct:
  - ☐ Black and White > AC hot and neutral, respectively
  - ☐ Red > AC control signals
  - ☐ Blue > DC power and control (Blue w/ White stripe for DC ground)
  - ☐ Yellow > Foreign voltages (those still present when panel power is disconnected)
  - ☐ Green > AC equipment ground
  - ☐ Black > TSP (+),
  - ☐ White> TSP(-)
- ☐ Analog wiring shields are continuous (connected by a dedicated terminal block for such shields)
- ☐ Analog shield wires are grounded within the panel, where not otherwise grounded at the transmitter itself
- ☐ Discrete inputs are separately fused or protected by a circuit breaker on a “per loop” basis
- ☐ Intrinsic Safety Wiring
  - ☐ Ensure wiring associated with intrinsic safety circuits or intrinsic safety barriers is kept away from all other wiring by UL minimum distances or by a physical (grounded metal) barrier preventing non-intrinsically safe wiring from coming in contact with intrinsically safe circuits or wiring
- ☐ Verify all spare terminals are installed according to the percentage listed in the specifications

Grounding

- ☐ Equipped with “Blackburn” or other grounding type lug
- ☐ Lug is securely fastened to the panel structure
- ☐ Verify Grounding bar is installed
- ☐ Verify Isolated ground bar is installed

PROJECT NAME:	_____	TEST DATE:	_____
FACILITY NAME:	_____	TESTED BY:	_____
PROCESS AREA:	_____	COMPANY:	_____
NETWORK ID:	_____	PAGE:	_____
WITNESSED BY:	_____	SIGNATURE:	_____

	FACTORY ACCEPTANCE TEST – CONTROL PANELS	

2. POWER TEST

A. AC Power

- ☐ AC Power is routed correctly within the panel, and is isolated from DC and network wiring
- ☐ All fuses are installed and sized properly
- ☐ All breakers are installed and sized properly
- ☐ 24 VDC Power Supplies are functional
- ☐ 24 VDC Power fail contacts are functional
- ☐ 24 VDC power supplies are redundant, and have diode modules enabling the hot swap-over between supplies
  - ☐ 24 VDC supplies are equipped with dry contact failure alarms, wired as PLC inputs to signal failure of any DC power supply Such alarm inputs to the PLC have been tested as being functional
- ☐ Dedicated receptacle is wired to receive a dedicated AC supply
- ☐ Verify continuity for all DC commons, ground, and AC neutrals
- ☐ Verify that the CP temporary input power is connected correctly and is the correct voltage
- ☐ Close the CP main circuit breaker(s)
- ☐ Verify that voltages at subsequent circuit breakers are correct
- ☐ Close circuit breakers
- ☐ Verify that power feeding interruptible and uninterruptible power supplies is correct
- ☐ Turn on power supplies if they are not already on
- ☐ Verify that voltages at distribution terminals are correct
- ☐ Energize any remaining hardware such as the PLC

B. Uninterruptible Power Supply (UPS)

- ☐ Mounted appropriately within the cabinet, on a dedicated shelf, or rear of a swing-out sub panel
- ☐ Is equipped with maintenance bypass switch (or at least plug/receptacle means for bypassing the unit)
- ☐ Has alarm (on inverter, failure, battery failure) alarms wired into PLC Such alarms have been tested as being functional
- ☐ Turn off the AC power supply and verify that the UPS will be switched on to supply the designated vital loads in the control panel

3. CONTROLS & AUXILIARY DEVICES TEST

- ☐ Verify all interposing and auxiliary relays are functioning
- ☐ Verify panel lights are functioning

Ventilation and Heating

- ☐ If ventilation fans are fitted , check the fans operate correctly any associated air filters are clean and not blocked
- ☐ Verify components are installed in the correct orientation for proper air flow

4. HARDWIRED INTERLOCK AND SAFETY TEST

- ☐ Verify that hardwired interlocks through the control panel as shown on schematic drawings are functioning. For example, outlet high pressure switch interlock to a pump.
- ☐ Verify that all hardwired safety devices through the control panel is functioning. For example, the pull cord emergency stops of conveyors.

PROJECT NAME:	_____	TEST DATE:	_____
FACILITY NAME:	_____	TESTED BY:	_____
PROCESS AREA:	_____	COMPANY:	_____
NETWORK ID:	_____	PAGE:	_____
WITNESSED BY:	_____	SIGNATURE:	_____

5. PLC TEST

A. Components

☐ PLC interior High Temperature alarm is installed, wired to the PLC, and is shown to be functional

☐ Relays have transient suppression across their coils This is particularly important for DC coil relays, where diodes in reverse polarity are often used

☐ TVSS is installed across the main incoming 120 VAC

PLC and PLC Rack

- ☐ Verify all cards are securely seated
- ☐ Ensure clearance around PLC rack has been met, such that convective heat transfer is not impeded by devices erroneously mounted in the “no encroachment” area Confirm with manufacturer clearance recommendations

B. PLC I/O Test

☐ Furnish **I/O test forms** and test all the listed input and output points as follows:

- ☐ Discrete Inputs: Simulate a field contact closure by “shorting” across the appropriate terminal blocks Observe the transition between a logical “0” and “1” in the PLC software
- ☐ Discrete Outputs: Force the output bit to toggle between logical “0” and logical “1” using the PLC software Measure contact resistance at the wired terminal blocks using a digital meter selected for the “ohms” setting
- ☐ Analog Inputs: Connect a signal generator to the appropriate terminal blocks Tailor the connection depending on whether a 2-wire or 4-wire simulation is required Modulate the 4-20mA signal Observe the associated PLC internal memory register to transition between 0-65535 or if scaled in engineering units, between 0 and the maximum scaled engineering unit The latter method is preferred
- ☐ Analog outputs: Force the output register to a value between 0-65535 or 0-100%, if the scaling block can be manipulated Observe the measured 4-20mA value increment and decrement using a digital ammeter

C. Redundant Controllers (where required) Test

☐ Remove Communication cable from PLC-1 to verify switching to PLC-1A

☐ Remove Communication cable from PLC-1A to verify switching back to PLC-1

☐ Remove Power from PLC-1 to verify switching to PLC-1A

☐ Remove Power from PLC-1A to verify switching to PLC-1

☐ Remove Communication cable from PLC-1 to I/O rack and verify switching to PLC-1A

☐ Remove Communication cable from PLC -1A to I/O rack and verify switching to PLC-1

D. PLC Control Logic Verification

☐ The PLC control strategy is verified by following the Control Logic Verification Form based on the specifications. Each control strategy will be verified by simulating the process and checking the state or value of PLC outputs. The results of equipment status and alarms and process instrument values and trends shall also be verified on the Plant SCADA graphic screens stored in a temporary SCADA computer. Since all PLC input and output wiring has been verified and some field devices are not available during Factory Acceptance Testing, certain inputs will be simulated either by means of additional hardware and/or software as described below.

- ☐ DI states are either simulated by hardwired switches or forced inputs using a programming terminal
- ☐ For example, when starters and drives are not provided as part of the contract, jumpers may be installed from the output call relays to the running confirmation inputs to simulate the running state of the motors
- ☐ AI values are either simulated by an external source or within software using a programming terminal
- ☐ For example, when a level transducer is not provided as part of the contract the level transducer loop current may be simulated with a loop powered potentiometer and adjusted manually for the level input

PROJECT NAME:	_____	TEST DATE:	_____
FACILITY NAME:	_____	TESTED BY:	_____
PROCESS AREA:	_____	COMPANY:	_____
NETWORK ID:	_____	PAGE:	_____
WITNESSED BY:	_____	SIGNATURE:	_____

5. PLC TEST (continued)

D. PLC Control Logic Verification (continued)

Typical Fault Logic

- ☐ If the fault input is high and the disable (if applicable) for the fault is not high and the common disable (if applicable) is not high begin timing. If any of these conditions changes, stop timing and reset the timer. If the timer reaches its preset, activate the alarm output. If the fault alarm is a shutdown alarm stop the associated motor and latch the alarm so that it remains present even if the condition clears.
- ☐ The fault condition must return to normal and the alarm must be reset for a latched alarm to clear.

Typical Fail to Start Logic

- ☐ If the motor is called to run (call output high) and no running feedback is received (running input is low) and the fail to start and common alarm disables (if applicable) are not high start timing. If any of these conditions changes, stop timing and reset the timer. If the timer reaches its preset, activate the alarm output, stop calling the motor and latch the alarm.

6. HMI OR OIT TEST

HMI / OIT Functionality

- ☐ Communication with PLC
- ☐ Screen Layouts
- ☐ Screen Navigation
- ☐ Set Point Entry
- ☐ Animation
- ☐ Color Correctness (Green=Run, Red=Off, Amber=Alarm, or the agreed upon convention)
- ☐ Alarms
- ☐ Acknowledge and Reset
- ☐ Security / Access Levels / Passwords

7. NETWORK COMMUNICATION TEST

A. Network Components

- ☐ Fiber Optic cabling terminates in a patch panel
- ☐ Media converters are installed and functional
- ☐ Terminating resistors have been installed for trunk/tap topologies or where required
- ☐ Wire and cable bending limitations have not been violated

B. Networking Functions

- ☐ Verify data transfer via the network to different PLCs as shown on the Network Block Diagrams
- ☐ Verify network traffic rate and error margin is acceptable
- ☐ Verify ring topology fault-tolerant (network counter-rotating) by removing fiber connection or turn off switch power and then confirm the other control panel is accessible (from HMI or ping)

PROJECT NAME:	_____	TEST DATE:	_____
FACILITY NAME:	_____	TESTED BY:	_____
PROCESS AREA:	_____	COMPANY:	_____
NETWORK ID:	_____	PAGE:	_____
WITNESSED BY:	_____	SIGNATURE:	_____

8. FAT DOCUMENTATION AND RECORD

Panel Documentation

- ☐ As-built panel drawings showing actual panel construction and devices arrangement and c/w Bill of Material.
- ☐ Panel schematic and interconnection drawings.
- ☐ P&ID drawings and schematic drawings for the process area controlled by the panel that is to be tested.
- ☐ I/O list test forms of the process area to be tested.
- ☐ FAT procedure of the process area to be tested.
- ☐ Test record forms of the process area to be tested. Forms shall include area for signature of responsible test personnel.
- ☐ Hard copy PLC application program of the process area to be tested.
- ☐ Hard copy of HMI/OIT graphic screens of the process area to be tested.
- ☐

9. FAT TOOLS AND SOFTWARE

- ☐ Simulation software if required
- ☐ Digital voltmeter Fluke 87
- ☐ Process meter Fluke 787
- ☐ Laptop computer with PLC application program
- ☐ Temporary SCADA computer with HMI software and applicable graphic screens
- ☐ Jumper wires

PROJECT NAME:	_____	TEST DATE:	_____
FACILITY NAME:	_____	TESTED BY:	_____
PROCESS AREA:	_____	COMPANY:	_____
NETWORK ID:	_____	PAGE:	_____
WITNESSED BY:	_____	SIGNATURE:	_____

	INSTALLATION AND CERTIFICATION CHECKLIST DOCUMENTATION	

INSTRUMENT LOOP NO. _____

SERVICE DESCRIPTION _____

A COPY OF LATEST ISSUE OF THE FOLLOWING DOCUMENTS ARE INCLUDED IN THIS INSTRUMENT INSTALLATION CERTIFICATION FILE:

- ☐ INSTRUMENT SPECIFICATION SHEETS (FOR ALL INSTRUMENTS IN THE LOOP)
- ☐ INSTRUMENT INSTALLATION DETAILS (FOR ALL INSTRUMENTS IN THE LOOP)
- ☐ INSTRUMENT LOOP WIRING DIAGRAMS
- ☐ INSTRUMENT INSTALLATION CERTIFICATION CHECKLIST
- ☐ SIZING CALCULATIONS
- ☐ INSTRUMENT INSTALLATION SCHEDULE (APPLICABLE PART)
- ☐ NAMEPLATE SCHEDULE (APPLICABLE PART)
- ☐ VENDOR LITERATURE CALIBRATION INFORMATION

	No	Yes
INSTRUMENT LOOP IS PART OF AN EQUIPMENT START UP/SHUTDOWN INTERLOCKS?	☐	☐

REMARKS: _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

	SWITCHES INSTALLATION AND CALIBRATION CHECKLIST	

INSTRUMENT LOOP NO. _____

SERVICE DESCRIPTION _____

CHECK BELOW, WHEN COMPLETED:

☐ BENCH CALIBRATED PER SPEC SHEET

☐ VERIFIED PER P&ID NO

☐ CORRESPONDS TO SPECIFICATION SHEET NO.

☐ WIRING CORRECT PER INSTRUMENT LOOP DRAWING NO.

☐ INSTALLATION CORRECT PER DETAIL NO.

☐ ACCESSORIES ARE PRESENT AND PROPERLY INSTALLED

☐ INSTRUMENT IS ACCESSIBLE FOR MAINTENANCE OR REMOVAL

☐ ENGRAVED LAMINATED NAMEPLATE (NO SPELLING ERRORS) PERMANENTLY INSTALLED

INSTRUMENT LOOP IS PART OF AN EQUIPMENT START UP/SHUTDOWN INTERLOCKS? ☐ No ☐ Yes

FIELD CALIBRATION CHECK

CONTACT NO.	FUNCTION	FOR SIGNAL	CONTACT IS TO	AT SPECIFIED VALUE FOR		ACTUAL TRIP POINT WAS…	
1	☐ ALARM	☐ INCR	☐ OPEN	SET PT =		SET PT =	
	☐ S/D PERM	☐ DECR	☐ CLOSE	RESET =		RESET =	
2	☐ ALARM	☐ INCR	☐ OPEN	SET PT =		SET PT =	
	☐ S/D PERM	☐ DECR	☐ CLOSE	RESET =		RESET =	
3	☐ ALARM	☐ INCR	☐ OPEN	SET PT =		SET PT =	
	☐ S/D PERM	☐ DECR	☐ CLOSE	RESET =		RESET =	
4	☐ ALARM	☐ INCR	☐ OPEN	SET PT =		SET PT =	
	☐ S/D PERM	☐ DECR	☐ CLOSE	RESET =		RESET =	

NOTE: PERM IS ABBREVIATED FOR PERMISSIVE

	SWITCHES **INSTALLATION AND CALIBRATION CHECKLIST**	

REMARKS: _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

	TRANSMITTER/CONTROLLER/INDICATOR INSTALLATION AND CALIBRATION CHECKLIST	

☐ No ☐ Yes

INSTRUMENT LOOP IS PART OF AN EQUIPMENT START UP/SHUTDOWN INTERLOCKS?

INSTRUMENT TYPE ☐ TRANSMITTER ☐ CONTROLLER ☐ INDICATOR

☐ OTHER DESCRIPTION _____

INSTRUMENT TAG NO. _____ SERIAL NO. _____

SERVICE DESCRIPTION _____

BENCH CALIBRATION CHECK

INPUT RANGE = _____

HEAD CORRECTION = _____

CALIBRATED SPAN = _____

OUTPUT RANGE = _____

☐ LINEAR

☐ SQUARE ROOT

% CALIB SPAN	DESIRED VALUE	ACTUAL VALUE	EXPECTED VALUE	ACTUAL VALUE
0				
50				
100				

CHECK BELOW, WHEN COMPLETED:

☐ BENCH CALIBRATED PER SPECIFICATION SHEET _____

☐ VERIFIED PER P&ID NO _____

☐ CORRESPONDS TO SPECIFICATION SHEET NO. _____

☐ WIRING CORRECT PER INSTRUMENT LOOP DRAWING NO. _____

☐ INSTALLATION CORRECT PER DETAIL NO. _____

☐ ACCESSORIES ARE PRESENT AND PROPERLY INSTALLED

☐ INSTRUMENT IS ACCESSIBLE FOR MAINTENANCE OR REMOVAL

☐ ENGRAVED LAMINATED NAMEPLATE (NO SPELLING ERRORS) PERMANENTLY INSTALLED

FIELD CALIBRATION CHECK

INPUT RANGE = _____

OUTPUT RANGE = _____

% CALIB SPAN	DESIRED VALUE	ACTUAL VALUE	EXPECTED VALUE	ACTUAL VALUE
0				
50				
100				

	TRANSMITTER/CONTROLLER/INDICATOR INSTALLATION AND CALIBRATION CHECKLIST	

☐ DIRECT ☐ REVERSE

☐ ACTION VERIFIED AT 50% SPAN

☐ ACTION VERIFIED AT _____ SPAN

CONTROLLER SETTINGS								
SETTING	GAIN	PB	RESET (INTEGRAL)	DERIV. (RATE)	HIGH LIMIT	LOW LIMIT	ELEV. ZERO	ZERO SUPP
PRE-TUNE								
POST-TUNE								

PRE-TUNE SETTINGS					
	GAIN	PB	RESET (REPEAT/MIN)	RESET (MIN/REPEAT)	DERIVATION (MINUTES)
FLOW:	1.0	100	10	0.1	N/A
LEVEL	1.0	100	MIN.	MAX.	N/A
PRESSURE	2.0	50	2.0	0.5	N/A
TEMP.	4.0	25	0.1	10	OFF

REMARKS _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

	ANALYZERS INSTALLATION AND CALIBRATION CHECKLIST	

☐ No ☐ Yes

INSTRUMENT LOOP IS PART OF AN EQUIPMENT START UP/SHUTDOWN INTERLOCKS?

TYPE OF INSTRUMENT _____

INSTRUMENT TAG NO. _____ SERIAL NO. _____

SERVICE DESCRIPTION _____

CHECK BELOW, IF TRUE

- ☐ BENCH CALIBRATED PER SPECIFICATION SHEET _____
- ☐ VERIFIED PER P&ID NO _____
- ☐ CORRESPONDS TO SPECIFICATION SHEET NO. _____
- ☐ WIRING CORRECT PER INSTRUMENT LOOP DRAWING NO. _____
- ☐ INSTALLATION CORRECT PER DETAIL NO. _____
- ☐ ACCESSORIES ARE PRESENT AND PROPERLY INSTALLED
- ☐ INSTRUMENT IS ACCESSIBLE FOR MAINTENANCE OR REMOVAL
- ☐ ENGRAVED LAMINATED NAMEPLATE (NO SPELLING ERRORS) PERMANENTLY INSTALLED

REMARKS _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

	CONTROL VALVES INSTALLATION AND CALIBRATION CHECKLIST	

☐ ☐

INSTRUMENT LOOP IS PART OF AN EQUIPMENT START UP/SHUTDOWN INTERLOCKS? No Yes

VALVE TAG NO. _____ SERIAL NO. _____

☐ TRANSDUCER TAG NO. _____ SERIAL NO. _____

☐ SOLENOID TAG NO. _____ SERIAL NO. _____

☐ VOLUME BOOSTER TAG NO. _____ SERIAL NO. _____

☐ POSITIONER _____ SERIAL NO. _____

SERVICE DESCRIPTION _____

TRANSDUCER CHECK					
INPUT RANGE =			OUTPUT RANGE =		
CALIBRATED SPAN =			CALIBRATED SPAN =		
BENCH					
SPAN	DESIRED	ACTUAL	SPAN	EXPECTED	ACTUAL
0%			0%		
50%			50%		
100%			100%		
FIELD					
SPAN	DESIRED	ACTUAL	SPAN	EXPECTED	ACTUAL
0%			0%		
50%			50%		
100%			100%		

CHECK BELOW, IF TRUE:

☐ BENCH CALIBRATED PER ABOVE _____

☐ VERIFIED PER P&ID NO. _____

☐ CORRESPONDS TO SPECIFICATION SHEET NO. _____

- ☐ VALVE SPECIFICATION NO. _____
- ☐ TRANSDUCER SPECIFICATION NO. _____
- ☐ SOLENOID SPECIFICATION NO. _____

☐ WIRING CORRECT PER INSTRUMENT LOOP DRAWING NO. _____

☐ INSTALLATION CORRECT PER INSTRUMENT INSTALLATION DETAILS _____

- ☐ VALVE DETAIL NO. _____
- ☐ TRANSDUCER DETAIL NO. _____
- ☐ SOLENOID DETAIL NO. _____

	CONTROL VALVES INSTALLATION AND CALIBRATION CHECKLIST	

☐ ACCESSORIES ARE PRESENT AND PROPERLY INSTALLED

☐ INSTRUMENT IS ACCESSIBLE FOR MAINTENANCE OR REMOVAL

☐ ENGRAVED LAMINATED NAMEPLATE (NO SPELLING ERRORS) PERMANENTLY INSTALLED

VALVE CHECK			
FLOW CHECK	☐ PROCESS FLOW DIRECTION THRU THE VALVE IS CORRECT		
SAFETY CHECK	ON LOSS OF AIR VALVE FAILS ☐ OPEN ☐ CLOSE	ON LOSS OF POWER SOLENOID FAILS ☐ TO VENT ☐ TO VALVE	
TRAVEL CHECK	FULL OPEN AT _____ PSI	FULL CLOSED AT _____ PSI	MEASURED TRAVEL _____ INCHES
SEATING CHECK	☐ ON BENCH ☐ IN-LINE	RESULTS	ACTUATOR BENCH SET
POSITIONER CHECK			
VALVE FULL OPEN AT _____ PSI TO POSITIONER			
VALVE FULL CLOSED AT _____ PSI TO POSITIONER			
VOLUME BOOSTER CHECK			
BYPASS VALVE (GAIN) ADJUSTING SCREW BACKED OUT _____ TURNS FROM CLOSED TO ENSURE QUICK BUT STABLE OPERATION (TYPICALLY 1-1/2 TO 2 TURNS)			

REMARKS _____

_____

_____

_____

_____

_____

_____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

	DEVICENET INSTALLATION TESTING	

DeviceNet Network _____

Network Installation Characteristics

Architecture	Baud Rate	Trunk Media	Drop Media
☐ Single Master	☐ 125 kBaud	☐ Thick Round	☐ Thick Round, Unshielded
or			
☐ Multi Master	☐ 250 kBaud	☐ Thin Round	☐ Thin Round, Shielded
☐ Redundant Power Supplies	☐ 500 kBaud		☐ Thick Round, Shielded
☐ Per Network			

Installed Node List

☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐ 11	☐ 12	☐ 13	☐ 14	☐ 15
☐ 16	☐ 17	☐ 18	☐ 19	☐ 20	☐ 21	☐ 22	☐ 23	☐ 24	☐ 25	☐ 26	☐ 27	☐ 28	☐ 29	☐ 30	☐ 31
☐ 32	☐ 33	☐ 34	☐ 35	☐ 36	☐ 37	☐ 38	☐ 39	☐ 40	☐ 41	☐ 42	☐ 43	☐ 44	☐ 45	☐ 46	☐ 47
☐ 48	☐ 49	☐ 50	☐ 51	☐ 52	☐ 53	☐ 54	☐ 55	☐ 56	☐ 57	☐ 58	☐ 59	☐ 60	☐ 61	☐ 62	☐ 63

☐ All nodes present and in accordance with network drawings/specifications

☐ ODVA approved devices

☐ Nodes/devices accessible for inspection and maintenance

☐ Nodes/devices properly addressed

Comments: _____

Media Inspection

Trunk Cable	Drop Cable	Installation
☐ ODVA approved	☐ ODVA approved	☐ No evidence of physical damage
☐ Labeling complete	☐ Labeling complete	☐ Installed in protective raceway
☐ Cable/conductor terminations	☐ Cable/conductor terminations	☐ Bending radius not exceeded
☐ Terminating resistors at ends	☐ Max drop length < 20'	☐ Cable supports in place
		☐ V- and shield are grounded
		☐ Clearance from high temperature/voltage sources
		☐ No installation subject to vibration

Comments: _____

Network Power Supplies

Power Supply Equipment	Supply Source (120 VAC)	Network Power Tap (24 VDC)
☐ ODVA compliant	☐ Overcurrent protection	☐ Overcurrent protection
☐ Quantity and ratings	☐ Conductor size	☐ Conductor size

Comments: _____

_____

_____

CHECKED BY (COMPANY)	ACCEPTED BY (COMPANY)
SIGNATURE	SIGNATURE
DATE	DATE

PROFIBUS
INSTALLATION QUALIFICATION AND TESTING

General Network Description

The Profibus network serves the RO pretreatment, blended water, and concentrate processes and consists of both DP and PA slave devices. The master is located in programmable logic controller, PLC-900. Profibus DP repeaters are deployed in the network to essentially support a radial network topology from each process control panel.

Network Design Characteristics

ARCHITECTURE

MASTER	☐ SINGLE	☐ REDUNDANT
TOTAL NODE COUNT ≤ 126	☐	
REPEATER COUNT	_____	
CASCADED REPEATER COUNT <9	_____	
NODE COUNT PER DP SEGMENT <32	☐	
DP/PA SEGMENT COUPLERS	_____	
REDUNDANCY (DP/PA COUPLERS	_____	
ACTIVE TERMINATORS	☐	
PROFIBUS DIAGNOSTICS	☐ PA ONLY	☐ DP & PA

BAUD RATE (kbits/sec)

☐ 9.6	☐ 187.5	☐ 3,000
☐ 19.2	☐ 50	☐ 6,000
☐ 93.75	☐ 1,500	☐ 12,000

SURGE PROTECTION FOR SLAVES LOCATED OUTSIDE ☐
SURGE PROTECTION FOR MEDIA ENTERING THE CONTROLLER CABINET ☐
INTRINSIC SAFETY WIRING: REQUIRED FOR ANY PA NETWORK ☐

INSTALLED NODE LIST

☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐ 11	☐ 12	☐ 13	☐ 14	☐ 15
☐ 16	☐ 17	☐ 18	☐ 19	☐ 20	☐ 21	☐ 22	☐ 23	☐ 24	☐ 25	☐ 26	☐ 27	☐ 28	☐ 29	☐ 30	☐ 31
☐ 32	☐ 33	☐ 34	☐ 35	☐ 36	☐ 37	☐ 38	☐ 39	☐ 40	☐ 41	☐ 42	☐ 43	☐ 44	☐ 45	☐ 46	☐ 47
☐ 48	☐ 49	☐ 50	☐ 51	☐ 52	☐ 53	☐ 54	☐ 55	☐ 56	☐ 57	☐ 58	☐ 59	☐ 60	☐ 61	☐ 62	☐ 63
☐ 64	☐ 65	☐ 66	☐ 67	☐ 68	☐ 69	☐ 70	☐ 71	☐ 72	☐ 73	☐ 74	☐ 75	☐ 76	☐ 77	☐ 78	☐ 79
☐ 80	☐ 81	☐ 82	☐ 83	☐ 84	☐ 85	☐ 86	☐ 87	☐ 88	☐ 89	☐ 90	☐ 91	☐ 92	☐ 93	☐ 94	☐ 95
☐ 96	☐ 97	☐ 98	☐ 99	☐ 100	☐ 101	☐ 102	☐ 103	☐ 104	☐ 105	☐ 106	☐ 107	☐ 108	☐ 109	☐ 110	☐ 111
☐ 112	☐ 113	☐ 114	☐ 115	☐ 116	☐ 117	☐ 118	☐ 119	☐ 120	☐ 121	☐ 122	☐ 123	☐ 124	☐ 125	R 126	R 127

☐ ALL NODES PRESENT IN ACCORDANCE WITH NETWORK DESIGN DOCUMENTS.

LEGEND

- **M** MASTER NODE PRESENT AT THIS ADDRESS
- **D** PROFIBUS DP NODE PRESENT AT THIS ADDRESS
- **P** PROFIBUS PA NODE PRESENT AT THIS ADDRESS
- **R** RESERVED ADDRESS
- ☐ NO DEVICE PRESENT AT THIS ADDRESS

COMMENTS *(Comments referenced by number. Refer to the Comments, Observations, and Recommendations Summary.)*

PROJECT NAME: _____ TEST DATE: _____
FACILITY NAME: _____ TESTED BY: _____
PROCESS AREA: _____ COMPANY: _____
NETWORK ID: _____ PAGE: _____
WITNESSED BY: _____ SIGNATURE: _____

PROFIBUS
INSTALLATION QUALIFICATION AND TESTING

Media Inspection

CABLING	DP NETWORK	PA NETWORK SEGMENTS			
PI COMPLIANT	☐	☐	☐	☐	☐
LABELING COMPLETE	☐	☐	☐	☐	☐
GROUNDING	☐	☐	☐	☐	☐
CABLE AND CONDUCTOR TERMINATIONS	☐	☐	☐	☐	☐
NO STUB LINES (DP ONLY)	☐	☐	☐	☐	☐
TERMINATING RESISTORS (IN PLACE)	☐	☐	☐	☐	☐
DEDICATED DIAGNOSTICS BUS	☐	☐	☐	☐	☐
INSTALLATION					
NO EVIDENCE OF PHYSICAL DAMAGE	☐	☐	☐	☐	☐
INSTALLATION IN PROTECTIVE RACEWAY	☐	☐	☐	☐	☐
CLEARANCES FROM HIGH TEMPERATURE SOURCES	☐	☐	☐	☐	☐
CLEARANCES FROM HIGH VOLTAGE SOURCES	☐	☐	☐	☐	☐
BEND RADIUS	☐	☐	☐	☐	☐
NO. INSTALLATION SUBJECT TO VIBRATION, SHOCK, HIGH FLEX, CHEMICALS, OR MOISTURE	☐	☐	☐	☐	☐
TERMINATING RESISTORS TURNED ON AT CORRECT LOCATION	☐	☐	☐	☐	☐

COMMENTS *(Comments referenced by number. Refer to the Comments, Observations, and Recommendations Summary.)*

Device Inspection

DEVICE QUANTITY/TYPE	INSTALLATION
☐ TOTAL SLAVE COUNT	☐ NO EVIDENCE OF PHYSICAL DAMAGE
☐ MOST UPDATED DEVICE DRIVER INSTALLED?	☐ ACCESSIBLE FOR INSPECTION AND MAINTENANCE
☐ INSTALLED DEVICES COMPLY WITH DRAWINGS AND SPECIFICATIONS	☐ FDT COMPLIANT DEVICES
☐ PI COMPLIANCE DEVICES	
☐ DIAGNOSTICS MODULE INSTALLED	

COMMENTS *(Comments referenced by number. Refer to the Comments, Observations, and Recommendations Summary.)*

Power Supplies

ACTIVE TERMINATIONS	COUPLERS	REPEATERS
☐ SOURCE LOCATION	☐ SOURCE LOCATION	☐ SOURCE LOCATION
☐ OVERCURRENT PROTECTION	☐ OVERCURRENT PROTECTION	☐ OVERCURRENT PROTECTION
☐ CONDUCTOR SIZE	☐ CONDUCTOR SIZE	☐ CONDUCTOR SIZE
☐ GROUNDING	☐ GROUNDING	☐ GROUNDING

COMMENTS *(Comments referenced by number. Refer to the Comments, Observations, and Recommendations Summary.)*

PROJECT NAME: _____ TEST DATE: _____

FACILITY NAME: _____ TESTED BY: _____

PROCESS AREA: _____ COMPANY: _____

NETWORK ID: _____ PAGE: _____

WITNESSED BY: _____ SIGNATURE: _____

PROFIBUS
INSTALLATION QUALIFICATION AND TESTING

DP Network Media Testing

DESCRIPTION	SEGMENT ID					
TRUNK LENGTH (feet)						
ALLOWABLE TRUNK LENGTH AT SPECIFIED DATA RATE:						
MEASURED TRUNK LENGTH:						
SPARE TRUNK LENGTH						
RESISTANCE MEASUREMENTS (ohms)						
NETWORK CABLE: NO TERMINATIONS						
ONE TERMINATION						
TWO TERMINATIONS						
POWER SUPPLY VOLTAGE (volts DC)						
ACTIVE TERMINATOR						
REPEATER CP1100-RPT1						
REPEATER CP1000-RPT1						
REPEATER CP1000-RPT2						
REPEATER CP2700-RPT1						

CABLE TEXTS	PASS	FAIL	PASS	FAIL	PASS	FAIL	PASS	FAIL	PASS	FAIL	PASS	FAIL
TESTED FOR SHORT CIRCUIT BETWEEN SIGNAL LINES	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
TESTED FOR SHORT CIRCUIT BETWEEN SIGNAL LINES AND SHIELD	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
TESTED FOR SHIELD CONTINUITY	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
TESTED FOR OPEN SIGNAL LINES	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
TESTED FOR CROSSED SIGNAL LINES	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
TESTED FOR CORRECT TERMINATOR POSITION	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
CORRECT CABLE TYPE AND LENGTH	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
TESTED FOR SECURE & TIGHT CONNECTORS	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

COMMENTS *(Comments referenced by number. Refer to the Comments, Observations, and Recommendations Summary.)*

PROJECT NAME: _____ TEST DATE: _____

FACILITY NAME: _____ TESTED BY: _____

PROCESS AREA: _____ COMPANY: _____

NETWORK ID: _____ PAGE: _____

WITNESSED BY: _____ SIGNATURE: _____

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SECTION 40 91 04 PRESSURE/VACUUM MEASUREMENT: INSTRUMENT VALVES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Valve manifolds and instrument valves.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

C. Provide all instruments identified in the Contract Documents.

1.02 REFERENCES

A. As specified in Section 40 61 00.

1.03 DEFINITIONS

A. As specified in Section 40 61 00.

1.04 SUBMITTALS

A. Furnish submittals as specified in Section 40 61 00.

B. Provide complete documentation covering the traceability of all calibration instruments.

C. Additional requirements:
   1. Product data:
      a. Valve type.
      b. Body material.
      c. Size.
      d. Options.
   2. Shop drawings:
      a. Mounting details for all manifold valves.

1.05 QUALITY ASSURANCE

A. As specified in Section 40 61 00.

B. Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:
   1. Process conditions: Fluids, pressures, temperatures, flows, materials, etc.
   2. Physical conditions:
      a. Installation and mounting requirements.

b. Location within the process.
c. Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

C. Notify the Engineer if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

D. Provide instruments manufactured at facilities certified to the quality standards of ISO 9001.

1.06 DELIVERY, STORAGE, AND HANDLING

A. As specified in Section 40 61 00.

B. Protect valve manifolds and protective coatings from damage during handling and installation. Repair coating where damaged.

1.07 PROJECT OR SITE CONDITIONS

A. Project environmental conditions as specified in Section 40 61 00.
1. Provide instruments suitable for the installed site conditions including, but not limited to, material compatibility, site altitude, site seismic conditions, humidity, and process and ambient temperatures.

1.08 WARRANTY

A. As specified in Section 40 61 00.

1.09 MAINTENANCE

A. As specified in Section 40 61 00.

B. Furnish all parts, materials, fluids, etc. necessary for operation, maintenance, and calibration purposes throughout the warranty period. Deliver all of these supplies before project substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Valve manifold manufacturers: One of the following or equal:
1. Anderson Greenwood.
2. Hex Valve.
3. Noshok.
4. Rosemount.

B. Block and bleed valve manufacturers: One of the following or equal:
1. Anderson Greenwood.
2. Hex Valve.

C. Gauge valve manufacturers: One of the following or equal:
1. Anderson Greenwood.

2. Hex Valve.

D. Level sensor isolation valve manufacturers: One of the following or equal:
1. Indu-Tech Level Sensor Isolation Valve.
2. DeZURIK Level Sensor Isolation Valve.
3. Tyco Rovalve Isolation Knife Gate Valve.

2.02 MANUFACTURED UNITS

A. Valve manifolds:
1. General:
a. Provide 2-valve, 3-valve, blowdown type 5-valve, or metering type 5-valve manifolds as indicated on the Drawings.
b. Valve manifolds shall have one piece bonnet with a metal to metal seal to the valve body below the bonnet threads.
2. Requirements:
a. Bonnet lock pin to prevent accidental loosening.
b. Gas leak tested metal-to-metal hard seat design for hard seat valves.
c. Gas leak tested soft seat design with replaceable seat for soft seat valves.
d. Manifold valves shall have straight through portion for bi-directional flow and easy roddable cleaning.
e. Manifold valves shall allow for direct or remote instrument mounting.
f. Shall be able to withstand pressures up to 6,000 psi for soft seat valves and 10,000 psi for hard seat valves at maximum 200 degrees Fahrenheit.
g. Materials of construction:
1) Body material: Type 316 stainless steel.
2) O-Ring: Teflon.
h. 2-Valve manifolds:
1) 1 isolation valve and 1 drain/vent and calibration valve.
i. 3-Valve manifolds:
1) 2 isolation valves and 1 equalizing valve for differential pressure applications.
2) Plugged vent connections used for vent/drain or calibration.
j. Blowdown 5-valve manifold:
1) 2 isolation valves, 1 equalizing valve, 2 blowdown valves for differential pressure applications.
k. Metering 5-valve manifold:
1) 2 isolation valves, 2 equalizing valves, 1 vent/drain and calibration valve for differential pressure applications.

B. Block and bleed valves:
1. General:
a. Valve shall provide process isolation and venting/draining capabilities.
b. Gas leak tested metal-to-metal hard seat design for hard seat valves.
c. Gas leak tested soft seat design with replaceable seat for soft seat valves.
d. Valve shall not be used with fluids with high solids content, such as raw wastewater or sludge.
2. Requirements:
a. Materials of construction:
1) Body material: Type 316 stainless steel.
2) O-Ring: Teflon.

C. Gauge valves:
   1. General:
      a. Valve shall provide process isolation from pressure instrument.
      b. Gas leak tested, metal-to-metal hard seat design for hard seat valves.
      c. Gas leak tested soft seat design with replaceable seat for soft seat valves.
   2. Requirements:
      a. Materials of construction:
         1) Body material: Type 316 stainless steel.
         2) O-Ring: Teflon.

D. Level sensor isolation valves:
   1. General:
      a. Valve shall provide process isolation from level diaphragm.
      b. Gas leak tested, metal-to-metal hard seat design for hard seat valves.
      c. Gas leak tested soft seat design with replaceable seat for soft seat valves.
   2. Requirements:
      a. Materials of construction:
         1) Body material: Type 316 stainless steel.
         2) Flange diameter size: 3 inches.

2.03 ACCESSORIES

A. Provide tube fitting, female NPT, or pipe butt weld connections if necessary.

B. Provide stainless steel concentric or eccentric pipe nipples when necessary.

2.04 SOURCE QUALITY CONTROL

A. As specified in Section 40 61 00.

B. Factory calibrate each instrument with a minimum 3-point calibration or according to Manufacturer's standard at a facility that is traceable to the NIST.
   1. Submit calibration data sheets to the Engineer at least 30 days before shipment of the instruments to the project site.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the installation location for the instrument and verify that the instrument will work properly when installed.
   1. Notify the Engineer promptly if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. As specified in Section 40 61 00.

B. Coordinate the installation with all trades to ensure that the mechanical system has all necessary appurtenances including weld-o-lets, valves, etc. for proper installation of instruments.

3.04 FIELD QUALITY CONTROL

A. As specified in Section 40 61 00.

3.05 ADJUSTING

A. As specified in Section 40 61 00.

B. Verify factory calibration of all instruments in accordance with the manufacturer's instructions:
   1. Return factory calibrated devices to the factory if they do not meet the field verification requirements for calibration.

3.06 CLEANING

A. As specified in Section 40 61 00.

3.07 DEMONSTRATION AND TRAINING

A. As specified in Section 40 61 00.

B. Demonstrate performance of all instruments to the Engineer before commissioning.

3.08 PROTECTION

A. As specified in Section 40 61 00.

3.09 SCHEDULES

A. The provided information does not necessarily include all required instruments. Provide all instruments identified in the Contract Documents:
   1. Instruments may be indicated on the Drawings, specified in the Specifications, or both.

END OF SECTION

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SECTION 40 91 06 PRESSURE/VACUUM MEASUREMENT: GAUGES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Pressure/vacuum gauges.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. As specified in Section 40 61 00.

B. American Society of Mechanical Engineers (ASME):
   1. B40.100 - Pressure Gauges and Gauge Attachments.

1.03 DEFINITIONS

A. As specified in Section 40 61 00.

1.04 SUBMITTALS

A. Furnish submittals as specified in Section 40 61 00.

B. Additional requirements:
   1. Product data:
      a. Accessories such as diaphragm seals, valve manifold, snubbers, and pulsation dampeners.

1.05 QUALITY ASSURANCE

A. As specified in Section 40 61 00.

B. Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:
   1. Process conditions: Fluids, pressures, temperatures, flows, materials, etc.
   2. Physical conditions:
      a. Installation and mounting requirements.
      b. Location within the process.
      c. Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

C. Notify the Engineer if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

1.06 DELIVERY, STORAGE, AND HANDLING

A. As specified in Section 40 61 00.

1.07 PROJECT OR SITE CONDITIONS

A. As specified in Section 40 61 00.

1.08 WARRANTY

A. As specified in Section 40 61 00.

1.09 MAINTENANCE

A. As specified in Section 40 61 00.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: One of the following or equal:
   1. Ashcroft:
      a. Maximum pressure less than 10 pounds per square inch: Model 1189.
      b. Maximum pressure greater than or equal to 10 pounds per square inch: Model 1379.
   2. Wika.
   3. Ametek U.S. Gauge.

2.02 MANUFACTURED UNITS

A. General:
   1. Pressure gauge assembly shall include pressure sensing element, gauge case, and dial mechanism.

B. Performance requirements:
   1. Pressure range:
      a. As specified in the Contract Documents.
   2. Accuracy:
      a. Grade 2A, as defined by ASME B40.100.
      b. Within 1.0 percent of span after friction errors are eliminated by tapping or vibration.
      c. Maximum allowable friction inaccuracy: Within 1.0 percent of span.
   3. Element:
      a. Where the maximum pressure is less than 10 pounds per square inch, provide sockets and bellows; for all other pressure ranges, employ a Bourdon tube.
      b. Socket tips for bellows and Bourdon tube:
         1) Materials: Type 316 stainless steel.
      c. Overpressure: Minimum 130 percent of maximum range pressure without damage to gauge or sensing element.
      d. Wetted materials: Type 316 stainless steel.
   4. Dial gauge:

a. Dial size: 4-1/2 inches.
b. Dial case material:
c. Maximum pressure less than 10 pounds per square inch:
   1) Phenolic
d. Maximum pressure greater than or equal to 10 pounds per square inch:
   1) Stainless steel
e. Provide safety gauge with safety blow out through the back or top of the unit.
f. Dial face: Gasketed shatterproof glass or polycarbonate.
g. Provide gauge locks on all pressure gauges directly connected to diaphragm seals.
h. Provide gauge locks where possible.
i. Hermetically sealed.
j. Connection and mounting:
   1) Direct mounted and suitable for outdoor installation.
   2) 1/2 inch NPT.
   3) Connection material: Stainless steel.
k. Pointer: Externally adjustable.

2.03 ACCESSORIES

A. Pulsation dampeners and snubbers:
   1. Provide pulsation dampener or snubber with each pressure gauge installed on discharge of positive displacement type pump.
   2. Provide piston-type snubber if pressure spikes exceed 130 percent of gauge maximum range.
   3. Materials: Type 316 stainless steel.
   4. Mount pulsation dampener or snubber integrally to the pressure gauge.
   5. Connection: 1/2-inch NPT.

B. Provide diaphragm seals as specified in the Contract Documents and in Section 17401:
   1. Diaphragm seal and pressure gauge shall be assembled by manufacturer and shipped as an assembly.

C. Provide means for gauge isolation as specified in Section 40 91 04:
   1. Mount valve manifold integrally to the gauge.
   2. Valve manifold and pressure gauge shall be assembled by manufacturer and shipped as an assembly.

2.04 SOURCE QUALITY CONTROL

A. As specified in Section 40 61 00.

B. Factory calibrate each pressure gauge at a facility that is traceable to the NIST.

C. Provide complete documentation covering the traceability of all calibration instruments.

PART 3 EXECUTION

3.01 INSTALLATION

A. As specified in Section 40 61 00.

B. Coordinate the installation with all trades to ensure that the mechanical system has all necessary appurtenances including weld-o-lets, valves, etc. for proper installation of instruments.

3.02 FIELD QUALITY CONTROL

A. As specified in Section 40 61 00.

3.03 ADJUSTING

A. Verify factory calibration of all instruments in accordance with the manufacturer's instructions:
   1. Return factory calibrated devices to the factory if they do not meet the field verification requirements for calibration.

3.04 CLEANING

A. As specified in Section 40 61 00.

3.05 DEMONSTRATION AND TRAINING

A. As specified in Section 40 61 00.

3.06 PROTECTION

A. As specified in Section 40 61 00.

3.07 SCHEDULES

A. The provided information does not necessarily include all required instruments. Provide all instruments identified in the Contract Documents:
   1. Instruments may be indicated on the Drawings, specified in the Specifications or both.

END OF SECTION

SECTION 40 91 07 PRESSURE/VACUUM MEASUREMENT: DIRECT

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Pressure transmitters and indicators.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

C. Provide all instruments identified in the Contract Documents.

1.02 REFERENCES

A. As specified in Section 40 61 00.

1.03 DEFINITIONS

A. As specified in Section 40 61 00.

B. Specific definitions:
   1. Lower range value (LRV): Lowest pressure that the pressure transmitter is capable of measuring.
   2. Upper range value (URV): Highest pressure that the pressure transmitter is capable of measuring.
   3. Calibrated range: The range that the pressure transmitter is configured to measure. The low end of the calibrated range must be greater than the LRV of the transmitter. The high end of the calibrated range must be less than or equal to the URV. The calibrated range corresponds to the flow signal sent from the transmitter.

1.04 SUBMITTALS

A. Furnish submittals as specified in Section 40 61 00.

B. Provide complete documentation covering the traceability of all calibration instruments.

1.05 QUALITY ASSURANCE

A. As specified in Section 40 61 00.

B. Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:
   1. Process conditions: Fluids, pressures, temperatures, flows, materials etc.

2. Physical conditions:
    a. Installation and mounting requirements.
    b. Location within the process.
    c. Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

C. Notify the Engineer if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

D. Provide instruments manufactured at facilities certified to the quality standards of ISO 9001.

1.06 DELIVERY, STORAGE, AND HANDLING

A. As specified in Section 40 61 00.

1.07 PROJECT OR SITE CONDITIONS

A. As specified in Section 40 61 00.

B. Project environmental conditions as specified in Section 40 61 00.
    1. Provide instruments suitable for the installed site conditions including, but not limited to, material compatibility, site altitude, site seismic conditions, humidity, and process and ambient temperatures.

1.08 WARRANTY

A. As specified in Section 40 61 00.

1.09 MAINTENANCE

A. Furnish all parts, materials, fluids, etc. necessary for operation, maintenance, and calibration purposes throughout the warranty period. Deliver all of these supplies before project substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. One of the following or equal:
    1. Rosemount: 3051 Series.
    2. Yokogawa: EJA Series.
    3. ABB: 264 Series.
    4. Endress & Hauser: Cerabar S Series.

2.02 MANUFACTURED UNITS

A. Pressure transmitters – direct:
    1. General:
        a. Pressure transmitter assembly shall include a diaphragm type pressure transducer and microprocessor based transmitter for measurement of gauge, vacuum, or absolute pressure.

2. Performance requirements:
   a. Maximum ratio of total instrument range to calibrated span: 10 to 1.
   b. Accuracy:
      1) Reference accuracy: Plus or minus 0.075 percent of calibrated span, including effects of hysteresis, nonlinearity, and repeatability.
      2) Total performance accuracy: Plus or minus 0.30 percent of calibrated span, including reference accuracy effects, static pressure and ambient temperature effects.
      3) Stability: Plus or minus 0.15 percent of upper range limit over 5 years.
3. Element:
   a. Diaphragm type transducer integral to pressure transmitter.
   b. Diaphragm material: Stainless steel or ceramic.
   c. Process material compatibility:
      1) Verify all material compatibilities with the instrument manufacturer.
   d. Process connection: As specified in the Instrument Data Sheets.
4. Transmitter:
   a. Power supply:
      1) 24 VDC - 2 wire loop powered.
      2) Power consumption: 3 VA maximum.
   b. Outputs:
      1) Isolated 4-20mA DC with HART communication protocol.
   c. Provided with electronic microprocessor.
   d. Adjustments: Adjustable electronic zero and span, with elevated or suppressed zero as required by application. Adjustment shall be possible without mechanical fulcrum points or handheld configurator.
   e. Local display:
      1) 5-digit LCD.
      2) Scaled in engineering units.
   f. Enclosure:
      1) NEMA Type 4X.
   g. Over range protection: To maximum process line pressure.
   h. Conduit: 1/2 inch male NPT.
5. Components:
   a. Transmitter mounting:
      1) As specified in the Instrument Data Sheets.
      2) Provide all necessary hardware for transmitter mounting.

2.03 ACCESSORIES

A. Provide valve manifolds as specified in Section 40 91 04:
   1. Mount valve manifold integrally to the transmitter.
   2. Valve manifold and transmitter shall be assembled by Manufacturer and shipped as an assembly.
   3. Provide remote or integral diaphragm seals as specified in the Instrument Data Sheets.

B. Provide sunshades for outdoor installations.

2.04 SOURCE QUALITY CONTROL

A. As specified in Section 40 61 00.

B. Factory calibrate each instrument with a minimum 3-point calibration or according to Manufacturer's standard at a facility that is traceable to the NIST.
   1. Submit calibration data sheets to the Engineer at least 30 days before shipment of the instruments to the project site.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the installation location for the instrument and verify that the instrument will work properly when installed.
   1. Notify the Engineer promptly if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. As specified in Section 40 61 00.

B. Coordinate the installation with all trades to ensure that the mechanical system has all necessary appurtenances including weld-o-lets, valves, etc. for proper installation of instruments.

3.04 FIELD QUALITY CONTROL

A. As specified in Section 40 61 00.

3.05 ADJUSTING

A. As specified in Section 40 61 00.

3.06 CLEANING

A. As specified in Section 40 61 00.

3.07 DEMONSTRATION AND TRAINING

A. As specified in Section 40 61 00.

3.08 PROTECTION

A. As specified in Section 40 61 00.

3.09 SCHEDULES

A. The provided information does not necessarily include all required instruments. Provide all instruments identified in the Contract Documents:
   1. Instruments may be indicated on the Drawings, specified in the Specifications, or both.

END OF SECTION

SECTION 40 91 08 ANALYZERS: DISSOLVED OXYGEN (DO)

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Dissolved Oxygen (DO) analyzer.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. As specified in Section 40 61 00.

1.03 DEFINITIONS

A. As specified in Section 40 61 00.

B. NEMA:
   1. Type 6P enclosure in accordance with NEMA 250.

C. Specific definitions:
   1. DO - Dissolved oxygen.

1.04 SUBMITTALS

A. Furnish submittals as specified in Section 40 61 00.

B. Provide complete documentation covering the traceability of all calibration instruments.

1.05 QUALITY ASSURANCE

A. As specified in Section 40 61 00.

B. Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:
   1. Process conditions: Fluids, pressures, temperatures, flows, materials etc.
   2. Physical conditions:
      a. Installation and mounting requirements.
      b. Location within the process.
      c. Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

C. Notify the Engineer if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

D. Provide instruments manufactured at facilities certified to the quality standards of ISO 9001.

1.06 DELIVERY, STORAGE, AND HANDLING

A. As specified in Section 40 61 00.

1.07 PROJECT OR SITE CONDITIONS

A. Project environmental conditions as specified in Section 40 61 00.

1.08 WARRANTY

A. As specified in Section 40 61 00.

1.09 MAINTENANCE

A. Furnish all parts, materials, fluids, etc. necessary for operation, maintenance, and calibration purposes throughout the warranty period. Deliver all of these supplies before project substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. One of the following or equal:
   1. Hach LDO probe with Hach sc200 controller.
   2. YSI FDO IQ probe with YSI 282/284 local and 2020 networked controller

2.02 MANUFACTURED UNITS

A. Dissolved oxygen analyzer:
   1. General:
      a. Dissolved oxygen analyzer for continuous monitoring of dissolved oxygen in liquid.
   2. Performance requirements:
      a. Measuring range: 0 to 20 parts per million (ppm).
      b. Sensor accuracy:
         1) Within 0.2 ppm for values above 1 ppm.
         2) Within 0.1 ppm for values below 1 ppm.
      c. Repeatability: Within 0.5 percent of span.
      d. Response time:
         1) 90 percent value: Less than 40 seconds.
         2) 95 percent value: Less than 60 seconds.
   3. Element:
      a. Optical type that measures the fluorescence or luminescence of a ruthenium or platinum coated sensor.
      b. Using no membrane, electrodes, or electrolyte.
      c. Drift: less than 1 percent per year.

d. Automatic self-diagnostics.
e. Integral temperature sensor.
f. Maximum pressure: 150 pounds per square inch.
g. Power supply: From transmitter through the sensor cable.
h. Enclosure: NEMA Type 6P.
i. Provide automatic cleaning.

4. Transmitter:
   a. Power supply:
      1) 120 VAC.
      2) Power consumption: 75 VA maximum.
   b. Outputs:
      1) Isolated 4 to 20 milliamperes DC with HART communication protocol.
      2) Relay outputs:
         a) 3 Form C contacts.
         b) Rated 5 amps at 120 VAC.
         c) Programmable.
   c. Microprocessor based with features resident in non-volatile memory.
   d. Display dissolved oxygen content with 0.01 ppm resolution over a range of 0.00 to 9.99 ppm and 0.1 ppm resolution over a range of 10.0 to 20.0 ppm.
   e. Display temperature with 0.2 degree Celsius accuracy.
   f. Enclosure rating: NEMA Type 4X.
   g. Automatic temperature compensation.
5. Components:
   a. Manufacturer's cable for sensor to transmitter connection.

2.03 ACCESSORIES

A. Calibration equipment:
   1. Provide components recommended by the manufacturer to verify calibration.

B. Provide sunshade for outdoor installations.

C. Provide a pole mount kit for mounting the sensor.

D. Provide head assembly for air cleaning.

2.04 SOURCE QUALITY CONTROL

A. As specified in Section 40 61 00.

B. Factory calibrate each instrument with a minimum 3-point calibration or according to Manufacturer's standard at a facility that is traceable to the NIST.
   1. Submit calibration data sheets to the Engineer at least 30 days before shipment of the instruments to the project site.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the installation location for the instrument and verify that the instrument will work properly when installed.

1. Notify the Engineer promptly if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

3.02 INSTALLATION

A. As specified in Section 40 61 00.

3.03 FIELD QUALITY CONTROL

A. As specified in Section 40 61 00.

B. Provide manufacturer's services to perform installation inspection, start-up and calibration/verification.

3.04 ADJUSTING

A. As specified in Section 40 61 00.

3.05 CLEANING

A. As specified in Section 40 61 00.

3.06 DEMONSTRATION AND TRAINING

A. As specified in Section 40 61 00.

3.07 PROTECTION

A. As specified in Section 40 61 00.

3.08 SCHEDULES

A. The provided information does not necessarily include all required instruments. Provide all instruments identified in the Contract Documents:
   1. Instruments may be indicated on the Drawings, specified in the Specifications, or both.

END OF SECTION

43 11 17 MULTISTAGE CENTRIFUGAL BLOWERS

1.00 GENERAL

1.01 SCOPE

A. Work Included: Furnish, install and test three factory assembled multistage centrifugal blower systems. The blower systems shall be complete, including blowers, motors, local control panels, inlet air filter/silencers, butterfly valves, check valves, flexible connectors, and other appurtenances as shown on the Drawings, as specified herein, and as needed for a complete and operational system

1.02 SYSTEM DESCRIPTION

A. All equipment including controls and drives specified herein shall be specifically designed for this service and the environment encountered in this installation.

B. Equipment shall be designed and capable of either continuous or intermittent operation.

C. All equipment, supports, anchors and fasteners shall be of adequate strength to withstand loads associated with starting, turbulence, thrusts, thermal expansion and contraction, and other loads encountered under normal operating conditions.

D. The equipment, sizes, materials, and arrangements described in this specification section are based on recommendations by equipment manufacturers and shall be considered minimum limits of acceptability. The equipment manufacturer shall be responsible for design, arrangement, and performance of all equipment supplied under this section. Arrangements other than those shown on Drawings shall be subject to the Engineer's approval.

1.03 SUBMITTALS

A. Product Data: Provide construction details, material descriptions, dimensions of individual components and profiles, and finishes for each component.

B. Shop Drawings: Provide plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Manufacturer and model number of all equipment within this specification, and an itemized list of components being furnished.
   3. Layout drawings and equipment cut sheets showing dimensions, clearances, sizes, arrangement and size of connections, supports, anchors, and total weights of the product.
   4. Applicable bid specification section with comments on conformance and deviations on each paragraph.
   5. Detailed specifications and data describing the materials of construction.
   6. Wiring Diagrams: For power, signal, and control wiring diagrams, including terminals and numbers. All wiring shall be in accordance with Division 26

electrical specifications in full compliance with NFPA 70 National Electrical Code 2011.

7. Detailed I/O listing of the PLC, including but not limited to all available data points and setpoint values. Include a complete memory map of available inputs, outputs, and setpoints to include the range and description of each point with Ethernet/IP address.
8. Motor requirements in accordance with Division 26.
9. Complete performance curves including capacity, operating pressures, efficiency, and brake horsepower over the full operating range.
10. Equipment weights and lifting points.
11. Blower paint specification and procedure

C. Information Submittals:
1. Factory functional and performance test reports and log
2. Field performance test reports and log
3. Special shipping, storage and protection, and handling instructions
4. Manufacturer's instructions for installation
5. Manufacturer's Equipment Installation Report
6. Location of nearest stocking distributor of spare parts
7. Suggested spare parts list to maintain the equipment in service for a period of one year. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current pricing information
8. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance
9. Warranty certificate

D. Performance Data: Blower certified performance test reports per ASME PTC-10 for each blower including but not limited to certified blower curves showing pressure, capacity, and horsepower demand over the entire operating range of the blower.

E. Submit complete instruction manual for operation and maintenance of the equipment in accordance with Section 01 78 23 and the General Conditions. Include the following data:
1. Alignment, adjustment, and repair instructions.
2. Installation and operation instructions.
3. Assembly diagrams.
4. Troubleshooting guide.
5. Recommended spare parts lists and predicted life of parts subject to wear.

1.04 QUALITY ASSURANCE

A. The package blower systems, including blower, motors, controls and all appurtenances to form an integrated system, shall be supplied by one manufacturer who shall provide all the equipment and appurtenances regardless of manufacturer.

B. Manufacturer Qualifications:
1. Manufacturer must have blowers permanently installed and operational in at least at least twenty wastewater treatment facilities. Five of these facilities must be 100 HP or over similar in design to what is specified.
2. Manufacturer shall have a history of manufacturing and providing this equipment in North America for at least five years. A list of similar installations

shall be furnished with the shop drawing submittal, including names and telephone numbers of contacts.

C. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The equipment, material, and spare parts shall be shipped complete except where partial disassembly is required by transportation regulations or for protection of components.

B. Spare parts shall be packed in containers bearing labels clearly designating contents and pieces of equipment for which they are intended.

C. The Contractor shall unload, store and safeguard equipment, materials, and spare parts in accordance with Manufacturer’s recommendations.

1.06 WARRANTY

A. The equipment shall be warranted for two years from the date the final or third blower is accepted.

B. Cost for the removal, shipment, repair and installation by Contractor shall be included in warranty, as well as correction of defective work.

1.07 SPARE PARTS

A. Furnish a list of recommended spare parts with the Operations and Maintenance Manual.

B. Provide the following minimum for each blower:
1. One set of blower bearings
2. One set of blower shaft seals
3. One set of blower gaskets
4. One set of replacement filter elements
5. One set of vibration isolation pads

C. Furnish one set of special tools required for complete assembly or disassembly of blower system components for each type or size of blower specified, together with a neat metal box (or boxes) for the same. The tool kit shall be sufficiently complete to permit normal repair and maintenance of all equipment furnished under this project.

2.00 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Lone Star Blower

B. Spencer

C. Continental

D. Hoffman and Lamson

2.02 CENTRIFUGAL BLOWER

A. General – Blower shall be high efficiency, cast-iron, multi-stage centrifugal.

B. Performance – Design each blower to meet the following performance requirements when operating at the specified environmental conditions:
   1. Design Flow: 1,400 scfm
   2. Blower Discharge Pressure: 9.3 psig
   3. Pressure Rise to Surge: 1.5 psig
   4. Minimum Flow Required: 1,100 scfm
   5. Max. BHP at Design Flow: 90 HP
   6. Min. Motor Nameplate HP: 125 HP
   7. Max RPM at Design Flow: 3,600 RPM
   8. Sound Limit: 85 dba
   9. Vibration Limit: 1.0 mils at maximum RPM
   10. Inlet Temperature Range: 0 to 120 °F.
   11. Specified Environmental Conditions at Design: 660 feet above mean sea level, temperature 110 °F, and 60-percent relative humidity.

C. Construction
   1. General – The blowers shall horizontally-mounted with outboard bearings and with inlet and outlet arrangement and drive end shall be as shown on the drawings. All parts for like blowers will be interchangeable. The blowers shall operate smoothly without abnormal noise, vibration or excessive heat throughout the specified range of operating conditions.
   2. Casing – The blower casing, which includes inlet head, discharge head and intermediate diffuser sections, shall be constructed of high strength cast iron, suitably ribbed to withstand all stresses and strains of service at full operating pressure and be in accordance with ASTM Designation A48, Class 25. The vertically split assembly shall be held together with high strength ASTM 108 steel tie rods.
   3. Inlet and outlet connections shall match ASA 125-pound drilling pattern.
      a. Minimum inlet diameter shall be 8-inches.
      b. Minimum outlet diameter shall be 8-inches.
   4. Impellers shall be one-piece cast ASTM A356 aluminum, with spacing hubs an integral part of the impeller casting. The impellers shall be keyed to the shaft with a one-piece key that extends the entire length of the impeller hub. Impellers shall be dynamically balanced individually and shall be individually replaceable without requiring dynamic rebalancing of the entire rotating assembly to maintain factory vibration specifications. Impeller peripheral speed shall not exceed 395 F.P.S.
   5. Shaft, Seals & Bearings –
      a. The blower shaft shall be AISI 4140 steel or better, accurately machined and ground to size. The shaft shall be of ample size to carry all loads imposed under continuous service. Critical speed will be at least 20% above the blower operating speed. Where the blower shaft passes through both the inlet and outlet head, seals shall be provided to minimize leakage. Seals shall be labyrinth type and shall be replaceable without having to disconnect the piping or disassemble the compressors. Inter-

stage shaft seals shall be provided to insure minimum leakage between stages.

b. Rotor assemblies are to be supported at each end by one or more oil lubricated anti-friction bearings. Provide bearings with a minimum AFBMA L10 life rating of 100,000 hours. Shaft speed shall not exceed the bearing manufacturer's limitations. Bearings are to be mounted in housings outboard of the casing heads. Bearing housings are to be arranged to permit inspection and replacement of the bearings without having to disconnect the piping or disassemble the compressors. Bearings to be equipped with 100 ohm platinum RTD's for bearing temperature monitoring and vibration sensors on each bearing.

6. Base and Mounting Pads - A common base of ASTM A36 structural steel shall be provided for each blower/motor assembly. The base shall be constructed to support the full weight of the blower, motor and accessories. Lifting provisions shall be included. Suitable resilient foundation mounting pads shall be provided
7. Coupling & Guard - Each compressor is to be directly connected to the drive motor by means of a flexible gear type coupling. The horsepower rating of each coupling is to be not less than 1.5 times the motor nameplate horsepower when the misalignment is within the coupling manufacturer's tolerance limit. A suitable coupling guard is to be furnished.
8. Paint – Provide a prime coat of epoxy primer 97-946 Series as manufactured by PPG or equal. Provide an external finish coat of urethane 95-812 Series as manufactured by PPG or equal.
9. Provide a shop coat of grease or rust-resistant coating to ferrous surfaces not to be painted.
10. Nameplates - Nameplates shall be stainless steel

2.03 MOTOR

A. Electric motors shall be constant speed, squirrel cage design in accordance with NEMA and IEEE standards. Motors shall be designed to operate at 3600 RPM on 3 phase, 60 cycle, 460-volt electrical supply. Motor shall have a 1.15 service factor and be sized to operate below motor nameplate rating at the specified capacity and design conditions. Motor enclosure shall be TEFC.

B. The motor shall meet the requirements in the applicable electrical sections in these bid documents.

2.04 MONITORING EQUIPMENT

A. The following shall be provided for each blower at a minimum:
   1. Blower bearing RTD
   2. Blower bearing vibration sensor
   3. Motor winding RTD
   4. Motor bearing RTD

B. Gauges shall be provided at the following minimum locations:
   1. Vacuum gauge at each blower inlet
   2. Common discharge header pressure gauge

2.05 CONTROL PANEL

A. Provide a PLC-based control panel, in a NEMA 4X enclosure, manufactured by the blower manufacturer, for each blower.

B. Each panel shall be furnished with a load control safety switch, surge protection, e-Stop, local-off-remote switch, and integral start/stop/reset control.

C. Provide I/O list of parameters to be monitored through interface with register assignments and engineering units. Provide communications with plant SCADA system via Modbus TCP/IP, with protocol gateway, if needed.

D. Provide other controls as shown on the process and instrumentation diagrams and as needed for a fully functioning system.

2.06 BLOWER ACCESSORIES

A. Anchor bolts shall be 316 SS, provided by the Contractor.

B. Inlet Filter Silencer – Synthetic fiber cartridge-style filter/silencer, sized for 125% of the design flow 1,750 cfm, (clean filter pressure drop not to exceed 3” w.c. at this flow). Filter efficiency is to be minimum 98% removal on 10 microns. Filter/silencer to have minimum 8" connection to blower inlet, manufactured by Endustra.

C. Butterfly Valves – A minimum 8-inch diameter butterfly valve to be installed in the blower inlet piping for throttling purposes. A minimum 8-inch diameter butterfly valve to be installed in the blower outlet piping for isolation purposes. The valves will be suitable for at least 15 psig air service and be gas tight along the shaft to the outer wall of the casting. The valves will have a cast iron body, a corrosion-resistant shaft, a shutter of steel or cast iron, ball bearings or bronze bushings and will be manually actuated. Butterfly valves to be wafer style, and manufactured by Tyco Keystone, PDC, Bray, or equal.

D. Inlet and Discharge Expansion Joints – Rubber, flanged, single-arch spool-type expansion joints to be supplied for inlet and discharge of each blower, manufactured by Red Valve, General Rubber, or equal.

E. Check Valve – Minimum 8-inch double disc, center pivot, with steel body, aluminum discs, hinge post, hinge clamp and flexible sealing. The valve discs shall be designed such that when there is no flow, the discs shall be held tightly against the interior wall of the valve body and the flexible sealing shall provide an air-tight seal to prevent reverse flow. The valve shall be capable of withstanding a temperature of 500 degrees F minimum. Valves shall be of the short body type suitable for mounting between a pair of flanges, supplied by US Valve, Flexi-Hinge, or equal.

3.00 EXECUTION

3.01 FACTORY TESTING

A. Each blower shall be given a mechanical run test at the manufacturer’s facility for a minimum of four hours. Blower bearing vibration and temperature shall be checked to ensure compliance with manufacturers standards.

B. All tests shall conform to ASME Power Test Code and shall extend from surge to beyond rated design flow. ASME tests are not required for blowers built from parts cast in patterns from which previous units have been cast, built and tested.

C. Vibration testing shall also be performed.

3.02 MANUFACTURER'S SERVICES:

A. Provide a trained, experienced representative for the following onsite tasks for each blower. Each day shall consist of eight hours at the project site excluding travel time and breaks. Provide services at no additional cost to the Owner.
   1. Equipment check out and startup – one (1) day
   2. Training of Owner's personnel – one (1) day

B. The Manufacturer's representative shall instruct the plant personnel in operation, care and maintenance of the blower equipment and supervise initial operation.

C. Provide a trained, experience representative for supplemental training for one (1) day of training, consisting of eight hours at the project site excluding travel time and breaks, about four months after equipment acceptance.

3.03 ASSEMBLY AND INSTALLATION

A. Install and adjust equipment in accordance with the Drawings, approved shop drawings, and the manufacturer's instructions. Do not operate the equipment in the field until the installation is approved by the manufacturer's representative.

B. The arrangement shown on the drawings is based on blowers by Lone Star Blower. Any modifications to the installation required for installation of the other named blowers shall be the responsibility of the Contractor.

C. Do not cut or weld any component in the field. Only bolted connections will be allowed in the field.

D. Check installation prior to start-up for conformance to manufacturer's instructions. Adjust or modify equipment to ensure proper operation.

E. Blowers shall be replaced one at a time in accordance with construction sequencing requirements. Work on the subsequent blower shall not commence until the work on the previous blower is accepted.

3.04 FIELD QUALITY CONTROL

A. Prior to equipment startup, the Contractor, with the assistance of the manufacturer's representative, shall inspect all equipment for proper assembly and alignment, quiet operation, and proper operation.
   1. All components shall operate without alarms or shutdowns, except as intended, for eight consecutive hours to be considered ready for startup.
   2. Operate the equipment through the design performance range consistent with available flows. Adjust, balance, and calibrate and verify that the equipment, safety devices, controls, and process system operate within the design conditions. Response shall be checked for each equipment item and alarm.

B. A copy of all information from functional tests, including data, worksheets, and other materials shall be turned over to the Owner at the completion of the testing program.

END OF SECTION

SECTION 43 11 38 POSITIVE DISPLACEMENT BLOWERS

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall install two positive displacement, high efficiency blower systems built by a qualified manufacturer for use in aerating a sludge storage tank. All components shall be furnished by a single manufacturer who shall be responsible for the performance and compatibility of the system.

1.02 REFERENCED STANDARDS

A. American National Standards Institute (ANSI) B16.1, B40.1

B. American Society of Mechanical Engineers (ASME) PTC 9

C. American Gear Manufacturers Association (AGMA)

D. American Society of Testing and Materials (ASTM)

E. Anti-Friction Bearing Manufacturers' Association (AFBMA) 9, 11

F. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

G. Institute of Electrical and Electronics Engineers (IEEE)

H. Mechanical Power Transmission Association

I. National Electrical Code (NEC)

J. National Electrical Manufacturers Association (NEMA) MG 1, ICS 6

K. National Fire Protection Association (NFPA) 70

L. Occupational Safety and Health Administration (OSHA)

M. Rubber Manufacturers Association (RMA)

N. Steel Structures Painting Council (SSPC)

O. Underwriters Laboratories (UL)

1.03 SUBMITTALS

A. Submittals shall be prepared and submitted in accordance with Section 01 33 00.

B. The following submittals are required, at a minimum, in addition to any other applicable requirements of Section 01 33 00 Submittals.

1. Shop drawings specific to project and applicable product data bound neatly in a single package. The following information shall be included as a minimum:
    a. Manufacturer and model number of equipment.
    b. Layout drawings and equipment cut sheets showing dimensions, clearances, sizes, arrangement and size of connections, supports, anchors, and total weights of the product.
    c. Detailed specifications and data describing the materials of construction and coatings.
    d. Submit the following information on electric motors furnished including make and type of motor:
        1) Name of Drive
        2) Horsepower of Motor
        3) Phase
        4) Full Load Efficiency
        5) Voltage
        6) Full Load Power Factor
        7) Speed
        8) NEMA Design Starting Torque
        9) NEMA Frame and Dimensions
        10) Full Load Current
        11) Locked Rotor Current
        12) Insulation Class
        13) Temperature Rise at 1.0 SF
        14) Enclosure
        15) Bearing life design
    e. Complete electrical wiring diagrams and data on equipment devices to be furnished.
    f. Complete performance curves including capacity, discharge pressure, efficiency, and brake horsepower over the full operating range.
    g. Layout, sizes, material, and type of anchor bolts to be furnished.
2. Attenuation performance curve for each type of silencer.
3. Pressure relief valve set pressure.
4. Location and telephone number of nearest stocking distributor of spare parts.
5. Complete operation and maintenance data for all equipment and controls in accordance with Section 01 78 23 Operation and Maintenance.
6. Startup and test schedule with test procedures in accordance with Section 01 75 00 Startup and Adjusting.
7. Equipment installation report with field test data and test records.
8. Warranties and service agreements, if specified.

C. All deviations from contract documents shall be clearly identified in the submittal and are only accepted if specifically approved in writing by the Engineer.

D. Any other information necessary for the Engineer to determine compliance with the specifications.

1.04 QUALITY ASSURANCE

A. The blower systems will be built by a blower system supplier who has units at 50 or more wastewater treatment plants, the same size or larger than those specified below, that have been in successful operation for fifteen or more years.

B. All components shall be furnished by a single supplier who shall be responsible for the performance and compatibility of the system.

C. The blower system manufacturer shall be an authorized warranty service center for the blower provided.

D. Blowers, motors, and all primary components shall be manufactured in the United States with replacements and parts available from multiple sources within the United States.

1.05 STORAGE & HANDLING

A. Care must be taken during unloading and handling of equipment to ensure against undue strain to the blower and motor. Use of lifting straps or chains under the blower or motor not permitted. Lift from under the main frame, base or use base mounted lifting lugs.

B. In storage blowers must be kept clean, free of moisture and rotated a minimum of 20 revolutions each week to maintain warranty. For storage more than four months, or in a damp or corrosive environment see the manufacturer's operation and maintenance manual.

1.06 CONDITIONS OF SERVICE

Application:	Sludge Storage Tank Blowers
Number of Blowers:	2
Site Elevation, ft ASL:	660
Design Inlet Temperature, ºF:	110
Design Relative Humidity, %:	85
Design Air Flow, scfm:	602
Minimum Turndown, %:	60
Differential Pressure, psig:	8.1
Maximum Motor Size, HP:	40
Sound Limit @ 1 meter in Free Field, dBA:	84

1.07 WARRANTY

A. Standard Warranty:

The manufacturer will provide a warranty stating that the blower system is warranted to be in accordance with the product specifications mutually agreed upon and to be

free from defects in workmanship and materials. The blower system manufacturer's product warranty will extend to all products supplied by the blower system manufacturer whether manufactured by the blower system manufacturer. This warranty shall terminate two years from equipment acceptance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Model 3C-HYBRID as manufactured by Universal Blower Pac, Inc., Noblesville, Indiana.

B. Equivalent equal, Aerzen USA Corporation, Coatsville, PA

2.02 CONSTRUCTION

A. The blower shall be able to accommodate the pressure and flow described in section 1.06 Conditions of Service. The blower shaft shall be integral with solid-cast ductile-iron helical impellers with a hybrid lobe profile. The blower shall have helical timing gears held by non-slip grip rings, piston ring compression chamber seals and both ports triangular tuned, splash oil lubrication on both ends, and projecting glass viewports for easy oil level indication. Straight lobed impellers shall not be acceptable. Blowers shall be dynamically balanced and provide oil free non-contact compression.

1. ATTENUATION

a. Each blower system shall be equipped with an acoustical enclosure. Enclosures shall be designed, assembled, and inspected at the manufacturing site with documentation provided to verify the noise reduction demanded in these documents. Noise attenuation shall be provided as necessary to reach the specified sound limit requirement at a distance of 1 meter from the operating equipment in a free field environment. All readings shall be taken by personnel experienced in the field of sound attenuation.

b. Enclosures shall be designed and manufactured by the blower system manufacturer specifically for the equipment supplied. Units shall be designed to be picked up by a fork truck. Each acoustical enclosure shall be shipped completely assembled. No field assembly permitted.

c. Absorption of sound waves shall be the basis of design for the enclosure. The complete blower system will be enclosed to meet the level specified. With absorption considered, perforated metal inner skin retaining devices shall not be considered acceptable.

d. Absorption media shall be a nominal 2-inch-thick resilient material capable of returning to its original form after compression. Media shall have an overall weight of not less than 1.6 pounds per cubic foot. Media sheets shall have an upper oil resistant layer a minimum of three mils in thickness to protect the integrity of the media. Absorption

media shall be interior and be fitted to each exterior facet and show contact at all points. Media shall be snug fit, be complete with pressure sensitive adhesive and held in place with washers, studs and cap nuts manufactured from corrosive resistant materials. All adhesives used in anchoring studs or other items in structure shall be high temperature industrial material rated for the application.

e. Outer skin shall be a minimum 14 gauge galvannealed steel. Enclosure panels to be 10 gauge aluminum. Lesser gauges shall not be acceptable. All surfaces are to be powder coated per section 2.02.I. Coatings.

f. No fastening hardware shall be visible on the exterior of the enclosure except those holding the instruments and relief valve exhaust differ in place for ease of repair. Rivets or loose fitting panels which can loosen during operation will not be accepted. Slide-in panels showing a loose fit shall provide grounds for rejection.

g. Each enclosure will have removable service panels. All surfaces and edges shall be free of burs and sharp edges. Panels shall lock closed using key-operated compression latches with folding handles that fit flush.

h. Each enclosure shall incorporate internal acoustical-lined intake-air vent boxes rated for the SCFM listed in the "service" section and discharge pipe openings with sound seal. Louvers shall not be acceptable.

i. A 120/60/1 electric cooling fan with thermostat control and acoustical vent shall be supplied installed on the enclosure. To ensure adequate cooling at all speeds the cooling fan will not be connected to the blower or motor shaft in any way.

j. A normally closed high enclosure temperature switch shall be supplied installed within the enclosure.

B. MOTOR

Design:	B, squirrel-cage, induction per NEMA MG1 & IEEE standards
HP:	Nameplate greater than the brake horsepower at 10% above the relief valve set pressure
RPM:	1800
Type:	TEFC
Power:	460 Volt, 3 phase, 60 Hertz
Insulation:	Class F with class B rise
Service Factor:	1.15 at power voltage and site elevation listed above
Efficiency:	"Premium efficient" per latest edition of NEMA MG1

C. V-BELT

High-capacity type, oil and heat resistant, static-dissipating drive belts selected to have a 1.4 or higher service factor above the required compressor brake horsepower. Sheaves shall mount to the compressor and motor shafts with QD type bushings.

D. DRIVE GUARD

Top, sides and bottom made of 14-gauge sheet steel with expanded metal front and back. Designed to allow ample ventilation for the drive, have an easy access cover and conform to applicable safety codes.

E. BASE

1. Base shall include spring loaded auto-tension device for ease of drive installation and maintenance. Covered forklift slots shall be integral to the base design.

2. The blower base shall have isolation mounts to minimize transmitted vibrations from the blower system to the surrounding structure.

F. ACCESSORIES

1. INLET FILTER/SILENCER

a. Each blower will have a filter/silencer with paper media that removes 99.5% of 2-micron particles. The maximum pressure drop across the clean element shall be less than 2-inches of water column. The filter/silencer shall be Stoddard FH64 or equal.

2. DISCHARGE SILENCER

a. Silencers 3" and smaller shall be of the premium, straight-through absorptive type. Larger silencers shall be of the multiple-chamber design. Silencers will have acoustically packed nozzle next to blowers operating above transition speed. Silencers with threaded connections shall have ports on each end and those with flanged connections will have ports on the side and end. Multi-chamber silencer attenuation performance shall be at least 18 dB at 63 hertz, 23 dB at 125 hertz, 27 dB at 250 hertz and 31 dB at 500 hertz.

b. Each blower shall have an inlet silencer with an air velocity of 4000 to 5700 feet per minute. Silencer shall be Progentex, Inc. series DS, RSI, DRSI, Universal Silencer, Inc. series U5, URB, RIS, Burgess Manning series CA, BMAI, BMSI Stoddard series L/C21, D13/L41, L61/63 or equal. Combination type inlet filter/silencers shall not be permitted.

c. Each blower shall have a discharge silencer. Based on inlet CFM air velocity shall be 5500 to 7000 feet per minute. Silencer shall be Progentex, Inc. series DS, RS, DRS, Universal Silencer, Inc. series U5, URB, SD, Burgess Manning series CA, BMA, BMSS, Stoddard

series L/C21, D13, D32/33 or equal. Combination type discharge silencer/base frames shall not be permitted.

3. FLEXIBLE JOINT

a. Each blower shall have an inlet and discharge flexible joint that matches the blower ports' size and type of connection. The joint's elastomer must be rated higher than the maximum expected service temperature and pressure.

b. Each blower shall have an external discharge flexible joint that matches the blower discharge silencer size. The joint's elastomer must be rated higher than the maximum expected service temperature and pressure.

G. VALVES

1. PRESSURE RELIEF VALVE: Each blower shall be protected by a spring loaded pressure relief valve preset to start opening at half a PSIG above the PSIG listed in the "service" section, be full open at not more than 10% above the set pressure and rated for the SCFM and PSIG listed in the "service" section. If the valve malfunctions it shall do so in the open condition to prevent blower damage. Valve shall vent outside of the enclosure.

2. CHECK VALVE: Each blower shall have a discharge check valve 6-inches or greater in diameter. Valves 8-inch and larger shall have a cast-iron wafer body. Internals shall be aluminum split discs with no-pinch elastomer and seal rated above the maximum anticipated discharge temperature.

3. ISOLATION VALVE: Each blower shall have a discharge isolation valve 6-inches or greater in diameter. Valves shall be cast-iron wafer-body butterfly type with a locking handle. Valves more than eight feet above the floor shall have a chain wheel operator. The temperature rating of the seat must exceed the maximum anticipated discharge temperature.

H. INSTRUMENTS

1. Each inlet filter shall have a filter restriction gauge that progressively measures vacuum in the filter element. A visual indicator, with a manual reset, shall lock at the current vacuum when the blower is shut off. Gauge shall be panel mounted on the acoustical enclosure. Inlet filter shall have a pressure high indicating transmitter.

2. Each blower shall have a 2-1/2" diameter, stainless steel case, brass bourdon tube, liquid filled, 1/4 NPT connection pressure gauge with a 0-15 PSIG scale on systems operating up to 10 PSIG and 0-30 PSIG for higher pressures. Gauge shall have a 1/4" brass snubber and isolation valve and be mounted in the enclosure wall. Gauge shall be Winters 901 or equal.

3. Each blower shall have a 4.5" diameter thermometer with a 50-300 ºF scale on systems up to 10 PSIG, 50-500 ºF for higher pressure. Thermometer shall

be mounted in the enclosure wall. The thermometer shall be Wika TI.V45RB or equal.

4. Each blower shall have a high discharge pressure switch.

5. Each filter shall have differential vacuum switch factory preset at 20" WC vacuum.

I. CONTROL PANEL

1. Each blower shall be provided with a NEMA 4X 316 SS control panel mounted to the blower enclosure. Each panel shall have NEMA rated components (soft starter, circuit breaker with interlocking door handle, 3-leg motor overload protection, 120 volt control transformer, door mounted overload reset pushbutton, door mounted run indicating light, door mounted HOA selector switch, inlet filter pressure high, terminals for field connection and power/control for the enclosure cooling fan).

2. Provide other controls as shown on the process and instrumentation diagrams and as needed for a fully functioning system.

J. Each blower shall be furnished with the following spare parts:

1. One spare filter element

2. One year supply of synthetic lubricants

3. One set of v-belts

K. Factory coat equipment in accordance with Section 09 91 00 Painting and Coating.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The following points must be followed to ensure an adequate installation:

1. The blower pad must be located on the equivalent of compacted soil substructure, which will allow the pad to remain flat, rigid, and free of resonant frequencies within the operating range of the equipment.

2. The blower must be anchored using bolts intended specifically for dynamic loading.

3. The unit must be installed and leveled per the manufacturer’s instructions.

3.02 START-UP AND TESTING

A. The blower system supplier shall provide the services of a factory trained technician to check installation and verify proper operation. Start-up services shall be a minimum of one day 6 hour day.

3.03 TRAINING

A. The blower system supplier shall provide the services of a factory trained technician to train the owner's personnel in proper maintenance procedures. Training shall be a minimum of one day 8 hour day.

END OF SECTION

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43 21 21.75 RECESSED IMPELLER PUMPS

1.00 GENERAL

1.01 SUMMARY

A. Section includes: Pump systems including horizontal cup type recessed impeller centrifugal pumps, flexibly coupled with fixed speed motor drives or adjustable frequency motor drives. Provide two pumps, one duty at the vortex grit removal and one identical spare.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
   3. Pumps shall be supplied by the vortex grit unit manufacturer. See Section 46 23 23 for vortex grit removal requirements.
   4. Electrical, instrumentation and controls shall be in accordance with Divisions 26 and 40 of the contract documents.

1.02 REFERENCES

A. American Bearing Manufacturers Association (ABMA):
   1. 9 – Load Ratings and Fatigue Life for Ball Bearings.
   2. 11 – Load Ratings and Fatigue Life for Roller Bearings.

B. American Iron and Steel Institute (AISI).

C. American Society of Mechanical Engineers (ASME):
   1. B16.1 – Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, and 250.

D. ASTM International (ASTM):
   1. A 48 – Standard Specification for Gray Iron Castings.
   2. A 108 – Standard Specification for Steel Bars, Carbon and Alloy, Cold-Finished.
   3. A 283 – Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
   4. A 532 – Standard Specification for Abrasion-Resistant Cast Irons.
   5. A 582 – Standard Specification for Free-Machining Stainless Steel Bars.
   6. A 743 – Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
   7. E 10 – Standard Test Method for Brinell Hardness of Metallic Materials.

E. Hydraulic Institute (HI):
   1. 1.1-1.2 – Centrifugal Pumps for Nomenclature and Definitions.
   2. 1.3 – Rotodynamic (Centrifugal) Pumps for Design and Application.
   3. 1.6 – Centrifugal Pump Tests.
   4. 9.1-9.5 – Pumps – General Guidelines for Types, Definitions, Application, and Sound Measurement and Decontamination.

1.03 DEFINITIONS

A. Pump head (total dynamic head, TDH), flow capacity, pump efficiency, net positive suction head available (NPSHa), and net positive suction head required (NPSHr): As defined in HI 1.1-1.2, 1.3, 1.6, and 9.1-9.5 and as modified in this Section.

B. Suction head: Gauge pressure available at pump intake flange or bell in feet of fluid above atmospheric; average when using multiple suction pressure taps, regardless of variation in individual taps.

1.04 SYSTEM DESCRIPTION

A. Recessed impeller pumps with components: Pump, driver, motors, and drive arrangements as specified or as scheduled with shafts, seals or packing, couplings, base plates, guards, supports, anchor bolts, necessary valves, gauges, taps, lifting eyes, stands, and other items as required for a complete and operational system.

B. Fluid service: Provide pumps that are capable of continuous operation while pumping grit containing up to 5 percent solids, hair, and other fibrous materials typically found in municipal wastewater streams. Fluid expected to be heterogeneous mixtures of inorganic and organic solids with grease and oil present.

C. Design requirements:
   1. Pump duty points: As determined by the vortex grit equipment manufacturer.
   2. Motor characteristics: Comply with Division 26 of these specifications.
   3. Design the belt drive system to provide the required pump speed and to meet the specified performance conditions.

D. Operations Summary: Each grit pump operates to transfer grit collected in a Grit Removal Unit to an associated Grit Separation/Classification Unit. The grit pumps are controlled by local control panel by grit removal equipment suppler.

E. Monitoring and Alarms:
   1. Monitoring:
      a. Run status of each pump.
      b. AUTO status of each pump.
   2. Alarms:
      a. Pump Fault
      b. High motor temperature.

1.05 SUBMITTALS

A. Submittal shall be in accordance with 01 33 00 – SUBMITTALS
   1. Shop drawings, cross sectional drawings, fabrication procedures, and erection drawings showing details of fabrication, construction and erection.
   2. Descriptive literature, bulletins and/or catalog data of equipment, to include the following:
      a. Listing of materials of construction of all components and any coatings used (where applicable).
      b. Details of drive assembly.
      c. Information for field installation requirements including total equipment weight and weights of sub-assemblies.

1) Submit total operating weight and foundation reaction loads for review.

d. Manufacturer's recommended spare parts.

e. A maintenance schedule showing the require maintenance, frequency of maintenance, lubricants and other items required at each regular preventative maintenance period, including all buy out items.

f. Complete data on motors, control panels, electrical, instrumentation and controls in accordance with Divisions 26 and 40.

g. Wiring and control diagrams for power, signal and controls, including terminals and numbers.

h. Any deviations from the specifications.

i. Warranties and service agreements.

j. Long term storage requirements for spare pump.

B. Complete Operation and Maintenance manuals in accordance with Section 01 78 23.

1.06 QUALITY ASSURANCE

A. References: Provide references for a minimum of 5 installations currently operating the same model of equipment in continuous service for a minimum of 5 years under similar operating conditions. Reference information shall include location, service, contact person and contact phone number.

B. Provide pumps in this Section from same manufacturer.

C. Manufacturer to furnish and coordinate pump, driver, drive, and pump components as scheduled and to provide written installation and checkout requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Preparation for shipment:

1. All materials shall be suitably packaged and braced to protect against damage during transit, handling, and unloading.
2. Manufacturer shall package equipment, be responsible for, and make good, any and all damage until the equipment is delivered to the job site.
3. Accessories shall be packaged separately in clearly marked containers.
4. A packing list, listing the contents of each container, shall be placed in a moisture-proof envelope and securely fastened to the outside of the container.
5. Provide written storage procedures for all equipment.

B. Delivery to job site: Manufacturer shall fabricate and deliver materials to the job site in conformance with the Contractor’s construction schedule to minimize handling and on-site storage of equipment.

C. Storage and protection:

1. Protect the system components at the site and during installation prior to project completion.
2. As a minimum, provide cover, ventilation, and proper stacking to prevent warping of any equipment stored on-site.

1.08 PROJECT CONDITIONS

A. Environmental Conditions:
   1. All equipment including controls and drives specified herein shall be specifically designed for this service and the environment encountered in this installation.
   2. When installed in wastewater treatment areas, the environment will be moist, and corrosive, exhibiting hydrogen sulfide and other corrosive gases encountered in municipal wastewater treatment plants.
   3. Designed and capable of operation at ambient temperatures of 0 degrees Fahrenheit to 110 degrees Fahrenheit.
   4. Furnish heat tracing and insulation as required, if required for exterior installation. Insulation alone shall not be sufficient to fulfill freeze protection provisions of this section.

1.09 WARRANTY

Provide a warranty and warranty certificate as part of the vortex grit removal equipment specified in Section 46 23 23.

1.10 MAINTENANCE

A. Special tools: For each type or size of pump specified, provide 1 set of all special tools required for complete assembly or disassembly of the pump system components.

B. Spare parts: For each type or size of pump specified, provide spare parts packed and labeled for warehouse storage.
   1. Pump thrust bearing set.
   2. Pump radial bearing set.

C. Provide two pumps, one duty and one spare.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Pump: One of the following or equal:
   1. Wemco, Model C.
   2. Yeomans Pump; model, Morris 6100.
   3. Hayward Gordon, Torus series

2.02 MATERIALS

A. General: Materials in the Pump Schedule shall be the type and grade as specified below.

B. Cast iron: ASTM A 48, Class 30 minimum.

C. Ni-hard: Abrasion resistant cast iron, ASTM A 532, Class I, Type D; minimum Brinell Hardness Number of 650.

D. High chrome cast iron: ASTM A 532, Class III, Type A; minimum Brinell Hardness Number of 450.

E. Iron-chromium alloy: ASTM A 743, Grade CA40; minimum Brinell Hardness Number of 450.

F. Type 416 stainless steel: ASTM A 582, Type 416 stainless steel; minimum Brinell Hardness Number of 650.

G. Steel: ASTM A 108, Grade as scheduled.

2.03 GENERAL PUMP CONSTRUCTION

A. Type: Heavy-duty recessed impeller, centrifugal type pumps.

2.04 PUMP CASINGS

A. Material: As scheduled.

B. Provide 2-piece, split type pump casing with separate removable suction cover.

C. Design to permit removal of impeller assembly without disturbing discharge casing or piping connections.

D. Design to withstand a design working pressure not less than 1.10 times the maximum shutoff total dynamic head with the maximum diameter impeller at the maximum operating speed plus the maximum suction static head.

E. Design to withstand a 5-minute hydrostatic test pressure not less than 1.5 times the design working pressure.

F. Provide casings, suction covers, impeller vanes, and impeller shrouds having following minimum thicknesses at the wear areas for each nominal pump discharge size; all in inches:

Discharge	Casing	Suction Cover	Vane	Shroud
3	0.563	1.000	0.875	1.125
4	0.750	1.250	0.875	1.625
6	0.750	1.250	0.875	1.125
8	0.875	1.500	1.125	1.375

G. Pipe connections: Provide flanged end suction and tangential discharge with ASME B16.1 Class 125 bolt patterns.

H. Provide casings with both 3/4-inch National Pipe Thread high point vent and low point drain taps; provide plugs.

I. Provide 1/2-inch National Pipe Thread taps for pressure gauges on the suction and discharge flanges.

J. Provide flow path clearances equal to or greater than discharge diameter, so that solid sphere of nominal discharge diameter can pass through pumps.

2.05 IMPELLERS

A. Material: As scheduled.

B. Design impeller to be completely out of the flow path between the suction and discharge.

C. Provide contoured cup type impeller with peripheral rim or shroud and vane, minimum thicknesses as specified.

D. Provide impeller vanes with thickest portion located near vane tips, to minimize tip wear and maintain performance as wear occurs.

E. Provide static, dynamic, and hydraulic balance of impeller and complete rotating element.

F. Provide keyed impeller bore and secure to shaft with stainless steel locknut.

G. Impeller lock nut: AISI Type 316 stainless steel.

2.06 WEAR PLATES

A. Material: Same as pump casing.

B. Type: Removable type wear plate or rear liner located behind impeller and not part of the stuffing box.

C. Design to direct flow from behind impellers to center of volute.

2.07 PUMP SHAFTS

A. Material: As scheduled, turned, ground, and polished.

B. Strength: Able to withstand minimum 1.5 times maximum operating torque and other loads.

C. Resonant frequency: As specified in Sections 23 05 94 and 46 05 10.

D. Deflection: Maximum 0.002 inches under operating conditions.

E. Impeller attachment: Taper fitted at impeller with key and bolt for securing impeller.

F. Pump shaft sleeve:
   1. Material: As scheduled with minimum Brinell Hardness Number of 450 when tested in accordance with ASTM E 10.
   2. Renewable, key locked in stuffing box, gland area, and bearings.
   3. Able to protect shaft from pumped liquid and wear.

2.08 STUFFING BOXES

A. Materials: As scheduled.

B. Provide separate stuffing box housing (not integral to the rear liner or wear plate) suitable for shaft seal type scheduled and to accommodate injectable packing.

C. Shaft seal type: As scheduled.

D. Provide 2 hydraulic injection guns of all-steel construction as manufactured by American Seal and Packing or equal.

E. Provide 4 10-pack stick cartridges of a synthetic finer, non-straining lubricant for general service.

2.09 BEARINGS AND BEARING FRAME

A. Bearing type: Anti-friction meeting ABMA standards; self-aligning spherical roller type radial bearings; angular contact ball type, or tapered roller for thrust bearings.

B. Bearing lubrication:
   1. When grease lubrication scheduled, provide:
      a. External grease fittings with grease relief pipe.
      b. Lip type grease seals and labyrinth type grease deflectors at both ends of bearing housings, able to prevent entrance of contaminants.
   2. When oil lubrication scheduled, provide:
      a. Pressure lubricating system or separate oil reservoir type system.
      b. Oil filler pipe.
      c. External level indicator gauge.
   3. Size sufficiently to safely absorb heat energy normally generated in bearing under maximum ambient temperature of 60 degrees Celsius.

C. Bearing life: Minimum L_{10} life of 100,000 hours at rated design point or 24,000 hours in accordance with ABMA 9 or 11 at bearing design load imposed by pump shutoff with maximum sized impeller at rated speed, whichever provides longest bearing life in intended service.

D. Pump bearing frames:
   1. Material: As scheduled.
   2. Provide a 1-piece rigid construction with bearing housing at outboard (pump) end, and end cover or housing at inboard (driver) end.

E. Inboard bearing frame drain hole: Tapped, 3/4 inch NPT, located as low as possible to drain leakage when adjacent to packing or seal.

2.10 COUPLINGS

A. Types: As scheduled.

B. Flexible coupling life: Infinite at up to 0.3-degree misalignment angle total or per disk for disk type at maximum operating loads.

C. Design coupling to withstand a minimum of 1.5 times the maximum operating torque and other imposed loads.

2.11 BELT DRIVES

A. Types: As scheduled.

B. Layout: As indicated on the Drawings.

C. The belt drive system shall be designed to allow a speed change by means of an adjustment to the motor sheave when the drive is not in operation.

D. Where multiple-belt drives are required, the belts shall be provided in matched sets.

2.12 SUPPORTS, PEDESTALS, AND BASEPLATES

A. Materials: Same as pump casing or ASTM A 283 steel, hot-dip galvanized after fabrication and coated.

B. Pump and driver support strength: Able to withstand minimum 1.5 times maximum imposed operating loads or imposed seismic loads, whichever is greater.

C. Configuration: Allow easy access to stuffing boxes, bearing frames, and couplings.

D. Design a structural steel base and support system for the drive arrangement specified and as schematically indicated on the Drawings.

E. Anchor bolts: Hilti HY200 or RE500.

2.13 EQUIPMENT GUARDS

A. Provide safety guards over rotating or moving equipment.

2.14 DRIVERS

A. Horsepower:
   1. As scheduled.
   2. Listed driver horsepower is the minimum to be supplied.
      a. Increase driver horsepower if required to prevent driver overload while operating at any point of the supplied pump operating head-flow curve including runout.
      b. When scheduled driver is a motor, increase motor horsepower if required to prevent operation in the service factor.
      c. Make all structural, mechanical, and electrical changes required to accommodate increased horsepower.

B. Motors: Provide motors in accordance with Division 26 and as specified in this section.

C. Other drivers: As specified and scheduled, including Sections listed in the Schedule.

2.15 FINISHES

A. Finishes: Prepare surfaces and apply protective finishes as specified.

3.00 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

3.02 FIELD QUALITY CONTROL.

A. Testing, training, and start-up: As specified in Section 01 75 00 and the following requirements below.

B. Tests:
   1. General: Conduct tests in presence of the Engineer.
   2. Upon completion of installation by the Contractor and certification of proper installation of the equipment by the Manufacturer’s factor employed service technician, the equipment shall be functionally tested under supervision of Contractor and Manufacturer’s factory employed service technician ensure that all clearances, vibration, tracking, and motor operating characteristics are within acceptable limits.

C. Required results:
   1. In event the equipment fails to meet field quality control test requirements of this Section, make necessary changes and retest.
   2. If equipment remains unable to meet test requirements to satisfaction of the Engineer, remove and replace such equipment with satisfactory equipment at no additional cost.

3.03 MANUFACTURER'S FIELD SERVICES

A. Manufacturer’s field service:
   1. Contractor to coordinate field service work with the manufacturer’s service representative, Owner, and Engineer prior to initiating such work.
   2. Manufacturer’s service representative:
      a. Manufacturer is to furnish services of representative experienced in erection and operation of the equipment.
      b. Period of services: The manufacturer shall include in his bid a minimum of one 8-hour day and 1 trip.
         1) The specified durations are the minimum time on the job site and do not include travel time.
      c. Services are to include the following:
         1) Installation consultation and advice.
         2) Final inspection and adjustment prior to testing.
         3) Supervision of testing.
         4) Instruction of personnel on operation and maintenance of equipment as specified in Section 01 75 00.

3.04 PUMP SCHEDULE

General Characteristics:	
Service	Grit Slurry
Quantity	1
First Named Manufacturer's Model Number	Model C
Maximum Noise, dBA at 3 feet	85
Minimum Pumped Fluid Degrees Fahrenheit	60
Normal Pumped Fluid Degrees Fahrenheit	75
Maximum Pumped Fluid Degrees Fahrenheit	90
Pump Characteristics:	
Pass Minimum Sphere Size, Inches	3
Impeller Bearing Lubrication	Oil
Shaft Seal Type	Packing
Coupling Type	V-Belt Drive
Speed Control	Fixed
Maximum Pump rpm	1,500
Minimum Pump rpm	500
Pump Materials:	
Pump Casing	Ni-Hard
Impeller	Ni-Hard
Wear Plate	Ni-Hard
Shaft	Steel, Gr 1045
Shaft Sleeve	416 Stainless
Stuffing Box	Cast Iron
Packing	Injectable
Pump Bearing Frame	Cast Iron
Driver Characteristics:	
Driver Type	Motor
Drive Arrangement	Horizontal, Coupled
Driver Horsepower	5
Maximum Driver rpm	1,500
Motor Characteristics (when motor is driver type):	
Inverter Duty Rated	No
Motor Voltage/Phases/Hertz	460/3/60
Enclosure Type	TEFC

END OF SECTION

43 21 27.64 SUBMERSIBLE CHOPPER CENTRIFUGAL PUMPS

1.00 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Submersible non-clog motor-driven chopper pumps.
   2. Installation, startup, testing and placing in service assistance.

B. Scope of Work:
   1. Furnish, install, test and place in operation two submersible chopper centrifugal pumping systems including all related equipment, material, and appurtenances at Secondary Clarifier Nos. 1 and 2.
      a. One solids handling centrifugal pump shall be installed in the scum well of Secondary Clarifier No. 1 to pump scum from the scum well to the Sludge Storage Tank.
      b. One solids handling centrifugal pump shall be installed in the scum well of Secondary Clarifier No. 2 to pump scum from the scum well to the Sludge Storage Tank.

C. Provide submersible chopper centrifugal pumps with components: Submersible pumps, motors, drivers, bearings, seals, supports, self-aligning discharge connection, base elbows, guide rails and lifting devices, electrical devices internal to pump housing, all submersible cabling for power and control conductors, control panel containing motor starter, disconnect, indicators, alarms, controls, and related elements, and other items as required for a complete and operational system.

D. Equipment Manufacturer shall be responsible to coordinate the testing and installation of the pumping units.

1.02 GENERAL

A. See Division 01, General Requirements, which contains information and requirements that apply to the work specified herein and are mandatory for this project.

B. Related Sections: The following Sections contain requirements that relate to this Section.
   1. Division 05, Metals
   2. Division 09, Finishes
   3. Division 10, Signs
   4. Division 26, Electrical
   5. Division 40, Process Integration

1.03 REFERENCES

A. American Bearing Manufacturers Association (ABMA):
   1. 9 – Load Ratings and Fatigue Life for Ball Bearings.
   2. 11 – Load Ratings and Fatigue Life for Roller Bearings.

B. American Society for Testing and Materials (ASTM):

1. A 48 – Standard Specification for Gray Iron Castings.
2. A 108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
3. A 148 – Specification for Steel Castings, High Strength, for Structural Purposes.
4. A 276 – Standard Specification for Stainless Bars and Shapes.
5. A 536 – Standard Specification for Ductile Iron Castings.
6. A 582 – Standard Specification for Free Machining Stainless Steel Bars.
7. F 593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
8. F 594 – Standard Specification for Stainless Steel Nuts.

C. CSA International (CSA)

D. FM Global (FM).

E. Hydraulic Institute (HI):
1. 1.1-1.2 – Centrifugal Pumps – Nomenclature, Definitions, Application, and Operation.
2. 1.3 – Centrifugal Pumps for Design and Application.
3. 9.1-9.5 – Pumps – General Guidelines for Types, Definitions, Applications, Definitions, Sound Measurement, and Documentation.
4. 14.6 – Rotodynamic Pumps for Hydraulic Performance Acceptance Tests.

F. Insulated Cable Engineer's Association (ICEA.

G. National Electrical Code (NEC).

H. Underwriters Laboratories, Inc. (UL).

1.04 SUBMITTALS

A. See Section 01 33 00, Submittals for the mechanics and administration of the submittal process.

B. Shop Drawings:
1. Product Technical Data including:
a. Complete catalog information, descriptive literature, performance specifications, and identification of materials of construction.
b. Material storage and handling.
c. Pump configuration.
d. Performance data and curves with flow (gpm), head (ft), horsepower, efficiency, NPSH requirements, submergence requirement.
e. Anchor Bolt Plan for pump base showing number of anchor bolts and anchor size.
f. Dimensional drawings (in English units) indicating maximum overall dimensions and clearance diagrams of equipment.
g. Wiring diagrams detailing wiring for power, signal, and control systems differentiating between manufacturer-installed wiring and field-installed wiring including terminals and numbers.
h. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including frame size and any motor modifications. Type and life rating of bearings.
i. Motor Performance Data, including the following:
1) Guaranteed min. efficiencies at 100%, 75% and 50% of full load.

2) Guaranteed min. power factor at 100%, 75% and 50% of full load.
3) Locked Rotor Current
4) Full Load Current
5) Starting Torque
6) Full Load Torque
7) Breakdown Torque

j. Factory finish system and/or shop painting.
k. Recommend Spare Parts List with pricing.
l. List of special tools required to perform preventative maintenance and repairs with pricing.

2. Operation and Maintenance Manuals:
   a. See Section 01 78 33 for the content, mechanics and administration of the submittal process.

3. Quality Control Submittals:
   a. Bearing calculations verifying B10 bearing life.
   b. Factory Functional and Performance Test Reports.
   c. Special shipping, storage and protection, and handling instructions.
   d. Manufacturer's printed installation instructions.
   e. Manufacturer's Certificate of Proper Installation.
   f. Certifications: Submit Certification of Rockwell C Hardness for cutter bars and impeller.
   g. Torsional analysis: Provide a lateral and torsional analysis. Interpret and provide results.

4. Contract Closeout Submittals:
   a. Service records for maintenance performed during construction.

1.05 QUALITY ASSURANCE

A. All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.

B. Pumps complete with motor, coupling, necessary guards and all other specified accessories and appurtenances shall be furnished by the pump manufacturer to ensure compatibility and integrity of the individual components, and provide the specified warranty for all components.

C. Pumps are to be engineered and manufactured under a written Quality Assurance program. The Quality Assurance program is to be in effect for at least ten years, to include a written record of periodic internal and external audits to confirm compliance with such program.

D. Pumps are to be engineered and manufactured under the certification of ISO-9001:2000.

E. Comply with provisions of the Hydraulic Institute's standards.

1.06 QUALITY CONTROL

A. Factory Inspections: Inspect control panels for required construction, electrical connection, and intended function.

B. Factory Tests and Adjustments: Test all equipment and control panels actually furnished.

C. Factory Test Report: Include test data sheets, curve test results, performance test logs, certified correct by a registered professional engineer. Reports shall be submitted for approval prior to shipment.

D. Factory Tests:
   1. Shop Performance Test: A certified factory hydrostatic and performance test shall be performed in accordance with Hydraulic Institute Standards, latest edition.
   2. Notify Owner 30 days prior to test. Owner may elect to witness test at Owner's expense and option.
   3. Provide performance test data curves showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the specific pump, from shutoff to maximum capacity. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition. Plot NPSHa recorded during test.
   4. Tests shall be run at full speed.
   5. Indicate separately the head, capacity, horsepower demand and efficiency. Plot NPSHa recorded during the test.
   6. Motor test: Provide NEMA short commercial test.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers include –
   1. WEMCO Pumps
   2. Vaughan Pumps
   3. Hayward Gordon

B. Where a manufacturer's standard equipment name and/or model number is listed, the equipment system shall be provided as modified to conform to the performance, functions, features, and materials of construction as specified herein.

C. Equipment furnished and installed under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with drawings, specifications, engineering data, and instructions and recommendations of the equipment manufacturer unless exceptions are noted by the Engineer.

D. Manufacturer shall have installations of like or similar application with a minimum of five years' service for specified pump size.

2.02 GENERAL

A. Chopping/maceration of materials shall be accomplished by the action of the cupped and sharpened leading edges of the impeller blades moving across the cutter box at the intake opening.

B. Pump shall be capable of continuous operation while pumping scum containing up to 6 percent solids with heavy rags, plastics, grease, hair, grit, and other stringy fibrous material. The presence of these items will not be considered as abnormal, unanticipated or abusive with regard to the equipment operation and warranty.

C. Pumps shall be designed and capable of operation at an ambient temperature range of 10 °F to 110 °F.

D. All necessary bolts, nuts, and washers shall be furnished and shall be Type 316 stainless steel.

2.03 PERFORMANCE

A. The pumps shall be designed and built for 24-hour continuous service at all points within the required range of operation, without overheating, without cavitation, and without excessive vibration or strain. All parts shall be so designed and proportioned as to have sufficient strength, stability, and stiffness and to be especially constructed to meet the Specifications.

B. See Pump Data Sheet at the end of this Section.

2.04 MATERIALS

A. General: When materials are referenced in this Section or on the pump schedule, the compositions shall be the UNS Alloys, Types, or Grades in this article unless specified or scheduled otherwise.

B. Cast Iron: ASTM A 48, Class 35 B minimum.

C. Cast Alloy Steel: ASTM A 148, Grade 90-60, case hardened to minimum Rockwell C 60.

D. Ductile Iron: ASTM A 536.

E. Steel: ASTM A 108, Grade or UNS Alloy as specified or scheduled.

F. Stainless steel: ASTM A 276 or ASTM A 582, Type or UNS Alloy as specified or scheduled.

G. Fasteners: Stainless steel, ASTM F 593 or ASTM F 594, type or grade as specified.

2.05 PUMP AND MOTOR CASING

A. Type:
   1. Two-piece construction with pump and motor casing bolted together. Seal faces shall be machined and fitted with Nitrile or Buna-N rubber O-ring seals. Bolting shall be Type 304 stainless steel.

2. Pump casing shall be of volute design, spiraling outward to a 125-pound flanged centerline discharge.
3. Back pullout adapter plate shall allow removal of pump components from above the casing, and allow external adjustment of impeller-to-cutter bar clearance.

B. Material: Cast Iron or Ductile Iron.

C. Watertightness: Able to run submerged up to 50 feet and to run dry.

D. Construction: Of sufficient strength, weight, and thickness to provide accurate alignment and watertightness.

E. Motor Cooling: Adequate for continuously submerged operation or unsubmerged operation for a minimum of 15 minutes as scheduled.

F. Design working pressure: Minimum 1.10 times maximum shutoff total dynamic head with maximum diameter impeller at maximum operating speed plus maximum suction static head; suitable for submergence in up to 65 feet of water.

G. O-ring seals: Capable of sealing mated surfaces (major components) watertight; with the following features:
1. Machined surfaces and grooves.
2. O-ring contact on four surfaces and O-ring compression on two surfaces.
3. Does not require specific fastener torque or tension to obtain watertight joint.
4. Does not require secondary sealing compounds, gasket, grease, or other devices.

H. Testing: Perform 5-minute hydrostatic test of pump casing at minimum 1.5 times Design Working Pressure.

I. Discharge interface:
1. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal watertight contact.
2. Self-aligning without bolting or having to enter the wet well.

2.06 IMPELLERS

A. Impellers:
1. Type: Semi-open, chopper-centrifugal impeller with pump-out vanes to reduce seal area pressure and smooth water passages to reduce clogging by rags, stringy, or fibrous materials on impellers or shafting.
2. Chopping/maceration shall be accomplished by the cupped and sharpened edge of the impeller blade moving across the cutter bar.
3. Impeller shall be threaded to the shaft with no axial adjustments and no set screws.
4. Casting: 1-piece, free of cracks and porosity.
5. Material: Cast alloy steel heat-treated to a minimum Rockwell C 60 hardness.

B. Cutter bar plate:
1. Material: Cast alloy steel or T1 alloy steel heat-treated to a minimum Rockwell C 60 hardness.

2. Design cutter bar plate to prevent blockage of intake and binding of debris at the shaft and impeller vanes.
3. Cutter bar shall be replaceable.

C. Upper cutter:
1. Shall be threaded into the back pullout adapter plate above the impeller.
2. Designed to cut against the pump-out vanes and the impeller hub, reducing and removing stringy materials from the mechanical seal area.
3. Material: Cast steel heat treated to a minimum Rockwell C 60 hardness.
4. Rear cutter plate shall be replaceable.

2.07 PUMP SHAFTS

A. Material: Heat-treated AISI 4140 or Type 316 stainless steel. Turned, ground, and polished.

B. Features:
1. Connects motor shaft by a bolt and key way or by threaded connection at the rear of the impeller.
2. Strength: Able to withstand minimum of 1.5 times maximum operating torque and other loads.
3. Deflection: Maximum 0.002 inch under operating conditions.

2.08 MECHANICAL SEALS

A. Provide dual tandem mechanical seal system with oil for seal lubrication and cooling:
1. Shaft sealing system shall be capable of withstanding volute pressure up to 1.5 times pump shutoff head.
2. No seal damages shall result from operating the pumping unit in its liquid environment, from running pump dry, or from reverse pump operation.

B. Oil chamber:
1. Provide oil chamber for shaft sealing system. Design oil chamber to assure that air is left in the oil chamber to absorb the expansion of the oil due to temperature variations.
2. Provide drain and inspection plug, with positive anti-leak seal, easily accessible from the outside.
3. Oil in oil chamber shall be FDA approved, paraffin type, colorless, odorless, and non-toxic.

C. Upper seal:
1. Tungsten carbide or,
2. A silicon carbide rotating seal and tungsten carbide stationary seal or,
3. A carbon rotating seal and ceramic stationary seal
4. Submerged in oil chamber located below the stator housing.

D. Lower seal:
1. Tungsten carbide rotating and stationary seals.

E. Springs and other hardware: Stainless steel, 300 or 400 series.

2.09 BEARINGS

A. Pump shaft shall rotate on a minimum of 2 permanently sealed, grease lubricated bearings:
   1. Upper bearing for radial forces.
   2. Lower bearing for combined axial and radial forces.

B. Bearing type: Anti-friction meeting ABMA standards.

C. Bearing lubrication system shall be sized sufficiently to safely absorb heat energy normally generated in bearing under maximum ambient temperature of 60 degrees Celsius under full load conditions.

D. Bearing life: Minimum L10 life of 100,000 hours at rated design point or 24,000 hours in accordance with ABMA 9 or 11 at bearing design load imposed by pump shutoff with maximum sized impeller at rated speed, whichever provides the longest bearing life in intended service.

2.10 MOTOR AND POWER CABLES

A. Motors:
   1. Squirrel cage induction motor, in an air chamber, moisture resistant, UL or FM listed for Class I, Groups C and D, Division 1 service, whether submerged or unsubmerged
   2. Material:
      a. Motor enclosure: ASTM type A-48, Class 25 or better.
      b. Windings: Copper.
      c. Shaft: Type 416 stainless steel.
      d. Rotor: Cast aluminum or copper
      e. Insulation: Class F, moisture resistant, able to withstand 40 degrees Celsius ambient temperature plus 105 degrees Celsius temperature rise.
   3. Motor shall be capable of continuous operation under load with the motor submerged, and a minimum of 15 minutes of full load operation when partially submerged or exposed, without derating the motor.
   4. Motor cooling system:
      a. Design to provide adequate cooling:
         1) At the minimum operating speed with a adjustable frequency drive.
         2) With motor submerged.
         3) With motor dry for a minimum of 15 minutes.
         4) Motor shall be designed for continuous duty handling pumped media of 40 degrees Celsius
   5. Motor sealing: Design to withstand 200 psi water pressure at all seal locations.

B. Moisture protection system:
   1. Provide dual moisture sensing probes extending into the oil chamber to detect the presence of moisture should the outer seal fails.
   2. The moisture protection system shall also detect water in the motor chamber.

C. Thermal protection system:
   1. Provide temperature detection in motor windings.
   2. The temperature detection system shall reset automatically.

D. Power cables:
   1. Submersible to same water depth as motor casing.
   2. Type SOOW with Carolprene jacket, approved for extra hard usage in accordance with NEC Article 501-11.
   3. Insulation rated for 90 degrees Celsius.
   4. Non-wicking fillers.
   5. Length: Sufficient to connect to surface junction box (without the need of splices) as indicated on the Drawings or 30 feet, whichever is greater.
   6. Sized to in accordance with NEC, ICEA, and CSA specifications.
   7. Provide stainless steel cable and stainless steel wire braid sleeve to support power cable from underside of wet well roof slab or access frame.

E. Monitoring or control cables:
   1. Provide separate cabling (not in common sheath with power cables) for low-voltage or DC cables for monitoring devices.

F. Cable entry seal and junction chamber:
   1. Designed to prevent moisture from wicking through the cable entry.
   2. Cable entry seal be epoxy encapsulated.
   3. Provide Buna-N power and control cable grommets in addition to the epoxy seal leads.
   4. The cable entry seal shall provide strain relief for the cable.
   5. The cable entry junction chamber shall be separate from the motor chamber to prevent foreign material from gaining access to the top of the pump.

2.11 SUPPORT BASE AND DISCHARGE ELBOW

A. Provide cast iron support base and discharge elbow for installation in wet pit.

B. Discharge elbow to mate to pump discharge and transition to discharge piping.

C. The entire weight of the pump/motor shall be borne by the pump discharge elbow.

2.12 GUIDE RAILS AND LIFTING DEVICES

A. General: Provide guide rails and lifting devices suitable for wet pit installation.

B. Materials:
   1. Wet pit: Type 304 stainless steel guide rails, lifting cable or chain and wall supports; Type 316 stainless steel anchor bolts and fasteners.

C. Wet pit guide rails:
   1. Type: Dual pipe or dual rail able to accurately guide the pump to mate with the discharge elbow.
   2. Strength: Withstand the greater of a minimum of 1.5 times the maximum imposed operating loads or seismic loads in accordance with building code as specified in Section 01 41 00 seismic loads.
   3. Intermediate supports: Provide at 10-foot maximum intervals; less as required to provide specified support.

D. Lifting device:
   1. Type: Chain or cable attached to lifting eye on the pump casing.

2. Length: Able to lower pump from top of wet well to operating position as indicated on the Drawings plus 5 additional feet of length.
3. Retainer: Provide Type 316 stainless steel locking hook or clasp at top of wet well to securely retain the upper end of the lifting chain or cable during pump operation.
4. Lifting device shall be sized for combined weight of pump and motor.

2.13 HOISTS

A. Hoist material: Type 316 stainless steel.

B. Winch material: Type 316 stainless steel, marine grade.

C. Anchor bolts: As specified in Division 05.

D. Mounting: Type 316 stainless steel socket, off side of sump access opening.

E. Winch: Electric, adjustable boom with, safety hook, and sufficient lift for pump removal from deepest sump.

F. Hoist and winch safe load rating: Minimum 1.25 times heaviest sump pump furnished or 500-pound minimum with maximum reach, whichever is greater.

G. Anchors:
1. Flush with internal thread anchor bolt sockets at each sump and socket with allowable working load of 5 times hoist pull out tension load on anchor bolts.

2.14 CONTROL PANEL

A. Each blower shall be provided with a NEMA 4X control panel. Each panel shall have NEMA rated components (soft starter, circuit breaker with interlocking door handle, 3-leg motor overload protection, 120 volt control transformer, door mounted overload reset pushbutton, door mounted run indicating light, door mounted HOA selector switch, terminals for field connection and power/control for the enclosure cooling fan).

B. Provide other controls as shown on the process and instrumentation diagrams and as needed for a fully functioning system.

2.15 FINISHES

A. Pump manufacturer to factory coat the pump/motor and discharge elbow as specified in Section 09 91 00.

2.16 TOOLS AND SPARE PARTS

A. Furnish one complete set of special tools recommended by the manufacturer for maintenance and repair of each separate type of equipment; tools shall be stored in tool boxes, and identified with the equipment number by means of stainless steel or solid plastic name tags attached to the box.

B. Spare parts: Provide one of the following for each size or type of pump.

1. Spare parts shall be tagged by project equipment number and identified as to part number, equipment manufacturer and subassembly component (as appropriate). Spare parts subject to deterioration such as ferrous metal items and electrical components shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping. Spare parts with individual weights less than 50 pounds and dimensions less than 2 feet wide, or 18 inches high, or 3 feet in length shall be stored in a wooden box with hinged wooden cover and locking clasp. Hinges shall be strap type. The box shall be painted and identified with stenciled lettering stating the name of the equipment, equipment numbers and the words “spare parts.” A neatly typed inventory of spare parts shall be taped to the underside of the cover.

C. Provide the following spare parts for each model pump:
   1. Mechanical seals: Upper and lower mechanical seal set.
   2. Pump bearings: Upper and lower bearing set.
   3. Impeller and cutter bar: One set.
   4. Casing seal gaskets or O-rings: One set.
   5. Power cable entry seal set: One set.

3.00 EXECUTION

3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. Storage and Handling: Products shall be carefully stored and handled in accordance with manufacturer’s instructions.

C. Protection of Equipment: Equipment shall be boxed, crated or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment and other equipment with anti-friction or sleeve bearings shall be stored in weathertight and heated storage facilities prior to installation. For extended storage periods, plastic equipment wrappers shall not be used to prevent accumulation of condensate in gears and bearings.

D. Comply with pump manufacturer's rigging instructions.

3.02 EXAMINATION

A. Examine areas, equipment foundations, and conditions, for compliance with requirements for installation and other conditions affecting performance of pumps.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and bases for suitable conditions where pumps are to be installed.

D. Report any unsatisfactory conditions to the Owner and do not proceed until unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. Install all pumps in complete accordance with manufacturer's instructions and recommendations.

B. Furnish and apply initial supply of grease and oil as recommended by manufacturer.

C. Support all piping independently of pump casings. All piping inside and outside the wet well shall be located and of the materials as shown on the plans. All piping shall be securely supported and/or braced by pipe hangers and/or pipe supports. Said supports and braces shall be a 316 stainless steel. Alternate configurations are subject to the approval by the Engineer.

D. Check and align pump, motor, discharge piping and couplings.

E. Provide pressure gauge connection at pump discharge. Pressure gauge location shall be as shown on the plans.

3.04 FIELD QUALITY CONTROL

A. Functional Test: Conduct on each pump.
   1. Alignment: Test complete assemblies of actual pump with motors furnished for correct rotation, proper alignment, and quiet operation.
   2. Demonstrate that the pump is capable of operating against a closed discharge valve for not less than two minutes without excessive vibration, binding, rubbing of rotating parts, or damage to pump, motor, or coupling.

3.05 MANUFACTURER'S FIELD SERVICE

A. A manufacturer's representative for the equipment specified herein shall be present at the job site for the minimum person-days listed in Section 01 75 00 Starting and Adjusting.

B. An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation and shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of the Engineer.

C. All costs for these services shall be included in the contract price for the number of days and round trips to the site as required.

D. Manufacturer representative is to train OWNER's personnel in the routine operation, maintenance and troubleshooting procedures. This period shall consist of a maximum of one eight-hour day. CONTRACTOR shall coordinate the scheduling of training with OWNER's personnel.

E. Manufacturer's representative shall:
   1. Approve installation before operation.

2. Test and operate system in presence of ENGINEER and OWNER and provided certified field test reports.
3. Verify conformance to the specification.

3.06 PUMP DATA SHEET

SUBMERISBLE CHOPPER CENTRIFUGAL PUMP DATA SHEET	
Location	Secondary Clarifier Scum Wells
Equipment Tag Number(s)	PMP-0511 and PMP-0521
Quantity	2
Pump Configuration	Submersible Chopper Centrifugal
Liquid Pumped	Scum and Wastewater
Installation Configuration	Wet Pit
Minimum solids passage, inches	3-inch
Abrasive (Y/N)	Y
Possible Scale Buildup (Y/N)	N
Explosion-proof (Y/N)	Y
Continuous Duty (Y/N)	Y
Design flow, gpm	75
Total Head, feet	26
Minimum Hydraulic Efficiency, %	25-percent
Pump Speed, Maximum, RPM	1750 RPM
Constant Speed (Y/N)	Y
Adjustable Speed (Y/N)	N
Maximum Horsepower (HP)	5
Hydrostatic Test Pressure (psig)	1.5 times shutoff head

END OF SECTION

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43 21 39 VERTICAL SOLIDS HANDLING PUMPS (LESS THAN 100 HP)

1.00 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Solids handling, centrifugal, vertical, close-coupled pumping units.
   2. Installation, startup, testing, and placing in service assistance.

B. Scope of Work:
   1. Furnish, install, test and place in operation solids handling centrifugal pumping units including all related equipment, material, and appurtenances.
      Three solids handling centrifugal pumps shall be installed in the Return Sludge Pumping Station to pump return activated sludge (RAS) from Secondary Clarifier Nos. 1 and 2 to the discharge of the grit system, as shown on the drawings.

   2. Pumping system shall include the following components: pump, motor and adjustable frequency drive (AFD), cooling system, control panel containing motor starter, disconnect, indicators, alarms, controls, and related elements for a complete and operating system.

   3. Equipment Manufacturer shall be responsible to coordinate the testing and installation of the pumping units and for the adequacy and compatibility of the pump, motor and AFD, if applicable.

1.02 GENERAL

A. See Division 01, General Requirements, which contains information and requirements that apply to the work specified herein and are mandatory for this project.

B. Related Sections: The following Sections contain requirements that relate to this Section.
   1. Division 05, Metals
   2. Division 09, Finishes
   3. Division 26, Electrical
   4. Division 40, Process Integration

1.03 REFERENCES

A. Following is a list of standards, which might be referenced in this Section:
   1. American Bearing Manufacturer's Association (ABMB)
      a. 9 - Load Ratings and Fatigue Life for Ball Bearings
      b. 11 - Load Ratings and Fatigue Life for Roller Bearings
   2. ASTM International (ASTM):
      a. A 48 –Specification for Gray Iron Castings
      b. A 278 - Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650°F (350°C)
   3. National Electrical Manufacturer's Association (NEMA): MG-1, Motors and Generators.

4. National Fire Protection Association (NFPA): NFPA 70, National Electric Code.

B. Terminology pertaining to pumping unit performance and construction shall conform to the ratings and nomenclature of the Hydraulic Institute Standards (ANSI/HI).

1.04 SUBMITTALS

A. See Section 01 33 00, Submittal for the mechanics and administration of the submittal process.

B. Shop Drawings:
1. Product Technical Data including:
a. Complete catalog information, descriptive literature, performance specifications, and identification of materials of construction.
b. Material storage and handling.
c. Pump configuration.
d. Performance data and curves with flow (gpm), head (ft), horsepower, efficiency, NPSH requirements, submergence requirement.
e. Anchor Bolt Plan for pump base showing number of anchor bolts and anchor size.
f. Dimensional drawings (in English units) indicating maximum overall dimensions and clearance diagrams of equipment.
g. Wiring diagrams detailing wiring for power, signal, and control systems differentiating between manufacturer-installed wiring and field-installed wiring including terminals and numbers.
h. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including frame size and any motor modifications. Type and life rating of bearings.
i. Motor Performance Data, including the following:
1) Guaranteed min. efficiencies at 100%, 75% and 50% of full load.
2) Guaranteed min. power factor at 100%, 75% and 50% of full load.
3) Locked Rotor Current
4) Full Load Current
5) Starting Torque
6) Full Load Torque
7) Breakdown Torque
j. Factory finish system and/or shop painting.
k. Recommend Spare Parts List with pricing.
l. List of special tools required to perform preventative maintenance and repairs with pricing.

2. Operation and Maintenance Manuals:
a. See Section 01 78 33 for the content, mechanics and administration of the submittal process.

3. Quality Control Submittals:
a. Bearing calculations verifying B10 bearing life.
b. Factory Functional and Performance Test Reports.
c. Special shipping, storage and protection, and handling instructions.
d. Manufacturer’s printed installation instructions.
e. Manufacturer’s Certificate of Proper Installation.

4. Contract Closeout Submittals:
   a. Service records for maintenance performed during construction.

1.05 QUALITY ASSURANCE

A. All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.

B. Pumps complete with motor, coupling, necessary guards and all other specified accessories and appurtenances shall be furnished by the pump manufacturer to ensure compatibility and integrity of the individual components, and provide the specified warranty for all components.

C. Pumps are to be engineered and manufactured under a written Quality Assurance program. The Quality Assurance program is to be in effect for at least ten years, to include a written record of periodic internal and external audits to confirm compliance with such program.

D. Pumps are to be engineered and manufactured under the certification of ISO-9001:2000.

E. Comply with provisions of the Hydraulic Institute's standards.

1.06 QUALITY CONTROL

A. Factory Inspections: Inspect control panels for required construction, electrical connection, and intended function.

B. Factory Tests and Adjustments: Test all equipment and control panels actually furnished.

C. Factory Test Report: Include test data sheets, curve test results, and performance test logs. Reports shall be submitted for approval prior to shipment.

D. Factory Tests:
   1. Shop Performance Test: A certified factory hydrostatic and performance test shall be performed in accordance with Hydraulic Institute Standards, latest edition.
   2. Tests shall be run using manufacturer’s calibrated shop motor and shop AFD.
   3. Provide performance test data curves showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the specific pump, from shutoff to maximum capacity. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition. Plot NPSHa recorded during test.
   4. Tests shall be run at full speed.
   5. Indicate separately the head, capacity, horsepower demand and efficiency. Plot NPSHa recorded during the test.
   6. Motor Test: Provide NEMA short commercial test.

1.07 WARRANTY

Contractor shall warrant the equipment against defects in materials and workmanship for a period of 2 years under the specified uses and with normal operation and service. This warranty shall be delivered, in writing, to the Owner and shall include 100 percent full payment coverage for parts and labor during the 2-year period. The warranty period shall commence when final acceptance of the equipment from Owner occurs.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Listed manufacturers include:
   1. KSB
   2. Flygt
   3. ABS Sulzer

B. Equipment furnished and installed under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with drawings, specifications, engineering data, and instructions and recommendations of the equipment manufacturer unless exceptions are noted by the Engineer.

C. Manufacturer shall have installations of like or similar application with a minimum of five years' service for specified pump size.

2.02 GENERAL REQUIREMENTS

A. The pumping units shall all be supplied by one manufacturer and shall be complete including pumps, motors, and appurtenances such as, but not limited to, bases, couplings, guards, and gauges.

B. The pumps are being installed in a municipal wastewater treatment plant. The RAS pumps will be installed outdoors.

C. Grit and other abrasive materials should be expected to be present as should rags, large solids and stringy material. The presence of these items will not be considered as abnormal, unanticipated or abusive with regard to the equipment operation and warranty.

D. Pumps shall be designed and capable of operation at an ambient temperature range of 10 °F to 110 °F.

E. All necessary foundation bolts, nuts, and washers shall be furnished and shall be Type 316 stainless steel.

F. Pumps shall be mounted on reinforced concrete pads at locations shown on the drawings.

G. Pumps shall be vertical solids handling type designed to minimize clogging as defined in ANSI/HI.

2.03 PERFORMANCE

A. The pumps shall be designed and built for 24-hour continuous service at all points within the required range of operation, without overheating, without cavitation, and without excessive vibration or strain. All parts shall be so designed and proportioned as to have sufficient strength, stability, and stiffness and to be especially constructed to meet the Specifications. Ample room and facilities shall be provided for inspection, repairs, and adjustment.

B. See Pump Data Sheet at the end of this Section.

2.04 PUMPS

A. Impeller:
   1. Type: Non-clog, open, solids handling type designed to pass minimum sphere size as specified in Pump Data Sheet.
   2. Material: Close grained cast iron conforming to ASTM A48 Class 35B.
   3. Statically and dynamically balanced.
   4. The impeller shall be securely fitted to the pump shaft in such a manner that it does not loosen or become detached if the pump is operated in the wrong direction.

B. Volute/Casing:
   1. Type:
      a. One-piece volute type, bottom suction, with smooth flow passages large enough to pass the sizes of solids that can pass through the impeller.
      b. Designed to permit the removal of the rotating assembly without disturbing the suction or discharge piping.
      c. Pumps may be centerline or tangential discharge type. Influent and discharge pipe connections to the centerline discharge type pump shall be aligned with the centerline of the RAS pump to preclude the use of offset spool pieces or custom fitting connections to the pump.
      d. Diffusion vanes not permitted.
      e. Volute cleanouts located at the impeller centerline, prime, drain flush, and gauge connections shall be provided on each pump.
      f. Casing shall be designed to support the motor weight as specified on the casing back head without stressing or deforming the casing.
   2. Material: Close-grained cast iron conforming to ASTM A48 Class 35B.
   3. Suction and Discharge Flanges: Integral 125 lb ANSI; size as specified in Pump Data Sheet.

C. Mechanical Seals:
   1. Provide mechanical shaft seal system that does not require neither routine maintenance nor adjustment, but capable of being easily inspected and replaced.
   2. Seals shall operate in a lubricant reservoir that hydro-dynamically lubricates seal faces at a constant rate. The lubricant reservoir shall be designed to prevent overfilling, and to provide lubricant expansion capacity.
   3. The drain and inspection plug shall have a positive anti-leak seal and shall be easily accessible from the outside of the pump.
   4. The seal system shall not rely upon pumped media for lubrication and shall not be damaged when the pump is run dry.

D. Suction Elbow:
   1. Provide a suction elbow of the low profile type on vertical type solids handling pumps; having flow characteristics, equal to or greater than a long radius elbow, producing a smooth laminar flow to the impeller eye.
   2. Provide a hand hole for inspection.

E. Baseplate, Pump and Motor:
   1. Provide a pump and motor stand of cast iron or fabricated steel.
   2. Pump will be vertically mounted with a coupling between the pump and motor.
   3. The pump stand shall be rugged, heavy duty, with ample strength for support of entire pump and imposed static and operational loads. The stand shall be anchored to the level surface of a concrete pad with Type 316 stainless steel anchor bolts.
   4. Pump stand shall be installed level to 0.005” per foot.

F. Shaft and Shaft Sleeve:
   1. Shaft:
      a. Material: ASTM A276 Type 420 stainless steel.
      b. Pump shaft and motor shaft shall be an integral, one piece unit adequately designed to meet the maximum torque required at any normal start-up condition or operating point in the system.
      c. Shaft shall be of sufficient size to transmit full driver output with a maximum deflection of 0.002 inches measured at the lower mechanical seal.
      d. Construction: Machined entire length with keyways at both ends.
   2. Shaft Sleeve:
      a. Material: ASTM A276 Type 420 stainless steel.
      b. Provide a shaft sleeve, positive adhesive sealed to prevent leakage between the shaft and the sleeve.
   3. Provide required shaft extensions and couplings for vertical, extended shaft pumping units.

G. Bearings:
   1. Pump shaft shall rotate on high quality, permanently lubricated, greased bearings.
   2. Bearings shall be of sufficient size and properly spaced to transfer all radial and axial loads to the pump housing and minimize shaft deflection and as needed to provide a B10 life of, at minimum, 100,000 hours at all anticipated radial and axial loadings.
   3. Bearings shall be manufactured by a major internationally known manufacturer of high quality bearings.
   4. Provide suitable seals in the bearing covers to prevent the entrance of contaminants.

H. Hardware: All machined bolts, nuts, and capscrews shall be of the hex-head type, 316 stainless steel, not requiring the use of any special tools.

I. High-Ring Base:
   1. For vertical mounted motors, provide a fabricated steel motor ring base designed to support the weight of the motor; assure accurate alignment of the pump and motor shafts; and of adequate height to permit access to the coupling.

2.05 ACCESSORIES

A. Equipment Identification Plate: 16-gauge stainless steel with 1/4-inch die-stamped equipment tag number securely mounted in a readily visible location.

B. Lifting Lugs: Provide for handling the casing.

C. Pressure Gauge: Each pump shall be provided with glycerin-filled suction and discharge pressure gauges with a 1/4-in NPT inlet and 4.5-in dials. A 316 stainless steel, oil filled, diaphragm with a 1/2-in NPT inlet, and 1/4-in flushing tap, with T-cock, shall be installed on each gauge. The suction gauges shall be of the compound type to indicate both vacuum and pressure and be graduated to read 15-psi positive pressures and 30-in mercury negative pressures. The gauges shall be connected to the pump suction and discharge. All fittings, bolting, and cocks shall be 316 stainless steel.

D. Anchor Bolts: Contractor to provide template and Type 316 stainless steel anchors in accordance with Section 05 05 19, ANCHORAGES and as shown on the Drawings. Size as required by manufacturer.

E. Initial Supply of Lubricants: Manufacturer shall indicate types, brands, and quantities of initial lubricants, oil, grease, etc. necessary to startup equipment. Contractor shall provide and install the recommended lubricants and shall comply with all manufacturer recommended procedures.

2.06 FACTORY FINISHING

A. Pumps and motor stands shall be prime coated in accordance to Division 09. Prime coating shall be touched up just prior to shipment. In order to avoid coating damage during shop moving and testing, finish painting shall be done by the Contractor in the field.

B. Motors shall have manufacturer’s standard finish paint system for corrosive environments.

2.07 MOTOR REQUIREMENTS

A. Motor shall conform to the requirements of Division 26, NEMA Frame Induction Motors, 600 Volts and below.

B. General: All motors shall be suitable for the intended service and the intended service shall be within the motor manufacturer's normal ratings. Horizontal motors adapted to the vertical are not acceptable.

C. Standard Products: Electric motors shall be the standard products of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate equipment that has been in satisfactory use for at least 10 years prior to bid opening.

D. Nameplates: Provide stamped stainless steel nameplates and nameplate-mounting hardware including all information required by NEMA MG 1, including NEMA nominal efficiency and minimum guaranteed efficiency on nameplate.

E. Compliance: Provide motors and components complying with NFPA 70 "National Electrical Code" and NEMA MG 1 and that are listed and labeled by UL.

F. Noise: Noise requirement may be considered an average based on sample tests of a statistical sample of production motors of identical electrical and mechanical design. Average sound pressure measured in a free field with a reference pressure of 0.00002 pascals at 3 feet from the motor shall not exceed 85 dBA.

G. Motor Sizes: Select motors that are non-overloading and not required to operate in the service factor range within the full range of the driven equipment performance curve.

H. Motor Speed: Coordinate design with the variable speed drive supplier and the driven equipment to provide motors which will not overheat, suffer reduced life or be damaged either from harmonic loading or reduced cooling efficiency from continuous or intermittent operation at any speed in the operating speed range.

I. Voltage and Phase: Each motor shall be wound for 3-phase, 60-Hz, 480 volts alternating current.

J. Temperature Rating: Motors shall have Class H insulation, Class A temperature rise.

K. Motor shall be of the squirrel-cage induction design, NEMA type B.

L. Service Factor: 1.15 when operated continuously in any mode.

M. Insulation System: All motors shall have a Class H non-hygroscopic, sealed, fungus-resisting insulation of a type designed and constructed to withstand severe moisture conditions, and insofar as practicable, to operate after long periods of idleness without previous drying out. All windings and connections shall be of the sealed type as defined in NEMA MG 1 paragraph 1.27.2. Insulated windings, unless otherwise approved, shall be completely assembled in the motor core before impregnating with the insulating compound. The compound shall consist of 100 percent solid resin. Insulation shall be rated for inverter duty operation.

N. Coils of all windings shall be fully braced so that vibration is virtually eliminated during repeated starts as required by the duty cycle specified as well as during normal operation. If a tied system is used it shall be such that no tie depends upon the integrity of any other tie within the system.

O. Winding Heaters: Heaters shall be wrapped around the winding end turns. Heaters shall be designated for operation on 120 V, 1-phase, 60 Hz, alternating current and of sufficient capacity or wattage that, when energized, will hold the temperature of the motor windings approximately 10 degrees C above the ambient temperature. Heaters shall be designed for continuous operation and to withstand at least 10 percent overvoltage continuously. The terminals of the heater, including the leads, shall be watertight and shall be provided with leads suitable for making connections to the drip-proof terminal box provided in paragraph “Motor Terminals and Boxes”.

The terminal box shall be readily accessible through the crating so that winding heaters can be energized while motors are in storage.

P. An integrated cooling system shall be utilized to allow the motor to operate at full rated power continuously without the need for de-rating or reduced duty cycle.
   1. Coolant pump impeller shall be mounted directly on the motor shaft between the tandem mechanical seals to circulate coolant fluid between the cooling jacket and motor housing, over the surface of the motor.
   2. Heat losses from the motor shall be transferred to the fluid pumped in the volute-casing heat exchanger.
   3. After passing through the volute-casing heat exchanger, the medium returns to the suction side of the internal coolant pump.

Q. Temperature Monitor

   1. Furnish each phase of the motor with a thermostat embedded in the motor windings
   2. Set operation of the thermostats at not higher than 90 percent of insulation temperature rating Automatic reset once the stator temperature returns to normal.

R. Motor Terminals and Boxes
   1. Stator Terminal Box - Drip-proof cast iron or steel conduit terminal boxes, treated as specified for frames in paragraph “Corrosion Prevention”, shall be supplied for housing the stator lead connections and shall have adequate space with regards to the project site conditions to facilitate the installation and maintenance of cables and equipment. Boxes shall have a bolted cover providing unrestricted access, be mounted on the motor frame, and shall have an auxiliary floor supporting structure, when required, supplied by the motor manufacturer. Conduit entrance shall be from the bottom. The boxes shall be designed to permit removal of motor supply leads when the motor is removed.
   2. Stator Terminals - Insulated terminal leads shall receive a treatment equal to that of the motor winding. Leads shall be brought out of the stator frame and shall be provided with terminal lugs for connection to the motor supply wiring.
   3. Grounding - A ground bus and means for external connection to the station grounding system shall be provided in the stator terminal box when surge protection is provided.
   4. Accessory Leads and Boxes - Terminal leads for motor winding space heaters, resistance temperature detectors and any other auxiliary equipment shall be brought into conveniently located terminal boxes provided with terminal blocks for extension by others. The terminal boxes shall be drip-proof and treated as specified for frames in paragraph “Corrosion Prevention”. All auxiliary wiring shall be stranded copper conductors with 600-volt flame-retardant insulation, except temperature detector leads may be in accordance with the manufacturer's standard practice. All wiring and terminals shall be properly identified.

S. Adjustable Frequency Drive Motors: All motors furnished shall be rated for operation with an adjustable frequency drive for use in continuous operation at any rated pumping speed.

T. The motor shall be labeled and listed for the application by a nationally recognized electrical testing laboratory.

U. Motor Bearings: As determined by the AFBMA B-10 method, antifriction bearings shall be rated on the basis of a minimum life factor of 100,000 hours, based on the life expectancy of 90 percent of the group, unless otherwise approved by the Engineer.

2.08 ADJUSTABLE FREQUENCY DRIVE

A. Provide adjustable frequency drives for the pumping units listed in the Pump Data Sheet to this specification, in accordance with Division 26.

2.09 ELECTRICAL COMPONENTS AND ACCESSORIES

A. General:
   1. Conform with Division 26, Electrical.
   2. Provide all necessary electrical components and wiring for a complete, functional system.

B. Wiring: The Drawings and Specifications indicate the anticipated wiring for the equipment provided under this section. If additional wiring is required, or if required wiring does not match what is indicated, the Contractor shall make the necessary modifications to the electrical wiring and documentation as part of the lump sum price. Wiring shall meet the requirements of Division 26, ELECTRICAL, and NFPA 70. Insulation shall be rated 600 volts, minimum. Low-voltage (24V) signals shall be run in twisted, shielded pair cable.

C. Electrical Raceways: Electrical wiring shall be installed in conduit meeting the requirements of Division 26. Raceways shall be installed in accordance with Division 26, and NFPA 70.

2.10 INSTRUMENTATION AND CONTROLS

A. All instrumentation and control components shall be provided in accordance with the requirements of Division 40.

B. Each pump shall be provided with a NEMA 4X control panel. Each panel shall have NEMA rated components (AFD, circuit breaker with interlocking door handle, 3-leg motor overload protection, 120 volt control transformer, door mounted overload reset pushbutton, door mounted run indicating light, door mounted HOA selector switch, terminals for field connection and power/control for the enclosure cooling fan).

C. Provide other controls as shown on the process and instrumentation diagrams and as needed for a fully functioning system.

2.11 TOOLS AND SPARE PARTS

A. Furnish two complete sets of special tools recommended by the manufacturer for maintenance and repair of each separate type of equipment; tools shall be stored in tool boxes, and identified with the equipment number by means of stainless steel or solid plastic name tags attached to the box.

B. Spare Parts:

1. Spare parts shall be tagged by project equipment number and identified as to part number, equipment manufacturer and subassembly component (as appropriate). Spare parts subject to deterioration such as ferrous metal items and electrical components shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping. Spare parts with individual weights less than 50 pounds and dimensions less than 2 feet wide, or 18 inches high, or 3 feet in length shall be stored in a wooden box with hinged wooden cover and locking clasp. Hinges shall be strap type. The box shall be painted and identified with stenciled lettering stating the name of the equipment, equipment numbers and the words “spare parts.” A neatly typed inventory of spare parts shall be taped to the underside of the cover.

2. Provide the following spare parts for each model pump:
   a. Complete set mechanical seals.
   b. Complete set pump bearings.
   c. Complete set gaskets and O-ring seals.
   d. Complete set keys, dowels, pins, etc.
   e. Pump casing gaskets.

3.00 EXECUTION

3.01 ASSEMBLY AND PREPARATION FOR SHIPMENT

A. Coordination shall include space and structural requirements, clearances, utility connections, signals, outputs and features required by the manufacturer including safety interlocks.

3.02 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. Storage and Handling: Products shall be carefully stored and handled in accordance with manufacturer’s instructions.

C. Protection of Equipment: Equipment shall be boxed, crated or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment and other equipment with anti-friction or sleeve bearings shall be stored in weathertight and heated storage facilities prior to installation. For extended storage periods, plastic equipment wrappers shall not be used to prevent accumulation of condensate in gears and bearings.

D. Comply with pump manufacturer's rigging instructions.

3.03 EXAMINATION

A. Examine areas, equipment foundations, and conditions, for compliance with requirements for installation and other conditions affecting performance of pumps.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and bases for suitable conditions where pumps are to be installed.

D. Report any unsatisfactory conditions to the Owner and do not proceed until unsatisfactory conditions have been corrected.

3.04 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor Bolts: Provide templates and specify bolts for furnishing by Contractor.

C. Shimming between machined surfaces will not be permitted.

D. Connect discharge piping without imposing strain to pump discharge head.

E. Support pumps and connected piping separately so that piping is not supported by pumps.

F. Adjust pump assemblies such that the driving units are properly aligned, plumb, and level with the driven units and all interconnecting shafts and couplings. Do not compensate for misalignment by use of flexible couplings.

G. Align pump and motor shafts and piping connections after setting them on foundations, after grout has been set and foundation bolts have been tightened, and after piping connections have been made. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.

H. Adjust alignment of pump and motor shafts for angular and parallel alignment to tolerances specified by manufacturer and comply with the method specified in the Hydraulic Institute's Standard 2.4 for "Vertical Pumps for Installation, Operation and Maintenance.

3.05 CONNECTIONS

A. Refer to mechanical drawings for piping connections.

B. Refer to electrical drawings for electrical connections for power, controls, vibration switches, and devices.

3.06 FIELD QUALITY CONTROL

A. Functional Tests: Conduct on each pump.
   1. Alignment: Test complete assemblies of actual pump with motors furnished for correct rotation, proper alignment and connection, and quiet operation.
   2. Vibration Test:
      a. Test with units installed and in normal operation, and discharging to the connected piping systems at rates between the low discharge head and

high discharge head conditions specified, and with the actual building structures and foundations provided. Units shall not develop vibration exceeding limits specified in HIS 9.6.4 at all operating speeds. Tests shall additionally be completed over the full operating range of the pumps from minimally allowed pump operating speed to 60 Hz on the variable frequency drive.

b. If units exhibit vibration in excess of the limits specified adjust or modify as necessary. Units which cannot be adjusted or modified to conform as specified shall be replaced.

3. Flow Output: Measured by plant instrumentation. Determine that the pump performance generally tracks with the factory pump tests. Demonstrate the average flow and head condition listed in 3.10 Pump Data Sheet can be achieved with the AFD.
4. Operating Temperatures: Monitor bearing areas on pump and motor for abnormally high temperatures.
5. Demonstrate that the pump is capable of operating against a closed discharge valve for not less than two minutes without excessive vibration, binding, rubbing of rotating parts, or damage to pump, motor, or coupling.

3.07 MANUFACTURER'S SERVICES

A. A manufacturer's representative for the equipment specified herein shall be present at the job site for the minimum person-days listed in Section 01 75 00 Starting and Adjusting.

B. An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation and shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of the Engineer.

C. All costs for these services shall be included in the contract price for the number of days and round trips to the site as required.

D. Manufacturer representative is to train Owner's personnel in the routine operation, maintenance and troubleshooting procedures. This period shall consist of a maximum of one eight-hour day. Contractor shall coordinate the scheduling of training with Owner's personnel.

E. Manufacturer's representative shall:
1. Approve installation before operation.
2. Test and operate system in presence of Engineer and Owner and provided certified field test reports.
3. Verify conformance to the specification.

3.08 MANUFACTURER'S CERTIFICATES

Manufacturer's representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily.

3.09 PUMP DATA SHEET

Location	RAS Pump Station
Quantity	3
Pump Name	RAS Pump Nos. 1, 2 and 3
Pump Configuration	Vertical Centrifugal
Service Conditions	Wastewater
Liquid Pumped	Activated Sludge
Minimum solids passage, inches	3-inch
Abrasive (Y/N)	Y
Possible Scale Buildup (Y/N)	N
Explosion-proof (Y/N)	N
Continuous Duty (Y/N)	Y
Design flow*, gpm	781 (Peak), 260 (Minimum)
Total Head, ft	14 (Peak), 11 (Minimum)
Minimum Hydraulic Efficiency, %	68 (Peak)
Pump Speed, Maximum, RPM	900
Maximum Motor HP	15
Constant Speed (Y/N)	N
Adjustable Speed (Y/N)	Y
Suction (inches)	6 or 8
Discharge (inches)	4 or 6
Hydrostatic Test Pressure (psig)	1.5 times shutoff head

*Peak is considered condition at full-speed of the pump. Minimum is considered condition at less than full-speed of the pump; achievable through the use of the AFD.

END OF SECTION

43 21 57 PROGRESSIVE CAVITY PUMPS

1.00 GENERAL

1.01 SUMMARY

A. Furnish, install, startup, and test progressive cavity pumps as shown on the plans and specified herein.

B. Scope of Work:
   1. Furnish, install, test and place in operation progressive cavity pumping units including all related equipment, material, and appurtenances.
      a. Two progressive cavity pumps shall be installed at the Sludge Pumping Station to pump waste activated sludge (WAS) from Secondary Clarifiers to the Sludge Holding Tank.
      b. Two progressive cavity pumps shall be installed in the Dewatering Building to pump sludge from the Sludge Holding Tank to the Screw Presses.

   2. WAS pumping system shall include the following components: pump, motor, control panel containing motor starter, disconnect, indicators, alarms, controls, and related elements for a complete and operating system.

   3. Sludge pumping system shall be provided by and controlled by the Screw Press Manufacturer.

1.02 GENERAL

A. See Division 01, General Requirements, which contains information and requirements that apply to the work specified herein and are mandatory for this project.

B. Related Sections: The following Sections contain requirements that relate to this Section.
   1. Division 05, Metals
   2. Division 09, Finishes
   3. Division 10, Signs
   4. Division 26, Electrical
   5. Division 40, Process Interconnections

1.03 REFERENCES

A. Following is a list of standards, which might be referenced in this Section:
   1. American Bearing Manufacturers Association (ABMA)
      a. ABMA-9 Load Ratings and Fatigue Life for Ball Bearings
      b. ABMA-11 Load Ratings and Fatigue Life for Roller Bearings

   2. American Gear Manufacturers Association (AGMA)
      a. AGMA 2001-D04 Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth
      b. AGMA 6001-E08 Design and Selection of Components for Enclosed Gear Drives

c. AGMA 6013-A06 Standard for Industrial Enclosed Gear Drives

3. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
   a. ANSI/ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
   b. ANSI/ASME B16.5 Pipe Flanges and Flanged Fittings

4. American Society for Testing and Materials (ASTM)
   a. ASTM A48 Standard Specification for Gray Iron Castings
   b. ASTM A108 Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality
   c. ASTM A276 Standard Specification for Stainless and Heat Resisting Steel Bars and Shapes
   d. ASTM A283 Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
   e. ASTM A576 Standard Specification for Steel Bars, Carbon, Hot Wrought, Special Quality
   f. ASTM A681 Standard Specification for Tool Steel Alloy
   g. ASTM A743 Standard Specification for Castings, Iron-Chromium, Iron Nickel,

5. Corrosion Resistant for General Application
   a. ASTM E10 Test Method for Brinell Hardness of Metallic Materials

6. American National Standards Institute/Hydraulic Institute (ANSI/HI)
   a. ANSI/HI 3.1 Rotary Pumps Nomenclature, Definitions, Application and Operation
   b. ANSI/HI 3.6 Rotary Pump Tests
   c. ANSI/HI 9.1 Pumps – General Guidelines for Types, Definitions, Application and Sound Measurement
7. American Bearing Manufacturer's Association (ABMB)
   a. 9 - Load Ratings and Fatigue Life for Ball Bearings
   b. 11 - Load Ratings and Fatigue Life for Roller Bearings
8. ASTM International (ASTM):
   a. A 48 –Specification for Gray Iron Castings
   b. A 278 - Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650°F (350°C)
9. National Electrical Manufacturer's Association (NEMA): MG-1, Motors and Generators.
10. National Fire Protection Association (NFPA): NFPA 70, National Electric Code.

B. Terminology pertaining to pumping unit performance and construction shall conform to the ratings and nomenclature of the Hydraulic Institute Standards (ANSI/HI).

1.04 SUBMITTALS

A. See Section 01 33 00, Submittals for the mechanics and administration of the submittal process.

B. Shop Drawings:
   1. Product Technical Data including:

a. Complete catalog information, descriptive literature, performance specifications, and identification of materials of construction.
b. Material storage and handling.
c. Pump configuration.
d. Performance data and curves with speed, flow (gpm), head (ft), and horsepower,
e. Anchor Bolt Plan for pump base showing number of anchor bolts and anchor size.
f. Dimensional drawings (in English units) indicating maximum overall dimensions and clearance diagrams of equipment.
g. Wiring diagrams detailing wiring for power, signal, and control systems differentiating between manufacturer-installed wiring and field-installed wiring including terminals and numbers.
h. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including frame size and any motor modifications. Type and life rating of bearings.
i. Motor Performance Data, including the following:
   1) Guaranteed min. efficiencies at 100%, 75% and 50% of full load.
   2) Guaranteed min. power factor at 100%, 75% and 50% of full load.
   3) Locked Rotor Current
   4) Full Load Current
   5) Starting Torque
   6) Full Load Torque
   7) Breakdown Torque
j. Factory finish system and/or shop painting.
k. Recommend Spare Parts List with pricing.
l. List of special tools required to perform preventative maintenance and repairs with pricing.

2. Operation and Maintenance Manuals:
   a. See Section 01 78 33 for the content, mechanics and administration of the submittal process.

3. Quality Control Submittals:
   a. Factory Functional and Performance Test Reports.
   b. Mill certifications confirming hardness of rotor.
   c. Special shipping, storage and protection, and handling instructions.
   d. Manufacturer’s printed installation instructions.
   e. Manufacturer’s Certificate of Proper Installation.

4. Contract Closeout Submittals:
   a. Service records for maintenance performed during construction.

1.05 QUALITY ASSURANCE

A. All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.

B. Pumps complete with motor, coupling, necessary guards and all other specified accessories and appurtenances shall be furnished by the pump manufacturer to ensure compatibility and integrity of the individual components, and provide the specified warranty for all components.

C. Pumps are to be engineered and manufactured under a written Quality Assurance program. The Quality Assurance program is to be in effect for at least ten years, to include a written record of periodic internal and external audits to confirm compliance with such program.

D. Pumps are to be engineered and manufactured under the certification of ISO-9001.

1.06 QUALITY CONTROL

A. Factory Inspections: Inspect control panels for required construction, electrical connection, and intended function.

B. Factory Tests and Adjustments: Test all equipment and control panels actually furnished.

C. Factory Test Report: Include test data sheets, curve test results, performance test logs, certified correct by a registered professional engineer. Reports shall be submitted for approval prior to shipment.

D. Factory Tests:
1. Shop Performance Test: A certified factory hydrostatic and performance test shall be performed in accordance with Hydraulic Institute Standards, latest edition.
2. Notify Owner 30 days prior to test. Owner may elect to witness test at Owner's expense and option.
3. Tests shall be run using manufacturer's calibrated shop motor and shop AFD.
4. Provide performance test data curves showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the specific pump, from shutoff to maximum capacity. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition. Plot NPSHa recorded during test.
5. Tests shall be run at full speed.
6. Indicate separately the head, capacity, horsepower demand and efficiency. Plot NPSHA recorded during the test.
7. Motor Test: Provide NEMA short commercial test.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Where a manufacturer's standard equipment name and/or model number is listed, the equipment system shall be provided as modified to conform to the performance, functions, features, and materials of construction as specified herein.

B. Equipment furnished and installed under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with drawings,

specifications, engineering data, and instructions and recommendations of the equipment manufacturer unless exceptions are noted by the Engineer.

C. Manufacturer shall have installations of like or similar application with a minimum of five years' service for specified pump size.

D. Acceptable Manufacturers
   1. Seepex
   2. Moyno
   3. Netszch

2.02 GENERAL REQUIREMENTS

A. The pumping units shall all be supplied by one manufacturer and shall be complete including pumps, motors, and appurtenances such as, but not limited to, bases, couplings, guards, and gauges.

B. The pumps are being installed in a municipal wastewater treatment plant.

C. Grit and other abrasive materials should be expected to be present. The presence of these items will not be considered as abnormal, unanticipated or abusive with regard to the equipment operation and warranty.

D. Pumps shall be designed and capable of operation at an ambient temperature range of 10 °F to 110 °F.

E. All necessary foundation bolts, nuts, and washers shall be furnished and shall be Type 316 stainless steel.

F. Pumps shall be mounted on reinforced concrete pads at locations shown on the drawings.

G. Pumps shall be vertical solids handling type designed to minimize clogging as defined in ANSI/HI.

2.03 PERFORMANCE

A. The pumps shall be designed and built for 24-hour continuous service at all points within the required range of operation, without overheating, without cavitation, and without excessive vibration or strain. All parts shall be so designed and proportioned as to have sufficient strength, stability, and stiffness and to be especially constructed to meet the Specifications. Ample room and facilities shall be provided for inspection, repairs, and adjustment.

B. See Pump Data Sheet at the end of this Section.

2.04 EQUIPMENT

A. Rotor and Stator:
   1. Type: Single-stage design employing a convoluted rotor operating in a similarly convoluted stator.
   2. Convolutions shall form a cavity between the motor and stator which shall progress from the pump's inlet to discharge port with the operation of the rotor.

3. The fit between the rotor and stator at the point of contact shall compress the stator materials sufficiently to form a seal and to prevent leakage from the discharge back to the inlet end of the pumping chamber.
4. The stator shall be molded with a seal agent from the elastomer from contacting the pumped liquid. Gaskets or “O” rings may not be used to form this seal.
5. Stators for sludge pumps shall have Buna elastomer.
6. Sludge pump rotors shall be D6 air hardened tool steel or 316 stainless steel.

B. Rotor Drive Train:
1. Pump rotor shall be driven through a positively sealed and lubricated pin joint.
2. The pin joint shall have replaceable bushings.
3. The pin shall be constructed of high speed steel, air hardened to 60-65 HRc.
4. The joint shall be grease lubricated with a high temperature PTFE filled synthetic grease.
5. Stator and rotor shall be replaceable without dismantling the pump suction or discharge flanges or associated piping.
6. Stator design shall permit inspection of and access to the cavities for removal of blockages without removing the rotor from the pump.
7. The rotor design shall include provisions so that the rotor replacement does not require disassembly of the universal joint.

C. Casing:
1. A 150-pound (ANSI B16.5) flanged connection shall be provided at both the inlet and discharge ports. The suction and discharge casings shall each be provided with a 3/8-inch (or larger) tap to permit installation of pressure instruments.

D. Bearings:
1. Provide with oil lubricated thrust and radial bearings, located in the gear motor, designed for all loads imposed by the specified service.

E. Shaft Sealing:
1. Shaft seal shall be injectable packing sealing compound, ChemStar S365IP high performance GFO/Graphite, or approved equal.

F. Baseplate:
1. Provide a pump and motor stand of cast iron or fabricated steel.
2. The pump stand shall be rugged, heavy duty, with ample strength for support of entire pump and imposed static and operational loads. The stand shall be anchored to the level surface of a concrete pad with Type 316 stainless steel anchor bolts. Refer to drawings.
3. Pump stand shall be installed level to 0.005” per foot.

G. Bearing Frame Assembly:
1. Pump Bearings:
   a. Antifriction type mounted.
   b. Designed for a minimum L-10 life of 100,000 hours in accordance with ABMA 9 or 11 at bearing design load imposed by pump shutoff at rated speed.
   c. Grease lubricated with external grease fittings. Provide grease relief ports with plugs.

d. Suitable seals provided in the bearing covers to prevent the entrance of contaminants.

H. Over Pressure Protection:

1. Provide a silicone-filled isolation ring with a dual mounted gauge and single point pressure switch.
2. The pressure ranges for the switch and gauge shall be selected specifically for the specified service.
3. The isolation ring shall be mounted between ANSI flanges, be sized according to the discharge pipe as shown on the plans, and be constructed with a carbon steel body and fittings with a Buna sleeve.
4. The switch shall be SPDT, NEMA 4.

2.05 ACCESSORIES

A. Equipment Identification Plate: 16-gauge stainless steel with 1/4-inch die-stamped equipment tag number securely mounted in a readily visible location.

B. Lifting Lugs: Provide for handling the casing.

C. Pressure Gauge: Each pump shall be provided with glycerin-filled suction and discharge pressure gauges with a 1/4-in NPT inlet and 4.5-in dials. A 316 stainless steel, oil filled, diaphragm with a 1/2-in NPT inlet, and 1/4-in flushing tap, with T-cock, shall be installed on each gauge. The suction gauges shall be of the compound type to indicate both vacuum and pressure and be graduated to read 15-psi positive pressures and 30-in mercury negative pressures. The gauges shall be connected to the pump suction and discharge. All fittings, bolting, and cocks shall be 316 stainless steel.

D. Anchor Bolts: Contractor to provide template and Type 316 stainless steel anchors. Size as required by manufacturer.

E. Initial Supply of Lubricants: Manufacturer shall indicate types, brands, and quantities of initial lubricants, oil, grease, etc. necessary to startup equipment. Contractor shall provide and install the recommended lubricants and shall comply with all manufacturer recommended procedures.

2.06 FACTORY FINISHING

A. Pumps and motor stands shall be prime coated in accordance to Division 9. Prime coating shall be touched up just prior to shipment. In order to avoid coating damage during shop moving and testing, finish painting shall be done by the Contractor in the field.

B. Motors shall have manufacturer’s standard finish paint system for corrosive environments.

2.07 MOTOR REQUIREMENTS

A. Motor shall conform to the requirements of Section 26 05 50, NEMA Frame Induction Motors, 600 Volts and below.

B. General: All motors shall be suitable for the intended service and the intended service shall be within the motor manufacturer's normal ratings.

C. Project Site Coordination: The physical size of the motor shall suit the existing field conditions for installation, operation, and maintenance of the motor. It shall be the Contractors responsibility to verify the existing site conditions to ensure the clearance is available for the motor selected for the project will not hinder installation, operation, and maintenance of the motor. Provide coordination drawing submittal to show clearances on all sides and top of motor.

D. Standard Products: Electric motors shall be the standard products of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate equipment that has been in satisfactory use for at least 10 years prior to bid opening.

E. Nameplates: Provide stamped stainless steel nameplates and nameplate-mounting hardware including all information required by NEMA MG 1, including NEMA nominal efficiency and minimum guaranteed efficiency on nameplate.

F. Compliance: Provide motors and components complying with NFPA 70 "National Electrical Code" and NEMA MG 1 and that are listed and labeled by UL.

G. Noise: Noise requirement may be considered an average based on sample tests of a statistical sample of production motors of identical electrical and mechanical design. Average sound pressure measured in a free field with a reference pressure of 0.00002 pascals at 3 feet from the motor shall not exceed 85 dBA.

H. Motor Sizes: Select motors that are non-overloading and not required to operate in the service factor range within the full range of the driven equipment performance curve.

I. Torque Characteristics: All motors shall be capable of producing sufficient torque to start and drive connected loads. Provide Design B, with a minimum accelerating torque of 130% of full load torque and sufficient at all voltages from 90% to 110% of rated voltage to accelerate the driven loads promptly and without overloading, overheating or damage to the motor or the driven equipment.

J. Motor Inrush and Code Letter: All motors shall be Code letter F. Inrush current shall be limited to 6.0 times the full load ampacity rating of the motor.

K. Motor Speed: Coordinate design with the adjustable frequency drive supplier and the driven equipment to provide motors which will not overheat, suffer reduced life or be damaged either from harmonic loading or reduced cooling efficiency from continuous or intermittent operation at any speed in the operating speed range.

L. Voltage and Phase: Each motor shall be wound for 3-phase, 60-Hz, 480 volts alternating current.

M. Temperature Rating: Motors shall have class H insulation, class B temperature rise.

N. Manufacturers: Subject to compliance with requirements, provide products as specified in Section 00 43 35, LIST OF EQUIPMENT MANUFACTURERS.

O. Motor Type: Unless otherwise specified, provide a Totally Enclosed Fan Cooled (TEFC) “Premium” energy efficient, solid shaft motor as specified. Provide standard frame sizes in accordance with NEMA MG 1 and with all cast iron construction including frame, end brackets, outlet box and fan cover guard. Provide manufacturer's standard bearing caps, grease fitting and drain. Provide cast iron or heavy duty steel outlet box with threaded entry. Provide shaft slingers to exclude entry of liquids through the shaft openings. Provide 120 VAC space heaters for use when motor is de-energized.

P. Service Factor: 1.15 when operated continuously in any mode.

Q. Insulation System: All motors shall have a Class H non-hygroscopic, sealed, fungus-resisting insulation of a type designed and constructed to withstand severe moisture conditions, and insofar as practicable, to operate after long periods of idleness without previous drying out. All windings and connections shall be of the sealed type as defined in NEMA MG 1 paragraph 1.27.2. Insulated windings, unless otherwise approved, shall be completely assembled in the motor core before impregnating with the insulating compound. The compound shall consist of 100 percent solid resin. Insulation shall be rated for inverter duty operation.

R. Coils of all windings shall be fully braced so that vibration is virtually eliminated during repeated starts as required by the duty cycle specified as well as during normal operation. If a tied system is used it shall be such that no tie depends upon the integrity of any other tie within the system.

S. Winding Heaters: Heaters shall be wrapped around the winding end turns. They shall be designated for operation on 120 volts, 1-phase, 60 Hz, alternating current and of sufficient capacity or wattage that, when energized, they will hold the temperature of the motor windings approximately 10 degrees C above the ambient temperature. They shall be designed for continuous operation and to withstand at least 10 percent overvoltage continuously. The terminals of the heater, including the leads, shall be watertight and shall be provided with leads suitable for making connections to the drip-proof terminal box provided in paragraph “Motor Terminals and Boxes”. The terminal box shall be readily accessible through the crating so that winding heaters can be energized while motors are in storage.

T. Temperature Monitor

1. Furnish each phase of the motor with a thermostat embedded in the motor windings
2. Set operation of the thermostats at not higher than 90 percent of insulation temperature rating. Automatic reset once the stator temperature returns to normal.

U. Motor Terminals and Boxes

1. Stator Terminal Box - Drip-proof cast iron or steel conduit terminal boxes, treated as specified for frames in paragraph “Corrosion Prevention”, shall be supplied for housing the stator lead connections and shall have adequate space with regards to the project site conditions to facilitate the installation and maintenance of cables and equipment. Boxes shall have a bolted cover providing unrestricted access, be mounted on the motor frame, and shall have an auxiliary floor supporting structure, when required, supplied by the motor

manufacturer. Conduit entrance shall be from the bottom. The boxes shall be designed to permit removal of motor supply leads when the motor is removed.

2. Stator Terminals - Insulated terminal leads shall receive a treatment equal to that of the motor winding. Leads shall be brought out of the stator frame and shall be provided with terminal lugs for connection to the motor supply wiring.
3. Grounding - A ground bus and means for external connection to the station grounding system shall be provided in the stator terminal box when surge protection is provided.
4. Accessory Leads and Boxes - Terminal leads for motor winding space heaters, resistance temperature detectors and any other auxiliary equipment shall be brought into conveniently located terminal boxes provided with terminal blocks for extension by others. The terminal boxes shall be drip-proof and treated as specified for frames in paragraph “Corrosion Prevention”. All auxiliary wiring shall be stranded copper conductors with 600-volt flame-retardant insulation, except temperature detector leads may be in accordance with the manufacturer's standard practice. All wiring and terminals shall be properly identified.

V. Adjustable Frequency Drive Motors: All motors furnished shall be rated for such use in continuous operation at any rated pumping speed. The motor shall be labeled and listed for the application by a nationally recognized electrical testing laboratory.

W. Motor Bearings: As determined by the AFBMA B-10 method, antifriction bearings shall be rated on the basis of a minimum life factor of 100,000 hours, based on the life expectancy of 90 percent of the group, unless otherwise approved by the Engineer.

2.08 ADJUSTABLE FREQUENCY DRIVE

A. Provide adjustable frequency drives for the pumping units listed in the Pump Data Sheet to this specification, in accordance with Section 26 29 23, Low Voltage Adjustable Frequency Drives.

2.09 ELECTRICAL COMPONENTS AND ACCESSORIES

A. General:
1. Conform with Division 26, Electrical.
2. Provide all necessary electrical components and wiring for a complete, functional system.

B. Wiring: The Drawings and Specifications indicate the anticipated wiring for the equipment provided under this section. If additional wiring is required, or if required wiring does not match what is indicated, the Contractor shall make the necessary modifications to the electrical wiring and documentation as part of the lump sum price. Wiring shall meet the requirements of Division 26, Electrical, and NFPA 70. Insulation shall be rated 600 volts, minimum. Low-voltage (24V) signals shall be run in twisted, shielded pair cable.

C. Electrical Raceways: Electrical wiring shall be installed in conduit meeting the requirements of Division 26, Electrical. Raceways shall be installed in accordance with Division 26, Electrical, and NFPA 70.

2.10 INSTRUMENTATION AND CONTROLS

A. All instrumentation and control components shall be provided in accordance with the requirements of Division 40.

2.11 TOOLS AND SPARE PARTS

A. Furnish one complete set of special tools recommended by the manufacturer for maintenance and repair of each separate type of equipment; tools shall be stored in tool boxes, and identified with the equipment number by means of stainless steel or solid plastic name tags attached to the box.

B. Spare Parts:
   1. Spare parts shall be tagged by project equipment number and identified as to part number, equipment manufacturer and subassembly component (as appropriate). Spare parts subject to deterioration such as ferrous metal items and electrical components shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping. Spare parts with individual weights less than 50 pounds and dimensions less than 2 feet wide, or 18 inches high, or 3 feet in length shall be stored in a wooden box with hinged wooden cover and locking clasp. Hinges shall be strap type. The box shall be painted and identified with stenciled lettering stating the name of the equipment, equipment numbers and the words “spare parts.” A neatly typed inventory of spare parts shall be taped to the underside of the cover.

   2. Provide the following spare parts for each model pump:
      a. 1 stator assembly
      b. 1 rotor
      c. 1 set of universal joint assemblies

3.00 EXECUTION

3.01 ASSEMBLY AND PREPARATION FOR SHIPMENT

A. Coordination shall include space and structural requirements, clearances, utility connections, signals, outputs and features required by the manufacturer including safety interlocks.

3.02 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. Storage and Handling: Products shall be carefully stored and handled in accordance with manufacturer’s instructions.

C. Protection of Equipment: Equipment shall be boxed, crated or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment and other equipment with anti-friction or sleeve bearings shall be stored in weathertight and heated storage facilities prior to installation. For extended storage periods, plastic equipment

wrappers shall not be used to prevent accumulation of condensate in gears and bearings.

D. Comply with pump manufacturer's rigging instructions.

3.03 EXAMINATION

A. Examine areas, equipment foundations, and conditions, for compliance with requirements for installation and other conditions affecting performance of pumps.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and bases for suitable conditions where pumps are to be installed.

D. Report any unsatisfactory conditions to the Owner and do not proceed until unsatisfactory conditions have been corrected.

3.04 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Anchor Bolts: Provide templates and specify bolts for furnishing by Contractor.

C. Shimming between machined surfaces will not be permitted.

D. Connect discharge piping without imposing strain to pump discharge head.

E. Support pumps and connected piping separately so that piping is not supported by pumps.

F. Adjust pump assemblies such that the driving units are properly aligned, plumb, and level with the driven units and all interconnecting shafts and couplings. Do not compensate for misalignment by use of flexible couplings.

G. Align pump and motor shafts and piping connections after setting them on foundations, after grout has been set and foundation bolts have been tightened, and after piping connections have been made. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.

3.05 CONNECTIONS

A. Refer to mechanical drawings for piping connections.

B. Refer to electrical drawings for electrical connections for power, controls, vibration switches, and devices.

3.06 FIELD QUALITY CONTROL

A. Functional Tests: Conduct on each pump.

1. Alignment: Test complete assemblies of actual pump with motors furnished for correct rotation, proper alignment and connection, and quiet operation.
2. Vibration Test:
   a. Test with units installed and in normal operation, and discharging to the connected piping systems at rates between the low discharge head and high discharge head conditions specified, and with the actual building structures and foundations provided. Units shall not develop vibration exceeding limits specified in HIS 9.6.4 at all operating speeds. Tests shall additionally be completed over the full operating range of the pumps from minimally allowed pump operating speed to 60 Hz on the adjustable frequency drive.
   b. If units exhibit vibration in excess of the limits specified adjust or modify as necessary. Units which cannot be adjusted or modified to conform as specified shall be replaced.
3. Flow Output: Measured by plant instrumentation. Determine that the pump performance generally tracks with the factory pump tests.
4. Operating Temperatures: Monitor bearing areas on pump and motor for abnormally high temperatures.
5. Demonstrate that the pump is capable of operating against a closed discharge valve for not less than two minutes without excessive vibration, binding, rubbing of rotating parts, or damage to pump, motor, or coupling.

3.07 MANUFACTURER'S SERVICES

A. A manufacturer's representative for the equipment specified herein shall be present at the job site for the minimum person-days listed in Section 01 75 00 Starting and Adjusting.

B. An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation and shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of the Engineer.

C. All costs for these services shall be included in the contract price for the number of days and round trips to the site as required.

D. Manufacturer representative is to train Owner's personnel in the routing operation, maintenance and troubleshooting procedures. This period shall consist of a maximum one eight-hour day. Contractor shall coordinate the scheduling of training with Owner's personnel.

E. Manufacturer's representative shall:
   1. Approve installation before operation.
   2. Test and operate system in presence of Engineer and Owner and provide certified field test reports.
   3. Verify conformance to the specifications.

3.08 MANUFACTURER'S CERTIFICATES

A. The manufacturer's representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily.

3.09 PUMP DATA SHEET

PROGRESSIVE CAVITY PUMPS		
Location	WAS Pump Station	Dewatering Building
Quantity	2	2
Pump Name	WAS Pump Nos. 1 and 2	Sludge Pump Nos. 1 and 2
Liquid Pumped	Waste Activated Sludge	Sludge and Scum
Minimum solids passage, inches	2-inch	2-inch
Abrasive (Y/N)	Y	Y
Explosion-proof (Y/N)	N	N
Continuous Duty (Y/N)	Y	Y
Design flow, gpm	220	By Screw Press Mfgr, minimum 200
Design Total Head, ft	15	By Screw Press Mfgr
Maximum Motor HP	10	10
Constant Speed (Y/N)	Y	N
Adjustable Speed (Y/N)	N	Y
Suction Inlet Size (inches)	8	6
Discharge Outlet Size (inches)	6	6

END OF SECTION

43 24 50.10 VERTICAL SHORT SETTING CENTRIFUGAL PUMPS

1.00 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Pump systems including vertical turbine pumps with radial, mixed flow, or axial (propeller) type impellers and drivers as scheduled.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. American Bearing Manufacturers Association (ABMA):
   1. 9 – Load Ratings and Fatigue Life for Ball Bearings.
   2. 11 – Load Ratings and Fatigue Life for Roller Bearings.

B. American Society of Mechanical Engineers (ASME):
   1. B16.1 – Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, and 250.
   2. B16.5 – Pipe Flanges and Flanged Fittings: NPS 1/2 through 24.

C. American Water Works Association (AWWA):
   1. C205 – Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe, 4 In. (100 mm) and Larger-Shop Applied.

D. ASTM International (ASTM):
   1. A 48 – Standard Specification for Gray Iron Castings.
   2. A 53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   3. A 108 – Standard Specification for Steel Bars, Carbon and Alloy, Cold-Finished.
   4. A 276 – Standard Specification for Stainless Steel Bars and Shapes.
   5. A 278 – Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650°F (350°C).
   6. A 283 – Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
   7. A 516- Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate-and Lower-Temperature Service.
   8. A 582 – Standard Specification for Free-Machining Stainless Steel Bars.
   9. A 743 – Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
   10. B 148 – Standard Specification for Aluminum Bronze Sand Castings.
   11. B 505 – Standard Specification for Copper Alloy Continuous Castings.
   12. B 584 – Standard Specification for Copper Alloy Sand Castings for General Applications.

13. F 593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
14. F 594 – Standard Specification for Stainless Steel Nuts.

E. Hydraulic Institute (HI):
1. 2.1-2.2 – Vertical Pumps for Nomenclature and Definitions.
2. 2.3 – Vertical Pumps for Design and Application.
3. 2.4 – Vertical Pumps for Installation Operation and Maintenance.
4. 9.1-9.5 – Pumps – General Guidelines for Types, Definitions, Application, and Sound Measurement and Decontamination.
5. 14.6 – Rotodynamic Pumps for Hydraulic Performance Acceptance Tests.

F. International Standards Organization (ISO):
1. ISO 9001 Certified.

1.03 DEFINITIONS

A. Pump head (total dynamic head, TDH), flow capacity, pump efficiency, net positive suction head available (NPSHa), and net positive suction head required (NPSHr): As defined in HI 2.1-2.2, 2.3, 9.1-9.5, and 14.6 and as modified in the Specifications. The pump head and efficiency are evaluated at the outlet of the discharge head and include the net losses in the pump column and discharge.

B. Flow, head, efficiency, and motor horsepower specified in this Section are minimums unless stated otherwise.

C. Suction head: Gauge pressure available at pump intake flange or bell in feet of fluid above atmospheric.

D. Tolerances: This Section and related sections contain tolerances that may be more stringent than Hydraulic Institute Standard tolerances. Where tolerances are not mentioned, Hydraulic Institute Standards 2.1-2.2, 2.3, 2.4, and 9.1-9.5 shall apply.

1.04 SYSTEM DESCRIPTION

A. Components: Pump, driver, motors, and drive arrangements as specified or as scheduled with shafts, columns, barrels, intermediate bearings, seals or packing, couplings, base plates, guards, supports, anchor bolts, necessary valves, gauges, taps, lifting eyes, stands, and other items as required for a complete and operational system.

B. Design requirements:
1. Pump performance characteristics:
a. As specified in the Pump Schedule.
b. Pump curve shall be continuously rising throughout the design conditions listed in the pump schedule.
2. Motor characteristics: As specified in the Pump Schedule.

1.05 SUBMITTALS

A. Submittals shall be prepared and submitted in accordance with Section 01 33 00.

B. The following submittals are required, at a minimum, in addition to any other applicable requirements of Section 01 33 00 Submittals.

1. Shop drawings specific to project and applicable product data bound neatly in a single package. The following information shall be included as a minimum:

   a. Manufacturer and model number of equipment.

   b. Layout drawings and equipment cut sheets showing dimensions, clearances, sizes, arrangement and size of connections, supports, anchors, and total weights of the product.

   c. Detailed specifications and data describing the materials of construction and coatings.

   d. Submit the following information on electric motors furnished including make and type of motor:

      1) Name of Drive

      2) Horsepower of Motor

      3) Phase

      4) Full Load Efficiency

      5) Voltage

      6) Full Load Power Factor

      7) Speed

      8) NEMA Design Starting Torque

      9) NEMA Frame and Dimensions

      10) Full Load Current

      11) Locked Rotor Current

      12) Insulation Class

      13) Temperature Rise at 1.0 SF

      14) Enclosure

      15) Bearing life design

   e. Complete electrical wiring diagrams and data on equipment devices to be furnished.

   f. Operating range, and submergence requirements.

   g. Complete performance curves including capacity, head, efficiency, and brake horsepower over the full operating range.

   h. Layout, sizes, material, and type of anchor bolts to be furnished.

   i. Pressure Control Data.

2. Location and telephone number of nearest stocking distributor of spare parts.

3. Complete operation and maintenance data for all equipment and controls in accordance with Section 01 78 23 Operation and Maintenance.

4. Startup and test schedule with test procedures in accordance with Section 01 75 00 Startup and Adjusting.

5. Equipment installation report with field test data and test records.
6. Warranties and service agreements, if specified.

C. All deviations from contract documents shall be clearly identified in the submittal and are only accepted if specifically approved in writing by the ENGINEER.

D. Any other information necessary for the ENGINEER to determine compliance with the specifications.

1.06 QUALITY ASSURANCE

A. Provide pumps specified in this Section from same manufacturer. Require pump manufacturer to furnish and coordinate pump, driver, drive, and pump components including barrel/can as scheduled and to provide written installation and checkout requirements.

B. Pump manufacturer must be ISO 9001 certified.

1.07 WARRANTY

A. Manufacturer shall provide a two-year warranty from the date of equipment acceptance.

1.08 MAINTENANCE

A. Special tools: Deliver 1 set for each furnished pump type and size needed to assemble and disassemble pump system.

B. Spare parts: Deliver the following spare parts to Owner; pack and label for storage.
1. Seal packing material: 1 set of each type supplied.
2. Mechanical seal: 1 complete seal of each type.
3. Pump impeller/bowl assembly: 1 of each type supplied.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers include:
1. Simflo
2. Peerless
3. Flowserve
4. National Pump

B. Equipment furnished and installed under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with drawings, specifications, engineering data, and instructions and recommendations of the equipment manufacturer unless exceptions are noted by the Engineer.

C. Manufacturer shall have installations of like or similar application with a minimum of five years' service for specified pump size.

2.02 MATERIALS

A. General: Materials in the Pump Schedule shall be the type and grade as specified in this Section.

B. Cast iron: ASTM A 48, Class 30 minimum.

C. Nickel cast iron: ASTM A 48, minimum Class 30, cast iron with 3 percent nickel.

D. Gray iron casting: ASTM A 278, Class 30.

E. Iron-chromium alloy: ASTM A 743, Grade CA40; ASTM A 276, Type 420 Stainless Steel may be substituted; Brinell Hardness Number of 350 to 380.

F. Nickle Aluminum Bronze: ASTM B 584, Alloy 95500.

G. 416 stainless: ASTM A 582, Type 416 Stainless Steel.

H. Neoprene: Polychloroprene rubber.

I. Steel: ASTM A 283, Grade D or ASTM A 516 Gr. 70.

J. Steel pipe: ASTM A 53, Grade B.

K. Aluminum bronze: ASTM B 148.

2.03 GENERAL PUMP CONSTRUCTION

A. Type: Industrial, heavy duty, vertical turbine, centrifugal type pumps meeting performance requirements and features as scheduled and as specified.

B. Discharge flange: ASME B16.1 or B16.5 drilled; rated for 1.2 times the pump shutoff head at 150 degrees Fahrenheit.

C. Discharge nozzles: Provide ½-inch NPT taps for pressure gauges; install nipple and gauge with block valve.

D. Bearings:
   1. Design driver/motor bearings to support the line shaft assembly and rated for ABMA L_{10} life of 40,000 hours at Design Rated Point flow and head in accordance with ABMA 9 or ABMA 11.
   2. Design motor to withstand continuous duty full load thrust and momentary upthrust that may occur during pump on/off or other operations.

E. Fasteners: Provide Type 316 stainless steel fasteners in accordance with ASTM F 593 or ASTM F 594.

2.04 PUMP SUCTION ASSEMBLY

A. Pump suction assembly: Provide suction bell. Provide anti-vortex baffles and strainer when scheduled.

B. Design suction bells and provide strainers and anti-vortex baffles to minimize solids plugging and vortexing. Screens to have a flow area at least 4 times the suction pipe area.

C. Materials:
   1. Pump suction bell: As scheduled
   2. Anti-vortex baffles: Same material as scheduled for pump suction bell
   3. Pump suction bell bearing: As scheduled.
   4. Pump suction strainer: When strainer scheduled, provide Type 316 stainless steel.

2.05 PUMP IMPELLER BOWL ASSEMBLIES

A. Pump impeller assembly:
   1. Type: As scheduled.
   2. Maximum number of vanes: As scheduled.
   3. Number of stages: As scheduled.
   4. Required balance: As recommended by the manufacturer requirements
   5. Method of securing impellers to shafts: Keyed and secured by a bronze nut locked in place or locked by other methods acceptable to the Engineer. Provide any special tools required for removal and installation of pump impellers.
   6. Provisions for adjustment of axial clearance: Make such adjustment through use of motor adjusting nut or adjustable coupling.
   7. Impeller thrust: When appropriate for the specified impeller type, provide hydraulically balanced impeller to minimize down thrust.

B. Intermediate and discharge impeller cases:
   1. Material: As scheduled.
   2. Attached with bolting.

C. Pump impeller bowl bearings: Provide bearing for each impeller; material as scheduled.

D. Diffusion vanes: Provide vanes cast into bowl.

E. Design with smooth water passages to reduce clogging by stringy or fibrous materials on impellers or shafting.

F. Design replaceable wear rings for both the bowl and impeller on each impeller bowl.

G. Design capable of passing solids with a sphere size as scheduled or larger.

2.06 LINE SHAFTS

A. Provide line shaft type and lubrication type as scheduled and as specified in this Section.

B. Open line shaft, product lubricated:
   1. Shaft and couplings:
      a. Provide keyed shaft type mechanical couplings with key or set screw locking of shaft couplings.
      b. Shaft threaded connections are not allowed.

2. Bearings and bearing retainers: Provide bearings and retainers spaced as scheduled, but not to exceed 10 feet; provide at least 1 bearing for each line shaft length; provide grease fitting for top bearing extended to outside any guards when grease lubrication specified.
3. Materials:
   a. Shaft and couplings: As scheduled; where hard faced steel shaft is specified, hard face at sleeve bearings to 550 Brinell minimum.
   b. Bearings: As scheduled; when not scheduled, Neoprene rubber bearings with ASTM B 584, Alloy C95500.

C. Design strength: Able to withstand minimum 1.5 times maximum operating torque and other loads.

D. Sleeves: Provide shafting with Type 316 stainless steel sleeve or hardened sleeves where shafts pass through bearings or stuffing boxes as scheduled; Brinell 550 or higher for hardened shaft; when the specified mechanical seals cannot be installed on a hardened shaft, hardened shafts are not required in the area of the mechanical seal.

E. Design pump line shafting in interchangeable lengths as scheduled, but not to exceed 10 feet; shaft lengths to match scheduled pump column lengths.

F. Coupling strength: Design driver to pump line shaft coupling of sufficient length and strength to maintain line shaft alignment.

G. Adjustment:
   1. Design a means to adjust shaft position to adjust impeller position.
   2. For motor driven units with solid shaft motors, design driver to pump line shaft coupling to allow adjustment of the impeller position.
   3. For motor driven units with hollow shafts, an adjusting nut may be provided at the top of the motor shaft.

H. Spacer coupling: When mechanical seals are scheduled, provide an adjustable spacer coupling to allow removal of the seal without driver removal.

2.07 PUMP COLUMN PIPE

A. Pump column pipe: Thickness and material as scheduled.

B. Head connection: Design with flanged and bolted connection to discharge head and flanged and bolted connection to impeller assembly to permit removal of impeller bowl assembly without disturbing the column or discharge connections.

C. Design Working Pressure: Design to withstand a design working pressure not less than 1.20 times the maximum shutoff total dynamic head with the maximum diameter impeller at the maximum operating speed plus the maximum suction static head.

D. Pressure test: Design to withstand a 5 minute hydrostatic test pressure not less than 1.5 times the design working pressure; perform test at source.

E. Lengths and connections: Design with maximum 10 foot length, or less if scheduled, interchangeable column sections with flanged or threaded with registered fit screwed connections as scheduled.

F. Diameter: Design column inside diameter for no more than 4 feet of fluid friction loss per 100 feet of column length.

2.08 PUMP DISCHARGE HEAD ASSEMBLY

A. Design the discharge head for above or base discharge as scheduled.

B. Design the discharge vertical to horizontal flow transition as a smooth pipe elbow or from a minimum of 3 pipe pieces mitered to form the elbow.

C. Design discharge head to mate with the driver as scheduled.

D. Head and base plate construction: Sufficient strength, weight, and thickness to provide accurate alignment, prevent excessive deflection and support the drive motor.

E. Stuffing box and seal:
1. Design the discharge head with a stuffing box to accommodate injectable packing, stuffing box shall have a button-head or flow-through fitting permanently installed.
2. Drain: Provide drain, minimum ¾ inch size, for pump stuffing box leakage, together with drain line to the pump can or wet well or to nearest equipment drain as indicated on the Drawings.
3. Provide 2 hydraulic injection guns of all-steel construction as manufactured by American Seal and Packing or equal.
4. Provide 4 10-pack stick cartridges of a synthetic fiber, non-straining lubricant for general service.

F. Discharge Vent: Provide ¾ inch NPT threaded high point vent on discharge; install pipe nipple with threaded gate valves in vent.

G. Stilling Tube: Provide ¾ inch PVC stilling tube that inserts through the top of the pump into the can to protect bubble tube.

H. Materials: As scheduled; when not scheduled, provide
1. Pump discharge head/driver stand: Steel, ASTM A 283, Grade B and/or ASTM A 53, Grade B; or Cast iron, ASTM A 48, Class 30 minimum.
2. Pump discharge head sleeve bearing: ASTM B 148, Alloy C95500 nickel aluminum bronze.
3. Stuffing box and seal: Container and gland, Cast iron, ASTM A 48, Class 30 minimum; Neoprene top shaft seal.

2.09 EQUIPMENT GUARDS

A. Provide equipment safety guards per manufacturer recommendations.

2.10 DRIVERS

A. Horsepower:

1. As scheduled.
2. Listed driver horsepower is the minimum to be supplied.
   a. Increase driver horsepower if required to prevent driver overload while operating at any point of the supplied pump operating head-flow curve including runout.
   b. When scheduled driver is a motor, increase motor horsepower if required to prevent operation in the service factor.
   c. Make all structural, mechanical, and electrical changes required to accommodate increased horsepower.

B. Motors: Provide motors as specified in Section 26 05 50 and as specified in this Section:
   1. RPM: As scheduled:
   2. Enclosure: As scheduled.
   3. Electrical characteristics: As scheduled.
   4. Efficiency, service factor, insulation, and other motor characteristics: As specified in Section 26 05 50.
   5. Motor accessories: As specified in Section 26 05 50 and in this Section.
   6. Coordinate motors with the adjustable frequency drive manufacturer to ensure compatibility between the motor and adjustable frequency drive.

C. Other drivers: As scheduled and as specified in sections listed in the Schedule.

D. Non-reverse ratchets: When scheduled, provide driver with nonreverse ratchets or pin mechanism to prevent reverse rotation of the pump and driver in the event of discharge valve failure.

E. Adjustable Frequency Drives: As scheduled and as specified in Section 26 29 23.

2.11 CONTROLS

A. Each pump shall be provided with a NEMA 4X control panel. Each panel shall have NEMA rated components (VFD, circuit breaker with interlocking door handle, 3-leg motor overload protection, 120 volt control transformer, door mounted overload reset pushbutton, door mounted run indicating light, door mounted HOA selector switch, terminals for field connection and power/control for the enclosure cooling fan, door mounted alarm indicator lights).

B. A pressure switch shall be provided to shut down the pumps in the event of an operator determined low suction pressure. The pressure switch shall be the snap action type rated for 5 amps at 240 VAC and have an adjustable differential. Switch shall be mounted on the control panel.

C. Provide other controls as shown on the process and instrumentation diagrams and as needed for a fully functioning system.

2.12 SUPPORTS

A. Strength: Design pump discharge head and driver (motor or engine) supports to withstand a minimum of 1.5 times the maximum imposed operating loads or the imposed seismic loads, whichever is greater.

B. Resonant frequency: Design supports in conjunction with the pump, shafting, drivers, bearings, and other components to avoid natural resonant frequencies, either torsional, radial, or axial.

C. Coordinate pump and drive system supports with the foundation designs as indicated on the Drawings.

2.13 FINISHES

A. Prepare surfaces and apply protective coatings as specified in Section 09 91 00

2.14 SOURCE QUALITY CONTROL

A. Equipment performance test: Test level as scheduled;

B. Vibration test: Test level as scheduled;

C. Noise test: Test level as scheduled;

D. Motor factory tests: Test as specified in Section 26 05 50.

E. Hydrostatic pressure tests: As specified for components in this Section.

3.00 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer’s instructions.

3.02 FIELD QUALITY CONTROL

A. Equipment performance test: Test level as scheduled

B. Vibration test: Test level as scheduled

C. Noise test: Test level as scheduled

3.03 MANUFACTURER’S FIELD SERVICES

A. Require manufacturer to inspect system before initial start-up and certify that system has been correctly installed and prepared for start-up as specified in this Section.

B. Furnish a qualified field representative for a minimum of 1 working day on a minimum of 1 trip to instruct Owner's personnel in routine maintenance and troubleshooting procedures. The Contractor shall coordinate the scheduling of such training and startup assistance with Owner's personnel. Owner may videotape training.

3.04 PUMP SCHEDULE

General Characteristics:	
Service	Plant Water (Filtered Effluent)
Quantity	2
Maximum Noise, dBA at 3 feet	85
Torsional Analysis	Not Required
Minimum Pumped Fluid ˚F	45
Normal Pumped Fluid Degrees ˚F	70
Maximum Pumped Fluid ˚F	90
Pump Characteristics:	
Number of Stages	Per Manufacturer
Impeller Type	Enclosed
Impeller, Maximum Number of Vanes	Per Manufacturer
Pass Minimum Sphere Size, Inch	0.5
Pump Impeller Bowl Bearing Lubrication	Water
Suction Bowl Bearing Lubrication	Water
Suction Strainer	Required
Anti-Vortex Baffle	Required
Line Shaft Type	Open
Line Shaft Lubrication	Product
Discharge Shaft Seal Type	Packing
Column Connection Type	Threaded
Discharge Arrangement	Above Base
Coupling Type	Screwed
Speed Control	Adjustable Frequency Drive
Maximum Pump, rpm	3600
Minimum Pump, rpm	900
Rated Design Point (at Maximum Revolutions per Minute):	
Flow, gpm	120
Head, Feet*	185
Minimum Efficiency, Percent	73
Other Conditions:	
Shut Off Head, Feet	250
Floor Elevation of Plant Water Box	652.50
Minimum WSE of Plant Water Box	656.50

Maximum WSE of Plant Water Box	658.50
Top of Wall Elevation at Plant Water Box	664.49
Pump Materials:	
Suction Bell	Cast Iron
Suction Bell Bearing	Nickle Aluminum Bronze B148 Alloy C95500
Impeller Cases	Cast Iron
Impeller	410 Investment Cast SS, A743-CA6NM with Stationary Rings, Ni. Al. Bronze B148-C95500 & Impeller Ring Alum Bronze B148-C95400
Impeller Bearing	Nickle Aluminum Bronze B148 Alloy C95500
Impeller Shaft Key	Steel or Tapered 416SS Lock Collets
Line Shaft and Coupling	Steel, Gr 1045 or 416SS, 416SS Threaded Coupling
Line Shaft Bearings	Neoprene or Rubber C425-65
Shaft Enclosing Tube	N/A
Shaft Sleeve	Hardened or coated with tungsten carbide
Strainer, Strainer Screws, Strainer Clips	316 SS
Column Material and Thickness, Inch or Schedule	Steel Pipe, 0.25
Discharge Head/Driver Stand	Steel or Cast Iron
Discharge Head Bearing	Bronze
Discharge Stuffing Box	Steel or Cast Iron
Packing	Injectable
Driver Characteristics:	
Driver Type	Motor
Starter Type	VFD
Drive Arrangement	Vertical, Coupled
Non-Reverse Ratchets	Required
Maximum Driver Horsepower	15
Maximum Driver rpm	1800
Motor Characteristics (when motor is driver type):	
Inverter Duty Rated	Yes
Motor Voltage/Phases/Hertz	460/3/60
Enclosure Type	TEFC

Source Quality Control Testing:	
Test Witnessing	Not Witnessed
Performance Test Level	1B
Vibration Test Level	None
Noise Test Level	None
Field Quality Control Testing:	
Performance Test Level	1B
Vibration Test Level	None
Noise Test Level	None

*The plant water pumps are to provide water to a closed distribution system at constant pressure. System pressure is controlled by varying the speed in direct ratio to the discharge pressure.

END OF SECTION

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SECTION 43 25 13 SUBMERSIBLE CENTRIFUGAL NON CLOG PUMPS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish, install, startup, and test non-clog, centrifugal, submersible pumps as shown on the plans and specified herein.

B. The submersible pumps shall be by the same manufacturer and shall be complete with all necessary accessories including pump monitoring/protection devices, guide rails, discharge elbows, connections, supports, submersible cables, hatches and removal systems necessary for a complete and operable system.

C. Each pump shall be capable of operating reliably with an adjustable frequency drive unit. Provide manufacturer certification that the pumps are designed to NEMA MG-1, Section 31, to operate with an adjustable frequency drive at the flow conditions required and a list of installations with adjustable frequency drive operation.

1.02 RELATED WORK AND SPECIFICATIONS

A. Section 09 91 00 Painting and Coating.

B. Division 26: Electrical.

1.03 QUALITY ASSURANCE

A. Manufacturer's installation report is required prior to final acceptance.

B. All equipment specified in this Section shall be supplied by a single manufacturer.

C. Manufacturer shall maintain a complete stock of spare parts commonly needed for the equipment specified at a location within the State of Texas or shall be capable of furnishing parts within 48 hours of request.

D. All pieces of equipment shall have a stainless steel manufacturer's nameplate securely affixed in a conspicuous place on the equipment showing the ratings, serial number, model number, manufacturer and other pertinent nameplate data.

E. The pump manufacturer shall furnish and be responsible for the complete system including pumps, motors, base elbows, and guide rails, and hatches.

1.04 SUBMITTALS

A. Submittals shall be prepared and submitted in accordance with Section 01 33 00.

B. The following submittals are required, at a minimum, in addition to any other applicable requirements of Section 01 33 00 Submittals.

1. Shop drawings specific to project and applicable product data bound neatly in a single package. The following information shall be included as a minimum:
    a. Manufacturer and model number of equipment.
    b. Layout drawings and equipment cut sheets showing dimensions, clearances, sizes, arrangement and size of connections, supports, anchors, and total weights of the product.
    c. Applicable bid specification section with comments on conformance and deviations on each paragraph.
    d. Detailed specifications and data describing the materials of construction and coatings.
    e. Submit the following information on electric motors furnished including make and type of motor:
        1) Name of Drive
        2) Horsepower of Motor
        3) Phase
        4) Full Load Efficiency
        5) Voltage
        6) Full Load Power Factor
        7) Speed
        8) NEMA Design Starting Torque
        9) NEMA Frame and Dimensions
        10) Full Load Current
        11) Locked Rotor Current
        12) Insulation Class
        13) Temperature Rise at 1.0 SF
        14) Enclosure
        15) Bearing life design
    f. Complete electrical wiring diagrams and data on equipment devices to be furnished.
    g. Operating range, and submergence requirements.
    h. Complete performance curves including capacity, head, efficiency, brake horsepower and submergence requirements over the full operating range.
    i. Size, type and length of submersible cables.
    j. Layout, sizes, material, and type of anchor bolts to be furnished.
    k. Level Control Data.
2. Location and telephone number of nearest stocking distributor of spare parts.

3. Complete operation and maintenance data for all equipment and controls in accordance with Section 01 78 23 Operation and Maintenance.

4. Startup and test schedule with test procedures in accordance with Section 01 75 00 Startup and Adjusting.

5. Equipment installation report with field test data and test records.

6. Warranties and service agreements, if specified.

C. All deviations from contract documents shall be clearly identified in the submittal and are only accepted if specifically approved in writing by the ENGINEER.

D. Any other information necessary for the ENGINEER to determine compliance with the specifications.

1.05 EXPERIENCE REQUIREMENTS

A. All equipment shall be the product of a manufacturer having at least ten (10) Texas installations of the type being proposed each with a minimum of 5 years of satisfactory service.

B. A list of similar installations shall be furnished upon request with the shop drawing submittal, including names and telephone numbers of contacts.

1.06 DELIVERY, STORAGE AND HANDLING

A. Delivery, storage and handling shall be in full accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. All equipment including controls and drives specified herein shall be specifically designed for this service and the environment encountered in this installation. The environment will be moist, and corrosive, exhibiting hydrogen sulfide, rags, grit, grease, and corrosive gases encountered in municipal wastewater lift stations.

B. Equipment shall be designed and capable of continuous and intermittent operation. The presence of abrasive materials, rags, large solids and stringy material shall not be considered as abnormal, unanticipated or abusive with regard to the equipment operation and warranty.

C. All equipment, supports, anchors and fasteners shall be of adequate strength to withstand loads associated with starting, turbulence, thrusts from liquid movement, thermal expansion and contraction and other loads encountered under normal operating conditions.

D. The equipment, sizes, materials, and arrangements described in this section are based on recommendations by equipment manufacturers and shall be considered minimum limits of acceptability. The equipment manufacturer shall be responsible for design, arrangement, and performance of all equipment supplied

under this section. Arrangements other than those shown on plans shall be subject to Engineer's approval.

E. The general arrangement of the piping, pumps and wet well are shown on the plans.

F. Operating Conditions:

1. The pumps shall pump municipal wastewater. Operating conditions for the pumps are shown in the equipment schedule below.
2. Motors shall be invertor duty rated, 480 volt, 3-phase, 60 hz.
3. All motors shall be designed to be non-overloading at all points along the pump performance curve. The motor shall be sized to be a minimum of 5 percent larger than the maximum brake horsepower required at any point on the pump curve.
4. The pumps shall pass 3-inch diameter solids and long, stringy, fibrous materials without clogging.
5. All pumps and motors shall be capable of running continuously for at least 30 minutes with no external cooling required while operating at a submergence level of the top of the volute (motor not submerged) and shall also be capable of 10 starts per hour.
6. Provide a control and status relay leakage and heat sensor detection unit capable of operating at 120 volts, and having contacts for interlocking. Furnish the unit for operation with VFDs. Provide complete wiring diagrams and installation details. Provide a monitor to automatically test motor windings and monitor incoming power phases before pumps start.
7. Contractor shall coordinate pump base elbow size with discharge piping. A pipe reducer located at the pump discharge shall be provided if necessary and shall be sized to transition from the pump base elbow to the discharge line size.

G. Equipment Schedule:

Pump No.	PMP-0318 PMP-0319	PMP-0317	PMP-0315 PMP-0316
Rated Capacity per pump at TDH, MGD	4.5	2.25	1.125
Rated Head, feet	35	34	34
Design Static Head, feet	33	33	33
Minimum efficiency at specified operating condition	65-%	65-%	65-%
Maximum Allowable Horsepower, hp	50	35	15
Maximum Operating Speed, rpm	1,800	1,800	1,800
Minimum Pump Shut-Off Head, feet	Curve rise at least 15% from design to shutoff		

2.02 GENERAL PUMP REQUIREMENTS

A. Pumps shall be furnished complete with discharge elbow, non-sparking guide rails and stainless steel supports all along the guide rail system, and 316 stainless steel anchor bolts for discharge bases, of epoxy or capsule type or embedded type. Supplier shall determine anchor bolt sizes.

1. Pump connection to discharge connection shall be automatic when the pump is lowered into place and shall be easily disconnected without the need for personnel to enter the wet well.

B. All fasteners shall be Type 316 stainless steel.

C. Discharge elbow connection shall be ANSI flanges of appropriate diameter and pressure rating for the pump's function.

D. Motors shall be submersible, Class H insulation, NEMA B design, 480 volt, 3-phase, 60 hz, and shall meet the requirements of NEMA MG 1, Section 31. Motors shall have a 1.0 service factor.

2.03 DETAILS OF CONSTRUCTION

A. Pump Details of Construction:

1. Discharge base elbow connection elbow:

a. Base shall be cast iron secured to floor of wet well with Type 316 stainless steel anchor bolts, sized and furnished by Supplier.

b. Discharge elbow shall have a flanged connection to discharge piping or flanged reducer provided.

c. Pump connection to discharge connection elbows shall be automatic when the pump is lowered into place and shall be easily disconnected without the need for personnel to enter the wet well.

d. Provide a cast iron sliding guide bracket for each pump as integral part of pump.

e. Provide a minimum of two (2) Type 316 stainless steel pipe guide rails and supports for each pump. Guide rail supports and spacing shall be as recommended by the pump manufacturer.

f. Lower guide bar/cable holders shall be integral with pump base discharge connection elbow assembly (cast iron).

g. The guide rails with all necessary brackets and hardware shall be supplied by the pump manufacturer for a complete workable system.

2. Power Cable:

a. Provide power cable to suit installation to the motor starter cabinet without splicing as shown on the drawings. Cables shall be long enough for pump removal from well without disconnecting cables.

b. Pump power and control cables shall be hypalon jacketed, Type SPC or SJO cable, suitable for submersible application and shall have stainless

steel Kellum-type cable grips for supporting cable at the top brackets without damaging cable.

c. Size according to NEC and ICEA standards.

d. Cable entry seal to be watertight and submersible.

e. Cable entry seal to be watertight and submersible by elastomer grommets, and without the use of epoxy or potting.

f. The cable entry chamber junction shall be separate from the motor chamber. The chamber junction shall be O-ring sealed from the motor chamber without the use of epoxy with a terminal board or motor leads staggered and sealed without the use of epoxy in a manner that prevents wicking.

g. The electrical cable entranceway to the motor shall be provided with positive strain relief to prevent leakage or pullout of the cable in the event that a force is placed on the cable during the lowering of the pump.

3. Pump Motor:

a. Designed to operate on 480V, three-phase power, unless otherwise indicated.

b. Squirrel-cage induction, shell-type design for submersible application.

c. Motor shall be housed in a watertight chamber with an integral cooling system suitable for continuous operation with wetwell water level at the top of the pump volute. NPT tapped inlet/outlet ports shall be provided with for clean water cooling if required for VFD control motors.

d. Stator leads and winding insulated with moisture-resistant, Class H insulation which will resist 180°C above ambient.

e. Designed for continuous duty capable of sustaining 10 starts per hour. Temperature rise shall not exceed 25°C above ambient.

f. Rotor bars and short-circuit rings shall be aluminum.

g. Motors shall meet Class I, Division II for explosion-proof conditions. Motors shall be fully functional with an adjustable frequency drive unit. The motor shall be inverter duty and meet NEMA MG 1 Section 31 requirements.

h. Refer to Division 26 specifications for applicable electrical components.

i. Pump manufacturer shall provide pump monitoring/protection devices to the electrical contractor for installation in the adjustable frequency drive(s).

j. Pump manufacturer shall provide pump protection relay for heat, moisture, and leak detection.

4. Protection:

a. Provide one (1) temperature overload protection device for each phase within the motor windings to automatically switch off motor if windings reach temperature of 285°F.

b. Provide leakage sensors to stop pump if moisture is present in the oil chamber.

5. Pump Shaft:

   a. Stainless steel, Type 420 or carbon steel with 416 stainless steel sleeve completely isolated from pumped liquid.

   b. Provide tandem mechanical shaft seal system.

   c. Provide minimum of two (2) permanently lubricated bearings consisting of upper radial bearings and lower thrust bearings rated for B-10 life of 100,000 hours in accordance with AFBMA.

6. Shaft Seal System:

   a. A tandem mechanical seal system consisting of two totally independent seal assemblies shall be provided that operates in a lubricant reservoir.

   b. Upper shaft seal consisting of stationary Tungsten carbide ring and rotating carbon ring or a rotating Tungsten carbide ring and a stationary carbon ring operating in an oil chamber below stator housing.

   c. Lower shaft seal consisting of stationary and rotating Tungsten carbide or silicone carbide rings designed to seal pumped liquid from stator housing.

   d. Each seal shall be held in place by its own independent stainless steel spring system.

   e. Oil chamber shaft sealing system shall be designed to prevent overfilling and to provide lubricant application capability. Provide drain and inspection plugs accessible from the outside.

7. Impeller:

   a. Gray cast iron, ASTM A48, Class 35B of 40B, multivane type.

   b. Statically and dynamically balanced, double shrouded non-clogging design.

   c. Secured to shaft with key and locknut with setscrew.

8. Volute:

   a. Gray cast iron, ASTM A48, Class 35B or 40B, single piece design with smooth fluid passages of sufficient size to pass solids passing through the impeller.

   b. Bottom shall have suction bell design.

9. Wear Rings/Wearing Plates:

   a. Required for all pumps.

   b. Removable.

   c. Stationary replaceable Nitrile rubber coated cast iron wear ring in volute and rotating stainless steel ring on impeller.

10. Finish:

   a. Pump exterior shall receive PVC epoxy primer with chloric rubber paint finish. Pump shall receive surface preparation, prime coat and finish

coat in factory. Provide one gallon of touch up paint with the pumps, for CONTRACTOR's use during installation.

b. Paint bases, piping and other surfaces in accordance with Section 09 90 00 Coatings and the Plans and as specified herein.

11. Lifting Device:

a. Provide sufficient 316 stainless steel lifting chain securely attached to each pump for removal. Chain shall be rated for a working load of at least five times the weight of the pump.

b. Provide stainless steel safety hook and connection to cable holder for each pump installed.

12. Manufacturer's Tests:

a. Inspect and test pumps prior to shipment for impeller, motor rating, electrical connections, motor and cable insulation defects and moisture contents.

b. Perform certified factory testing for performance compliance for each pump.

c. Factory Test Report: Include test data sheets, curve test results, performance test logs, certified correct by a registered professional engineer.

d. Shop Performance Test: A certified factory hydrostatic and performance test shall be performed in accordance with Hydraulic Institute Standards, latest edition Tests shall be run using manufacturer’s calibrated shop motor and shop VFD. Provide performance test data curves showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the specific pump, from shutoff to maximum capacity. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition. Tests shall be run at maximum speed and minimum speed. Intermediate curves at 10Hz increments will be added to the test curves by affinity law. Indicate separately the head, capacity, horsepower demand and efficiency. Plot NPSHA recorded during the test. Results of the performance tests shall be certified by a Registered Professional Engineer and submitted for approval before final shipment. Motor Test: Provide NEMA short commercial test.

13. Access Hatches

a. Access hatch shall be the size and type shown on the drawings.

b. An access hatch shall be provided for each pump to allow each pump to be safely removed and installed from working floor.

c. Access hatches for the three smaller pumps shall be accommodate future pumps with capacities of the two larger pumps.

d. Hatch location above the pump, rail locations, and orientation of hatch shall be the responsibility of the pump manufacturer.

e. Provide the following minimum features of construction:

1.) Mounted flush to adjacent walking surface

2.) Aluminum “I” bar construction

3.) 316SS hardware

4.) Lifting handle

5.) Spring or mechanical lift assistance to allow hatch to be lifted to an upright position with 50 pounds or less force.

6.) Lockable in the closed position

7.) 300 pounds per square foot load rating

8.) Hinged with positive latch and/or aluminum hold open bar to automatically maintain an open position with a safety release latch to allow the hatch to return to the closed position.

9.) Aluminum or FRP safety grating panel with aluminum beam support

10.) 316SS support brackets and mounting hardware

2.04 CONTROL PANELS AND INSTRUMENTATION

A. Control Panels

1. General

a. Refer to Section 40 for general requirements of control panels.

b. All instrumentation, control and electrical components provided under this section shall comply with the requirements on the Drawings and Divisions 26 and 40.

c. Control panels shall be NEMA 4X 316 stainless steel unless shown otherwise on contract drawings, oversized enclosure, with three-point latching handle.

d. Provide all controls necessary for the fully automatic operation of the system.

2. Pilot and Control Devices

a. The following devices shall be mounted on panel door:

1) Hand-Off-Auto selector switch each piece of equipment.

2) Emergency Off switch.

3) Provide engraved nameplates for each function.

2.05 TOOLS, SPARE PARTS AND MAINTENANCE MATERIALS

A. Two (2) sets of the following spare parts shall be furnished for the pump provided under this specification:

1. Mechanical seals.

2. Wearing rings (casing and impeller).

3. Bearings.

4. Special tools required for maintenance or adjustment.

5. Other items as recommended by manufacturer.

B. Spare parts shall be packed in sturdy containers with clear, indelible identification markings and shall be stored in a dry, warm location until transferred to the OWNER at the conclusion of the project.

C. Indicate type, brand and quantities of initial supply of grease and oil required by manufacturer to be furnished and installed by CONTRACTOR.

2.06 PAINTING

A. Pumps, appurtenances, etc., shall receive surface preparation, prime coating, and finish coating in the factory prior to shipment in accordance with applicable requirements of Section 09 90 00 Coatings. Furnish 1-gallon container of touch up paint for submersible pumps. Ductile and cast iron, bases, piping and valves shall be shop prepared and primed and field primed and finish coated. CONTRACTOR shall apply second primer coat and finish coat for all items except pumps.

B. Machined, polished, and non-ferrous surfaces shall be coated with corrosion prevention compound.

2.07 ACCEPTABLE PRODUCTS AND MANUFACTURERS

A. Xylem Flygt

B. KSB

C. ABS

PART 3 - EXECUTION

3.01 STARTUP PREPARATION

A. Complete equipment installation with controls, safety devices and auxiliary support systems necessary to start the equipment and verify that the equipment functions correctly under no load conditions. Turn rotating equipment by hand to check. Complete cleaning and testing of piping systems. Inspect and clean equipment, devices, piping, and structures of debris and foreign material.

B. Remove temporary bracing supports and other construction debris that may damage equipment.

C. Remove protective coatings and oils used for protection during shipment and installation.

D. Flush, fill, and grease lubricated systems in accordance with Manufacturer's instructions.

E. Install temporary connections and devices required to fill, operate, checkout and drain the system. Provide temporary valves, gauges, piping, test equipment, and other materials and equipment necessary to conduct testing and startup.

F. Check equipment for correct direction of rotation and freedom of moving parts.

G. Align equipment to Manufacturer's tolerances. Adjust clearances and torques.

H. Check installation prior to start-up for conformance to Manufacturer's instructions.

I. Adjust or modify equipment to ensure proper operation.

J. Correct any deficiencies or problems noted in Manufacturer's representative's installation reports.

3.02 STARTUP AND TRAINING

A. The equipment manufacturer shall furnish a qualified field representative for a minimum of three (3) working days on a minimum of one (1) trip to inspect all equipment described herein after installation, to assist in troubleshooting, to advise the Contractor and Owner during startup and testing.

B. The equipment manufacturer shall furnish a qualified field representative for a minimum of one (1) working day on a minimum of one (1) trip to instruct Owner's personnel in routine maintenance and troubleshooting procedures. The Contractor shall coordinate the scheduling of such training and startup assistance with Owner's personnel. Owner may videotape training.

3.03 FIELD QUALITY CONTROL

A. Verify that structures, pipes, and equipment are compatible.

B. Place each piece of equipment in the system in operation until the entire system is functioning. All components shall continue to operate without alarms or shutdowns, except as intended, for 8 consecutive hours to be considered started up.

C. Operate the equipment through the design performance range consistent with available flows. Adjust, balance, and calibrate and verify that the equipment, safety devices, controls, and process system operate within the design conditions. Each safety device shall be tested for proper setting and signal. Response shall be checked for each equipment item and alarm. Simulation signals may be used to check equipment and alarm responses.

D. Manufacturer’s representative shall:

1. Approve installation before operation.
2. Perform acceptance test and operate system to verify satisfactory operation of each unit in presence of Owner's representative, and provide certified field test reports. Check units for excessive noise, vibration, alignment, general operation, etc.
3. Verify conformance to requirements.
4. Check each pump shutdown from low level float switch lockout.
5. Simulate seal water leakage and motor temperature and check shutdown.
6. Start and stop each pump in Auto mode based on the level in the wet well. Start and stop each pump in manual mode.
7. Instruct plant personnel on operation, care, and maintenance.
8. Revisit job site as often as necessary to correct deficiencies to satisfaction of the Owner's representative.

3.04 FIELD TESTING

A. After initial startup under the supervision of a qualified representative of the pump manufacturer, a preliminary “running-in” period will be provided for the Contractor, per the Contract Documents, to make field tests and necessary adjustments. At the end of the specified period of operation, the pumps will be accepted if, in the opinion of the Engineer, the pumps have operated

satisfactorily without excessive power input, wear, lubrication, or undue attention required for this operation, and if all rotating parts operate without excessive vibration or noise at any operating speed and head, including shutoff.

END OF SECTION

43 41 11 GLASS FUSED BOLTED STEEL TANK

1.00 GENERAL

1.01 SUMMARY

A. Design and furnish a factory glass fused to steel, site erected above ground atmospheric pressure bolt-together steel sludge storage tank, including tank structure and tank appurtenances as shown on the contract drawings and described herein.

1.02 RELATED SECTIONS

A. Site Work per Division 31

B. Concrete per Division 03

C. Piping and Mechanical per Division 33

D. Geotechnical Report

1.03 REFERENCES, CODES AND STANDARDS

A. The materials, design, fabrication and erection of the bolt together tank shall conform to the AWWA Standard for “Factory-Coated Bolted Steel Tanks for Water Storage” ANSI/AWWA D103.

B. Occupational Safety & Health Standards, 29 CFR, Part 1910

C. Texas Commission on Environmental Quality, Chapter 217

1.04 SUBMITTALS

A. Submit as specified in Section 01 33 00.

B. Submittal shall include at a minimum:
   1. Foundation and tank design shall be completed by the manufacturer and sealed by a professional engineer registered in the State of Texas. Foundation and tank design shall consider the recommendations made in the Geotechnical Report.
   2. Shop Drawings: Detailed tank fabrication drawings, system assembly and installation drawings.
   3. Product Data: Specifications for system components, accessories and protective coatings.
   4. Catalog cuts of standard manufactured items:
      a. Piping
      b. Valves
      c. Floor Drain
      d. Level Measurement and Alarm Systems
      e. Roof Vent
      f. Roof Hatch
      g. OSHA approved Access Equipment

h. Lightning Protection
i. Coating

5. Mill test reports for steel plate and structural members.
6. Coatings manufacturer, product data and color samples
7. Cathodic Protection System, if required.
8. Admixtures to be used in concrete and their purpose.
9. Operation and Maintenance Manual: Provide as a single document in digital PDF format prior to delivery.

1.05 QUALITY ASSURANCE

A. The tank supplier shall be a specialist in the design, fabrication, and erection of factory coated bolted steel tanks.

B. Tank manufacturer shall have a current ISO 9001 quality system certification.

1.06 SHIPPING

A. Steel sheets shall be protected from damage prior to packing for shipment.

B. Heavy paper or plastic foam sheets shall be placed between each panel to eliminate sheet-to-sheet abrasion during shipment.

C. Individual stacks of panels will be wrapped in heavy thickness black plastic and steel banded to special wood pallets built to the roll-radius of the tank panels to minimize contact or movement of finished panels during shipment.

1.07 WARRANTY

A. Manufacturer shall provide a two year warranty from the date sludge is first introduced to the tank. As a minimum, this warranty shall provide assurance against defects in material or workmanship for the minimum period specified.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Ground Storage Tank system shall be manufactured by one of the following:
1. CST Storage
2. Permastore

B. Equipment furnished and installed under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with drawings, specifications, engineering data, and instructions and recommendations of the equipment manufacturer unless exceptions are noted by the Engineer.

C. Manufacturer shall have a minimum of ten installations of like or similar application with a minimum of five years' service.

2.02 PROJECT CONDITIONS

A. For storage of wastewater sludge, 0.8 to 2.0-percent solids

B. Dimensions
   1. Minimum Usable Capacity – 150,000 gallons
   2. Diameter – 37 to 39 feet
   3. Maximum Water Depth – 18.2 feet
   4. Maximum Height (not including domed roof) – 22 feet
   5. Design Freeboard – 18-inches
   6. Pipe Connections
      a. Overflow Diameter – 6-inches
      b. Aeration Air Diameter – 6-inches
      c. Waste Activated Sludge (WAS) and Scum Inlet Diameter – 6-inches
      d. Outlet Diameter – 6-inches
      e. Drain Diameter – 6-inches

C. Design Loads
   1. Minimum Roof Live Load: 20 lbs/sq. ft plus two (2) concentrated 250 lb concentrated live loads applied simultaneously on two separate one square foot areas.
   2. Dead, Wind, Ponding, Snow and Wind Loads shall be determined by the Manufacturer in accordance with ASCE/SEI 7-05 for Aubrey, Texas. Minimum wind load shall be based on a wind speed of 100 mph.
   3. Seismic Loads shall be determined by the Manufacturer for Seismic Zone 1, Occupancy Importance Factor = 1.0.

2.03 TANK FOUNDATION AND FLOOR

A. Foundation and floor design shall be based on the recommendations provided in the geotechnical report and the needs of the tank manufacturer.

B. Top of tank foundation shall be a minimum of 6-inches above finished grade.

C. Tank floor to be reinforced concrete with an embedded glass fused steel starter sheet per the manufacturer's design and in accordance with AWWA D103, Sec. 11.4, Type 6

2.04 TANK MATERIALS

A. Plates and Sheets
   1. Plates and sheets used in the construction of the tank shell, tank floor (when supplied) and tank roof (when supplied), shall comply with the following minimum standards.
   2. Design requirements for steel plates and sheets shall be:
      a. Grade 30 – ASTM A1011 - maximum allowable tensile stress 19,800 psi (13,652 N/cm2)
      b. Grade 60 – ASTM A1011 or ASTM A656 - maximum allowable tensile stress 39,600 psi (27,303 N/cm2)
      c. Grade 80 ASTM A656 - maximum allowable tensile stress 52,800 psi (36,405 N/cm2)

B. Rolled Structural Shapes
   1. Material shall conform to minimum standards of ASTM A36, AISI 1010 or ASTM A992.

C. Horizontal Wind Stiffeners

1. Intermediate horizontal wind stiffeners shall be of the “web truss” design with extended tail to create multiple layers of stiffener, permitting wind loads to distribute around tank.
2. Web truss stiffeners shall be of steel with hot dipped galvanized coating.

D. Bolt Fasteners
1. Bolts used in tank lap joints shall have ½” – 13 UNC-2A rolled threads, and shall meet the minimum requirements of AWWA D103, Section 2.2. Bolt material shall conform to the following:
2. Bolt Material
   a. SAE J429 Grade 2 (1” bolt length): Tensile strength 74,000 psi minimum (51,021 N/cm2), Proof load 55,000 psi minimum (37,921 N/cm2), Allowable shear stress 18,163 psi (12,523 N/cm2). Note: SAE J429 Grade 5 may be substituted for SAE J429 Grade 2 for 1” bolts.
   b. SAE J429 Grade 5 (1-1/4” bolt length): Tensile strength 120,000 psi minimum (82,737 N/cm2), Proof load 85,000 psi minimum (58,605 N/cm22), Allowable shear stress 30,000 psi (20,684 N/cm22).
   c. SAE J429 Grade 8/ASTM A490 (> 1-1/4” bolt length) heat treated to: Tensile strength 150,000 psi minimum (103,421 N/cm22), Proof load 120,000 psi minimum (82,737 N/cm2), Allowable shear stress 40,000 psi (27,579 N/cm2).
3. Bolt Finish – Zinc, mechanically deposited, 2.0 mils minimum (50 microns) – under bolt head, on shank and threads.
4. Bolt Head Encapsulation – The entire bolt head up to the splines on the shank shall be encapsulated with high impact polypropylene copolymer. Resin shall be stabilized with an ultraviolet light resistant material. The bolt head encapsulation shall be certified to meet the ANSI/NSF Standard 61 for indirect additives.
5. All bolts on the vertical tank wall shall be installed such that the head portion is located inside the tank, and the washer and nut are on the exterior.
6. All lap joint bolts shall be properly selected such that threaded portions of the bolts will not be exposed to the “shear plane” between tank sheets.
7. Bolt lengths shall be sized to achieve a neat and uniform appearance. Excessive threads extending beyond the nut after torquing will not be permitted.
8. All lap joint bolts shall include a minimum of four (4) splines on the underside of the bolt head at the shank in order to resist rotation during torquing.

E. Sealants
1. The lap joint sealant shall be a one component, moisture cured, polyurethane compound. The sealant shall be suitable for contact with wastewater sludge.
2. The sealant shall be used to seal lap joints and bolt connections and edge fillets for sheet notches and starter sheets. The sealant shall cure to a rubber-like consistency, have excellent adhesion to the glass fused steel, low shrinkage, and be suitable for interior and exterior use.
3. Sealant curing rates, tack-free times and final cure times shall be suitable for tank construction purposes and requirements.

2.05 SIDEWALL STRUCTURE

A. Field erection of the glass-fused, bolted steel tank shall be in strict accordance with the procedures outlined by the manufacturer and performed by an authorized

erector of the tank manufacturer, regularly engaged in erection of these tanks, using factory trained and certified personnel.

B. Specialized erection jacks and building equipment developed and manufactured by the tank manufacturer shall be used to erect the tanks.

C. Particular care shall be taken in handling and bolting of the tank panels and members to avoid abrasion of the coating system. Prior to a liquid test, the Engineer shall visually inspect all surface areas.

D. The placement of sealant on each panel may be inspected prior to placement of adjacent panels. However, the Engineer's inspection shall not relieve the bidder from his responsibility for liquid tightness.

E. No backfill shall be placed against the tank sidewall without prior written approval and design review of the tank manufacturer. Any backfill shall be placed according to the strict instructions of the tank manufacturer.

2.06 COATINGS

A. Coatings shall be in accordance with AWWA D103, Section 12.4. Manufacturer shall be currently listed on NSF website (www.nsf.org) as approved and in full compliance with NSF61 and NSF372 standards.

B. Surface Preparation and Cleaning:

After plate fabrication and prior to application of the glass coating system, all sheets/plates shall be grit-blasted to SSPC SP-10/NACE2 (Near White Metal) on both sides.

C. Coating Application:
1. Glass coatings to be applied by Wet Spraying and must be fused-to-steel by firing in high temperature oven at 1450°F - 1600°F.
2. 3-Coats & 2-Fires Process

D. Dry Film Thickness of the interior and exterior coating should be minimum 12.0 mils and should not exceed 18.0 mils DFT.

E. Tank exterior color shall be the manufacturer standard of Tan.

F. Enamel Coating Characteristics:
1. Acid and alkali resistant: pH range 3-11
2. Hardness: 6.0 (Mohs)
3. Adhesion: 3,450 N/cm

G. Inspections:
1. Holiday testing per AWWA D – 103-09.
   a. The maximum voltage of the meter shall not exceed 67.5 volts for wet testing.
   b. The sponge shall be dipped in plain tap water as required to keep it uniformly damp, not soaked or dry.
2. Visible inspection as well as Holiday Detection Test shall be performed on both sides of the glass coated plates. If any unacceptable pinholes are found

they shall be repaired i.e. coated second time and Holiday Detection Test shall be performed again on the entire panel.

3. If upon completion of Holiday repairs still any unacceptable pinholes are found at least on one side of the panel, the entire plate shall be rejected and substituted with the one that has successfully passed Holiday Testing inspection.
4. All coated sheets shall be inspected for mil thickness (Mikrotest or equal).
5. An electrical leak detection test shall be performed on the inside surface of each panel after fabrication. Every sheet shall be 100% tested for holidays and any sheet with unacceptable discontinuity shall be rejected.

2.07 DOMED ROOF, VENT AND ACCESS HATCH

A. Clear-span aluminum dome roof system – Tank roof shall be provided by tank supplier and shall include an aluminum geodesic dome roof constructed on non-corrugated triangular aluminum panels, which are sealed and firmly clamped in an interlocking manner to a fully triangulated aluminum space truss system of wide flange extrusions, thus forming a dome structure. The dome shall be clear span and designed to be self-supporting from the periphery structure with primary horizontal thrust contained by an integral tension ring. The dome and tank shall be designed to act as an integral unit. The tank shall be designed to support the dome roof including all specified live loads. Materials of construction shall be:

1. Triangulated space truss and tension ring: 6061-T6 aluminum
2. Triangular closure panels: 3003-H16 aluminum sheet
3. Fasteners: 7075-T73 anodized aluminum or series 300 stainless steel
4. Sealant and gaskets: Silicone or neoprene rubber
5. Ancillary items (dormers, doors, vents, hatches, etc.): 6061-T6, 5086-H34 or 3003-H16 aluminum.

B. Roof Vent – A properly sized vent assembly in accordance with AWWA D103 shall be furnished and installed above the maximum water level of sufficient capacity so that at maximum design rate of water fill or withdrawal, the resulting interior pressure or vacuum will not exceed 12 mm (0.5 inches) water column.

1. The overflow pipe shall not be considered to be a tank vent.
2. The vent shall be constructed of aluminum such that the hood can be unbolted and used as a secondary roof access.
3. The vent shall be so designed in construction as to prevent the entrance of birds and/or animals by including an expanded aluminum screen 12 mm (0.5 inch) opening. An insect screen of 23 to 25 mesh polyester monofilament shall be provided and designed to open should the screen become plugged by frost or debris.

C. Roof Hatch – A minimum 30-inch by 30-inch access hatch shall be furnished and installed at the access ladder for level instrument access. Access hatch must be as watertight as possible to exclude surface runoff, debris, bats, insects, birds, and other animals.

1. Access hatch much be lockable to prevent unauthorized access.
2. Hatch lid shall be fitted with a solid watertight cover which extends down around the frame at least 2-inches and have a rubber-type gasket seal to prevent contamination from entering the water system.
3. Access hatch must be framed at least 4” above the surface of the tank roof.

2.08 MISCELLANEOUS COMPONENTS

A. Pipe Connections
   1. Where pipe connections are shown to pass through tank panels, pipe connection shall be field located, saw cut, (acetylene torch cutting or welding is not permitted), and utilize an interior and exterior flange assembly and the tank shell reinforcing shall comply with AWWA D103. A single component urethane sealer shall be applied on any cut panel edges or bolt connections.
   2. No stainless steel piping or appurtanences shall be attached to the tank interior unless electrically isolated from the carbon steel tank materials. The use of stainless steel internal elements is to be eliminated to avoid the potential for tank lining damage caused by cathodic disbonding effects.
   3. Factory lined tanks of modular construction use high strength steel materials. As such, it is typical for larger capacity tanks to exhibit radial expansion during commissioning and operations. Pipework shall be designed to accommodate such radial expansion without causing undue or damaging distortion to the tank.

B. Overflow
   1. Sized to handle the maximum fill rate of 220 gpm.
   2. Discharge to plant drain.
   3. Overflow piping shall be schedule 80 PVC or ductile iron pipe.

C. Outside Tank Ladder
   1. An outside tank ladder shall be furnished and installed as shown on the contract drawings.
   2. Ladders shall be fabricated of aluminum and utilize grooved, skid-resistant rungs.
   3. Step-off platforms shall be fabricated of galvanized steel.

D. Liquid Level Indicator and Transmitter
   1. Liquid level instruments can be floats, an ultrasonic, and/or a pressure gauge calibrated in feet of water.
   2. Local level indicator pressure gauges must not be less than three inches in diameter and calibrated at not more than two-foot intervals.
   3. Liquid level transmitter shall provide input for automatic control of the well water pumps.
   4. Low liquid level float shall provide automatic low water level cutoff to prevent damage to downstream pumps. The service pump circuitry shall also resume pumping automatically once the minimum water level is reached in the tank.

E. Access Doors
   1. Wall access doors shall be manufacturer's standard and located as near to the bottom of the tank as practical, and shall be provided as shown on the contract drawings.
   2. The manway opening shall be 36 inches in diameter.

F. Tank Grounding: Tank grounding shall be direct to ground and not to any facility or plant grid that could induce residual electrical currents into the tank in order to avoid the potential for tank lining damage caused by cathodic disbanding effects.

G. Identification Plate: A manufacturer's nameplate shall list the tank serial number, tank diameter and height, and maximum design capacity. The nameplate shall be

affixed to the tank exterior sidewall at a location approximately 1.5 metres (5 feet) from grade elevation in a position of unobstructed view.

PART 3 EXECUTION

3.01 INSTALLATION

A. General
   1. Do not field bend steel plate.
   2. Field erection of factory coated bolted steel tanks shall be in strict accordance with the tank manufacturers recommendations. Particular care shall be exercised in handling and bolting of the tank plates, supports, and members to avoid abrasion or scratching of the coating.
   3. Touch-up coating shall be done in accordance with the tank manufacturer's recommendations where and as directed.

B. The supplier shall provide all components and assembly instructions to the Contractor for installation.

C. System supplier shall provide start up support to test and instruct project personnel on the supplied components.

3.02 HYDROSTATIC TESTING

A. Following completion of erection and cleaning of the tank, the structure shall be tested for liquid tightness by the tank erector by filling tank to its overflow elevation.

B. The erector in accordance with the manufacturer’s recommendations shall correct any leaks disclosed by this test.

C. Contractor shall furnish water required for testing at the time of tank erection completion. Disposal of test water shall be the responsibility of the Contractor.

D. Labor and equipment necessary for tank testing is to be included in the price of the tank construction.

END OF SECTION

SECTION 43 41 45 FIBERGLASS REINFORCED PLASTIC (FRP) TANKS

PART 1 GENERAL

1.01 SUMMARY

A. Provide all labor, supervision, materials, equipment, and related work required to furnish, install, test, and place in operation one sodium hydroxide storage tank and one coagulant tank as shown on the Drawings and described herein.

B. The work of this section includes, but is not limited to, providing fiberglass reinforced plastic tanks and accessories. All necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in this section or not shall be furnished and installed as required for an installation incorporating the highest standards for this type of service.

C. All equipment provided under this section shall be the product of a single manufacturer.

1.02 REFERENCES

A. Referenced Standards: Design, manufacture, and assembly of elements of the equipment herein specified shall be in accordance with, but not limited to published standards of the following as applicable:
1. Chlorine Institute Pamphlet 94 “Sodium Hydroxide Solution and Potassium Hydroxide Solution (Caustic) Storage Equipment and Piping Systems”
2. ASTM C581 “Standard Practice for Determining Chemical Resistance of Thermoset Resins in Glass Fiber Reinforced Structures Intended for Liquid Storage”.
3. ASTM D2583 “Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor”.
4. ASTM D2563 “Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts”.
5. ASTM D3299 “Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion Resistant Tanks”
6. ASTM D4097 “Standard Specification for Contact-Molded Glass-Fiber-Reinforced Thermoset Resin Corrosion Resistant Tanks”

1.03 SYSTEM DESCRIPTION

A. Design, furnish and install single wall fiberglass reinforced plastic tanks for chemical storage as described in Part 2 of this specification and as shown on the drawings, including all accessories as necessary for a complete and operable system.

1.04 SUBMITTALS

A. Product data: Provide construction details, material descriptions, dimensions of individual components and profiles, and finishes for each component.

B. Shop Drawings: Provide plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Manufacturer and model number of all equipment within this specification, and an itemized list of components being furnished.
   3. Layout drawings and equipment cut sheets showing dimensions, clearances, sizes, arrangement and size of connections, supports, anchors, and total weights of the product.
   4. Detailed specifications and data describing the materials of construction.
   5. Equipment weights and lifting points.

C. Information Submittals:
   1. Materials of construction.
   2. Design calculations.
   3. Manufacturer's Certification of Compliance with this specification.
   4. Special shipping, storage and protection, and handling instructions.
   5. Manufacturer's instructions for installation.
   6. Manufacturer's Certificate of Proper Installation.
   7. Location of nearest stocking distributor of spare parts.
   8. Suggested spare parts list to maintain the equipment in service for a period of one year. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current pricing information.
   9. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
   10. Qualification Data: For manufacturer and manufacturer's representative.
   11. Field quality-control reports.
   12. Warranty certificate

D. Operation and Maintenance Data: Provide operation and maintenance manual in accordance with Section 01 78 23.

1.05 QUALITY ASSURANCE

A. Manufacturers' Qualifications:
   1. All storage systems shall be the product of a manufacturer having at least ten (10) U.S. installations of the type being proposed, each with a minimum of 5 years of satisfactory service.
   2. A list of similar installations shall be furnished with the shop drawing submittal, including names and telephone numbers of contacts.

3. Tank design calculations and drawings shall be sealed by a Professional Engineer Licensed in Texas.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

C. Source Limitations: Equipment units of each type specified in this section shall be supplied by a single manufacturer.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail(s) in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of equipment acceptance of the second tank regardless of date of delivery or installation.
   2. Cost for the removal, shipment, repair and installation by Contractor shall be included in warranty, as well as correction of defective work.

PART 2 PRODUCTS

2.01 DESIGN

A. Manufacturers:
   1. Belco Manufacturing Company
   2. ECS, Inc.
   3. Ershigs, Inc.
   4. Augusta Fiberglass
   5. Diamond Fiberglass
   6. Belding Tank Technologies
   7. Daniel Company

B. Materials
   1. Resin shall be bisphenol-A epoxy vinyl ester resin suitable for the intended service. Submit resin manufacturer’s certification that resin used is suitable for the intended application. Resin shall be
      a. AOC Vipel
      b. Ashland Dekrane
      c. Or approved equal
   2. Structural reinforcement shall consist of chopped strand mat and direct roving using E-Glass with resin.
   3. Minimum interior corrosion barrier:
      a. Hand Layup or Chopped Spray.
      b. C-Glass veil with 90% resin to 10% glass ratio
      c. Double Nexus veil with 90% resin to 10% glass ratio
      d. Minimum corrosion barrier thickness shall be 100 mils.
   4. Exterior laminate shall be a protective gel surface coat with UV inhibitors pigmented to a color selected by Owner.
   5. Embedded materials shall be 316 stainless steel.

C. Curing:
   1. All tanks shall be post cured with indirect heaters or steam. Temperatures and length of curing shall be per resin manufacturer recommendations.
   2. Tanks for sodium hypochlorite service shall have the corrosion liner cured using a BPO/DMA curing system.
   3. All tanks shall utilize a curing system conforming to the resin Manufacturer's recommendations.

D. Common Design Requirements for All Tanks:
   1. The Manufacturer shall be responsible for the basic design of the FRP tanks based on the drawings and specifications, including but not limited to structural design, resin selection, wall thickness, methods and locations of stiffening and support, glass reinforcement selection, and other items not listed herein. Design shall be subject to Engineer's review.
   2. Ambient temperature range: 0 to 110 degrees Fahrenheit.
   3. Vacuum rating: Tanks shall withstand a vacuum load of 3 inches water column.
   4. Configuration: Vertical installation, flat bottom, dish top.
   5. Tanks shall be fully vented to atmosphere and shall have 316 stainless steel mesh insect screens over atmospheric vents. Vent shall be gooseneck and sized by the manufacturer to accommodate truck tank loading and drawdown.
   6. Tanks shall include fittings for overflow oriented to match existing overflows or drains.
   7. Minimum design loads: The following loads shall be accounted for in the tank design, in addition to loads present from the stored material and any other appropriate design loads:
      a. Wind speed: 90 mph
      b. Concentrated live load (roof): 250 lbs
      c. Uniform live load (roof): 100 lbs/square foot
      d. Snow load: 5 lbs/square foot
      e. Seismic Zone: 1
   8. Connections
      a. Connections shall be as indicated on the drawings and as specified herein.
      b. Connections located at the bottom of the tank wall shall be fabricated to fully drain the tank (invert of connection shall match invert of tank floor). Extend connection as needed for flange to clear equipment pad by a minimum of 6 inches.
      c. Flanges shall be dimensioned per ANSI B16.5 Class 150 and shall be rated for minimum 50 psig.
      d. The back face of the flanges shall be spot-faced, flat and parallel to the flange face of sufficient diameter to accept a SAE metal washer under the bolt head or nut.
      e. All tank nozzles 4" and smaller shall be gusseted with either conical type or plate type gussets.

f. Nozzles shall have a 6-inch projection (8-inch for insulated tanks) as measured from the face of the flange to the outside wall of the tank.

g. Shell nozzles shall be mounted radially, perpendicular to the side shell. Top nozzles shall be mounted parallel to the vertical axis of the tank with bolt holes straddling this principle axis. Nozzles shall be finished flush with the inside surface of the tank.

9. Closed top tanks shall be designed with a head knuckle radius of not less than 1.5 inches.

10. Bottom knuckle radius of flat bottom tanks shall be a minimum of 1.5 inches. The reinforcement of the knuckle-radius area shall extend up the vertical wall a minimum of 12 inches.

11. Tank heads with top fittings shall have a factory-applied non-skid coating.

E. Tank Schedule

Chemical Stored	Sodium Hypochlorite	Aluminum Sulfate Coagulant
Location	Chemical Building	Chemical Building
Min. Capacity, gallons	2,000	4,000
Max. Diameter	7’-6”	9’
Chemical Concentration	12.5-percent	48-percent
Specific Gravity	1.2	1.3

F. Accessories

1. Provide a 30 inch diameter hinged and bolted manway on the top of all tanks.

2. Insulation and heating: Not required.

3. Provide taps and connections as shown on the drawings, as indicated herein, and as necessary for a fully functioning tank suitable for the intended purpose. Minimum connections include:

a. 30” manway on top of tank.

b. 6” blind flange located on top of tank

c. 6” vent on top of tank

d. 6” blind flange on top of tank for mounting level indicator

e. Overflow (size as shown on drawings)

f. Tank fill (size as shown on drawings)

g. Tank drain (size as shown on drawings)

h. Process (size as shown on drawings)

i. Provide other connections as shown on the drawings

j. Liquid level sight gauge with shutoff valves.

k. Anchor bolts shall be sized by the Manufacturer and shall be 316SS threaded epoxy anchors. Mounting adapter at tank shall be 316SS.

4. Hardware shall be 316 stainless steel.

5. Provide gaskets for all flanges suitable for the intended chemical service.

6. Provide lifting lugs at four locations around the tank circumference.
7. Provide a sight gauge calibrated in 6-inch increments.
8. Access:
   a. Provide fiberglass reinforced plastic ladders with cages to access top of tank.
   b. Comply with OSHA 1910.21-30 requirements for railings, cages, ladders, and stairs.
9. Equipment Tagging:
   a. Provide a Manufacturer's standard nameplate containing the following items at a minimum:
      1) Facility name
      2) Tank tag number
      3) Vessel name
      4) Manufacturer's name
      5) Fabrication date (month and year)
      6) Chemical stored, including concentration and specific gravity
      7) Maximum design temperature
      8) Design pressure
      9) Capacity in gallons
      10) Resin type
   b. Right to Know Labeling
      1) Provide labels or signs stating "DANGER" and the chemical name on each tank.
      2) Provide a "fire diamond" per NFPA 704 for each tank.

G. Fabrication
   1. Shop assembly – Tank shall be fully fabricated and assembled in the manufacturer's permanent fabrication facility. Field fabrication shall not be permitted.

H. Finishes
   1. Pigmented exterior gel coat white in color.

PART 3 EXECUTION

3.01 INSTALLATION

A. All equipment and accessories shall be installed in accordance with the manufacturer's written recommendations, as approved by the Engineer, and as shown on the Drawings. Mount systems as indicated.

B. Do not begin fabrication or erection prior to submittal approval.

C. The factory certified service representative of tank Manufacturer shall inspect complete installation and provide written certification stating that the installation of the equipment is satisfactory. The certification must also

indicate the equipment is ready for operation and that the operating personnel have been suitably instructed in the operation of the system.

3.02 FIELD INSPECTION AND PERFORMANCE TESTING

A. Functional Test: Prior to start-up, all equipment shall be inspected by the manufacturer for proper alignment, proper connection and satisfactory performance.

B. After completion of installation, the tanks shall be filled with water to the top and allowed to stand full for a period of not less than 48 hours. During testing, flanged connections may be plugged by the installation of temporary blind flanges on the outside of the tank but shall not be blocked or plugged on the inside. All leaks or indications of leaks shall be repaired by the tank manufacturer and made completely watertight. A leaking tank, upon repair, shall be re-tested to satisfaction of the Engineer.

C. Upon written certification from the tank certified service engineer that the equipment is approved for start-up, the system shall be placed into service in the presence of the Owner's Representative.

D. If the system performance does not meet the Specifications, corrective measures shall be taken to satisfy the conditions specified.

E. Once the system is in operation and performing as specified, a 48 hour operating period will be required; with no interruptions of the equipment; before Owner acceptance and warranty initiation.

F. Any component parts which are damaged as a result of this testing or which fail to meet the requirements of these specifications shall be replaced, reinstalled and retested at the Contractor's expense.

G. Owner shall provide the initial tank filling of chemicals.

END OF SECTION

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46 21 16 RAKE BAR SCREENS AND WASHER COMPACTORS

1.00 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Self-cleaning bar multi-rake unit with washer/compactor unit and control panels, two systems, one in each channel.
   2. Screens, washer/compactors, and controls shall be supplied through a single Manufacturer to insure compatibility.

B. Contractor shall coordinate all details of the equipment with other related parts of the work and shall verify that all structures, piping, wiring, and equipment components are compatible. Contractor shall be responsible for all structural and other alterations required to accommodate equipment differing in dimensions, weight, or other characteristics from these specifications and drawings.

C. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

A. National Electric Manufacturers Association (NEMA):
   1. 250 – Enclosures for Electrical Equipment (1000 V Maximum).

1.03 DEFINITIONS

A. NEMA Type 4X enclosure in accordance with NEMA 250.

1.04 SYSTEM DESCRIPTION

A. Screening system: Automatic screen, washer/compactor, piping, control panels, and all equipment necessary for controlling the equipment.

B. Each screening system furnished shall capture and remove debris from the raw influent. Each screen shall transport the screenings up and discharge the screenings into a washer/compactor. The screened solids shall be washed and agitated within the washer/compactor to liquefy and remove organic matter from the screenings. The screens shall then be compacted through the screw compactor and removed through a discharge conveyance pipe into a discharge chute.

C. Screening structure/tank, covers and supports shall be 304/304L stainless steel.
   1. Materials:
      a. All fabricated metal shall be ANSI/AISI Type 304L stainless steel. All hardware shall be type 316 stainless steel. Anchor bolts shall be 316 stainless steel epoxy anchors.

b. Welding shall be performed in accordance with AWS D1.1; field welding of stainless steel is not allowed.

2. Two screen channels shall be provided. Each channel to convey over 9 MGD.

D. Screen shall be sized as follows based on 35 percent blinded screen:
1. Type: Multi-rake
2. Average Daily Flow: 1.125 mgd (per screen).
3. Maximum Peak Flow: 9 mgd (per screen).
4. Channel Width: 3’-0”.
5. Channel Depth: 12.0 feet.
6. Bar Spacing: 0.25 inch.
7. Maximum allowed headloss is 8 inches at 35-% blinding.

E. Washer/Compactor shall be sized as follows:
1. Minimum capacity: 70 cubic feet / hour.
2. Dry solids content: 30% to 40%.
3. Weight reduction: 70%
4. Each Screen shall be served with a Washer/Compactor. Provide a discharge chute downstream of each screen into the washer/compactor.

1.05 SUBMITTALS

A. Submit product data and shop drawings, operation and maintenance manuals, and test reports as specified in Section 01 33 00, and as detailed in this Section.

B. Product data and shop drawings:
1. Shop drawings shall consist of a cover sheet indicating the drawing number and specification page and number to which referenced, intended use and data summary, outline drawings, cut-away drawings, parts lists, material specification lists, and all information required to substantiate that the proposed equipment meets the specifications.
   a. Shop drawings submittals will not be considered complete if cut-away or assembly drawings with part and material specification lists are not included.
2. General arrangement drawings showing the complete assembly, part number, and material list.
3. Applicable bid specification section with comments on conformance and deviations on each paragraph.
4. Detailed drawings:
   a. Screen.
   b. Washer/compactor.
   c. Certified motor data sheets.
   d. Gear reducers.
   e. Shop primer and coating data.
   f. Control system data, schematics, and wiring diagrams.
   g. Spare parts lists.
   h. Equipment weights
   i. Training course outlines.
   j. Manufacturer’s experience and reference list as specified in Article “Quality Assurance.”

C. Manufacturer's installation instructions including anchor bolt layouts and details, support details, and other drawings required for proper installation.

D. Reference list: Include the following information as a minimum:
   1. Name and location of installation.
   2. Name and telephone number of the person in direct responsible charge of the equipment.
   3. Month and year the equipment was placed in operation.
   4. Size of equipment.
   5. Number of units installed.
   6. Service.

E. Operation and maintenance manuals:
   1. Operation and maintenance manual submittals shall be complete in one comprehensive submittal.
      a. Individual submittals for components of the system will not be accepted for review.
   2. Submit operation and maintenance manuals as specified in Section 01 78 23.
      a. Start-up of the system will not be permitted until operation and maintenance manuals have been submitted and approved by the Engineer.
      b. The submittal shall include the following:
         1) Operation and maintenance instruction bulletins for each equipment item.
         2) Complete parts list.
         3) Schematic, physical wiring diagrams, and any as-built field modifications.

F. Certificates: Manufacturer's certification that the equipment was installed in accordance with the manufacturer's instructions, inspected by the manufacturer, serviced with the proper lubricants, and equipped with applicable safety equipment and controls.

G. Technician's qualifications resume: Submit resume of technician to perform Manufacturers Field Service.

1.06 QUALITY ASSURANCE

A. Experience: The manufacturer of the equipment specified in this Section shall have completed and made operational not less than 10 separate installations of screen and washer/compactor units of similar size and specified type in the United States, with those units being made operational not less than one year prior to the bid opening date of this project.

1.07 PROJECT CONDITIONS

A. Environmental Conditions:
   1. All equipment including controls and drives specified herein shall be specifically designed for this service and the environment encountered in this installation.
   2. When installed in wastewater treatment areas, the environment will be moist, and corrosive, exhibiting hydrogen sulfide and other corrosive gases encountered in municipal wastewater treatment plants.

3. Designed and capable of operation at ambient temperatures of 0 degrees Fahrenheit to 110 degrees Fahrenheit.
4. Manufacturer or Contractor shall furnish heat tracing, insulation and jacketing. Insulation alone shall not be sufficient to fulfill freeze protection provisions of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Individual equipment shall be delivered to the site fully assembled (shipping requirements may require minor disassembly).

B. The units shall be capable of being set in place and field erected by the Contractor with minimal field assembly.

C. Preparation for shipment:
1. All materials shall be suitably packaged and braced to protect against damage during transit, handling, and unloading.
2. Manufacturer shall package equipment, be responsible for, and make good, any and all damage until the equipment is delivered to the job site.
3. Accessories shall be packaged separately in containers clearly marked "ACCESSORIES ONLY."
4. A packing list, listing the contents of each container, shall be placed in a moisture-proof envelope and securely fastened to the outside of the container.
5. Provide written storage procedures for all equipment.

D. Delivery to job site: Manufacturer shall fabricate and deliver materials to the job site in conformance with the Contractor's construction schedule to minimize handling and on-site storage of equipment.

E. Storage and protection:
1. Protect the system components at the site and during installation prior to project completion.
2. As a minimum, provide cover, ventilation, and proper stacking to prevent warping of any equipment stored on-site.

1.09 WARRANTY

A. Provide a warranty and warranty certificate for a two-year period beginning on the date the equipment is accepted by the Owner. Cost for removal, shipment, repair, and installation shall be included in the warranty.

1.10 MAINTENANCE

A. Spare parts: Furnish the following spare parts suitably packaged and marked. Include a price list and name, address, and telephone number of local supplier:
1. Screen:
a. Two (2) wipers for scraper for each screen, four total
b. Two (2) proximity switches for each screen, four total
2. Washer/compactor:
a. Six (6) Guide bars for each washer/compactor, 12 total
b. One (1) Cleaning brush for each screen, two total
c. One (1) Solenoid valve rebuild kit for each screen, two total

B. Special tools: Provide the following special tools:
   1. Tools required to assemble, dissemble, repair, and maintain equipment, and that have been specifically made for use on the equipment.
   2. Necessary eyebolts, hooks, and rods for handling equipment parts.
   3. List of tools with the maintenance and operation data describing the uses of the tools.

2.00 PRODUCTS

2.01 SCREENING EQUIPMENT

A. All equipment components of the screening equipment including the multi-rake screen, washer/compactor, electrical controls, and overload devices and alarms, shall be furnished by the same manufacturer. Exercise care to assure that the electrical, mechanical, structural, and miscellaneous systems comply with the requirements specified in this Section or in other referenced sections.

B. Basis of design: Costs to redesign any facilities to accommodate selected system shall paid by the Contractor or Manufacturer.

C. Manufacturers: One of the following:
   1. Screens:
      a. Huber Technology, Inc.
      b. Vulcan Industries
      c. Duperon
      d. Headworks

   2. Washer/compactors:
      a. Huber Technology, Inc.
      b. Vulcan Industries
      c. Duperon
      d. Headworks

D. Listing of a manufacturer does not in any way indicate that the manufacturer's standard equipment model meets the specification.
   1. Listing a manufacturer does not relieve the manufacturer of meeting all the requirements of the specifications.

E. All components shall be so designed that jamming at any point will not result in structural failure but will cause the drive motor to stall. All components, including the gear reducer, shall be designed to withstand, without damage or permanent distortion, the full stalling torque of the drive motor and/or the maximum differential head at any channel water depth.

2.02 MATERIALS

A. For all components, unless otherwise specified, use the materials of construction specified below:
   1. Screen including sole plate, slewing bracket unit, blade cross pieces, grit flap, drive console, discharge chute, and cover shall be manufactured in Type 304 stainless steel.

2. Washer/compactor including wash press body, screw, feed hopper, trough, and discharge pipe shall be manufactured in Type 304 stainless steel.
3. Carbon or allow steels are not acceptable.

2.03 SCREEN

A. Design:
1. Each furnished screen shall screen influent raw sewage to separate solid and semi-solid debris and floating material from the influent flow.
2. The travel speed of the multi-rakes shall be between 10 and 40 feet per minute.

B. Materials:

Frame, Deadplate, Chain Guides & Discharge Chute	304L Stainless Steel
Screening Bars & Rakes	304L Stainless Steel
Screen Covers	304L Stainless Steel
Drive Chain Links	316L Stainless Steel
Drive Chain Pins & Bushings	AISI-431 Stainless Steel
Drive Chain Rollers	Polyamide
Drive Shaft & Sprockets	304L Stainless Steel
Wiper Blade	Polyethylene
Channel Seals	EPDM

1. Screen shall be manufactured from shapes (rods, angles, and channels), pipes, and sheets from stainless steel material as noted in the table above.
2. Screen shall be manufactured in a stainless steel only factory to prevent contamination of the stainless steel with rusty dust.
3. All stainless steel components and structures shall be submersed in a chemical bath of nitric acid and hydrofluoric acid (pickling bath) to remove any residues that may be present on the material as a result of forming, manufacture, or handling. After removal from the pickling bath, the equipment must be washed with a high-pressure wash of cold water to remove any remaining surface debris and promote the formation of an oxidized passive layer which is critical to the long life of the stainless steel. Sand blasting, bead blasting, spray pickling or hand pickling of stainless steel surfaces shall not be acceptable
4. Upper sprocket bearings shall have a paint coated cast iron casing and include ball bearings with grease nipples that are double-sealed with Nilos rings.

C. CONSTRUCTION
1. Screen shall remove debris (screenings) from the incoming wastewater by means of a positively cleaned bar rack that is installed within a concrete channel. The screen shall retain debris at the bar rack. A multitude of rake blades shall remove and lift the debris to a discharge mechanism. The bar rack shall be cleaned by a series of rakes engaging the bar rack and continuously engaging within the screening bars while moving along the entire bar rack length. The debris shall be lifted above the channel and dropped on a discharge chute at the downstream side (back) of the screen. Screens with single rakes shall not be approved. Screens employing brushes and spray water for screenings removal shall not be approved.

2. The bar rack shall consist of equally spaced bars that are inclined from the horizontal with the inclination angle specified above. The lower ends of the bars shall be provided with a minimum 10/64” (4 mm) thick curved base plate such that the rakes positively remove all screenings from the bottom of the bar rack. Bars shall have a teardrop (up to a bar spacing of ½ inch or 12 mm) cross section. Teardrop bars shall have a width of 5/16” (8 mm), a depth of minimum 2.4” (60 mm) and a tail width of 13/64" (5mm). Round, tear-shape, rectangular or trapezoidal bar shapes will not be acceptable. The bar rack shall be made up of equally sized sections securely fastened to the frame of the screen and be readily removable. Screens without the ability to replace bar screen sections will not be acceptable.
3. A frame shall be provided supporting all required loads. Side frames shall be made of 10/64 inch (4 mm) thick stainless steel plates with a minimum of four axial edges. The side frames shall be connected with each other through channels having a minimum thickness of 10/64 inch (4 mm) and a minimum cross section of 4-1/4 inch x 2 inch (108 x 49 mm). The shell frames shall be connected to extended support brackets to reach the side channel walls. The support brackets shall be securely anchored onto the operating floor.
4. The bar screen shall be provided with a dead plate extending from the bar rack to the discharge chute. The dead plate shall be made of 10/64 inch or 4 mm thick stainless steel plate and shall be stiffened by structural members so that it is flat without undulation so that the tips of the rake’s teeth ride at a distance between 5/64 and 10.64 inch (1 to 2 mm) over the dead plate. The dead plate shall be securely fastened to the side frames.
5. A discharge chute shall be provided that fully encloses the discharge section of the screen. An access hatch with hinges and a handle shall be provided in the chute permitting easy access. The discharge chute shall be mounted to direct screenings into the appropriate receiving container or conveyor. The chute shall have a slope of minimum 60 degrees. The discharge chute shall be made of a minimum 2.5 mm thick stainless steel plate.
6. Each side frame shall include separate roller tracks to guide the rakes. The roller tracks shall be bolted to the frame so that they can easily be replaced. The roller tracks shall be made of minimum 10/64 inch (4 mm) thick L-profiles.
7. Drive chains for the rakes shall be roller type. Each chain shall be rated for a maximum load of 56,000N (12,589lbs.f) Drive chains, chain guides, sprockets and their bearings shall be replaceable without the need for removing the screen from the channel. Chain pitch shall be no less than 6-5/16 inch (160mm). Screens utilizing drive chains constructed from alternative materials will not be acceptable for this project due to the corrosive nature of wastewater.
8. Chain rollers shall have a diameter of 2-3/8 inch (60 mm) and shall be a minimum of 1-1/4 inch (32 mm) wide.
9. Each screen shall be provided with two upper sprockets with a reference diameter of 17-3/8 inch (442 mm). The sprockets shall be split to facilitate maintenance. The sprockets shall be constructed from solid stainless steel plates. Screen designs that utilize sprockets constructing of differing materials will not be acceptable for this project.
10. Upper bearings shall be flange bearings, and shall be provided with grease nipples for easy lubrication. The bearings shall be designed for use with biodegradable grease. Their diameter shall be a minimum of 2 inch (50mm). The casing shall be made of paint coated cast iron.

11. Lower bearings shall be slide bearings in a stainless steel casing. They shall include white cast iron shafts and silicon carbide slide bushings with a length of 2” (50 mm) and an internal diameter of minimum 2-5/16” (59 mm). Bearings employing slide bushings made of plastic material shall not be accepted. Screen designs that utilize guide tracks or shoes will not be acceptable for this project.
12. Rakes shall include rake bars made of ¼” (6 mm) thick channel profile having a cross section of 4-1/4” x 2-3/8” (105 x 60 mm). Rake blades with a thickness of 5/8” (15 mm) and a depth of minimum 6-1/2” (170 mm) shall be bolted on the rake bars. The rake blades shall have teeth matching and engaging the bars of the bar rack. The rake blades shall each consist of several pieces with teeth such that only one of the pieces needs to be replaced in case that a tooth should be damaged.
13. A pivoting scraper mechanism shall be positioned at the point of discharge and shall be attached to the shell frames. The scraper shall clean the rake on each pass and return to its rest position with minimal shock. The scraper shall be designed such that screenings do not wrap around the rake or scraper. The scraper shall be provided with a scraper bar made 10/64 inch (4 mm) thick channel profile with a minimum cross section of 1-1/2 inch x 2-11/16 inch (39 x 68 mm) and an adjustable 3/8 inch (10 mm) thick blade. The scraper shall be connected with the frame through a pair of minimum 20 inch (500 mm) long scraper arms that shall be made of 10/64 inch (4 mm) thick channel profile with a minimum cross section of 2-3/4 inch x 2-3/8 inch (68 x 59 mm). A pair of shock absorber elements made of EPDM shall be provided.
14. The drive shaft shall be hollow and have a diameter of minimum 3-1/8 inch (80mm) and a wall thickness of minimum 13/64 inch (5 mm). Solid drive shafts shall not be accepted.
15. The drive-mounted rocker arm assembly shall consist of a drive unit mounted to a stainless steel arm. The stainless steel arm will be held in place by a flanged roller bearing connected to the drive shaft and two heavy duty tension springs. The flange bearing shall be connected to the rocker arm by four bolts. The rocker arm position shall be maintained in the standard operating position by the two tension springs. An intrinsically safe proximity switch shall indicate the position.
16. The drive unit shall be designed for continuous service and intermittent spray water contact.
17. The bevel gear reducer shall be a totally enclosed unit. Gear reducer shall have ball or roller bearings throughout with all moving parts immersed in oil. Gear reducers which require periodic disassembly of the unit and manual re-greasing of bearings are not acceptable. The nominal input power rating of the gear reducer shall be at least equal to the nominal horsepower of the drive motor. Gear reducer shall be designed and manufactured in compliance with applicable AGMA or equivalent standards. During continuous operation the oil temperature shall not exceed 200 degrees F (95 degrees C).
18. The multi-rake assembly shall be driven by an electric motor. The motor shall be UL rated for operation in Class 1 Division 1 environment. The motor shall be inverter duty rated, 460 Volts, 60 Hz, 3-phase. The motor shall be rated for operation in a 104 degree F (40 degree C) environment.
19. Covering system:
    a. The screen shall be fully enclosed with a covering system so that odors are retained within the system.

1) Removable covers or doors shall be provided for servicing and inspection.

b. Removable covers shall be a minimum of 1.5 mm thick Type 304 stainless steel with engineered bends on all sides to prevent deflection.

1) Covers shall be attached to the screen with a 1/4 turn latching mechanism. Covers bolted directly to the frame shall not be allowed.

20. Lifting lugs:

a. Sized by manufacturer to support the full weight of a fouled screen.

b. Located at positions for service in the channel or detached and removed from the channel.

2.04 WASHER/COMPACTOR

A. Design:

1. Each washer/compactor shall consist of a screenings feed hopper, a washing chamber, a preliminary compaction zone, a main compaction zone, a drive unit, a discharge conveyance pipe, and controls.
2. The unit shall wash the screenings to remove fecal matter and reduce the water content of the screenings using a pressing action.
   a. The screenings shall fall from the fine screen discharge transferring the screenings by gravity into the unit's feed hopper within which the screenings are conveyed by screw conveyor to the preliminary compaction zone.
   b. Within the preliminary compaction zone, the fecal material shall be crushed.
   c. From the preliminary compaction zone the screenings shall be conveyed into the washing chamber, within which wash water is fed and discharged into the screenings.
   d. Following the washing chamber, the screenings shall pass into the main compaction zone where dewatering and compaction of the screenings shall take place.
   e. From this zone, the screenings shall then be conveyed to the discharge conveyance pipe.
   f. The discharge conveyance pipe shall transport the washed and compacted screenings plug upward to the degree of being able to be discharged into a stainless steel discharge chute as indicated on the Drawings.
   g. Water expelled from the screenings by the washer/compactor shall drain through a substantially sized drainage holes in the bottom of the press chamber.
   h. Said drainage water shall be piped for gravity drainage from the washer/compactor to a drainpipe as indicated on the Drawings.
   i. Wear bars/Guide bars shall be provided at the end of the compactor to assist in screenings rotation. These guide bars should be bolted to the compactor, and replaceable. Cantilever screw designs with externally mounted thrust bearings are also acceptable.
3. The discharge conveyance pipe shall be stainless steel and provided with supports to support the weight of a fully loaded discharge conveyance pipe. Provide a flexible canvas chute to convey screenings from the tube discharge to the container.
4. The washer/compactor unit shall have continuous screenings washing capacity of not less than 70 cubic feet per hour of wet screenings.

5. The drive unit shall be a minimum 5.0 horsepower Premium Efficiency 460 volt, 3 phase, 60-Hertz motor, having a maximum nominal speed of 1,800 revolutions per minute as specified in Division 26.
    a. The drive unit shall be approved for use in a Class I, Division 1, Group D environment.
6. The unit shall be provided with a suitable number of connections for injecting wash water into the unit.
    a. The unit shall be designed to accept wash water from the facility's non-potable plant water system, which is sourced from filtered plant effluent.
    b. Wash water connections shall be sized and positioned by the unit manufacturer.
    c. Maximum water consumption for the unit shall be 20 gallons per minute.
    d. Water pressure required at the connection to the unit for proper unit operation shall be 60 to 90 psi. Provide a pressure reducing valve as needed for proper operation.
7. The main wash water supply line to the wash and press unit shall be provided with a strainer (100 micron or smaller).
8. The washer/compactor shall be equipped with lifting lugs sized by the Manufacturer to support the weight of a fully loaded unit.
9. Mounting legs shall be attached to the washer/compactor and anchored to the equipment pad/floor with epoxy anchor bolts sized by the manufacturer.
10. Wash water manifold and valves shall be located in a manufacturer provided 304SS enclosure, heat traced and insulated.

2.05 SCREENINGS BAGGER UNIT

A. A Paxxo Longofill continuous bagging system shall be provided to abate odors and to seal dewatered screenings to prevent any direct contact. The discharge bagging system shall provide a clean, odor-free means of collecting and containing the material discharged from the screenings equipment.

B. The bagging system components shall be attached to the screenings discharge. An accordion-folded plastic Paxxo Longopac cassette bag shall be fitted to the end of the bagging system and will collect any discharged material. The end of the cassette bag will be tied in a knot. When the operator decides that the cassette bag is full, the cassette bag shall be cut and the exposed ends tied in knots.

C. A Longofill stainless steel adapter flange and a Paxxo Longofill ABS plastic cassette bag holder shall be utilized to mount for the screenings discharge. The adapter flange shall be fitted to the discharge chute such that it is positioned as close to horizontal as possible. The plastic holder shall be attached to the stainless steel adapter and shall hold the continuous cassette bag.

D. The adapter flange shall be stainless steel. The holder shall be of ABS plastic and shall consist of two parts, a tube and brim, which shall be held together by a stainless steel ring. The cassette bag shall be 230 ft (70m) long, non-porous, three-ply, co-extruded polyethylene with a thickness not to exceed 1.8 mils and a dart drop of not less than 1.81 lbs (820 g).

2.06 FULL OUTDOOR WEATHER PROTECTION

A. The screenings discharge tube, wash water manifold, drain pan and inlet hopper shall be furnished with a heat tracing system for outdoor weather protection. The

outdoor weather protection system shall include (Class I, Division 2) self-regulating heat tracing, adjustable thermostat, insulation, and a protective jacket.

B. The heat tracing system shall be suitable for operation down to a minimum temperature of -13 deg F (-25 deg C) and shall be powered from the main control panel.

C. Outdoor insulation protection shall have a minimum thickness of 2 inches and shall have weather and UV resistant cover protection.

2.07 CONTROL SYSTEM

A. Provide a complete fully functional control system for operation of each screen and associated washing compactor.
   1. Both control systems shall be a self-contained package containing a Manufacturer's provided control panel, Type 316L stainless steel NEMA 4X local control station, and all necessary equipment and instrumentation required for the Screen and Washer/Compactor operation.
   2. Two control panels, one for each Screen and associated Washer/Compactor shall be provided.
   3. Comply with the requirements of Divisions 26 and 40 of the specifications.
   4. Control panels shall carry a UL label certifying the assembled industrial control panel complies with UL 508.
   5. Vendor control panels shall be located on top of the headworks structure.
   6. Control panels shall be completely prewired and factory tested for proper operation prior to shipment.
   7. Controls and instruments shall fail into a safe condition.
   8. Design controls such that the equipment cannot operate unless controls are energized.
   9. Provide I/O list of parameters to be monitored through interface with register assignments and engineering units. Provide communications with plant SCADA system via Modbus TCP/IP, with protocol gateway, if needed.
   10. Provide separate alarm and emergency shutdown functions.

B. Panel enclosure:
   1. NEMA 4X rated Type 316 stainless steel with a hinged door for front access as specified in Division 40.
   2. Power systems:
      a. Power supply to panel: 480 volt, 60 hertz, 3-phase.
      b. Provide main power disconnect interlocked to the enclosure door.
      c. Provide surge protection device.
      d. Provide duplex GFCI protected, 120 volt, 60 hertz, 1-phase receptacle.
   3. Starters per requirements of Division 26.
   4. Wiring:
      a. Factory assemble and wire the control panel such that field wiring shall consist only of connections to terminals.
      b. Identify each end of each wire by a unique wire number printed on a heat shrunk sleeve marker.

C. Screen Controls
   1. General: Each screen removes particulate matter from the raw wastewater through the use of closely spaced bars. Upon signal to operate in an automatic

mode, the rakes shall begin transporting the captured solids upward on the screen. Screen operation shall continue for a preset, adjustable time interval.

2. The screen shall be operable by each of the following methods:
   a. Automatic: Intermittent operation based on a timer and the water level.
   b. Manual: Continuous operation when on.
3. Provide a fully adjustable recycle timer capable of automatically cycling the screen on and off.
4. Provide a level control system to provide automatic screen operation based on head loss through the screen.
   a. System shall include a Siemens Milltronics HydroRanger 200 with two ultrasonic transducers to sense differential level across the screens.
   b. Mount one transducer upstream and one downstream of each screen in each channel.
   c. When the high level is reached, the screen shall begin operating and shall continue to operate until the head loss is reduced to the normal level. High head loss shall initiate screen operation regardless of the timer position. Timers shall be automatically reset when screen operation is initiated by the ultrasonic level controller. The level transducers shall be mounted on a stainless steel channel cover plate and all hardware shall be stainless steel.
5. Each screen shall be factory-equipped with a 316SS junction terminal box containing terminals for connection of three phase power from the motor starter, control power supply, and "home position" proximity switch.
   a. The current (torque) overload protection device shall be mounted in the control panel to cause the motor starter to be automatically de-energized upon current overload. If a blockage occurs, causing motor overload, the screen shall automatically shut down and illuminate a red alarm light at the control panel. The control panel shall be equipped with a manual reset button.
   b. Provide an adjustable pulse counter/controller to count the number of rotations ("pulses"). This will be used to control the screenings press operation (i.e. the press will begin to operate after an adjustable, preset number of pulses). The pulse counter shall be adjustable from the control panel. Provide a contact or proximity switch to interface between the pulse counter and control panel.
   c. Provide "Hand-Off-Auto" selector switch for the screen.
      1) "Hand" position shall allow a user to start the fine screen.
      2) "Off" position shall turn off the screen.
      3) "Auto" position shall provide automatic operation. Operation shall begin when the timer cycle is initiated or when the predetermined head loss is exceeded, whichever occurs first. Operation shall continue until the timer cycle times out.

D. Washer/Compactor Controls
   1. General: Each wash press operation shall be controlled by its screen revolution counter, which is field adjustable. Each revolution represents a given volume of solids dumped into the wash press. After a preprogrammed number of screen revolutions, the wash press shall operate and convey screenings into the compacting cylinder. The wash press shall wash, dewater, and convey the screenings into the discharge conveying pipe until the slug drops into the disposal container.
   2. The press shall be operable by each of the following methods:

a. Automatic: Intermittent operation based on the number of fine screen pulses and a recycle timer.
b. Manual: Start/stop operation.

3. Automatic operation shall be controlled using the fine screen pulse counter. The press shall begin operating after a preset number of screen pulses, which is representative of a given volume of solids discharged to the press inlet chute. The number of pulses shall be adjustable and set at the control panel.
4. Provide mushroom head emergency stop pushbutton. Provide a Hand-Off-Auto selector switch at the control panel.
   a. Each emergency stop pushbutton shall immediately turn off the screen and wash press.
   b. "Hand" position shall allow a user to start the wash press.
   c. “Off” position shall turn off the wash press.
   d. "Auto" position shall provide intermittent, automatic operation based on a signal from the fine screen pulse counter or recycle timer.
   e. Forward-reverse switch shall be provided to reverse the wash press if required to clear a jam.

E. Manufacturer shall provide a normally open dry contacts for run status and alarms to SCADA:
1. For each screen:
   a. Power on
   b. Screen motor running
   c. Ascending/descending high torque alarm
   d. Motor starter overload alarm
   e. High motor temperature alarm
   f. Common alarm
2. For the washer/compactor:
   a. Power on
   b. Motor running
   c. Motor torque alarm
   d. Motor starter overload alarm
   e. Common alarm

3.00 EXECUTION

3.01 INSTALLATION

A. Installation of equipment specified shall be in accordance with the contract documents and requirements of the manufacturer’s written instructions and shop drawings.

B. It is the Contractor’s responsibility to verify the accuracy of all necessary dimensions in the field to ensure compatibility with the specifications and equipment.

C. Route non-potable water piping to each wash water connection and provide a true union shut-off ball valve upstream of each individual connection.

D. Route spent wash water piping from the unit to the plant drain system.
1. Size of spent wash water drainage piping and their connections to the unit shall be as recommended by the unit manufacturer.

3.02 FIELD QUALITY CONTROL

A. Testing, training, and start-up: As specified in Section 01 75 00 and the following requirements below.

B. Tests:
   1. General: Conduct tests in presence of the Engineer.
   2. Upon completion of installation by the Contractor and certification of proper installation of the equipment by the Manufacturer's factor employed service technician, the equipment shall be functionally tested under supervision of Contractor and Manufacturer's factory employed service technician for a minimum of 8 hours to ensure that all clearances, vibration, tracking, and motor operating characteristics are within acceptable limits.

C. Required results:
   1. In the event a screen and/or washer/compactor fail to meet field quality control test requirements of this Section, make necessary changes and retest.
   2. If screen and washer/compactor remain unable to meet test requirements to satisfaction of the Engineer, remove and replace such equipment with satisfactory equipment at no additional cost.

D. Manufacturer's field service:
   1. Contractor to coordinate field service work with the manufacturer's service representative, Owner, and Engineer prior to initiating such work.
   2. Manufacturer's service representative:
      a. Manufacturer is to furnish services of representative experienced in erection and operation of screens and washer/compactors.
      b. Period of services: The manufacturer shall include in his bid a minimum of five 8-hour days and 2 trips.
         1) The specified durations are the minimum time on the job site and do not include travel time.
      c. Services are to include the following:
         1) Installation consultation and advice.
         2) Final inspection and adjustment prior to testing.
         3) Supervision of testing.
         4) Instruction of personnel on operation and maintenance of equipment as specified in Section 01 75 00.

END OF SECTION

46 23 23 VORTEX GRIT REMOVAL SYSTEM AND CLASSIFIER

1.00 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Vortex grit removal unit with support structure.
   2. Grit dewatering unit / classifier.
   3. Control panel.
   4. Services for design, installation, installation supervision, equipment checkout, commissioning, startup, testing and operator training.

B. All equipment specified in this section shall be supplied by a single manufacturer.

C. Related Sections
   1. General Conditions, Supplementary Conditions, and General Requirements sections apply to work of this Section.
   2. 43 21 21.75 Recessed Impeller Pumps
   3. Electrical, instrumentation and controls shall be in accordance with Divisions 26 and 40 of the contract documents.

1.02 REFERENCES

A. American Society of Civil Engineers (ASCE):
   1. ASCE/SEI 7 Minimum Design Loads for Buildings and Other Structures

B. American Institute of Steel Construction (AISC):
   1. ANSI/AISC 360-10 Specification for Structural Steel Buildings
   2. ANSI/AISC 303-10 Code of Standard Practice for Steel Buildings and Bridges

C. American Society for Testing and Materials (ASTM)
   1. ASTM A276 Standard Specification for Stainless Steel Bars and Plates
   2. ASTM A380 Standard Specification for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment and Systems

D. American Welding Society (AWS)
   1. AWS D1.6 Structural Welding Code – Stainless Steel

1.03 SYSTEM DESCRIPTION

A. Design, furnish and install all equipment, instrumentation and controls specified herein or shown on the drawings for a vortex grit collection system with grit removal pumping for wastewater applications. The vortex grit equipment shall be complete with the following equipment: gear motor, drive head, impeller, impeller drive tube, grit chamber, baffles, grit pump, grit washer, supports, anchorages, control panels and all appurtenances necessary for a fully functioning unit.

B. The equipment under this specification shall be provided by a single supplier. These specifications are intended to give a general description of what is required, but do not cover all details that will vary in accordance with the design requirements of the equipment application. It is, however, intended to cover the furnishing, delivery,

installation and field testing of all materials, equipment and all appurtenances necessary to provide a complete functioning.

C. The grit chamber shall be housed in a pre-engineered tank. Manufacturer to provide tank, inlet and outlet channels with connections, and structural supports.

D. Refer to drawings, process and instrumentation diagrams, and other specifications in the contract documents for additional monitoring and control information.

E. All equipment, supports, anchors and fasteners shall be of adequate size and strength to withstand loads associated with starting, turbulence, debris, thrusts from liquid movement, thermal expansion and contraction and other loads encountered under operating conditions. Support and anchor sizes, quantities and locations shall be determined by the equipment manufacturer.

F. All equipment, including control and drives, shall be specifically designed for the service and environment anticipated, including exposure to raw wastewater containing grit and a corrosive atmosphere with hydrogen sulfide concentrations up to 1,000 ppm.

1.04 PERFORMANCE REQUIREMENTS

A. Vortex grit removal shall be designed an peak flow of 9.0 mgd. Flows at time of startup will be 0.5 mgd average and 2.0 peak.

B. The grit removal system shall be engineered to meet the following requirements at up to the maximum grit chamber hydraulic capacity:
   1. Remove 95% of grit greater than 50 mesh in size
   2. Remove 85% of grit greater than 70 mesh in size.
   3. Remove 65% of grit greater than 100 mesh in size

   The efficiency level relates to grit having a specific gravity of 2.65 and to the difference in grit content in the influent channel as compared to that of the effluent in the effluent channel.

1.05 SUBMITTALS

A. Submittal shall be in accordance with Section 01 33 00 Submittals.
   1. Shop drawings, cross sectional drawings, fabrication procedures, and erection drawings showing details of fabrication, construction and erection.
   2. Sealed structural drawings prepared in accordance with applicable design procedures and showing loads developed per ASCE 7. Structural drawings shall be sealed by a Professional Engineer licensed in the State of Texas.
   3. Descriptive literature, bulletins and/or catalog data of equipment, to include the following:
      a. Listing of materials of construction of all components and any coatings used.
      b. Details of drive assembly.
      c. Information for field installation requirements including total equipment weight and weights of sub-assemblies.
         1) Submit total operating weight and foundation reaction loads for review.
      d. Manufacturer's recommended spare parts.

e. A maintenance schedule showing the require maintenance, frequency of maintenance, lubricants and other items required at each regular preventative maintenance period, including all buy out items.
f. Complete data on motors, control panels, electrical, instrumentation and controls in accordance with Divisions 26 and 40.
g. Wiring and control diagrams for power, signal and controls, including terminals and numbers.
h. Any deviations from the specifications.
i. Warranties and service agreements.

B. Complete Operation and Maintenance manuals in accordance with Section 01 78 23.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. All equipment shall be the product of a manufacturer having at least ten (10) U.S. installations of the type being proposed, each with a minimum of 5 years of satisfactory service.
2. A list of similar installations shall be furnished with the shop drawing submittal, including names and telephone numbers of contacts.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

C. Source Limitations: Equipment shall be supplied by a single manufacturer. This does not require that all equipment be manufactured by a single manufacturer but does require that the manufacturer of the system shall be responsible for the complete system.

D. Stainless Steel Construction:
1. Structural stainless steel components shall conform to AISC “Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.”
2. Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel” and AWS D1.6, "Structural Welding Code--Stainless Steel."
3. Fabricate parts and assemblies from sheets and plates of Type 304 stainless steel with 2D finish conforming to AISI 304 and ASTM A666, unless otherwise noted.
4. Fabricate rolled or extruded shapes to conform to ASTM A276.
5. Fabricate tubular products and fittings to conform to ASTM A269, A351 and A403.
6. Factory welding to be by the arc, inert gas, MIG, or TIG method. Add filler wire to all welds to provide for a cross section and weld metal equal to or greater than the parent metal. Fully penetrate butt welds to the interior surface and provide gas shielding to interior and exterior of the joint.
7. Field welding of stainless steel will not be permitted. Equipment and tanks that are shipped in sections shall be bolted together in the field.
8. Bolts, nuts, and washers shall be Type 316 stainless steel in accordance with ASTM A193.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.07 PROJECT CONDITIONS

A. System Arrangement:
   1. The equipment, sizes, materials, and arrangements described in this Specification section are typically based on recommendations by equipment manufacturers and shall be considered minimum limits of acceptability. The equipment manufacturer shall be responsible for design, arrangement, and performance of all equipment supplied under this section.
   2. Modifications to structural design due to a manufacturer's design to fit manufacturer specific requirements shall be coordinated by Contractor and included in the Bid.
   3. The Contractor shall be responsible for any modifications to the piping, electrical, structural, and mechanical layouts to accommodate, as well reimbursement to Owner for additional charges by Engineer for additional work required accomplishing changes.

B. Environmental Conditions:
   1. All equipment including controls and drives specified herein shall be specifically designed for this service and the environment encountered in this installation.
   2. When installed in wastewater treatment areas, the environment will be moist, and corrosive, exhibiting hydrogen sulfide and other corrosive gases encountered in municipal wastewater treatment plants.
   3. Designed and capable of operation at ambient temperatures of 0 degrees Fahrenheit to 110 degrees Fahrenheit.
   4. Furnish heat tracing and insulation as required, if required for exterior installation. Insulation alone shall not be sufficient to fulfill freeze protection provisions of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Preparation for shipment:
   1. All materials shall be suitably packaged and braced to protect against damage during transit, handling, and unloading.
   2. Manufacturer shall package equipment, be responsible for, and make good, any and all damage until the equipment is delivered to the job site.
   3. Accessories shall be packaged separately in containers clearly marked "ACCESSORIES ONLY."
   4. A packing list, listing the contents of each container, shall be placed in a moisture-proof envelope and securely fastened to the outside of the container.
   5. Provide written storage procedures for all equipment.

B. Delivery to job site: Manufacturer shall fabricate and deliver materials to the job site in conformance with the Contractor's construction schedule to minimize handling and on-site storage of equipment.

C. Storage and protection:
   1. Protect the system components at the site and during installation prior to project completion.

2. As a minimum, provide cover, ventilation, and proper stacking to prevent warping of any equipment stored on-site.

1.09 WARRANTY

A. Provide a warranty and warranty certificate for a two-year period beginning on the date the equipment is accepted by the Owner. Cost for removal, shipment, repair, and installation shall be included in the warranty.

1.10 MANUFACTURERS

A. Manufacturers: One of the following or approved equal:
   1. Smith & Loveless
   2. Ovivo Jetta
   3. Lakeside Equipment Corporation
   4. Veolia John Meunier

B. Listing of a manufacturer does not in any way indicate that the manufacturer's standard equipment model meets the specification. Listing a manufacturer does not relieve the manufacturer of meeting all the requirements of the specifications.

2.00 PRODUCTS

2.01 VORTEX GRIT REMOVAL UNIT

A. General
   1. All the equipment specified herein is intended to be standard vortex grit collecting equipment capable of removing grit from raw wastewater and plant recycles. Each vortex unit shall handle all flows up to the hydraulic peak design flow.
   2. The grit collection equipment shall be of the "vortex" or "forced vortex" type, provided with all necessary equipment and accessories. The equipment shall be designed to remove grit from the raw wastewater and plant recycles by means of a variable or factory set pitch propeller or impeller and deposit the grit into a storage chamber. The grit removal chamber shall have inlet and outlet orientations as shown on the drawings.
   3. The settled grit shall be pumped from the grit storage hopper to the grit classifier for washing and dewatering. The grit pump shall be abrasion resistant, non-clog wastewater pumps designed specifically for grit service and located adjacent to the grit storage hopper.
   4. Motors shall meet electrical classification requirement for Class I, Division II Group D motors and shall be in accordance with Division 26 of the Specifications.
   5. Grit units with flat floors shall have a ½ -inch thick 304/304L stainless steel floor plate in the grit chamber. The floor plate shall consist of two removable sections to allow access to the grit storage hopper.
   6. Baffles shall be ¼ -inch thick 304/304L stainless steel furnished to optimize the chamber's hydraulic conditions.

B. Structure and Appurtenances
   1. The grit removal system housing shall be constructed of 304/304L stainless steel with minimum 10-gauge plate. The housing shall be adequately stiffened

to prevent distortion due to the liquid operating loads. Stainless steel support legs shall be provided by the equipment Manufacturer for anchoring to a base slab.

2. The housing shall include inlet and outlet channels as shown on the contract drawings. Stainless steel support legs shall be provided by the equipment Manufacturer for anchoring to a base slab.
3. Grit basin shall be furnished with a platform and bridge to allow plant personnel access to the drive equipment. The access platforms shall consist of 1-1/4-inch aluminum grating and shall be designed to support, in addition to the dead load, a live load of 50 lb/sq ft with deflection not exceeding 1/360 of the span.
4. The vortex grit unit platform and bridge shall be furnished with handrail in accordance with the standard details.
5. Provide a 1-1/2” connection for plant water used for scouring. Provide a solenoid ball valve and controls for automatic operation.
6. Provide controls for automatic operation of 4” plug valve on grit pump suction line. If Manufacturer recommends grit piping high loop for air gap in lieu of valve, provide additional 4” grit piping, supports, heat tracing, insulation and jacketing installed at no cost to Owner.
7. Provide ANSI 125# inlet and outlet flanges to connect to piping shown on the drawings.

2.02 GRIT WASHER/CLASSIFIER

A. Vortex grit unit manufacturer shall supply a grit washer/classifier compatible with the supplied vortex grit unit. The following types of equipment are acceptable:
   1. Cyclone with dewatering screw
   2. Settling tank with dewatering screw
   3. Settling tank with dewatering belt.

B. Common Requirements:
   1. Screw conveyor or belt shall be extended and supported as necessary for the discharge to fall into the nominal center of the 8-ft wide container as shown on the drawings. Conveyor and supports shall not interfere with container placement and provide minimum 6-inches clearance in the horizontal direction and minimum 12-inches clearance in the vertical direction.
   2. Materials of construction shall be 304/304L stainless steel except where abrasion resistant materials are necessary. Areas where abrasion resistance is necessary shall be constructed from NiHard. Hardware (anchors, nuts, bolts, washers, screws and rivets) shall be 316/316L stainless steel.
   3. Provide solid covers over all open water surfaces for odor control purposes.
   4. Motors shall meet electrical classification requirement for Class I, Division II Group D motors and shall be in accordance with Division 26 of the Specifications.
   5. The drive mechanism shall consist of a motor, a helical reduction unit, and an enclosed final reduction unit consisting of one pinion and an integral gear/bearing. All components shall be directly coupled. Units using belts and sheaves or chain and sprockets for gear reduction are not acceptable.

C. Cyclone Units:
   1. Each cyclone shall consist of a fabricated 304/304L stainless steel steel volute feed chamber with cylindrical and conical sections of steel and aluminum to

minimize overhung weight. Each section of the cyclone shall be completely lined and protected from the high velocity grit by a replaceable liner. The cyclone shall be so constructed so any section liner can be replaced independently. The inlet and overflow connections shall be 125 lb. flanges.

2. The cyclone vortex finder shall be made of abrasion-resistant Nihard. A pivot pin and quick disconnect toggle clamps shall be provided between the apex assembly and lower cone section to allow removal of material, which may clog the apex, without disconnecting any piping on the cyclone itself. Each cyclone inlet shall be tapped for a 1.25" NPT gauge connection and a diaphragm-protected pressure gauge shall be provided.
3. The cyclone underflow shall feed into the classifier for washing and dewatering and will be sized so that the proper hydraulic loading is provided to the classifier.
4. The cyclone overflow will feed to piping furnished by the Contractor, which must be adequately vented to prevent siphoning.

D. Settling Tank Units:
1. Provide an integral clarifier constructed of 304/304L stainless steel with sloping walls to the dewatering screw or belt. Clarifier shall be sized and configured by the manufacturer for effective removal of grit.
2. At least three inches of freeboard shall be present.
3. The clarifier shall include an overflow weir sized for the ultimate capacity.
4. Grist shall be removed from the bottom of the settling tank with either a helical screw or a belt escalator.
5. Provide a 6-inch diameter ANSI 125# flange at the top of the tank for overflow.
6. Provide a 4-inch diameter ANSI 125# flange at the tank inlet.

E. Screw Dewatering Units
1. Grit shall be removed from the bottom of the settling tank by a sloped helical screw conveyor and discharged by means of a pitched helical screw conveyor. The helix shall be made up from preformed heavy steel flight sections with a minimum thickness of ¼ inch welded to the shaft, fitted with wearing shoes or weld hardened edge. The wearing shoes shall be of 5/8-inch minimum thickness, replaceable and shall be mounted on the flights by means of countersunk 316 stainless steel bolts and nuts. Hardened weld edge shall be minimum ½ inch wide.
2. Lower bearings:
   a. Internal lower bearings shall be housed in a watertight enclosure suitable for completely submerged operation in grit service. The bearing shall be oil lubricated and accessible for oil change without draining the system. Internal parts of the bearing shall be sealed from outside contamination.
   b. External bearings shall be completely external to the tank and shaft seal shall be continuous grease lubricated packing gland seal or shall be a sealed composite bearing with a minimum of two seals and UHMW PE seal retainer plates.
   c. Bearings shall have a minimum L-10 rating life of 50,000 hours while operating at maximum load.
3. At the upper end of the helical screw a minimum 3/8-inch diameter connection shall be provided to ensure continuous flushing of one side of the unit. The connection shall be equipped with a shutoff valve.
4. Slope shall not exceed 3-1/2 inches per foot.

5. Solid cover plates, equal to or greater than 3/16” Type 304 stainless steel, shall be provided over the full length of the rotating screw. Cover plates shall be bolted to the trough with Type 304 stainless steel fasteners to provide access for inspection. Cover plates shall be segmented so that no individual plat weighs over 40 pounds.
6. A drain with ball valve shall be provided at the bottom of unit to allow complete drainage of the unit.

F. Belt Escalator Units
1. Grit shall be removed from the bottom of the settling tank by a sloped escalator belt constructed from two-ply reinforced continuous conductor belting. Belt cleats shall be molded neoprene and aluminum reinforced and shall be vulcanized on the belt.
2. The housing for the Grit Dewatering Escalator belt shall be fitted under the clarifier. The housing for the Grit Dewatering Escalator belt shall be stainless steel with urethane bonded to the internal surfaces. The belt housing shall be 24 inches wide and inclined at 30 degrees.
3. The belt housing shall be fabricated from 0.135-inch thick 316 stainless steel. Welding shall conform to the most current standard of the American Welding Society. Surfaces shall be acid washed and glass bead blasted to a uniform finish. Passivate surfaces after finish.
4. The belt housing shall be provided with clean out plates and (1) flanged 3” NP drain. A 4” plug valve shall be supplied for connection directly to the 4” drain. The CONTRACTOR shall connect the plug valve to the drain and provide one (1) 4” tee for cleanout and drain. Piping from the tee to an open drain shall also be supplied by the CONTRACTOR. The straight arm of the tee shall be used as the clean-out.
5. The Grit Dewatering Escalator unit shall be supplied with a belt 18 inches wide made of 1/8 inch x 1/32 inch two-ply polyester reinforced continuous conductor belting. The belt cleats shall be 3-3/8” X 4-9/16” of molded 60 Durometer neoprene and aluminum reinforced and shall be vulcanized on the belt. The cleats shall attach to the belt with minimum 5/32 inch thick neoprene hinges.
6. The Grit Dewatering Escalator unit shall be provided with a headroll manufactured of 316 stainless steel. The headroll shall be 9-3/4 inch diameter and lagged. The headroll shall be adjustable to allow take-up of slack in the Grit Dewatering Escalator belt. Adjustment of the headroll shall not affect the headroll retainer plate, scraper, or drive unit.
7. The Grit Dewatering Escalator unit shall be provided with a headroll scraper having 1/4 inch thick high density polyethylene (HDPE) contact surfaces with a 1/4 inch thick HDPE retainer plate. Both retainer plate and scraper shall be loaded to keep belt cleats closed tightly around the headroll during operation.
8. The Grit Dewatering Escalator unit shall be provided with a tailroll manufactured of 316 stainless steel. The tailroll shall be designed to mount internal to the unit belt housing with external sealed bearings.
9. The tailroll mechanism shall be self-cleaning. As the belt rotates with the tailroll at the bottom of the unit the belt cleats shall lift from the belt to provide a gap of at least a 1-inch. The Grit Dewatering Escalator unit belt shall be provided with 2” openings to allow transfer of fine solids internal to the belt to the underside of each cleat. The tailroll shall be fitted with a scraper, which shall also function as an internal belt scraper.
10. The Grit Dewatering Escalator unit shall be supplied with a rinse bar system. The rinse bar system shall be pre-piped and factory installed. The flow to the

rinse bars shall be manually adjustable with a flow indicator at the tailroll rinse. The system shall include:

11. One spray bar shall be located above the belt and above the clarifier liquid level for Belt rinse.
12. Two spray bars shall be located above the belt and below the clarifier liquid level to enhance grit washing. This section shall be isolated from the belt rinse water piping by a 3/4” ball valve for maintenance.
13. One spray bar shall be located at the bottom of the clarifier as a tailroll area rinse. The tailroll rinse will include a 1” globe valve to regulate the flow of rinse water to the tailroll section.
14. A motion sensor, a zero speed switch, shall be installed on the side of the Grit Dewatering Escalator unit and will detect movement of the headroll scraper arm. Lack of motion of the headroll scraper arm shall indicate lack of belt movement, drive unit failure and/or scraper arm overload.

2.03 GRIT PUMP

A. Grit pumps shall comply with Section 43 21 21.75 - Recessed Impeller Pumps. Provide one duty and one shelf spare pump.

2.04 CONTROLS AND INSTRUMENTATION

A. Provide a common PLC-based control panel for the vortex grit unit and the grit classifier. Control panel shall include:
   1. Vortex Grit Unit
      a. Running
      b. Motor High Temperature
      c. Fluidizer Valve
      d. E-Stop Status
   2. Grit Classifier:
      a. Grit Pump Suction Line Valve (If Manufacturer recommends grit piping high loop for air gap in lieu of valve, provide additional 4” grit piping, supports, heat tracing, insulation and jacketing installed at no cost to Owner.)
      b. Grit Pump Running
      c. Grit Pump Motor High Temperature
      d. Grit Pump Emergency Stopped
      e. Provide a pressure switch on the discharge side of the grit pump integral to the pump operation. The pressure switch shall be designed to shut the pump down in the event of high pressure in the discharge line.
      f. Classifier Running
      g. Classifier Motor High Temperature
      h. E-Stop Status
      i. Provide other controls as shown on the process and instrumentation diagrams and as needed for a fully functioning system.
   3. Comply with Division 40 for panel requirements.
   4. All panels shall be UL508 labeled NEMA 4X 316 stainless steel.
   5. Control panel will be located outside where freezing can occur. Provide a panel heater with adjustable thermostat.
   6. Provide a panel air conditioner.

7. Provide I/O list of parameters to be monitored through interface with register assignments and engineering units. Provide communications with plant SCADA system via Modbus TCP/IP, with protocol gateway, if needed.
8. This list is not intended to completely depict all of the functional requirements of the control system provided under this Section. The system supplier shall provide all additional instrumentation and controls necessary to produce a safe and operable system.

3.00 EXECUTION

3.01 INSTALLATION

A. Install and adjust equipment in accordance with the Contract Documents, approved shop drawings, and the manufacturer's instructions. Do not operate the equipment until the installation is approved by the manufacturer’s representative.

B. It is the Contractor’s responsibility to verify the accuracy of all necessary dimensions in the field to ensure compatibility with the specifications and equipment.

3.02 ASSEMBLY AND INSTALLATION

A. Assemble and install equipment in accordance with the manufacturer's instructions and approved shop drawings.
   1. Do not cut or weld any stainless steel component in the field unless specifically approved in writing by the engineer.
   2. Remove temporary bracing supports and other construction debris that may damage equipment.
   3. Remove protective coatings and oils used for protection during shipment and installation.
   4. Check equipment for correct direction of rotation and freedom of moving parts.
   5. Align equipment to Manufacturer's tolerances. Adjust clearances and torques.
   6. Adjust or modify equipment to ensure proper operation.
   7. Flush, fill, and grease lubricated systems in accordance with Manufacturer's instructions.

B. Touch up scratches and scrapes in painted surfaces in accordance with Division 9.

C. Check installation prior to start-up for conformance to manufacturer's instructions. Adjust or modify equipment to ensure proper operation.

3.03 QUALITY CONTROL

A. Prior to plant startup, the contractor and manufacturer’s representative, shall inspect all equipment for proper assembly and alignment, quiet operation, and proper operation.

B. Operate the equipment through the design performance range consistent with available flows. Adjust, balance, and calibrate and verify that the equipment, safety devices, controls, and process system operate within the design conditions. Each safety device shall be tested for proper setting and signal. Response shall be checked for each equipment item and alarm.

3.04 MANUFACTURER'S FIELD SERVICES

1. Contractor to coordinate field service work with the manufacturer's service representative, Owner, and Engineer prior to initiating such work.
2. Manufacturer's service representative:
   a. Manufacturer is to furnish services of representative experienced in erection and operation of vortex grit units and grit classifiers.
   b. Period of services: The manufacturer shall include in his bid a minimum of five 8-hour days and 2 trips.
      1) The specified durations are the minimum time on the job site and do not include travel time.
   c. Services are to include the following:
      1) Installation consultation and advice.
      2) Final inspection and adjustment prior to testing.
      3) Supervision of testing.
      4) Instruction of personnel on operation and maintenance of equipment.

B. Submit the preliminary operations and maintenance manual at least four weeks before training.

C. Provide the services of the manufacturer's representative to conduct two training sessions for the Owner. Schedule training to accommodate the Owners schedule and to cover multiple work shifts.

END OF SECTION

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46 33 44 PERISTALTIC PUMP SKID SYSTEM

1.00 GENERAL

1.01 SUMMARY

A. Furnish, install, startup and test hypochlorite and coagulant dosing systems as shown on the Plans and described herein. The components of each dosing system include a pre-piped, pre-wired system, consisting of a support stand, two peristaltic metering pumps with self-contained variable speed drives, calibration column, pulsation dampers, piping, controls and appurtenances. For the two systems, both pumps shall be mounted on the support stand and shall be plumbed and fully operational. One pump will normally operate while the other is on standby, but both shall be capable of operating simultaneously.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 SUBMITTALS

A. Submit as specified in Section 01 33 00.

B. Shop drawings and applicable product data specific to this project shall be bound neatly in a single package. The following information shall be included as a minimum:
   1. Manufacturer and model number of all equipment within this specification.
   2. Design performance characteristics including performance curves, set points, operating point, rotative speeds, efficiencies, and ranges of each component, and other appropriate information.
   3. Layout drawings including all proposed system components with dimensions, clearances required, and sizes indicated, and arrangement and size of connections.
   4. Listing of materials of construction for each component.
   5. Complete information on all instruments and devices with schematics and electric power requirements.
   6. Complete wiring diagrams and data on controls to be furnished.
   7. Manufacturer's instructions regarding delivery, storage handling, and installation of equipment.

C. The following certificates and other information shall be included as a minimum:
   1. Startup and test schedule.
   2. Equipment installation report with field test data and test records.
   3. Warranties and service agreements.

D. Any other information necessary to determine compliance with the specifications.

E. Operation and Maintenance Manual:

1. Provide as a single document in digital PDF format prior to the delivery of the system.
2. Include complete operation and maintenance data for all major equipment and ancillary items.

1.03 QUALITY ASSURANCE

A. Pump manufacturer shall furnish and coordinate pumps, controls, skid and other skid components as specified and to provide written installation and checkout requirements.

B. Pump manufacturer must be ISO 9001 certified.

1.04 WARRANTY

A. Manufacturer shall provide a two year warranty from the date of final acceptance.

1.05 MAINTENANCE AND SPARE PARTS

A. Special tools: Deliver one set for each furnished pump type and size needed to assemble and disassemble pump system.

B. Spare parts: Deliver the following spare parts to Owner; pack and label for storage.
1. Two hose elements of appropriate diameter for estimated flows summarized in Article 2.02.B, of material suitable for metering hypochlorite and coagulant
2. Roller assembly
3. Special tools required for maintenance or adjustment
4. Other items as recommended by manufacturer

C. Spare parts shall be packed in sturdy containers with clear, indelible identification markings and shall be stored in a dry, warm location until transferred to the Owner at the conclusion of the project.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Pumps shall be manufactured by and pump skid and other components shall be supplied by:
1. Blue-White Industries
2. Watson-Marlow
3. Approved Equal

B. Equipment furnished and installed under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with drawings, specifications, engineering data, and instructions and recommendations of the equipment manufacturer unless exceptions are noted by the Engineer.

C. All equipment shall be the product of a manufacturer having at least ten U.S. installations of the type being proposed, each with a minimum of 5 years of satisfactory service.

2.02 DESIGN AND GENERAL REQUIREMENTS

A. Metering pumps shall be designed for pumping hypochlorite and coagulant.

B. Hypochlorite flow estimates are summarized in the table below. Pumps shall be capable of output volumes from 0.01 to 500 gallons per hour (gph).

	0.3 MGD	**2.25 MGD**	**Units**
Minimum			
Hypochlorite Design Concentration	0.5	0.5	mg/L
Approx. Hypochlorite Design Dose	0.1	0.4	gph
	3.3	25	mL/min
Maximum			
Hypochlorite Design Concentration	2.0	2.0	mg/L
Approx. Hypochlorite Design Dose	0.2	1.6	gph
	13	99	mL/min

C. Coagulant flow estimates are summarized in the table below. Pumps shall be capable of output volumes from 0.03 to 1,500 gallons per hour (gph).

	0.3 MGD	**2.25 MGD**	**Units**
Minimum			
Coagulant Design Concentration	40	40	gal/MG
Approx. Coagulant Design Dose	0.5	3.8	gph
	32	237	mL/min
Maximum			
Coagulant Design Concentration	60	60	gal/MG
Approx. Coagulant Design Dose	0.7	5.2	gph
	43	325	mL/min

2.03 METERING PUMPS

A. Metering pumps hall be positive displacement, peristaltic type tubing pumps with a brushless variable speed motor, non-spring loaded roller assembly located in the pumphead, integral tube failure detection system, tube life roller revolution counter with user alarm set-point and flexible tubing with attached connection fittings.

B. There shall be no valves, diaphragms, springs, or dynamic seals in the fluid path. Process fluid shall contact the pump tubing assembly and connection fittings only.

C. Pump shall be capable of 24 hour continuous duty, self priming and operating in either direction of flow at the rated maximum pressure of up to 125 psi.

D. Pump sizing shall include normal operating speeds not to exceed 50 RPM and intermittent operation not to exceed 70 RPM unless approved by the Engineer.

E. Pump shall be capable of running dry without damage.

F. Pump shall be capable of operating in either direction without output variation.

G. Suction lift shall be 25 feet of water.

2.04 PUMPHEAD

A. Pumphead shall be a single, unbroken track with a clear removable cover.

B. Tube failure detection sensors shall be wholly located in the pumphead. Tube failure detection system shall not trigger with water contact. Float type switches shall not be used. Process fluid waste ports or leak drains shall not be provided.

C. Squeeze rollers with encapsulated ball bearings shall be directly coupled to a one piece thermoplastic rotor. Four polymeric rollers shall be provided; two squeeze rollers for tubing compression shall be located 180 degrees apart and two guide rollers that do not compress the tubing shall be located 180 degrees apart. The roller diameters and occlusion gap shall be factory set to provide the optimum tubing compression; field adjustment shall not be required. Spring loaded or hinged rollers shall not be used.

D. Rotor assembly shall be installed on a D-shaped, chrome plated motor shaft and removable without tools.

E. For tubing installation and removal, rotor assembly shall be rotated by the motor drive at 6 RPM maximum when the pumphead cover is removed. Hand cranking of the rotor assembly shall not be required.

F. Pump head and tubing compression surface shall be corrosion resistant Valox thermoplastic.

G. The pump head cover shall be clear, polycarbonate thermoplastic with an integral ball bearing fitted to support the overhung load on the motor shaft. Cover shall include an imbedded magnetic safety interlock which will limit the motor rotation speed to 6 RPM when removed.

H. Cover shall be positively secured to the pump head using a minimum of four thumb screws. Tools shall not be required to remove the pump head cover.

2.05 PUMP TUBE ASSEMBLY

A. To ensure pump performance and accuracy, only tubing provided by the manufacturer is acceptable.

B. Pump tube shall be assembled to connection fittings of PVDF material.

C. Connection fittings shall be permanently clamped to the tubing with stainless steel clamps or over molded directly to the tubing. To prevent tubing misalignment and ensure accuracy, fittings shall insert into keyed slots located in the pump head and secured in place by the pump head cover.

D. Connection fittings shall be 1/2” M/NPT.

E. Tube sizes and connections shall be measured in inches.

2.06 DRIVE SYSTEM

A. Drive system shall be factory installed and totally enclosed in a NEMA 4X, wash-down enclosure. Capable of operating on any input power from 110VAC to 240VAC, 50/60 Hz single phase supply without user configuration or selection switches.

B. Motor
   1. Reversible, brushless DC gear motor rated for continuous duty.
   2. Motor shall include overload protection.
   3. The maximum gear motor RPM shall be 125 RPM.

C. Enclosure
   1. Pressure cast aluminum with acidic liquid iron phosphate three-stage clean and coat pretreatment and exterior grade corrosion resistant polyester polyurethane powder coat.
   2. Rated NEMA 4X (IP66).
   3. A wiring compartment shall be provided for connection of input/output signal wires and alarm output loads to un-pluggable type terminal block connectors. Terminal board shall be positively secured to the rear of the pump housing by two polymeric screws and fully enclosed by the wiring compartment cover. The terminal board shall not be disturbed by the removal of the wiring compartment cover. Ribbon cables shall not be used in the wiring compartment.

D. Controls
   1. All control circuitry shall be integral to the pump and capable of adjusting the pump motor speed from 0.001% to 100.0% in 0.001% increments less than 1% motor speed, in 0.01% increments between 1% and 10% motor speed, and in 0.1% increments greater than 10% motor speed (10,000:1 turndown ratio).
   2. Pump output shall be capable of being manually controlled via front panel user touchpad controls.
   3. Pump output shall be capable of being remotely controlled via SCADA operating via Modbus. Four values shall be user configurable to define the low and high points on the output slope; a low input value, the required pump percentage of motor speed at the low input value, a high input value, the required pump percentage of motor speed at the high input value.
   4. The pump shall include an internal cycle timer capable of automatically cycling the pump on and off. The pumping total cycle time shall be adjustable from 1 to 999999.9 seconds. The pumping on time during the cycle shall be adjustable from 1 to 999999.9 seconds. The pump motor speed during the cycle shall be adjustable from 0% to 100.0% motor speed in 0.1% increments.
   5. The pump shall be capable of dispensing upon demand. The dispensing shall be manually triggered by pressing the front panel start button or by inputting a contact closure. The dispensing volume shall be adjustable from 1 to 999999.9 milliliters. The pump motor speed during the dispensing cycle shall be adjustable from 0% to 100.0% motor speed in 0.1% increments.
   6. The pump shall be capable of automatically calculating the pump motor speed required to achieve a part per million dosing output that is proportional to a fixed system flow rate. The pump shall permit the user to input the dispensing chemical percentage concentration from 0% to 100.0% in 0.1% increments. The pump shall permit the user to input the dispensing chemical specific

gravity from 0.1 to 9.9 in 0.1 increments. The pump shall permit the user to input the fixed system flow rate from 1.0 to 9999.9 liters per minute in 0.1 liters per minute increments. The pump shall permit the user to input the required dosing parts per million (ppm) from 0.1 to 100.0 in 0.1 increments.

7. The pump shall be capable of automatically calculating the pump motor speed required to achieve a ppm dosing output that is proportional to a variable system flow rate. The pump shall permit the user to input the dispensing chemical percentage concentration from 0% to 100.0% in 0.1% increments. The pump shall permit the user to input the dispensing chemical specific gravity from 0.1 to 9.9 in 0.1 increments. The pump shall permit the user to input a K-factor in pulses per liter from a sensor in the water system that outputs a high speed digital pulse from 0 to 1000 Hz that is proportional to the system water flow velocity. The pump shall permit the user to input the required dosing ppm from 0.1 to 100.0 in 0.1 increments.
8. Provide an 11-button front panel user touchpad control for stop/start, configuration menu access and navigation, operating mode selection, auto priming, display options selection, tube life data, and reverse direction.
9. Provide a multi-color VGA graphic LCD display for menu driven configuration settings, pump output value, service alerts, tube failure detection (TFD) system and flow verification system (FVS) alarms status, remote input signal values, tubing life timer value. Display color shall be green when indicating normal operation, blue when in stand-by, and red to indicate an alarm condition exists.
10. Provide for remote stop/start pump.
11. Provide a user selectable output signals which are scalable and proportional to pump output volume.
12. Provide four alarm outputs. Each alarm output shall be assignable to monitor any of the following pump functions: TFD system, FVS system, motor run/stop, motor failed to respond to commands, motor is running in reverse, general alarm (TFD, FVS, and/or motor over current), input signal failure, output signal failure, remote/local control status, revolution counter (tube life) set-point, or monitor which of the nine different pump operating modes is currently active.
13. Provide a flow verification system with programmable alarm delay time from 1-255 seconds. FVS system shall monitor the FVS flow sensor while pump is running only. System shall not monitor pump while not running.
14. Provide a roller revolution counter display (tube life indicator) with user programmable alarm set-point value from 1 to 999,999,999 revolutions which can be assigned to any one of the 4 contact closure alarm outputs.
15. Provide a user programmable maximum RPM set-point value from 0.1 to 100.0 RPM in 0.1 increments.
16. Provide a user adjustable response delay time from 0 to 999.9 seconds for the remote start/stop input and the four contact closure alarm outputs to facilitate closed-loop applications.
17. Provide a power interruption pump restart option which is user programmable to either automatically restart or require a user re-start if AC mains power is interrupted.

2.07 SAFETY

A. The pump shall be certified to UL standard 778 motor operated pump and CSA standard C22.2 process control equipment.

B. Tube Failure Detection (TFD) system sensors shall be wholly located in the pumphead. TFD system will stop the pump within three seconds of leak detection. To prevent false alarms due to rain, wash-down, condensation, etc., tube failure detection system shall not trigger with water contact. Process fluid waste ports or leak drains shall not be provided.

C. Pumphead cover shall include an imbedded magnetic safety interlock which will stop the pump when removed. Pump rotor speed shall be limited to 6 RPM when cover is removed.

D. Secondary user confirmation input required for motor reversal, tube life revolution count reset, and factory default configuration reset.

2.08 SKID-MOUNTED FEED SYSTEM

A. The skid mounting of the metering pumps shall conform to the following requirements:
   1. Each chemical feed system shall be completely assembled, mounted, calibrated, tested, and delivered to the site on a single skid. Components to be mounted on the skid shall include two metering pumps, calibration column, piping, valves, piping accessories (pulsation dampeners, strainers, back pressure valves, pressure relief valves, etc.), and wiring integral to the skid. The chemical metering pump manufacturer shall be responsible for providing all equipment, valves and piping within the skid boundary.
   2. The skids shall be constructed of fusion welded polypropylene sheets with adequate supports for all equipment and piping and a ½" drip lip. Forklift truck cut outs shall also be provided.
   3. All components of the skid-mounted system (pumps, piping and controls) shall be tested.

B. Skid-mounted accessories to include the following:
   1. Calibration Chamber:
      a. Provide one, clear plastic calibration chamber with vent for use in calibrating the metering pumps.
      b. The chamber shall be sized to give adequate capacity for a minimum 30 second draw down test.
      c. The scale shall give direct readings in mL and GPH without the need for calculations.
      d. The calibration chamber shall be piped and valved so that each pump shall be able to utilize the calibration chamber without interfering with the operation of the other pumps.
      e. The top of the chamber shall have a threaded fitting to allow for piping to a common vent.
   2. Pulsation Dampeners:
      a. Shall be of the single diaphragm design, capable of arresting water hammer in the pump discharge lines created by the metering pumps.
      b. Materials of construction of diaphragm and body shall be corrosion resistant to the chemical fluid pumped.
      c. Provide one dampener on the discharge side of each metering pump.
      d. Each pulsation dampener shall include an integral pressure gauge.

e. Pulsation dampeners shall be sized appropriately for each pump to remove a minimum of 95% of the pulsations. The manufacturer shall provide calculations to verify sizing if requested by the Engineer or Owner.

3. Backpressure and Pressure Relief Valves
   a. Adjustable diaphragm backpressure sustaining type valve installed on pump discharge header and set at location recommended by manufacturer. Materials to be suitable for rated chemical service.
   b. Adjustable diaphragm pressure relief valve installed externally on pump discharge header and set at location recommended by manufacturer. PRV required for each pump mounted on feed system. Materials to be suitable for respective chemical service.
4. Pressure Gauge and Diaphragm Isolators: Provide a pressure gauge and diaphragm type chemical isolation suitable for each chemical service. Range of pressure gauge to be suitable with each chemical service. Pressure Switches with Diaphragm Isolators shall be provided when shown on the plans.
5. Piping, Valves and Appurtenances:
   a. Skid piping shall be Schedule 80 CPVC. Cement shall be as recommended by the pipe manufacturer for the service outlined in this Section.
   b. True-union ball valves shall be provided for isolation of major equipment. Seals shall be compatible with the chemical being pumped.

3.00 EXECUTION

3.01 INSTALLATION

A. Install all equipment in complete accordance with manufacturers' instructions and recommendations, and as indicated on Plans.

B. The chemical feed equipment shall be carefully stored, handled, and installed in such a manner as to prevent damage to any part of the equipment.

C. All lines shall be cleaned and tested for leaks. All leaks and defective components shall be repaired or replaced and the test procedure repeated until no leaks or defects are discovered.

3.02 STARTUP PREPARATION

A. Complete equipment installation with controls and auxiliary support systems necessary to start the equipment and verify that the equipment functions correctly under no load conditions. Complete cleaning and testing of piping systems. Inspect and clean equipment, devices, piping, and structures of debris and foreign material.

B. Remove temporary bracing supports and other construction debris that may damage equipment.

C. Remove protective coatings and oils used for protection during shipment and installation.

D. Install temporary connections and devices required to fill, operate, checkout and drain the system. Provide temporary valves, gauges, piping, test equipment, and other materials and equipment necessary to conduct testing and startup.

E. Align equipment to Manufacturer's tolerances. Adjust clearances and torques.

F. Check installation prior to start-up for conformance to Manufacturer's instructions. Adjust or modify equipment to ensure proper operation.

G. Correct any deficiencies or problems noted in Manufacturer's representative's installation reports.

3.03 FIELD QUALITY CONTROL

A. Verify that equipment, pipes, valves, fittings, and other appurtenances of the hypochlorite and coagulant feed systems are compatible, and place equipment in proper operating condition.

B. The services of the feed equipment manufacturer's technical representative shall be provided for pre-startup installation checks, startup assistance, training of Owner's personnel, troubleshooting, acceptance testing, and other services as required within these Contract Documents to ensure that the chemical feed systems are complete.

C. Manufacturer's representative shall:
   1. Approve installation in writing before operation.
   2. Verify conformance to all specified requirements.
   3. Fully instruct all designated Owner's personnel on proper care, maintenance, and operation of all equipment and appurtenances.
   4. Perform specified acceptance tests and operate system to verify satisfactory operation of all equipment in presence of Owner’s personnel.
   5. Operate the equipment through the design performance range consistent with available flows. Adjust, balance, calibrate and verify that the equipment, controls, and process system operate within the design conditions. Response shall be checked for each equipment item and alarm. Simulation signals may be used to check equipment and alarm responses.
   6. Check all equipment for excessive noise or vibration, proper alignment, general operation, etc.

3.04 ACCEPTANCE TEST

A. Upon completion of the installation of the complete chemical feed systems, an acceptance test will be conducted to verify the satisfactory operation of the equipment.

B. The test shall be conducted in a manner approved by the Engineer. The equipment and piping will be completely checked for leakage, general operation, etc.

C. After initial startup under the supervision of a qualified representative of the manufacturer, a preliminary running-in period will be provided for the Contractor to make field tests and necessary adjustments. At the end of a minimum of eight hours of consecutive operation, the system will be accepted if, in the opinion of the Owner,

the system has operated satisfactorily without excessive power input, headloss, wear, vibration, noise, or undue attention required for this operation.

END OF SECTION

46 43 21 CIRCULAR SECONDARY CLARIFIER EQUIPMENT

1.00 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Circular spiral scraper cage drive clarifiers and appurtenances.
   2. Installation, startup, testing, and placing in service assistance.

B. Scope of Work:
   1. Furnish, install, test and place in operation a circular spiral scraper cage drive clarifier including all related equipment, material and appurtenances. The equipment shall include control panel, center drive unit with torque control, walkway and platform with handrail, stationary center influent column, energy dissipating inlet, center feedwell, rotating drive cage, rake arms with spiral blades, sludge collection ring or drum, scum skimmer, scum box, effluent weir, and scum baffle.
   2. Contractor shall verify installation meets specified weir elevations tolerances at time of installation and from three to five months after continuous operation prior to project completion. Relevel as needed to meet specified tolerances.

1.02 GENERAL

A. See Division 01, General Requirements, which contains information and requirements that apply to the work specified herein and are mandatory for this project.

B. Related Sections: The following Sections contain requirements that relate to this Section.
   1. Division 05, Metals
   2. Division 09, Finishes
   3. Division 26, Electrical
   4. Division 40, Process Interconnections

1.03 REFERENCES

A. American Bearing Manufacturers Association (ABMA):
   1. 9 – Load Ratings and Fatigue Life for Ball Bearings.

B. American Gear Manufacturers Association (AGMA):
   1. 908 – Information Sheet – Geometry Factors for Determining the Pitting Resistance and Bending Strength of Spur, Helical, and Herringbone Gear Teeth.
   2. 915-1 – Inspection Practices – Part 1: Cylindrical Gears – Tangential Measurements.
   3. 915-2 – Inspection Practices – Part 2: Cylindrical Gears – Radial Measurements.
   4. 2001 – Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth.
   5. 2004 – Gear Materials, Heat Treatment and Processing Manual.
   6. 2009 – Bevel Gear Classification, Tolerances and Measuring Methods.

7. 2011 – Cylindrical Wormgearing Tolerance and Inspection Methods.
8. 2015-1 – Accuracy Classification System – Tangential Measurements for Cylindrical Gears.
9. 2015-2 – Accuracy Classification System – Radial Measurements for Cylindrical Gears.
10. 6013 – Standard for Industrial Enclosed Gear Drives.
11. 6022 – Design Manual for Cylindrical Wormgearing.
12. 6034 – Practice for Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors.
13. 9005 – Industrial Gear Lubrication.

C. American Institute of Steel Construction (AISC):
1. 360 – Specification for Structural Steel Buildings.

D. American Society of Mechanical Engineers (ASME):
1. B29.1M – Precision Power Transmission Roller Chains, Attachments, and Sprockets.

E. American Welding Society (AWS):
1. D1.1 – Structural Welding Code for Steel.
2. D1.6 – Structural Welding Code – Stainless Steel.

F. ASTM International (ASTM):
1. A 36 – Standard Specifications for Carbon Structural Steel.
2. A 48 – Standard Specification for Gray Iron Castings.
3. A 148 – Standard Specification for Steel Castings, High Strength, for Structural Purposes.
4. A 276 – Standard Specification for Stainless Steel Bars and Shapes.
5. A 325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
6. A 536 – Standard Specification for Ductile Iron Castings.

G. International Organization for Standardization (ISO):
1. 53 – Cylindrical Gears for General and Heavy Engineering – Standard Basic Rack Tooth Profile.

H. National Electrical Manufacturers Association (NEMA):
1. 250 – Enclosures for Electrical Equipment (1,000 V Maximum).

1.04 DEFINITIONS

A. NEMA:
1. Type 4X enclosure in accordance with NEMA 250.
2. Type 7 enclosure in accordance with NEMA 250.

B. Continuous operation: 24 hour-per-day operation for design life of not less than 20 years which equals 175,200 hours.

C. Intermittent operation: Periodic operation, including starts and stops, and prolonged periods of resting.

D. Subassemblies: Includes, but may not be limited to, complete center column, drive cage, drive assembly, truss arms, and scum skimming system.

E. Set: Equipment necessary to completely furnish 1 clarifier.

F. Continuous running torque:
   1. The 100 percent AGMA torque, assumed to be continuously applied, 24 hours a day, to the drive system.
   2. Bearing life, gear strength, gear durability, gear rating, mechanism structural design, and alarm and shutdown setpoints are specified as a percentage of the continuous running torque.

G. Momentary peak torque:
   1. The maximum torque for rating yield strength or ultimate strength of center drive mechanism components.
   2. The numerical value for momentary peak torque shall be 2.0 times continuous running torque.

H. Manufacturer:
   1. Firm responsible for the design, operation, delivery, installation certification, and warranty of sludge collection equipment.
   2. Manufacturer shall also provide sludge collector drive mechanism.

I. Fabricator:
   1. Firm responsible for the fabrication of sludge collection equipment conforming to the manufacturer's design.
   2. Manufacturer may also be the fabricator if fabrication of all components is self-performed.

1.05 SUBMITTALS

A. Submit product data and shop drawings, operation and maintenance manuals, and test reports.

B. Product data and shop drawings:
   1. Shop drawings shall consist of a cover sheet indicating the drawing number and specification page and number to which referenced, intended use and data summary, outline drawings, cut-away drawings, parts lists, material specification lists, and all information required to substantiate that the proposed equipment meets the specifications.
      a. Shop drawings submittals will not be considered complete if cut-away or assembly drawings with part and material specification lists are not included.
   2. General arrangement drawings showing the complete assembly, part numbers, and materials list.
   3. Applicable bid specification section with comments on conformance and deviations on each paragraph.
   4. Detailed drawings:
      a. Sludge collector mechanism indicating dimensions, member sizes and thicknesses, welding, and connection details.
      b. Drive mechanism showing sizes, dimensions, and arrangement of each drive component.
      c. For gears, except those contained in the gearmotor speed reducer, detailed drawings with the following minimum data for each gear:
         1) Number of teeth.
         2) Net face width.

3) Outside diameter of external gears.
4) Inside diameter of internal gears.
5) Normal diameter pitch or axial pitch for worms.
6) Normal generating pressure angle.
7) Lead angle (for worms).
8) Operating center distance.
9) Addendum modification coefficient.
10) Tooth thickness or pin or span measurements.
11) Quality numbers in accordance with AGMA 915-1, 915-2, 2009, 2011, 2015-1, and 2015-2.
12) Material alloy.
13) Type of heat treatment.
14) Tooth surface hardness.
15) Tooth core hardness.
16) For case hardened gears, effective case depth to Rc 50.
17) Lubricant type (mineral/synthetic/EP).
18) Lubricant viscosity.

d. Certified motor data sheets.
e. Shop primer and coating data.
f. Control system data, schematics, and wiring diagrams.
g. Control panel dimensions and details.
h. Spare parts lists.
i. Qualifications and resume of installation engineer.
j. Training course outlines.
k. Manufacturer's experience and reference list as specified in Article Quality Assurance.

C. Manufacturer's Installation Instructions.

D. Calculations: Include, without necessarily being limited to:
1. Structural calculations:
a. Calculations shall be prepared and signed by a professional civil engineer licensed in the state where the Project is located demonstrating compliance with structural criteria specified in this Section.
b. Submit design calculations with complete shop drawings.
2. Mechanical and hydraulic calculations: Performed by a professional civil or mechanical engineer licensed in the state where the Project is located. Calculations are intended to:
a. Substantiate continuous running torque rating and overload torque loading of each component of drive mechanism.
1) Calculations shall be in accordance with AGMA 908.
2) Calculations shall clearly specify all design parameters used in developing the ratings, including materials in accordance with AGMA 2004.
3) All ratings shall be in strict conformance with the latest revisions of AGMA 6034 and AGMA 2011.
b. Demonstrate that each bearing in drive mechanism complies with life requirements of this Section.

E. Quality control submittals:
1. Welder's certificates.

2. Submit manufacturer's or designated contract fabrication facility's structural steel fabrication qualifications and information.
3. Engineer's qualifications to complete structural analysis and design.

F. Fabrication certification report:
1. Provide fabrication certification report prior to equipment delivery to project site.

G. Test reports:
1. Method of conducting cutout test and verification that method of testing will not impose stresses in any member which exceeds maximum allowable stresses specified in this Section.
2. Results of field torque tests on sludge collector mechanism.

H. Operation and Maintenance Manuals.
1. See Section 01 78 23 for the content, mechanics and administration of the submittal process.

I. Certificates: Manufacturer's certification that equipment was installed in accordance with the manufacturer's instructions, inspected by the manufacturer, serviced with the proper initial lubricants, and equipped with applicable safety equipment and controls.

1.06 QUALITY ASSURANCE

A. All clarifier equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.

B. Clarifier equipment is to be engineered and manufactured under a written Quality Assurance program. The Quality Assurance program is to be in effect for at least ten years, to include a written record of periodic internal and external audits to confirm compliance with such program.

C. Clarifier equipment is to be engineered and manufactured under the certification of ISO-9001:2000.

D. The equipment supplier shall have a minimum of fifteen (15) years' experience in the design, application, and supply of circular clarifiers in wastewater treatment plants and shall submit a reference list of not less than 5 operating installations of clarifiers with spiral rake blades of similar size. Reference list is to include the following information as a minimum:
1. Name and location of installation.
2. Name and telephone number of the person in direct responsible charge of the equipment.
3. Name and contact information for equipment fabricator.
4. Name and contact information for manufacturer's engineer responsible for structural design.
5. Month and year the equipment was placed in operation.
6. Size of equipment.
7. Number of units installed.
8. Process performance data.

9. History of warranty repair items.

E. Manufacturer qualifications:
1. Experience: Demonstrate minimum 10 years' experience in the manufacture and fabrication of tapered spiral scraper sludge collectors which have been successfully utilized in domestic wastewater applications.
   a. Experience of fabricator, if manufacturer does not self-perform fabrication, shall meet or exceed that required of manufacturer.
   b. Submit substantial information as necessary to establish qualifications of fabricator, if manufacturer does not self-perform fabrication, including location (address), experience, qualifications, and certifications of all fabricator's staff to be utilized.
   c. Manufacturer's engineer responsible for structural design shall also demonstrate minimum 5 years' experience designing sludge collectors to withstand operational and seismic loads, including sloshing of tank contents on sludge collection mechanism.
2. References: Provide a reference list of at least 5 different installations in domestic wastewater treatment plants in the continental United States, where the manufacturer has supplied equipment substantially similar in design and characteristics to that proposed in this Section.
   a. The installations listed must:
      1) Have been designed and fabricated by the manufacturer. If manufacturer does not self-perform fabrication, the installation list shall also include the experience of the Project equipment fabricator.
      2) Have been in operation for last 5 years.
   b. Provide the following information related to the installation:
      1) Owner name, address, and telephone number.
      2) Design flow of plant.
      3) Sludge collector dimensions.
      4) Time in operation.
      5) References for manufacturer's engineer responsible for the structural design.
      6) Number of units installed.
      7) Process performance data including influent flow rate, hydraulic loading, effluent suspended solids, return sludge solids concentration, return activated sludge flow rate and waste sludge flow rate.
      8) History of warranty repair items.

F. Welding and welder qualifications:
1. Perform welding and qualify and certify welders in accordance with AWS D1.1 and D1.6.

G. Steel fabrication:
1. Manufacturer's authorized representative shall provide a fabrication certification report complete with certified fabrication drawings, a journal of the fabrication work process, photo documentation of the shop assembly of all components required to be field erected, and a certification that the fabricated equipment is complete and ready for installation by the Contractor.

H. Equipment subassemblies:

1. Each component subassembly requiring field erection shall be test assembled and documented at the Manufacturer's fabrication facility.
2. Digital photographic evidence of assembly shall be submitted as part of the fabrication certification report.
3. Mark parts with erection matchmarks for ease of field erection.
4. Lubricate moving parts before shipment.
5. When necessary to disassemble parts for shipping, coat uncoated exposed machine surfaces with suitable, easily removable, rust-preventive compound before shipping.

1.07 SYSTEM DESCRIPTION

A. Process description:
1. The sludge collector mechanism includes a central driving mechanism mounted on a center support pier which supports and rotates a center cage with 2 truss arms each of them supporting a tapered spiral scraper blade and 2 surface skimmers.
2. Sludge accumulated in the clarifier is scraped to a center well for continuous removal.
3. Scum from the surface of the clarifier is collected and deposited into a scum collection hopper using skimming arms with articulated blades.
4. The clarifier shall perform the following integrated functions:
   a. Dissipate energy and control localized currents
   b. Separate solids from the clear liquid
   c. Evenly withdraw the clear liquid
   d. Transport and thicken settled sludge
   e. Remove scum from the clarifier surface

B. Design Criteria:
1. Influent flow rates per clarifier (MGD without recycle):
   a. Average Flow: 1.125 MGD
   b. Peak Flow: 4.5 MGD
2. Clarifier Diameter (ft): 70
3. Side Water Depth (ft): 14
4. Bottom Slope (in/ft): 1
5. Minimum continuous operating torque: 21,800 ft-lb

C. Project conditions:
1. Installation in a domestic wastewater treatment plant.
2. Moderate quantities of commercial and industrial waste.
3. Exposure to industrial solvents and petroleum products.
4. Operation 660± feet above mean sea level.
5. Ambient air temperature:
   a. Maximum 120 degrees Fahrenheit.
   b. Minimum 10 degrees Fahrenheit.
6. Wastewater temperature:
   a. Maximum 95 degrees Fahrenheit.
   b. Minimum 60 degrees Fahrenheit.

D. Sludge collector mechanism:
1. Supply as a complete and operational system by a single manufacturer.
2. Equipment to include, but not be limited to, the following components:

a. Center work platform
b. Center column.
c. Influent well.
d. Center drive cage.
e. Sludge collector truss arms with tapered spiral scraper blades.
f. Scum skimming system.
g. Center drive mechanism.
h. Drive motor.
i. Electrical controls.
j. Overload devices and alarms.
k. Alarms.
l. Other components necessary to provide a complete system.

E. Mechanical design:
1. Use no chains, sprockets, bearings, or gears below the water surface.
2. Design for continuous operation for a 20-year life span.
3. Design collector mechanism to operate at a tip speed, measured at the ends of the truss arms, of approximately 10 feet per minute.

F. Structural design:
1. Design the sludge collector mechanism in accordance with AISC 360 except:
   a. Provide a ¼ inch minimum thickness for all members, except where specifically modified for specified equipment components.
   b. Include stresses in members caused by bending and twisting due to eccentricities in members.
2. Slenderness ratio (KL/R) using K value of 1.0 shall not exceed the values specified below:
   a. Tension members not greater than 240.
   b. Compression members not greater than 200.
3. Base member weights used for design on final full member thickness.
4. Full member thickness may be used for performing deflection calculations.
5. Design the center cage and the truss arms as an integral structure. Design the center cage and the connections to the truss arms for the reactions from the truss arms.
6. Do not include live load where its inclusion results in lower stresses in a member under investigation.
7. Load combinations: Design each structural member of the sludge collector mechanism shall for the most critical load combination resulting from the following load combinations:
   a. Dead load plus live load plus continuous running torque.
   b. Dead load plus live load plus continuous running torque plus seismic load.
      1) Seismic load shall include seismic load from the water inside the clarifier acting on members of the clarifier mechanism.
      2) For elements of the clarifier such as the center column and the influent well, impulsive and convective seismic loads from the water shall be applied appropriately on both the inside and outside surfaces.
      3) These seismic loads shall be in addition to the seismic loads due to the dead loads of the elements.
   c. Dead load plus live load plus torque due to screeding grout topping on slab using sludge collector mechanism.
   d. Dead load plus live load plus torque due to cutout torque test.

e. Other load combinations selected by the manufacturer.
f. Truss arm load cases: Use the following load cases on the truss arms for load combinations:
   1) Equal uniform horizontal load along the full length of both truss arms which results in a combined torque equal to the continuous running torque.
   2) Uniform horizontal loads along the full length of both truss arms which results in 70 percent of the torque from 1 truss arm and 30 percent of the torque from the other truss arm for a combined torque equal to the continuous running torque.
   3) Load on truss arms due to spreading grout topping on slab using sludge collector mechanism.
   4) Load on truss arms due to cutout torque load test.

8. Deflections:
   a. The horizontal deflection of the truss arm, due to truss deflection plus rotational deflection of the center cage for load cases which contain continuous running torque, shall not exceed a deflection equal to the radius of the clarifier divided by (L/360)
      1) Not more than 60 percent of the total horizontal deflection shall be due to center cage rotation.
      2) Horizontal deflection of the truss arm shall be measured at the end of the sludge collection header furthest from the center column.
   b. The vertical deflection of the truss arm due to equipment dead load shall not exceed the length of the truss arm divided by (L/360)

1.08 WARRANTY

A. Provide a warranty and warranty certificate for a two-year period beginning on the date the equipment is accepted by the Owner. Cost for removal, shipment, repair, and installation shall be included in the warranty.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: One of the following:
   1. WesTech
   2. Evoqua
   3. Walker Process
   4. Ovivo

B. Equipment furnished and installed under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with drawings, specifications, engineering data, and instructions and recommendations of the equipment manufacturer unless exceptions are noted by the Engineer.

C. Manufacturer shall have installations of like or similar application with a minimum of five years' service for specified size.

2.02 GENERAL REQUIREMENTS

A. Sludge collector mechanism:

1. All equipment components of the sludge collector mechanism including the center work platform, center column, influent well, center drive cage, sludge collector truss arms, scum skimming system, spiral scraper blades, center drive mechanism, drive motor, electrical controls, and overload devices and alarms, shall be furnished by the same manufacturer.
2. Some equipment may require modification from the manufacturer's standard.
3. Exercise care to assure that the electrical, mechanical, structural, and miscellaneous systems comply with the requirements specified or in other referenced sections.

2.03 MATERIALS

A. For all components, unless otherwise specified, use the materials of construction specified below.

B. Structural steel:
   1. All material in the basin in accordance to ASTM A36
   2. Grind all edges of steel members to approximately 1/16 inch minimum radius using standard workmanship and a grinder

C. Anchor bolts: Type 316 stainless steel.

D. Weir plate: Fiberglass reinforced plastic as specified in Section 06 80 17.

E. Scum baffles: Fiberglass reinforced plastic as specified in Section 06 80 17.

F. Fasteners and washers: Type 304 stainless steel, except for bolts which will be removed during installation and any high strength bolts.

G. High strength bolts: Use Type 316 stainless steel high strength bolts in attaching truss arms to cage, and cage to center drive gear casting. Manufacturer to size as required.

H. Do not use cadmium plated parts and fasteners.

I. Dissimilar metals: All dissimilar components shall be isolated from steel components as specified in Division 05 to prevent electrolysis.

2.04 SLUDGE COLLECTOR MECHANISM

A. Center work platform:
   1. Materials:
      a. Welded steel truss construction**.**
   2. Design:
      a. Composed of 2 main members laterally braced together.
      b. Minimum live load of 100 pounds per square foot.
      c. Maximum deflection not to exceed span length divided by 360 (L/360) for dead plus live loads center column.
      d. Support light standards and fixtures as indicated on the Drawings.
      e. Supported using center column
   3. Platform at the center turntable: Provide a minimum clearance of 2 feet 6 inches around all sides of drive mechanism and provide uninhibited access to all parts of the drive unit.

4. Guardrail with kickplate:
    a. Around center work platform.
    b. Guardrail and kickplate as specified in Division 05 and matching other railing supplied for Project.
5. Walking surface:
    a. Materials: aluminum grating as specified in Division 05.
    b. Location: Center work platform.

B. Center column:
1. Materials:
    a. Vertically mounted cylindrical center column.
        1) Inside diameter: 24-inch diameter minimum
        2) Wall thickness: ¼ inch minimum.
2. Design:
    a. Support the entire sludge collector mechanism including inboard end of bridge.
    b. Size and anchor the entire assembly to be capable of resisting overturning moments when tank is empty or full.
3. Center column anchorage: Mount center column over influent port at center of clarifier. Connect the base flange of the center column to the concrete foundation using anchor bolts.
    a. Use a rigid steel template of minimum ¼-inch thickness to accurately locate anchor bolts for the center column.
    b. Supplier shall coordinate with the Contractor to ensure proper anchor bolt location.
    c. Center column base anchor bolts:
        1) Not less than 8 in number.
        2) Not less than 15 bolt diameters of embedment length.
        3) Not less than 1 inch in diameter.
        4) Minimum edge distance for anchor bolts shall be the larger of 6 inches or 6 anchor bolt diameters, and as required to clear reinforcing bars located around opening.
    d. Center column base mounting flange:
        1) Size and reinforce using gussets or other stiffeners as necessary to adequately transfer loads from the sludge collector mechanism to clarifier structure.
        2) Bolt holes in flange to accommodate anchor bolts shall not exceed 1/8 inch plus bolt diameter.
4. Center column outlet ports: Provide outlet ports to disperse influent flow into the feedwell, including the following:
    a. A minimum of 4 outlet ports
    b. Appropriately reinforced port openings.
    c. Other dimensions as indicated on the Drawings.
5. Flange and stiffen the top of the center column for supporting the sludge collector mechanism, the drive mechanism, and the access bridge.
    a. Attach the center column to the drive assembly using bolts.
    b. Attach center column to drive assembly using bolts.
6. Drain holes: Provide two 2-inch holes at bottom to allow column to drain within the tank.

C. Energy Dissipating Inlet (EDI)
1. Materials:

a. 3/16-inch painted steel plate with necessary stiffening angles

2. Design:
   a. Locate inside rotating flocculation feedwell.
   b. Diffuse the liquid into the feedwell in a bi-directional or tangential direction without excessive disturbance or formation of vertical velocity currents.
   c. Prevent sludge from depositing in the EDI.
   d. Multiple ports equally spaced around the dispersion well shall be provided to induce impinged flow.
   e. Include full bottom plate extending to within 1 inch of the center column.
   f. Bottom plate of EDI to be provided with properly sized drain holes.
   g. Diameter, depth and detention time of the EDI shall be included in the submittal with the design calculations.

D. Influent flocculation feedwell:
   1. Materials:
      a. 3/16 inch minimum thickness painted steel plate.
      b. Reinforced with steel stiffening angles where necessary.
   2. Design:
      a. Supported around the outside of the center drive cage using rigid connection. Other methods of connection such as swinging or breakaway supports are not permitted.
      b. Reduce influent flow energy in a contained area and prevent short-circuiting of flow.
      c. Dimensions: 17-feet minimum
      d. Equip with a minimum of 4 baffled slots as indicated on the Drawings to allow for removal of floating material in the well.

E. Center drive cage:
   1. Materials: Painted structural steel members.
   2. Design:
      a. Box truss design.
      b. Design to carry load from the truss arms plus its own dead load.
      c. Design to withstand 2.0 times the design running torque of the drive without overstressing the members.
      d. Fasten center drive cage to spur gear assembly using bolted connection.
      e. Center drive cage shall support and rotate the truss arm assemblies with the attached spiral scrapers and surface skimming arms.

F. Sludge collector truss arms:
   1. Materials: Painted structural steel.
   2. Design:
      a. Truss design. Tie rods not permitted.
      b. Design to withstand 2,0 times of the design running torque of the drive without overstressing the members.
      c. Design with sufficient structural strength to sweep in a layer of grout on the clarifier bottom under its own power.
      d. Maintain width of truss arm same as the width of center drive cage to ensure alignment and proper connection.
      e. Rigidly connect truss arms to center drive cage.
      f. Conform truss arms to slope of tank floor.
      g. Use the truss arm to support the spiral scraper blades and scum skimmer arms.

h. Truss arms shall be adjustable at the cage to assure an even grout thickness over the tank bottom.
i. The rake speed shall be sufficient to transport the necessary volume of sludge to the sludge outlet, but shall not re-suspend settled sludge.

G. Tapered spiral scraper blades:
1. General:
a. Manufacturer shall be solely responsible for the design of the spiral scraper blades.
b. Spiral sludge blades indicated on the Drawings are for illustration purposes only, and shall not be construed as design intent.
c. Additional blades to transport sludge away from center column to withdrawal point shall be provided, if required by manufacturer's design configuration.
2. Blades:
a. Materials: Painted structural steel.
b. Thickness and stiffeners as required to limit blade deflection.
1) Taper blades as required to match floor slope.
2) Top of blade shall be horizontal.
c. Sized and spaced so entire circular portion of tank is scraped twice for each revolution of the mechanism.
3. Squeegees:
a. Materials: Stainless steel, spring type, not less than 26-gauge thickness.
b. Attach squeegees to blades utilizing stainless steel hardware. Squeegees shall be designed to allow 2 inches of vertical adjustment.

H. Sludge withdrawal ring or drum:
1. Sludge withdrawal ring or drum design shall be by the clarifier equipment manufacturer. The sludge withdrawal ring or shall be located and sized to prevent short-circuiting of the influent to the underflow. It shall be placed at a point of high sludge concentration. It shall and shall remove sludge uniformly around the center of the tank.

2. Sludge withdrawal ring or drum shall surround the center column and shall include appropriate anchorage to the tank floor. The cross section shall be tapered along its length to assure a constant sludge velocity. Equally spaced orifices shall be cut into the outer wall. The orifices shall be sized to avoid plugging. The annulus between the column and the ring or drum shall be filled with grout.

I. Scum skimming system: Consisting of a scum skimmer assembly that pushes floating scum to a scum trough for removal. Basic components of skimmer assembly include scum deflector blades and skimmer device. Dual scum skimmers shall be required.
1. Scum deflector blades:
a. Material: Painted structural steel plate.
b. Designed to collect and push floating scum radially outward toward the circumferential scum baffle.
c. Extends from the flocculating well to the scum skimmer device.
d. Attached to the rotating collector mechanism at the flocculating well, supported with skimmer assembly supports from the sludge collector truss arms.

e. Attach inner end of deflector blade tangentially to the flocculating well where practicable. Otherwise, provide maximum angle of approach of scum deflector blade to the scum in order to drift the scum to circumferential baffle.

2. Scum skimmer device:
   a. Materials: Structural steel plate and members.
   b. Attach to outer end of the scum deflector blade to trap scum for discharge into scum trough.
   c. Size: Full length of the scum trough.
   d. Design:
      1) Maintain continuous contact and proper alignment with scum baffle and inclined scum ramp to positively rake scum to the scum trough.
      2) Use a hinged blade to move entrapped scum up the scum beach to the scum trough.
      3) Provide a replaceable wear block on the outer edge of each scum skimmer device.
   e. Hinged blade:
      1) Adjustable vertically to control the dewatering of scum as it travels up the inclined ramp to the scum trough.
      2) Adjustable vertically over the length to ensure contact with the scum trough even though the trough may not be level.
      3) Capable of being raised and locked out above the water level or held horizontally against the circumferential scum baffle when skimming is not required.
      4) Equipped with replaceable scum skimmer wipers on the bottom inner and outer edges to seal the entrapped scum and water when moving up the inclined approach ramp to the scum trough.
   f. Scum skimmer wipers: Oil resistant neoprene.
   g. Wear block:
      1) Material: Polyvinyl chloride.
      2) Wear block constantly forced against circumferential scum baffle to keep baffle clean using a coiled spring arrangement.
      3) Force between baffle and wear block adjustable between 1 to 5 pounds.
   h. springs:
      1) Material: Type 18-8 stainless steel.
   i. Scum Flushing Valve: A valve shall be attached to the scum box which automatically opens and allows clarified liquid into the scum box to flush out solids. The valve shall actuate at every pass of the scum skimmer over the scum box. Delay and flush duration shall be adjustable. The valve shall provide 2 to 5 gallons of flush water per each pass of the skimmer assembly.
3. Scum trough and scum beach:
   a. Fabricated from 3/16-inch minimum thickness stainless steel plate.
   b. Supported from clarifier wall by structural stainless steel members.
   c. Scum trough:
      1) Width: As recommended by clarifier manufacturer
      2) No internal stiffeners or structural members which obstruct scum flow.
      3) Standard pipe flanged connection for scum discharge pipe. Size as indicated on the Drawings.
   d. Scum beach (inclined approach ramp):

1) Length: As recommended by clarifier manufacturer
2) Shaped to contain scum as it is moved up the incline to the trough by the scum skimmer.

4. Skimmer assembly supports:
   a. Material: Structural steel members.
   b. Attached to the sludge collector truss arms. Do not support scum skimmer assembly from the scum baffle.
   c. Space supports, brought up from the truss arm, at not greater than 10 feet apart.
5. Equipment manufacturer shall size and locate counterweights to be installed by the Contractor.
6. Threaded fasteners: Type 18-8 stainless steel.

J. Fiberglass Weirs and Scum Baffles
   1. Design per Section 06 80 17 Fiberglass Reinforced Plastic Fabrications.

K. Scum Spray System:
   1. A fixed scum spray system to be supplied to direct surface scum for removal. System to include the following:
      a. Water supply line fabricated from 2” diameter Schedule 40 galvanized steel piping starting at the basin wall, extending along the access truss bridge to the drive service platform. Piping to supply spray water to three individual surface spray headers and include a cast iron Y-strainer with blow-off valve.
      b. Two surface spray headers fabricated from 2” diameter Schedule 40 galvanized steel pipe. One header to extend from the peripheral scum baffle to the influent feed well. Second header extends from the drive cage to the feed well. Headers to include ½” diameter stainless steel drop pipes with flat pattern spray nozzles spaced on approximate 48” centers and a cast iron screwed plug valve for flow control and throttling.
   2. Manual valves shall be accessible from the bridge, at handrail level.

L. Foam Suppression System
   1. A foam suppression spray system shall be provided to spray water around the center column just below the gear drive.
   2. Foam suppression system to include 1” diameter schedule 80 PVC pipe, fittings, a minimum of five PVC cone shape nozzles, and 1” diameter true-union plug valve for flow control and throttling.

M. Scum Beach Switch and Solenoid Valve

N. Effluent Weir Cleaning System
   1. Design per Section 46 43 21.13 Circular Clarifier Cleaning Equipment

O. Drive, Option A:
   1. Center drive mechanism: Provide a center drive mechanism consisting of a primary speed reducer driven by electric motor, through a roller chain using an intermediate gearset consisting of a cylindrical-worm and helical-wormgear, and a low speed gearset consisting of a spur pinion and internal spur gear supported within a cast iron housing by a circular main bearing featuring replaceable bearing race inserts.
      a. Gear motor speed reducer:

1) Type: Cylindrical-worm or helical-wormgear motor. Planetary gear units will not be acceptable.
2) Speed reducer in accordance with AGMA 6013 and 6034.
3) Service factors: Minimum speed reducer service factor of 2.0 minimum based on continuous running torque.
4) Connect speed reducer output shaft to drive sprocket of chain drive.
5) Speed reducer overhung load rating:
   a) Exceed the chain pull (based on continuous running torque) by 1.5 minimum.
6) Oil bath lubrication:
   a) Lubricant in accordance with AGMA 9005.
   b) Provide oil fill, drain, and oil level indicator devices.
   c) Oil bath protection seal: Felt.
7) All gears supported by anti-friction bearings.

b. Intermediate gearset:
   c. Type: Cylindrical-worm and wormgear.
   d. Materials:
      1) Worm: Alloy steel, hardened, ground, and polished.
      2) Wormgear: Centrifugally cast bronze.
      3) Washers: Hardened steel to prevent embedding of bolt head or nut.
      4) Bushings: Bronze.
      5) Housing: Cast iron in accordance with ASTM A 48, Class 30 minimum.
   e. Load capacity: Rated in accordance with AGMA 6034.
   f. Service factor: Minimum of 1.25 based on continuous running torque.
   g. Wormgear shaft:
      1) Drives pinion of low-speed gearset.
      2) Support shaft by anti-friction bearings or combination of anti-friction bearings and bushing.
   h. Wormgear: In accordance with AGMA 6022.
   i. Worm shaft: Support by anti-friction bearings. If the wormgear is bolted to a drive hub, it shall be piloted for concentricity.
   j. Worm and wormgear shaft: Anti-friction bearings shall have ABMA 9, L-10 life of 180,000 hours minimum based upon continuous running torque.
   k. Provide oil bath lubrication.
      1) Lubricant in accordance with AGMA 9005.
      2) Provide oil fill, drain, and oil level indicator devices.

2. Low-speed gearset:
   a. Provide low-speed gearset using spur pinion and internal spur gear.
   b. Spur pinion shall be:
      1) Integral with its shaft or keyed to a shaft.
         a) If keys are used, the pinion shall be secured to the shaft with a shrink fit.
         b) Set screws will not be acceptable.
      2) Welded spur pinion and shafts will not be acceptable.
      3) Keyed spur pinions shall have a wall thickness above the keyway equal to 1 tooth whole depth minimum.
         a) Keyway and keyseat shall have 0.02 inch minimum inside radii.
         b) Keys shall have 0.04 inch minimum chamfer on all edges.

4) Manufactured to have a minimum AGMA Quality Class 8 in accordance with AGMA 915-1, 915-2, 2015-1, and 2015-2.

c. Provide full depth teeth in accordance with ISO 53:
   1) Stub pitch gear teeth will not be accepted.
   2) Undercut gear teeth will not be accepted.

d. Load capacity rated according to AGMA 2001.

e. Power rating based on continuous service and the lower of the:
   1) Pitting resistance for the pinion and gear.
   2) Bending strength for the pinion and gear.

f. Minimum service factor of 1.25 based on continuous running torque.

g. Overload torque capacity (based on yielding of the pinion or gear teeth) exceeding the momentary peak torque by 1.8 minimum.

h. Internal spur gear:
   1) Material: Ductile (nodular) iron in accordance with ASTM A 536 or cast steel in accordance with ASTM A 148, or heat-treated alloy steel.
   2) Minimum AGMA Quality Class 6 in accordance with AGMA 915-1, 915-2, 2015-1, and 2015-2.
   3) Internal spur gear bolted to the center drive cage.

i. Turntable base:
   1) Material:
      a) Ductile (nodular) iron in accordance with ASTM A 536 or cast iron in accordance with ASTM A 48, Class 40 minimum.
   2) Bolted to the center column to provide support for the internal spur gear, entire rotating collector mechanism, and one end of the access bridge.

j. Raceways, ball bearings, and oil bath:
   1) Raceways and ball bearings:
      a) Raceways: Heat-treated alloy steel.
      b) Ball bearings: Heat-treated alloy steel.
   2) Provide replaceable annular raceways to support vertical and horizontal forces transmitted by ball bearings on turntable base and internal spur gear.
      a) Raceway 40 inches minimum in diameter.
      b) Size the raceways using the following equation:

$$q = 59{,}466\left(\frac{P}{N * D^2}\right)^{1/3}$$

Where:

q = Contact stress, pounds per square inch (maximum = 300,000 pounds per square inch)

P = Total rotating (hung) load, pounds, including truss arms, center cage, internal spur gear, influent well, skimmers, tapered spiral scraper blades, counterweights, and any other rotating weight.

N = No. of balls.

D = Ball diameter, inch.

3) Design raceway and ball bearings for ABMA 9, L-10 life of 200,000 hours minimum.
4) Provide oil bath for turntable base and internal spur gear.
a) Include felt seal and dust shield protection.
b) Provide oil fill, oil drain, and oil level indicator devices in readily accessible locations.
c) Lubricant in accordance with AGMA 9005.

3. Chain drive:
a. Material:
1) Sprockets: Steel.
b. Type: Standard roller chain in accordance with ASME B 29.1M connecting drive sprocket of the gear motor speed reducer to the driven sprocket.
c. Drive sprocket: Minimum of 12 teeth.
d. Chain and sprockets enclosure: Enclose roller chain and sprockets in weatherproof fabricated steel guard with service openings.
e. Chain:
1) Minimum tensile strength greater than 4 times chain pull based on momentary peak torque.
2) Power rating exceeding the transmitted power (based on continuous running torque) by 1.5 minimum.

4. Drive motor:
a. Motor design:
1) Drive motor shall be a squirrel-cage indication type.
2) Motor characteristics:
a) Maximum continuous horsepower not more than 1 hp.
b) Voltage: 480-volts.
c) Phase: 3.
d) Frequency: 60-hertz.
e) Insulation: Class B, moisture resistant.
f) Service factor: 1.15.
g) Maximum ambient temperature: 50 degrees centigrade.
h) Enclosure: TEFC, suitable for installation in a Class 1, Division 2 environment.
i) Synchronous speed: 1,800 revolutions per minute.
3) Nameplate: Include all information listed above under subparagraph "Motor Characteristics."
4) As specified in Division 26.

P. Drive Option B:
1. Design Parameters: The drive unit shall be designed and manufactured by the clarifier equipment supplier to ensure unit responsibility. The drive unit shall be designed for the torque values previously listed. It shall turn the mechanism at the design collector tip speed. The drive main bearing shall be designed for the total rotating mechanism loads with a minimum L-10 life of 50 years or 433,500 hours. The drive unit shall be capable of producing 21,800 ft. lbs. continuous torque and withstanding 43,600 ft. lbs. momentary peak torque while starting. The 31” drive main gear shall be designed to a minimum AGMA 5 rating when rated in accordance with the latest AGMA standard. Gear teeth shall be designed for proper load distribution and sharing. Stub tooth design and surface hardening of the main gear shall not be allowed. The main bearing shall be capable of withstanding the listed overturning moment without the aid

of any underwater guides or bearings to ensure correct tooth contact for AGMA rating of the main gear.

2. All spur gearing shall be designed to the latest AGMA spur gear standard for strength and surface durability, based on a life of 175,000 hours. he design running torque rating of the drive gearing shall be based on the smaller of the strength and durability values determined from the above AGMA standard. To ensure safety and ease of maintenance, all components of the drive shall be direct coupled and enclosed within the gear housing.
3. Physical Characteristics: The drive unit shall consist of the following items: Electric motor, speed reducer, overload protection, pinion gear, lower pinion bearing, internal main spur gear, cross contact precision main bearing, fabricated steel support base and cage adapter. The drive shall be mounted on the center column and support the entire rotating load of the mechanism.
4. The support base and cage adapter for the drive shall be of ASTM A36 fabricated steel. The center cage shall be fastened to and supported from the cage adapter. The support base shall be designed to eliminate any condensate from coming in contact with the lower pinion bearing. The gear housing shall be designed so that the main bearing and gear teeth are submerged in oil. It shall have an annular cavity for oil and condensate storage. Any condensate that collects shall flow 180 degrees away from the lower pinion bearing. The oil bath shall be enclosed and protected by a neoprene dust shield. A two-inch diameter “Bulls Eye” type oil sight glass, oil fill pipe, and drain line shall be provided for the reservoir. Lubrication fittings shall be readily accessible.
5. The pinion shall be heat treated alloy steel. A lower pinion bearing shall be provided to support the separating loads caused from the gear-to-pinion mesh. No overhung pinions shall be allowed on the speed reducing unit. The lower pinion bearing shall not be located below the turntable base.
6. Overload Protection: An overload device shall be provided in a stainless steel, weatherproof enclosure. A minimum of three adjustable set points (for alarm and motor cutout and backup motor cutout) shall be actuated from the reaction torque due to a heavy sludge loading in the tank. The two set points shall be set at the following percentages of design running torque: a) Alarm shall be set at 100 percent; b) Motor cutout shall be set at 120 percent; c) Backup motor cutout shall be set at 140 percent. These three set points shall be factory calibrated and set. A torque indicator shall be provided and oriented so that it may be read from the walkway. It shall be calibrated from 0 to 160 percent of design running torque.
7. Turntable: The support base shall have a maximum allowable deflection in accordance with the bearing manufacturer’s specifications under load. The allowable tensile yield strength shall be a minimum of 45,000 psi.
8. The main internal gear shall be integral with the main bearing and be forged of alloy hardened steel. The drive bearing shall include fully contoured raceways hardened to a minimum 58-60 Rc and protected by a neoprene seal. Ball bearings shall be of high carbon chrome alloy 52100 steel running in fully contoured races, as part of a precision gear/bearing set.
9. Speed Reducing Unit: The speed reducing unit shall consist of cycloidal, helical, or planetary speed reducers directly connected to a motor without the use of chains or v-belts and shall be keyed to the pinion. All speed reducers shall be fully enclosed and running in oil or grease.
10. The main ring gear of cycloidal drives shall be made of high carbon chromium bearing steel and be fixed to the drive casing. An eccentric bearing on the

high-speed shaft shall roll cycloidal discs of the same material around the internal circumference of this main ring gear. The lobes of the cycloid disc shall engage successively with pins in the fixed ring gear. The movement of the cycloid discs shall be transmitted then by pins to the low-speed shaft. Speed reducer efficiency shall be a minimum of 90% per reduction stage.

11. Speed reducer helical or planetary gearing shall be manufactured to AGMA standards and shall provide at least 95% power transmission efficiency per stage. The speed reducer shall have a minimum service factor of 1.25 based on the output torque rating of the drive.
12. The reducers shall be fitted with radial and thrust bearings of proper size for all mechanism loads and be grease. As a safety feature, the speed reducer shall be back drivable to release any stored energy as the result of an over torque condition.
13. Motor: The 1/2 HP motor shall be a squirrel cage, induction type, TEFC, ball bearing heavy duty unit of ample power for starting and operating the mechanism without overload, with a minimum service factor of 1.15.

Q. Electrical controls:
1. Local control panel:
   a. Enclosure: NEMA Type 4X, 316 Stainless Steel.
   b. Mount local control panel near drive mechanism on guardrail.
   c. Include spray system solenoid valve H-O-A.
   d. Provide other controls as shown on the process and instrumentation diagrams and as needed for a fully functioning system.
2. Electrical wiring as specified in Division 40
3. Overload device and alarms:
   a. Torque overload device: Incorporate into drive assembly.
      1) Mechanical overload device shall be actuated by torque from the rotation of the wormgear.
      2) Torque indicator:
         a) Provide a visual torque indicator oriented so that it may be always read from the walkway during operation.
         b) Calibrate torque indicator from 0 to 160 percent of the continuous running torque.
      3) Include with the overload device, 2 independently adjustable switches as follows:
         a) Alarm switch: An alarm switch that shall be adjusted to activate an alarm when load reaches 90 percent of the continuous running torque.
         b) Cutout switch: A cutout switch that shall be adjusted to shut-off the motor when load reaches 100 percent of the continuous running torque.
         c) Alarm circuit to sound an alarm horn and illuminate a red lamp, both mounted at the local control panel.
         d) Alarm contacts of the maintained type rated at 10 amps continuous pilot duty.
         e) Overload device indicating meter enclosure: Weather proof steel,
         f) NEMA Type 4X
      4) Provide electrical supply to overload device as indicated on the Drawings. Include:

a) Electrical components of overload device compatible with alarm devices.
b) Other electrical requirements as indicated on the Drawings.

b. Additional protection:
1) Provide shear pins in the drive assembly for additional protection above the shut-off torque rating.
a) This additional protection device shall function at approximately 125 percent of continuous running torque.
b) Shear pins: Corrosion resistant material.
2) Provide limit switch that indicates breakage of the shear pin due to any circumstance. Shear pin limit switch shall be interlocked with motor controls to prevent mechanism from operating with a broken shear pin.
a) Materials: Corrosion resistant.
b) Electrical enclosure: NEMA Type 4X

c. Alarm lamp:
1) Provide vapor-tight red alarm lamp suitable for outdoor installation.

4. Equipment identification plates: Provide identification plate, securely mounted on equipment in readily visible location, bearing equipment identification tag number.

2.05 FINISHES

A. Drive: Manufacturer shall prime and finish paint before shipping to project site. Contractor shall provide all touch up coating to damages caused by shipping and installation after complete installation.

B. Mechanism: For all metal surfaces, except stainless steel or aluminum components, surface preparation and coating shall be as specified in Division 09. Shop prime prior to delivery and finish coat after installation.

2.06 TOOLS AND SPARE PARTS

A. Spare parts: Furnish the following spare parts suitably packaged and marked. Include a price list and name, address, and telephone number of local supplier:
1. 2 sets of scum skimmer blade wear strips.
2. 1 set of stainless steel squeegees for each clarifier furnished.
3. 4 sets of shear pins. (if used)
4. 1 set each of oil seals for the worm shaft and pinion shaft.

B. Special tools: Provide the following special tools:
1. Tools required to assemble, disassemble, repair, and maintain equipment, and that have been specifically made for use on the equipment.
2. Necessary eyebolts, hooks, and rods for handling equipment parts.
3. List of tools with the maintenance and operation data describing the uses of the tools.

3.00 EXECUTION

3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. Storage and Handling: Products shall be carefully stored and handled in accordance with manufacturer’s instructions.

C. Protection of Equipment: Equipment shall be boxed, crated or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment and other equipment with anti-friction or sleeve bearings shall be stored in weathertight and heated storage facilities prior to installation. For extended storage periods, plastic equipment wrappers shall not be used to prevent accumulation of condensate in gears and bearings.

D. Comply with manufacturer's rigging instructions.

3.02 INSTALLATION

A. Sludge collector mechanism: Install mechanism and appurtenances as indicated on the Drawings and in accordance with the manufacturer's installation instructions and recommendations.

B. Field welding:
   1. Field welding is permitted only for the bridge splice.
   2. Use shielded arc welding and conform to requirements of design loads.

C. Guardrail with kickplate: Install on both sides of walkway and around center turntable as specified in Division 05.

D. Scum skimming system: Install counterweights designed and located by manufacturer.

E. Center column: Mount center column vertically over influent port at center of basin floor.

3.03 FIELD QUALITY CONTROL

A. Testing, training, and start-up: As specified in Section 01 75 00 and the following requirements below.

B. Tests:
   1. General: Conduct tests in presence of the Engineer.
   2. Working under direction of manufacturer's engineer, perform field tests on each mechanism as follows:
      a. Cutout torque test:
         1) Entire sludge collector mechanism shall be statically load tested by loading the rake arm with 1.5 times of the continuous operating torque rating.
         2) Test shall verify the torque overload control device settings for alarm and motor cutout.
         3) Perform cutout torque test prior to placement of grout topping on concrete slab.
         4) The manufacturer shall propose a method of conducting this test and shall verify that the method of testing will not impose stresses in members that exceed allowable stresses.

b. Adjustments and settings to overload device:
   1) Adjustments and settings: Perform necessary adjustments and settings to overload device to ensure that sludge collector mechanism will sound an alarm and switch off drive motor when specified overload conditions occur in tank.
   2) Test run: Perform test run following completion of adjustments and settings of overload device to confirm effectiveness of overload device.
c. Operational test:
   1) Operate the mechanism in a dry tank for a minimum of four continuous hours before flow is allowed to enter the system. There shall be no binding, jerky or unusual motion exhibited during this run period. Check motor amperage at least hourly for any unusual or higher than normal readings.
   2) If dry run is successful, introduce flow into tank and repeat four hour test, checking motor amperage hourly and observing equipment motion.
   3) Special attention: Give attention during dry test run of equipment to operation of scum skimming device.
   4) Settings of skimmer boom to scum box lip and rubber wiping and sealing strips: Set as required to ensure that adequate volume of scum is discharged under normal operating conditions.

C. Required results:
   1. Sludge collector mechanism:
      a. In the event the mechanism fails to meet field quality control test requirements of this Section, make necessary changes and retest mechanism.
      b. If mechanism remains unable to meet test requirements to satisfaction of the Owner or Engineer, remove and replace such mechanism with satisfactory mechanism at no additional cost.
   2. Contractor shall verify installation meets specified weir elevations tolerances at time of installation and from three to five months after continuous operation prior to project completion. Relevel as needed to meet specified tolerances.

D. Manufacturer's field service:
   1. Contractor to coordinate field service work with the manufacturer's service representative, Owner, and Engineer prior to initiating such work.
   2. Manufacturer's service representative:
      a. Manufacturer is to furnish services of representative experienced in erection and operation of the sludge collector mechanism for a period of two trips and two days.
      b. Services are to include the following:
         1) Installation consultation and advice.
         2) Checking and supervision of the collector installation.
         3) Inspection and certification that unit is ready to sweep in grout prior to grouting operation.
         4) Final inspection and adjustments prior to testing.
         5) Supervision of testing.
         6) Instruction of personnel on operation and maintenance of equipment.

END OF SECTION

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SECTION 46 43 21.13

CIRCULAR CLARIFIER CLEANING EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. The automated brush system for algae and debris control shall be designed for a brush to contact each of the following surfaces on the two Secondary Clarifiers as indicated below:

1. Inner Baffle
2. Outer Baffle
3. Inner Weir
4. Outer Weir
5. Top Spillway surface
6. Angle Spillway surface
7. Inner Launder wall
8. Launder Bottom
9. Outer Launder Wall

1.02 REFERENCES

A. Division 01: General Requirements

B. ASTM A240: Chromium and Chromium-Nickel Stainless Steel

1.03 SUBMITTALS

A. Product Data:

1. Comply with the general requirements of Division 1 and the supplemental requirements below.
2. Submit one drawing or illustration showing unit construction for each type and size brush cleaning unit used.
3. Submit the following for each brush cleaning system:
   a. Description including type of brush and accessories included.
   b. Brush dimensions and connection details
   c. Materials of construction and coatings for brush and accessories.
   d. Recommended spare parts list, including special tools, materials, and supplies furnished with equipment.

e. If catalog bulletins are used to communicate above information, mark out inapplicable information.

f. Location of nearest stocking distributor.

1.04 DELIVERY, STORAGE AND HANDLING

Comply with the requirements of the Special Conditions and Manufacturer's recommendations.

1.05 WARRANTY

The equipment will be warranted for two years after installation and final acceptance of this equipment.

1.06 EXPERIENCE REQUIREMENTS

Qualifications of manufacturer: The manufacturer of automated brush systems shall regularly engage in the manufacture of automated brush systems with a minimum of ten years' experience in the manufacture and installation of automated brush systems, have automated brush systems presently in operation for more than five years as examples of quality, longevity, and clarifier compatibility. Manufacturer shall have a minimum of 100 automated brush systems in operation in the US.

1.07 QUALITY ASSURANCE

A. The equipment covered by these Specifications is intended to be algae cleaning equipment of proven ability as manufactured by reputable companies having extensive experience in the production of such equipment. Cleaning systems specified herein shall be furnished by a single Manufacturer. The equipment furnished shall be designed and constructed in accordance with the best practice and methods and shall operate satisfactorily when installed as shown on the Drawings.

B. The cleaning system Manufacturer shall be fully responsible for the design, arrangement, and operation of all connected components, if any, of the assembled brush cleaning unit.

C. The cleaning system shall all be supplied by one manufacturer or manufacturer's representative. The cleaning system Manufacturer shall be responsible for the furnishing and performance of the complete brush cleaning system.

1.08 MAINTENANCE

Contractor shall provide owner with one (1) set of replacement brushes for each brush cleaning system installed.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

1. Ford Hall Company, Inc.
2. Envirodyne Systems, Inc.

2.02 GENERAL

A. The automated brush system shall be designed to work off the power of the existing clarifier drive motor. The system shall be constructed to avoid any noticeable torque increases. The unit shall be capable of encountering an indefinite stall without incurring damage.

B. The automated brush system shall weigh less than 200 lbs. in total for a single skimmer installation in order to minimize skimmer arm deflection. Counterweights will be added to the rake truss opposite of the skimmer to ensure the clarifier will remain in balance and to preserve the integrity of the clarifier drive and bearings.

C. The unit shall be designed with an engaged position for cleaning, and a disengaged position allowing the system to ride idle around the clarifier.

2.03 ACCESSORIES

A. ATTACHMENT ASSEMBLY

1. The attachment assembly shall provide a means of attaching the automated brush system to the skimmer arm so as not to interfere with any other operations of the skimmer arm (such as the effective skimming of floatable solids or the operation of the skimmer blade assembly at the scum box).
2. It shall be constructed of 304 stainless steel.

B. MAINFRAME

1. The automated brush system mainframe shall be constructed of 304 stainless steel and designed to slip easily into the attachment assembly and be tightened in position with the use of set screws. The mainframe shall be designed so that the brush arms can be positioned at any point on the mainframe.

C. BRUSH ARMS

1. Brush arms shall be constructed of stainless steel tubing to allow for adequate strength to support spring loaded brush assembly and to keep the automated brush system within the required weight limits. Each brush arm will allow / contain the following:
   a. Designed to allow flexibility to clean effluent surfaces within a plus or minus four-inch radial variance (specifically: clarifier launders, both sides of weirs and baffle).
   b. To have opposite the mainframe end, a brush holder component allowing for the insertion of a brush.
   c. To allow brush holder to be adjusted so that a maximum number of brush arm adjustments are possible.
   d. To have an adjustable means of biasing the arm to the mainframe so as to provide sufficient force to remove algae and debris.

e. Include a component that allows for each brush arm to be "locked out" or disengaged. This will allow operators to customize cleaning schedule and extend life of the brushes.

D. SPRING ASSEMBLIES

1. Each brush arm requires spring tension to bias the brush arm with the brush holder and brushes into tight engagement with the appropriate surface to be cleaned. Spring assemblies require the following:

   a. A minimum of one spring assembly of 316 stainless steel is required for each brush arm.

   b. Spring assemblies consist of two 316 stainless steel springs and three stainless steel guides to allow for maximum adjustability.

   c. Each spring will be composed of 316 stainless steel wire with a minimum diameter of 0.093 inch and a minimum of 240 active coils per spring length.

   d. Spring coils will have a mean diameter 0.093 inch. A minimum inner coil diameter of 0.56 inch and an outer diameter of 0.75 inch are required for each spring.

   e. Springs shall have a minimum initial spring tension of 9.8 lbs.

   f. Each end of the spring shall include a self-aligning captured swivel hook with heavier diameter wire, making for a more rugged (long lasting) low wire stress design. The last three to four coils of the spring are gradually tapered by reducing the coil end diameters, leaving a proper interference that prevents the captured swivel hook from pulling out.

E. BRUSH HOLDER

1. At the end of each brush arm there will be a 316 stainless steel brush holder to allow the insertion of a cleaning brush.

2. A brush holder shall be aligned with each of the following surfaces: both sides of the baffle, both sides of the weir, and each of the effluent launder surfaces.

   a. Each brush holder shall consist of a "bolted clamp design" to allow for the easy insertion of a cleaning brush.

   b. Each brush holder shall include a factory supplied brush in the proper size suitable for prolonged exposure to wastewater environment.

   c. Brush holder shall incorporate an anti-slip that compresses into the brush backing as brush holder is tightened. This provides additional security to ensure brush is firmly in brush holder.

   d. Each brush holder shall contain a shear safety component at the point where the brush holder attaches to the brush arm to allow for safety breakaway.

F. BRUSHES

1. Each brush holder shall contain one cleaning brush. Brushes shall slip easily into the brush holder and provide the cleaning means necessary to remove algae and

debris from their respective surfaces. A brush shall be aligned to contact both sides of the baffle, both sides of the weir, and all the effluent launder surfaces.

2. Brush construction shall be as follows:

   a. The brush base shall be made of durable injection molded polypropylene that is infused with a foaming agent to reduce the weight of the block. The material is impervious to UV rays, temperature fluctuations and the corrosive elements found in wastewater.

   b. The brush bristles shall consist of extruded polypropylene or polyester monofilament. Each filament type is extruded at a specific diameter to allow for different levels of stiffness and abrasion resistance. The filaments are secured into the base using tried and true brush manufacturing practices and utilize a corrosion resistant anchor to secure the bristles into the molded base. Each brush carries a unique penetrating trim which allows the filaments to penetrate the irregular concrete surfaces far better than a standard flat trim brush.

   c. The brushes shall be cut and shaped appropriately to clean their respective surfaces without binding. Injection molding the brush bases creates a brush block that is consistently uniform allowing for accurate fitting of each individual brush into its holder.

3. Replacement brushes shall be stocked by the manufacturer to the exact dimensions per clarifier and will be available for purchase. Brushes provided by the automated brush system manufacturer should average approximately one-year life span.

G. LOCK IN / LOCK OUT DESIGN

1. Each automated brush system shall be designed with the engaged or locked in position for cleaning and a disengaged or locked out position for riding idle around the clarifier.

2. Each brush arm will have a permanently mounted lock out ring that corresponds to a lock out hook which allows disengagement of the individual brush assembly. The lock out ring is mounted to a lock out boss that is attached to the brush arm.

3. Each automated brush system shall be designed so that the entire brush system can be disengaged, or individual brush arms can be disengaged allowing for customized cleaning of weir and effluent surfaces.

H. BRUSH BRIDGES

1. Shall provide the automated brush system launder brush assembly a “bridge” over/across the effluent discharge outlet.

2. Brush bridge / ramp will need to be provided at the scum box. An incline and a decline guide ramp will need to be provided for each scum box in the clarifier.

3. Brush bridge/s shall be constructed entirely of stainless steel.

I. BRUSH SYSTEM WEIGHT AND COUNTERBALANCES

1. Weight of the Automated Brush System will be less than 200 lbs. including all Brush System attachments, brush arms, components and parts for a single skimmer arm design.
2. Single skimmer designs require counterbalances to be installed on the rake mechanism opposite the skimmer to offset the weight of the Automated Brush System. Manufacturer of the Automated Brush System will need to provide additional counterbalances totaling the weight of the installed Brush System, attachment sleeve, and mainframe and be responsible for the correct placement and installation. (This is an additional counterweight beyond the counterbalances provided by the clarifier manufacturer.)

PART 3 EXECUTION

3.01 INSTALLATION

A. Contractor shall survey the effluent weir, and if necessary, relevel the weir prior to installation of the brush cleaning system.

B. The Construction Contractor shall install the brush cleaning system in accordance with the following requirements:

1. Installation shall be in accordance with the plans, approved shop drawings and the manufacturers' instructions.
2. Install brushes and operators to provide for ease of access and operation.

C. The Equipment Manufacturer shall furnish all accessories and hardware necessary for installation.

3.02 FIELD QUALITY CONTROL

A. The Equipment Manufacturer shall perform the following services:

1. Inspect the completed installation and note deficiencies.
2. Assist the Contractor during start-up, adjusting, and site testing of competed installation as required.
3. Instruct Owner personnel in the operations and maintenance of the equipment

B. Factory trained technician with five plus years' experience shall be onsite for a minimum of two days per clarifier to custom install and certify the custom designed automated brush system.

C. Clarifier manufacturer must approve custom designed automated brush system.

END OF SECTION

46 51 21 COARSE BUBBLE AERATION SYSTEM

1.00 GENERAL

1.01 SCOPE

A. Furnish and install all materials and equipment for a coarse bubble aeration system for one sludge storage tank with one aeration zone.

B. Include coarse bubble discs, disc holders, piping, supports, connections, tees, manifolds, valves and moisture purge systems necessary for a complete and operable system.

C. Design life of the coarse bubble aeration system shall exceed 20 years or 175,200 hours.

1.02 SUBMITTALS

A. Product Data: Provide construction details, material descriptions, dimensions of individual components and profiles, rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings:
1. Provide dimensional layouts, materials, details of appurtenances, anchoring, and installation and operating instructions. Fabrication and installation shall be in accordance with approved drawings.
2. Submit certified diffuser performance test data including air flow versus pressure drop data and oxygen transfer tests.
3. Submit certified curve of SOTE versus air flux rate (defined as airflow in scfm per active diffuser area) at the design submergence, prepared, sealed, and signed by a registered professional engineer.
4. Standard Oxygen Transfer Efficiency (SOTE) calculations to verify the clean water oxygen transfer efficiency of the diffuser at both design and maximum airflow.
5. Pressure Drop Calculations for the complete aeration system from the top of the drop leg to the furthest diffuser at both design and maximum airflow.
6. Equipment weights and lifting points.
7. Operation and Maintenance Manuals
8. Information Submittals:
9. Shipping, storage and installation instructions
10. Location of nearest stocking distributor of spare parts.
11. Suggested spare parts list
12. List of equipment installations.
13. Factory Test Reports

1.03 SYSTEM PERFORMANCE AND DESIGN

Comply with the requirements of Tables 1.03 except that the total number of diffusers provided may be greater than listed to accommodate individual manufacturer’s layouts.

Table 1.03-1: Coarse Bubble Aeration System Information at Sludge Holding Tank

Description	Sludge Holding Tank
Maximum Water Surface Elevation, ft	678.0
Finished Floor Elevation, ft	660.0
Ambient Air Temperature Range, °F	15 – 115 °F
Water Temperature Range, °F	50 – 90 °F
Tank Diameter, ft	38’
Maximum Diffuser Grid Submergence, ft	17’
Water Depth Pressure at Typical WSE, psig	7.4 psig
Available Pressure at Top of Dropleg, psig	7.9 psig
Percent Solids Range, %	0.7 – 1.5
Design Air Flow per Diffuser, scfm/diffuser	5.0
Minimum No. of Diffusers	120

1.04 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail(s) in materials or workmanship within specified warranty period.

B. Warranty Period: Two years from date of equipment acceptance of the final basin or tank for which equipment is installed.

C. Cost for the removal, shipment, repair and installation by Contractor shall be included in warranty, as well as correction of defective work.

2.00 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Stamford Scientific International, Inc. (SSI)

B. Aquarius Technologies, Inc.

C. Xylem Sanitaire Snap-Cap

2.02 MATERIALS, MANUFACTURING & FINISHING

A. Stainless Steel
   1. Fabricate all welded parts and assemblies from sheets, plates, or bars of 304L stainless steel with a 2D finish conforming to ASTM A240, A554, A774 and A778.
   2. Fabricate all non-welded parts and assemblies from sheets, plates, or bars of 304 stainless steel conforming to ASTM A240, or ASTM A276.
   3. Furnish all nuts, bolts, washers, and anchors bolts from 18-8 series stainless steel.
   4. Weld in the factory with ER 316L filler wire using MIG, TIG or plasma-arc inert gas welding processes. Provide a cross section equal to or greater than the parent metal.

5. Clean all welded stainless steel surfaces and welds after fabrication to remove weld splatter and finish clean all interior and exterior welds by full immersion pickling and rinse with water to remove all carbon deposits and contaminants to regenerate a uniform corrosion resistant chromium oxide film per ASTM A380 Section 6.2.11, Table A2.1 Annex A2 and Section 8.3.

B. PVC
1. Fabricate 4 inch diameter manifolds and air distribution headers of SDR 17.8 PVC conforming to ASTM D1784 and D3034.
2. Fabricate manifolds 6 inch diameter and larger of Schedule 40 PVC conforming to ASTM D1784, D1785 and D2466.
3. Fabricate diffuser holders, retainer rings and subplates of PVC material conforming to ASTM D1785.
4. PVC components shall contain a minimum 1.5 percent titanium dioxide to minimize ultraviolet light degradation.

2.03 EQUIPMENT COMPONENTS

A. Drop Pipes – Provide a minimum 12 gauge stainless steel drop pipe from the air main connection to a point 3 feet above the manifold.
1. Provide a stainless steel flange with a 150-pound drilling at the top connection.
2. Provide a stainless steel EPDM gasketed coupling for connection to the manifold.

B. Manifolds – Provide a PVC manifold for connection to the air distribution headers.
1. Fabricate manifolds in sections up to 25 feet in length.
2. Connections between separate manifold sections and between the manifold and air distribution headers shall be threaded union or flanged joints to prevent rotation and blow apart. All joints shall be factory solvent welded.
3. Design manifolds to withstand a 130° F mean wall temperature.

C. Air Distribution Headers
1. Fabricate air distribution headers in sections up to 24 feet in length.
2. Connections between air distribution header sections shall be threaded union or flanged joints to prevent blow apart and rotation. All joints shall be factory solvent welded.
3. Design air distribution headers to withstand a 130° F mean wall temperature.
4. Design threaded union joints with spigot and socket ends joined with a threaded ring and sealed with an O-ring gasket.
5. Threaded unions will provide an uninterrupted 360° rotation to provide for leveling adjacent distributors. Unions with spline locks or ratchets will not be acceptable.
6. To prevent damage to the joint, the union will provide the anti-rotation feature through the O-ring, spigot and socket.
7. Threads on union joints shall be a minimum of 0.013 square inches to provide adequate strength of the socket and retainer ring.
8. Flange joints shall be Van Stone style follower flanges with 150lb drilling and stainless steel hardware.
9. Provide end caps at the end of each air distribution header.

D. Pipe Supports – Provide each section of manifold and air distribution header with a minimum of two supports.

1. Design all supports to allow for thermal expansion and contraction forces over a temperature range of 125° F and to minimize stress build up in the piping system.
2. Design supports to be adjustable without removing the manifold or air distribution header from the support.
3. Manifold Support – 6-inch diameter and larger
   a. Support spacing shall be limited to a maximum of 8 feet.
   b. Design supports to include guide straps, support structure and two anchor bolts.
   c. Guide straps shall be fabricated from minimum 2 inch wide, 12 gauge stainless steel to eliminate point load on manifold and minimize binding.
   d. Design support to allow +/- 2 inches of vertical adjustment for leveling of manifold within ¼ inch of a common plane.
   e. Attach supports to tank floor with stainless steel anchor bolts.
4. Air Distributor and Manifold Supports – 4-inch diameter
   a. Support spacing shall be limited to a maximum of 7.5 feet.
   b. Design supports to include guide straps, support structure, locating plate and a single anchor bolt.
   c. To prevent improper installation, the locating plate shall be able to be installed in either of two directions relative to the support.
   d. Guide straps shall be fabricated from minimum 1 1/2-inch wide, 18 gauge stainless steel and have contoured bearing surfaces with chamfered edges to minimize binding and resistance to movement of air distributor under full buoyant uplift load.
   e. Design guide straps with 1/8 inch clearance around distributor so strap is self-limiting and cannot be over tightened.
   f. Design support to allow +/- 1 1/2 inches of vertical adjustment for leveling air distribution headers within ¼ inch of a common plane.
   g. Attach supports to tank floor with stainless steel anchor bolts designed for installation in 4,000 psi concrete.

E. Diffuser Assemblies – Furnish diffuser assemblies including diffuser cap, diffuser base, and diffuser connector.

1. Air Diffuser
   a. Diffuser shall be of the flexible diaphragm type.
   b. Provide diffuser fabricated of injection molded corrosion resistant polypropylene base with a long life EPDM diaphragm.
   c. The diffuser shall incorporate air discharge from the underside of the assembly to prevent fouling and shall provide a self-cleaning wiping action between the diaphragm and the base.
   d. A molded baffle on the base shall be designed to distribute the air evenly around the periphery of the diffuser.
   e. The diaphragm shall be designed to provide a positive check valve action to minimize the entry of debris and liquid into the air piping when air flow ceases.
   f. The diaphragm shall be field replaceable.

g. The base of the diffuser shall include an integrally molded 3/8” NPT Schedule 80 pipe thread.

2. Diffuser Connectors
   a. Diffuser connector shall consist of a female 3/8” NPT, Schedule 80 pipe thread bushing for each diffuser.
   b. Factory solvent weld connector to the top centerline of the air distribution header.
   c. Furnish PVC plugs for all unused diffuser connectors.

D. Anchor Bolts
   1. Design a mechanical or adhesive anchor bolt system for embedment in 4,000 psi concrete with a pullout safety factor of 10.

E. Condensate Evacuation System - Provide a condensate evacuation system to substantial drain the submerged aeration piping system for each aeration grid.
   1. Provide a minimum of 1 moisture blowoff system per aeration zone including all required pipe, fittings, valves, and accessories.
   2. Design the moisture blowoff system to be capable of effectively removing any liquid that has entered the piping system.
      a. Include a sump in the piping at the location of the purge pipe to allow the purge pipe to extend below the invert of the manifold and completely remove moisture from the manifold.
      b. This fitting shall be a cross or a tee with a factory-solvent welded cap installed on the downward facing branch.
   3. Provide Schedule 80 PVC for all moisture blowoff piping, except for a short length of flexible, reinforced EPDM hose from the header/lateral purge pipe connection to the rigid blower piping mounted on the tank wall.
      a. The use of lengths of EPDM hose greater than 4 feet for extending to the surface of the basin is not acceptable.
      b. All hose and fittings to have a pressure rating of no less than the attached pipe, except that the cross fitting used for the sump may be Schedule 40 PVC.
   4. Solvent welds may be used to join fittings to PVC pipe.
      a. A union shall be required in each blowoff line.
      b. Properly support the systems and allow for expansion and contraction of the piping over a temperature range of 160 degrees Fahrenheit with no stress buildup in the piping.
      c. Provide stainless steel hose clamps at each end of the flexible hose.
   5. Attach moisture blowoff piping to wall of basin with Type 304 stainless steel clips. The use of hose clamps or plastic ties to support blowoff piping from dropleg piping (or other piping) is not acceptable.
   6. Locate the valves in the blowoff piping in an easily accessible location above the water surface adjacent to the wall and just above the grid system. Valves shall be a socket end type, 304 stainless steel ball valve.
   7. Coordinate any tank penetrations with the tank cover supplier for a sealed penetration.

3.00 EXECUTION

3.01 INSTALLATION

A. Installation of all systems, subsystems, equipment, materials and other items covered by this Section shall be assembled, installed and aligned in compliance with the diffused aeration equipment manufacturer's instructions and recommendations and in conformance with this section.

B. The equipment manufacturer shall include in their instructions such information as is required to properly install all items covered in this Section, whether manufactured by them or not.

3.02 INSPECTION

A. Furnish a factory representative experienced in the erection, operation, and maintenance of the equipment. The representative shall be present during the initial installation of the diffusion equipment to ensure that satisfactory procedures are followed and shall provide periodic supervision and inspection consisting of a number of trips listed herein. The equipment manufacturer’s representative shall in addition, be present to supervise testing and startup of the aeration system and shall provide any other assistance to the Construction Contractor necessary to guarantee satisfactory performance of the equipment.

B. Manufacturer’s Services. Provide field services for coarse bubble aeration equipment. Qualified manufacturer’s representative shall present at site for minimum person-days listed below, travel time excluded. The 8-hour working day allowed for the training serves shall be timed overlap plant personnel shifts.

No. Person Days	Work Description
1	Installation assistance and inspection.
1	Functional and performance testing and training.

3.03 FIELD ACCEPTANCE TESTS

A. Prior to plant start-up, coarse bubble diffused aeration equipment shall be inspected for proper alignment, proper connection and satisfactory performance. System shall be operated continuously for 24 hours without leakage and perform the specified function. No testing shall be performed until the manufacturer’s service engineer has provided written certification that the installed equipment has been examined and found to be in the complete accordance with the manufacturer’s requirement.

B. After the installation is complete and the system is certified by the manufacturer, field acceptance tests shall be conducted. Field acceptance tests shall be done with clear water to demonstrate that the diffused aeration system is level within plus or minus 1/8-in and to demonstrate the airtightness of the joints and the strength of the stands. Should it be necessary to correct the elevation of any diffuser assembly as a result of this check, such action shall be taken before proceeding any further.

C. Uniformity and Leakage Test. Each aeration tank shall be flooded with plant water to a depth of one foot above the diffusers. The air supply will be turned on to design

air flow rates and air supplied evenly to all laterals. The surface of the water will then be visually inspected to see that air flow is uniformly distributed across the tanks and that no air leaks are present within the piping systems. If, in the opinion of the Owner, there are areas of consistent low or high air quantity release, or leaks within the piping system, the manufacturer shall make all necessary adjustments to correct these deficiencies.

D. Upon installation of the supports and prior to installation of piping, all of the supports of each type shall be tested to demonstrate compliance with uplift forces as specified herein. Testing shall include no less than 10 percent of the supports of each type, chosen at random to be witness tested by the Owner. Each support chosen for testing shall be attached to a lever which shall be placed on a fulcrum. A static load shall be applied the opposite end producing a vertical extracting force on the support tie-down as specified herein. The application of the test load shall be such that the entire pipe support, including pipe hold down strap, is tested.

E. The field acceptance tests shall be made by the Contractor under the direct supervision of a qualified representative of the manufacturer, and in the presence of the Owner. Field acceptance tests shall be mutually arranged and coordinated with the Owner's plant personnel and representative. The test shall not adversely affect the operation of plant facilities.

F. Cost of Testing: All of the above field tests and subsequent retests, including the filling, dewatering and cleaning of the aeration tanks and reaeration tanks shall be conducted at the expense of the Contractor.

END OF SECTION

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46 51 33 FLEXIBLE MEMBRANE DISK DIFFUSERS

1.00 GENERAL

1.01 SCOPE

A. Furnish and install all materials and equipment for a fine bubble membrane disc aeration system for two aeration basins, each with three aeration zones.

B. Include all membrane discs, disc holders, piping, supports, connections, tees, manifolds, valves and moisture purge systems necessary for a complete and operable system.

1.02 SUBMITTALS

A. Product Data: Provide construction details, material descriptions, dimensions of individual components and profiles, rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings:
   1. Provide dimensional layouts, materials, details of appurtenances, anchoring, and installation and operating instructions. Fabrication and installation shall be in accordance with approved drawings.
   2. Submit certified diffuser performance test data including air flow versus pressure drop data and oxygen transfer tests.
   3. Submit certified curve of SOTE versus air flux rate (defined as airflow in scfm per active diffuser area) at the design submergence, prepared, sealed, and signed by a registered professional engineer.
   4. Standard Oxygen Transfer Efficiency (SOTE) calculations to verify the clean water oxygen transfer efficiency of the diffuser at both design and maximum airflow.
   5. Pressure Drop Calculations for the complete aeration system from the top of the drop leg to the furthest diffuser at both design and maximum airflow.
   6. Equipment weights and lifting points.
   7. Operation and Maintenance Manuals
   8. Information Submittals:
   9. Shipping, storage and installation instructions
   10. Location of nearest stocking distributor of spare parts.
   11. Suggested spare parts list
   12. List of equipment installations.
   13. Factory Test Reports

1.03 SYSTEM PERFORMANCE AND DESIGN

Comply with the requirements of Tables 1.03 except that the total number of diffusers provided may be greater than listed to accommodate individual manufacturer’s layouts.

Table 1.03-1: Fine-Bubble Diffuser System Information at Aeration Basins

Description	**Each Aeration Basin**		
Level Controlling Weir Elevation, ft	675.35		
Finished Floor Elevation, ft	655.02		
Ambient Air Temperature Range, °F	15 – 115 °F		
Water Temperature Range, °F	50 – 90 °F		
Basin Width, ft	34’		
Diffuser Grid Submergence, ft	19.46’		
Water Depth Pressure at Typical WSE, psig	8.4 psig		
Available Pressure at Top of Dropleg, psig	8.9 psig		
MLSS Range, mg/L	2,500 - 4,000		
Design Air Flow per Diffuser, scfm/diffuser	1.5		
Minimum No. of Diffusers, per Basin	938		
Description for Each Zone	**Zone 1**	**Zone 2**	**Zone 3**
Nominal Length, ft	33.3’	33.3’	33.3’
Minimum Diffuser Density, %AD/AT	13.8%	12.2%	10.5%
Minimum No. of Diffusers / Zone	354	314	270

A. Layout
   1. Tapered floor coverage, fine bubble aeration at Aeration Bains.
   2. Minimum spacing between centerline of diffuser rows shall be 1.5 ft. to allow adequate access for plant personnel for cleaning under the diffuser grid.
   3. Maximum spacing between centerline of diffuser rows shall be 3.5 ft.
   4. Maximum distance between centerline of diffuser rows adjacent to basin walls to basin wall shall be 4.5 ft. All basin walls shall have diffusers within 4.5 ft from each wall.
   5. The distance between headers shall not be more than twice the distance between diffusers on each header.
   6. Grids arranged so that the specified oxygen transfer efficiency is obtained using only the available floor area specified in Tables 1.03.

B. Certified Efficiency Curve
   1. Provide certified oxygen transfer curves for the fine bubble aeration equipment specified herein. Tests for each specified condition shall be provided in complete accordance with ASCE Clean Water Test Procedure.
   2. The certified efficiency curve of SOTE versus air flux rate shall illustrate shall a minimum clean water transfer efficiency of 32-percent at a diffuser depth of 18-feet and at a wastewater temperature of 20 °C.

C. Oxygen Transfer Efficiency Factory Test
   1. The Owner reserves the right to require testing to determine the oxygen transfer efficiency of the proposed diffused aeration equipment. If required, the testing will be conducted by an independent testing facility approved by the Engineer at the Owner’s expense. The results of the oxygen transfer tests will be used to determine the actual oxygen transfer efficiency, OTE (actual).
   2. If required, shipment of the diffused aeration equipment shall not commence until the factory testing has been completed, test results have been received by the ENGINEER and any necessary revisions or modifications have been made to the equipment.

3. Factory testing conditions shall be at sidewater depth, submergence, and air flows for each set of basins as listed in Tables 1.03.
4. The oxygen transfer efficiency factory test procedure will be as follows:
   a. Comply with ASCE Standard No. 002-06: Measurement of Oxygen Transfer in Clean Water.
   b. Submit to the ENGINEER with the shop drawings the proposed testing procedure.
   c. Measure air flow during testing with a sharp-edged orifice plate.
   d. The test tank shall simulate the applicable specified operating conditions including, but not limited to: air pressure, air flow per diffuser, diffuser density (number of diffusers per unit area) and diffuser depth.
   e. Fill the test tank to the specified sidewater depth with tap water, before any test series begins.
   f. Deoxygenate water using cobalt chloride and anhydrous sodium sulfite
   g. Utilize luminescent dissolved oxygen probes in-situ for the oxygen concentration measurements.
   h. Determine C_{sat}, Kl_a, and mass oxygen transfer rates
   i. Perform at least three (3) test runs for each quadrant diffuser density for average and maximum air flow rates. The OTE shall be the average of all tests for each set of conditions.
   j. Report to the ENGINEER in writing all data sheets, plots and calculations in a clear and concise manner. Include a written explanation of all pertinent information dealing with testing or analysis of the data.
5. OTE factory testing, if required by the Owner, shall confirm a minimum clean water transfer efficiency of 32-percent at a diffuser depth of 18-feet and at a wastewater temperature of 20 °C. If not, diffusers supplied shall be replaced with diffusers that meet OTE requirements at no cost to the Owner.

2.00 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Stamford Scientific International, Inc. (SSI)

B. Aquarius Technologies, Inc.

C. Sanitaire, a Xylem brand

2.02 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail(s) in materials or workmanship within specified warranty period.

B. Warranty Period: Two years from date of equipment acceptance of the final basin or tank for which equipment is installed.

C. Cost for the removal, shipment, repair and installation by Contractor shall be included in warranty, as well as correction of defective work.

2.03 DROP PIPE:

A. Fabricate all welded parts and assemblies from sheets and plates of 304 stainless steel. Fabricate non-welded parts and pieces from sheets and plates of 304 stainless steel.

B. Pickle all stainless steel assemblies and parts after welding, fabrication and wire brushing by complete immersion in an acid solution as specified in ASTM A380. The acid shall be a nitric-hydrofluoric solution as defined in Table A2.1, Annex A2 of ASTM A380. Providing a final rinse using ordinary industrial or potable water and dry in conformance with Section 8.3 of ASTM A380. Corrosion protection techniques not employing full immersion methods are not acceptable.

C. Do all welding in the factory using MIG, TIG or plasma-arc welding inert gas processes. Field welding is not permitted.

2.04 MANIFOLD AND DISTRIBUTION HEADERS

A. Submerged manifolds shall be minimum Schedule 80 PVC, conforming to ASTM D1784 and D1785. Distribution headers shall be minimum Schedule 40 PVC, conforming to ASTM D1784 and D1785.

B. Factory solvent-weld all PVC joints. Field solvent welding is not permitted. Utilize 125 lb flanges with EPDM gaskets, 304 stainless steel band couplings, or stainless steel or PVC expansion joints for field connections.

C. Headers to terminate in removable end caps, to facilitate water flushing of the piping before installation of diffusers.

D. One PVC drain line sump with airlift purge ejector line and eductor carrier column to be provided to drain the submerged aeration piping system. System to include one ball valve.

E. Manifold shall be the same diameter as the drop pipe, 30-ft lengths maximum.

F. Distribution header shall be minimum 4-inch diameter, maximum 30-ft lengths.

G. PVC moldings shall have a minimum tensile strength of 7000 psi and shall include UV protection.

2.05 MEMBRANE AERATION SYSTEM EQUIPMENT COMPONENTS

A. All welded metals shall be 304 SS.
   1. Field welding not permitted.
   2. Do all welding in the factory using MIG, TIG or plasma-arc welding inert gas processes.
   3. Passivate after welding, fabrication and wire brushing by complete immersion in an acid solution as specified in ASTM A380.

B. Provide expansion joints with 304 SS shell and PVC liners. Minimum of 4 slotted bands with stainless steel screws to be used.

C. Provide support stands, which include hold-down, guide straps, anchor bolts, and supporting structure. Guide straps shall be a minimum of 2” wide for the manifolds and 1 ½” wide for the air distributors. Supports to have a mechanism to provide for +/- 2” vertical adjustment for alignment of the manifold in the field. Supports shall be designed to allow for complete removal from the tank (less anchor bolt) to enable cleaning and maintenance of tank bottom.

D. Guide supports to consist of a self-limiting hold down and sliding mechanism. Hold down and sliding mechanism shall provide a full circumferential 2” or 1 ½” wide contoured bearing surface with chamfered leading edges to minimize binding of the air distribution header. Sliding mechanism shall provide minimum resistance to movement of the air distribution header under full buoyant uplift load. Mechanism to provide 1/8” clearance around header and be self-limiting if the mechanism is over-tightened. Worm gear clamps are not to be utilized for attaching header pipe to supports, and U-bolts are not acceptable.

E. Fixed supports to consist of a self-limiting hold down and sliding mechanism. Hold down and sliding mechanism shall provide a full circumferential 2” or 1 ½” wide contoured bearing surface. Clamping device shall positively grip the air distribution header when tight and be self-limiting to prevent overstressing the header if the clamp is over-tightened. Worm gear clamps are not to be utilized for attaching header pipe to supports, and U-bolts are not acceptable.

F. Aligning and adjusting shall be infinitely adjustable within its limits to allow precise leveling of the air distribution headers and diffuser assemblies to within ¼” of a common horizontal plane without removing the header from the support.

G. Supports shall be 304 stainless steel.

H. Attach supports to tank floor with 316 stainless steel epoxy anchor bolts designed for embedment in 3000 PSI concrete. Supports and anchor bolts shall be designed to withstand 4 and 10 times, respectively, the calculated buoyancy force of the diffuser system.

2.06 DIFFUSER ASSEMBLIES

A. Furnish disc type 9” membrane diffusers only. Odd sizes and cylindrical diffusers are not acceptable.

B. Diffuser to consist of a membrane with integral gasket, base, retaining ring, air flow control orifice, and pipe saddle or grommet. Diffusers with ceramic or plastic type diffusion media elements are not acceptable as alternatives to the membrane. Diffusers that require a center bolt or webbing to limit membrane deflection are not acceptable.

C. Membrane material to be premium quality EPDM with an oil content between 9.5% and 12%. Membranes which have an oil content of above 12% are not acceptable.

D. Membrane shall collapse and seal when aeration system air is turned off. Membrane shall collapse onto base when air is not being diffused. Design should permit air to exit through the entire periphery of the membrane. Membrane shall be designed to resist clogging. Characteristics follow:

Flexible Membrane Properties

Property	Value	ASTM
Specific Gravity	1.25 or less	
UV Resistance	Carbon Black	
Ozone Resistance	Pass	D-1171
Durometer, Shore A	58 ± 5	D-2240
Tensile Strength	≥ 1,200 PSI	D-412
Elongation at Break	≥ 350%	D-412
Elongation (% Retained)	≥ 60% @ 100°C, 70hrs	D-573

E. Diffuser Holder, Support Plate, and Ring:
   1. Material: Molded PVC conforming to ASTM D1784 with a minimum tensile strength of 7000 psi per ASTM D638.
   2. Holder: Molded with threads to accept a retaining ring, with a minimum 2-1/2 threads of engagement.
   3. Ring: Molded and designed to apply equal pressure around outer edge.
   4. Ring and holder to have raised lip around diffuser contact surface to insure proper seal against diffuser gasket.
   5. Design retainer ring threads with minimum cross section of 1/8 inch to allow for one complete turn to engage threads.

F. Diffuser Connection:
   1. Diffuser holder shall be solvent and/or ultrasonically welded or connected by mechanical saddle to the distribution piping.
   2. Diffuser holders shall be factory installed.

G. Each diffuser assembly shall incorporate a flow control orifice or integrated orifice to ensure even air distribution throughout the zone.

H. Provide a moisture purge system to remove excess water from the air system when the system is started following a shutdown.

3.00 EXECUTION

3.01 INSTALLATION

A. Installation of all systems, subsystems, equipment, materials and other items covered by this Section shall be assembled, installed and aligned in compliance with the diffused aeration equipment manufacturer's instructions and recommendations and in conformance with this section.

B. The equipment manufacturer shall include in their instructions such information as is required to properly install all items covered in this Section, whether manufactured by them or not.

3.02 INSPECTION

A. Furnish a factory representative experienced in the erection, operation, and maintenance of the equipment. The representative shall be present during the initial installation of the diffusion equipment to ensure that satisfactory procedures are

followed and shall provide periodic supervision and inspection consisting of a number of trips listed herein. The equipment manufacturer's representative shall in addition, be present to supervise testing and startup of the aeration system and shall provide any other assistance to the Construction Contractor necessary to guarantee satisfactory performance of the equipment.

B. Manufacturer's Services. Provide field services for fine bubble aeration equipment. Qualified manufacturer's representative shall present at site for minimum person-days listed below, travel time excluded. The 8-hour working day allowed for the training serves shall be timed overlap plant personnel shifts.

No. Person Days	Work Description
2	Installation assistance and inspection.
1	Functional and performance testing and training.

3.03 FIELD ACCEPTANCE TESTS

A. Prior to plant start-up, fine bubble diffused aeration equipment shall be inspected for proper alignment, proper connection and satisfactory performance. System shall be operated continuously for 24 hours without leakage and perform the specified function. No testing shall be performed until the manufacturer's service engineer has provided written certification that the installed equipment has been examined and found to be in the complete accordance with the manufacturer's requirement.

B. After the installation is complete and the system is certified by the manufacturer, field acceptance tests shall be conducted. Field acceptance tests shall be done with clear water to demonstrate that the diffused aeration system is level within plus or minus 1/8-in and to demonstrate the airtightness of the joints and the strength of the stands. Should it be necessary to correct the elevation of any diffuser assembly as a result of this check, such action shall be taken before proceeding any further.

C. Uniformity and Leakage Test. Each aeration tank shall be flooded with plant water to a depth of one foot above the diffusers. The air supply will be turned on to design air flow rates and air supplied evenly to all laterals. The surface of the water will then be visually inspected to see that air flow is uniformly distributed across the tanks and that no air leaks are present within the piping systems. If, in the opinion of the Owner, there are areas of consistent low or high air quantity release, or leaks within the piping system, the manufacturer shall make all necessary adjustments to correct these deficiencies.

D. Upon installation of the supports and prior to installation of piping, all of the supports of each type shall be tested to demonstrate compliance with uplift forces as specified herein. Testing shall include no less than 10 percent of the supports of each type, chosen at random to be witness tested by the Owner. Each support chosen for testing shall be attached to a lever which shall be placed on a fulcrum. A static load shall be applied the opposite end producing a vertical extracting force on the support tie-down as specified herein. The application of the test load shall be such that the entire pipe support, including pipe hold down strap, is tested.

E. The field acceptance tests shall be made by the Contractor under the direct supervision of a qualified representative of the manufacturer, and in the presence of

the Owner. Field acceptance tests shall be mutually arranged and coordinated with the Owner's plant personnel and representative. The test shall not adversely affect the operation of plant facilities.

F. Cost of Testing: All of the above field tests and subsequent retests, including the filling, dewatering and cleaning of the aeration tanks and reaeration tanks shall be conducted at the expense of the Contractor.

END OF SECTION

46 61 41 CLOTH FILTER SYSTEM

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish, install, startup, and test two cloth media disk filter systems. Contractor shall furnish all labor, materials, equipment, and incidentals required for complete, fully functional filters as shown on the drawings and as specified herein, including all necessary controls, piping, valves, fasteners, and other accessories specified and shown.

B. Each unit shall include:
   1. Tank Assembly
   2. Drive Assembly
   3. Cloth Media Disk Assembly
   4. Backwash System
   5. Backwash Pump
   6. Backwash and Solids Piping Assembly
   7. Valves
   8. Float Switch
   9. Vacuum Transmitter
   10. Filter Control System with PLCs.
   11. Basin Level Pressure Transducer and High-Level Probe Installation.
   12. Electrical controls and internal components with cabinet air conditioner.
   13. Freeze Protection
   14. Motors and Variable Frequency Drives (VFDs)
   15. Power Distribution

C. All motors, pumps, and bearings shall be designed for continuous duty and long operating life in a high humidity atmosphere. All motors and pumps shall be 480-volt, 60 hertz, 3 phase.

D. Each filter unit will be shipped fully assembled and wired from the factory.

E. Cloth/frame assemblies shall be constructed such that each segment is easily removable. If the weight of the filter disk segment is greater than 50 pounds, a lifting mechanism shall be provided by the filter manufacturer and installed by the contractor. If a monorail is required, structural design shall be provided by an engineer licensed in Texas.

1.02 Related Sections include but are not necessarily limited to:

A. Division 00 – Bidding Requirements, Contract Forms and Conditions of the Contract

B. Division 01 – General Requirements

C. Division 26 – Electrical

1.03 SUBMITTALS

Submit the following in accordance with 01 33 00 – Submittals:

A. Drawings and Product Data
   1. Drawings – Shop drawings specific to project and applicable product data bound neatly in a single package. The following shall be included at a minimum:
      a. Manufacturer and model number of equipment.
      b. Layout drawings and equipment cut sheets showing dimensions, clearness, sizes, arrangement and size of connections, supports, anchors, and total weight of all products supplied. Shop drawings shall include filter assembly, supports, bearings, anchor bolts, pumps, controls, valves, and piping arrangements. Include dimensions, clearances, and any other information necessary for Engineer to determine whether the equipment complies with these specifications. Furnish media material specifications and characteristics.
      c. Detailed specifications and data describing the materials of construction.
      d. Complete electrical wiring diagrams and data on equipment devices to be furnished, including control panel arrangement and cables for power and controls.
      e. Complete performance curves including capacity, head, efficiency, and brake horsepower for all pumps over the full operating range. Solids handling capability and operating range for solids handling pumps.
         1. Location of nearest stocking distributor of spare parts.
   2. Complete operation and maintenance data for all equipment and controls.
      a. Operation and Maintenance plan shall include cold-weather event Standard Operating Procedure (SOP) for operations to perform prior to, during, and after a cold-weather event for proper operation of the filter system.
   3. Startup and Testing schedule
   4. Warranties and service agreements.

B. Submit and electronic copy and one (1) hardcopy of the PLC programs and information for main plant HMI coordination in 4 to 6 weeks after the Engineer's approval of submittal package. The programs will be reviewed for compliance with Owner's process control system.

C. All deviations from the Contract Documents shall be clearly identified and approved in advance in writing by the Engineer.

D. Any other information necessary for the Engineer to determine compliance with the specifications.

E. Partial or incomplete submittals will not be reviewed by the Engineer.

F. Elongation and breaking strength test report from ISO certified textile laboratory

G. Operations and Maintenance Manual:
   1. Location and telephone number of nearest stocking distributor of spare parts for all equipment.
   2. Complete operation and maintenance data for all equipment and controls.
   3. Equipment installation report with field test data and test records.

4. Warranties and service agreements.
5. Provide O&M data in indexed pdf format.
6. Cold weather protection instructions.

H. Preliminary O&M Manual shall be submitted prior to the start of the Performance Acceptance Test.
   1. Operation and Maintenance plan shall include cold-weather event Standard Operating Procedure (SOP) for operations to perform prior to, during, and after a cold-weather event for proper operation of the filter system.

1.04 SERVICE

A. The equipment manufacturer shall furnish the services of a factory trained representative for a minimum of eight-hour days at the jobsite per the summary table below. The Contractor shall coordinate the scheduling of such inspection, training, and startup assistance with Owner's personnel. Owner may videotape training session.

Item	Work Description	Number of Person Days	Number of Trips
1	Installation guidance for the equipment	2	1
2	Inspect the completed installation and note deficiencies	3	1
3	Assist Contractor during start-up, adjusting, initial testing of complete installation	3	1
4	Verification of each I/O point on each panel	2	1
5	Performance acceptance test set-up assistance	1	1
6	Classroom training for Owner to instruct routine operation, maintenance, and troubleshooting procedures	1	Can be combined with Item 3
7	Field training for Owner	2	Can be combined with item 5

B. The trips shall be for the purpose of equipment installation guidance, inspecting all equipment described herein after installation, to assist in troubleshooting, advise the Contractor and Owner during startup and testing, and to instruct Owner's personnel in routine maintenance and troubleshooting procedures. This time period shall consist of a minimum of 8-hour days, and travel to and from the project site shall not be included in the time period. Field representatives shall have a minimum of three (3) years of experience with the operation of and training on cloth media filtration equipment. Factory-employed personnel will be required to perform this service. The field representative shall submit a resume for approval before startup assistance can be provided. The Contractor shall coordinate the scheduling of such training and startup assistance with Owner's personnel. Owner may videotape training sessions.

C. The field representative shall assist the Contractor in conducting a performance acceptance test as described in Paragraph 3.03. The performance acceptance test shall occur between 60- and 120-days following equipment start-up to demonstrate the performance of the equipment. The Owner shall perform TSS sampling and testing and provide the manufacturer with the test results. The manufacturer shall submit a summary report to the Owner on the results of the testing. Also, in the report the manufacturer shall give details of actual operation, maintenance, and care of equipment and suggested revisions and improvements.

D. Manufacturer's installation report is required prior to final acceptance.

E. All equipment specified in this section shall be new and unused and shall be the standard product of the manufacturer. All equipment shall be supplied by a single manufacturer.

F. Manufacturer shall maintain a complete stock of spare parts commonly needed for the equipment specified at a location within the State of Texas or shall have next day delivery of spare parts not exceeding 50 pounds.

G. All pieces of equipment shall have a 316 stainless steel manufacturer's nameplate securely affixed on a conspicuous place on the equipment showing the ratings, serial number, model number, manufacturer, and other pertinent nameplate data.

H. The manufacturer shall furnish and be responsible for the complete system including the disks with chlorine resistant cloth media, backwash system, solids removal system, drive mechanism, electrical controls, local operator machine interface, and all other appurtenances furnished by the filter manufacturer, and required for the satisfactory installation and operation of the entire filter system.

I. Provide Equipment per the latest National Electric Code.

J. Welding shall be performed to AQS D1.6 specifications with all applicable procedures.

1.05 WARRANTY

A. The Manufacturer shall provide a written warranty against defects in materials and workmanship. Manufacturer shall warrant the goods provided by the Manufacturer to be free from defects in materials and workmanship under normal conditions and use for a period of two (2) years from the date both filters meet performance testing requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery, storage, and handling shall be in full accordance with manufacturer's instructions.

1.07 MANUFACTURING QUALIFICATIONS

A. The filter supplier shall have experience in the design and manufacture of cloth media filters for a minimum of five (5) years and shall be able to demonstrate a minimum of twenty (20) installations within the United States in municipal wastewater applications with cloth media.

1.08 PERFORMANCE AND DESIGN PARAMETERS

A. All equipment including controls and drives specified herein shall be specifically designed for the environment encountered in this installation. The environment will be hot, moist, and corrosive, exhibiting hydrogen sulfide, chlorine and other corrosive gases encountered in municipal wastewater treatment plants in hot, sunny climates. There are infrequent cold-weather events when temperatures are below freezing for extended periods of time. All necessary drains, controls, temporary housing, etc. should be included to protect the equipment during these events.

B. Equipment shall be designed for continuous duty and long operating life in a high humidity atmosphere and be capable of either continuous or intermittent operation.

C. The equipment, sizes, materials, and arrangements described in this specification section are based on recommendations by the equipment manufacturer and shall be considered minimum limits of acceptability. The equipment manufacturer shall be responsible for design, arrangement, and performance of all equipment supplied under this section. Arrangements other than those shown on Plans shall be subject to the Engineer's prior written approval.

D. The dimensions and orientation of the equipment are shown on the plans.

E. The filters shall be hydraulically designed to prevent overflow of filters at peak flow, preventing packing up of wastewater upstream, and allow for enough head to discharge to the receiving stream.
   1. Inlet peak water surface elevation shall be limited to 666.35'. Peak water surface elevation over the overflow weir shall be limited to 666.85'. Higher elevations shall require the Contractor to design and provide a lower foundation with retaining walls minimum 3 inches above grade and with two sets of concrete stairs for access.

F. Plant must still process and filter effluent during backwashing.

G. Filter system must have an overflow weir to enable effluent to be diverted around the filters if they are inoperable.

H. Filter manufacturer shall provide controls and all necessary electrical equipment for a fully functional filter system with automatic backwash capability.

I. Filter manufacturer shall provide O&M protection instructions for cold weather and provide all necessary drains, controls, etc. to facilitate such. Exposed piping shall be heat traced, insulated, and jacketed in accordance with Section 40 05 04 General Requirements for Piping Systems.

J. Design shall be for:
   1. 2.25 MGD Average Daily Flow (1.125 MGD per filter with both filters in service)
   2. 9 MGD Peak Flow (4.5 MGD per filter with both filters in service)
   3. Filter equipment shall be designed to operate with influent total suspended solids concentrations of 10 mg/l at the 2.25 MGD Average Daily Flow and 30 mg/l at the 9 MGD Peak Flow.
   4. Design the surface area of the filter cloth for a peak hydraulic loading rate of 6.5 gpm/ft^2.

5. Filter effluent total suspended solids concentration shall not be greater than 5 mg/l at the conditions specified above. Owner reserves the right (at Owner's expense) to conduct field testing by introducing return activated sludge into the filters at the specified flow rates to achieve the design loadings specified.
6. Maximum filter headloss: 12 inches.
7. Backwash system shall be capable of operating by headloss differential, by timed cycle or manually. All components shall be designed to operate continuously.
8. The filter unit shall be capable of meeting the performance testing requirements described in Paragraph 3.03.

K. Filter Hydraulics
1. During filtration, the filter unit shall operate in a static condition with no moving parts. The filter system shall provide for the collection of filtered solids on the outside of the cloth media surface to allow for the direct contact of cleaning systems. Filtered effluent shall be used for backwashing. The filter flow path shall be from the outside of the cloth frame to the inside. Systems with flow paths from the inside to the outside of the cloth frame that collect filtered solids on the interior surfaces of the cloth frame will not be acceptable.
2. Only media area below the effluent weir or port elevation will be considered in the filtration area calculation.
3. Submittal information shall include calculations that verify the effective filtration surface area. Media surface fused directly to support structure such that water cannot pass through the media shall not be included in these calculations.
4. The Operator shall be able to bring a drained filter online by simply opening the influent isolation device. If the filter design is such that it must be filled with water before the influent isolation device is opened to prevent damage to the filter media, an automated process that sequentially brings the filter back online with a single switch shall be provided to prevent accidental media damage. The automated process shall activate a minimum 6" diameter motorized valve to fill the filter with effluent or other clean water source in not more than five minutes, verify that the filter is full, and open the motorized influent isolation device.
5. Designs that utilize high pressure spray as the sole means of solids removal will not be acceptable.

1.09 MAINTENANCE

A. Spare Parts
1. One (1) backwash pump.
2. One (1) cloth media repair kit or Two (2) disk segments.
3. Two (2) valve actuators of each size and type provided.
4. Two (2) fuses and two (2) I/O cards of each size and type provided.
5. Any other equipment necessary for the operation and maintenance of the filter during the provided warranty.

2.00 PRODUCTS

2.01 MANUFACTURER(S)

A. Cloth filter system shall be manufactured by
1. Aqua-Aerobic Systems, Inc.

2. Alfa Laval, Inc.

2.02 MATERIALS AND/OR EQUIPMENT

A. All fabricated material shall be ANSI 304 stainless steel. All welding shall conform to the latest standards of the American Welding Society. Filter media shall be designed for easy removal and installation. Media supports shall be non-metallic or stainless steel construction.

B. All structural steel shapes shall be designed for the intended use and of adequate strength to withstand all loads during fabrication, shipping and operations.

C. Tank
1. The filter tank shall be constructed of a minimum 10 gauge plate with horizontal reinforcing channels installed around the perimeter of the tank.
2. Each tank shall have a rounded or sloped bottom to ensure deposition of solids does not occur in the corners of the tank. Each tank shall be provided with an integral solids waste collection manifold.
3. The filter tank shall have one (1) 18” flanged influent connection and one (1) 18” flanged effluent connection.
4. Tank interior shall be blasted per SSPC-10 and coated with one epoxy basecoat and one epoxy topcoat for a total of 8-12 mils. Tank exterior shall be blasted per SSPC-6 and coated with two epoxy basecoats and one polyurethane topcoat for a total DFT of 8-12 mils.
5. The filter assembly shall include a robust framework that shall be adequate to provide mounting and structural support for the drive mechanism, backwash assembly and multiple filter elements.

D. Drive Assembly
1. The drive assembly shall either rotate the filter assembly, leaving the backwash assembly fixed, or raise and lower the backwash assembly, leaving the filter assembly fixed.
a. For a fixed backwash assembly:
1) Each filter shall include an adjustable drive assembly with a gearbox, nylon drive sprocket, acetal drive chain with 304 stainless steel link pins, and a 304 stainless steel chain guard. The gearbox shall be parallel in-line helical type, AGMA Class 1 with a ¾ HP drive motor rated for 460 volt, 3 phase, 60 Hz. Gear reducer shall be Nord or approved equal. Drive motor shall be Nord, Weg, Baldor, or approved equal.
2) The drive assembly shall rotate the disks only during backwash. Systems requiring constantly rotating disks during filtration will not be acceptable. Belt driven systems or systems with multiple drive units per filter will not be acceptable.
.
b. For a fixed filter assembly:
1) The drive assembly shall be designed to cycle the backwash carriage during the backwash cycle.
2) Power for the drive system shall be provided by a 2 hp, 480V/3-phase/60Hz right angle gear motor.
3) A reversing motor starter shall be used to allow the backwash carriage to move across the filter media surface in either direction.

4) Bevel gearboxes are driven by the right angle gearmotor and rotate jackscrews to cause the washbox carriage to raise or lower based on jackscrew direction of rotation.
5) Ultrahigh molecular weight polyethylene drive nuts are installed in the backwash assembly that cause raising and lowering as the jackscrews are rotated.
6) Two inductive proximity sensors monitor the position of the drive assembly.

c. If motors and gearboxes require routine maintenance and are not accessible from the outside tank side walls, the equipment manufacturer shall provide an internal access platform between the tank side walls and motors and gearboxes.

E. Filter Cloth Frame Assemblies

1. Each cloth disk assembly shall consist of a cloth media sock supported by a steel or plastic frame with corrosion resistant assembly hardware. The frame shall be designed to secure the cloth media in place and minimize wear. The media shall not be deformed or folded during backwash. Cloth/frame assemblies shall be constructed such that each segment is easily removable. If the weight of the filter disk segment is greater than 50 pounds, a lifting mechanism shall be provided.
2. Cloths shall be of fiber pile construction having a nominal filtration rating of 10 microns. Granular media and screens having structured identical openings shall not be allowed. The pile cloth shall be free chlorine resistant cloth.
3. The cloth media shall have an active filter depth of 3 to 5 mm to provide additional collisions between solids particles and the media within the media depth, resulting in capture of solids across a broader particle range. The cloth depth shall also provide storage of captured solids, reducing backwash volumes while maintaining an operational headloss. Woven mesh or microscreen type media with no filtration depth are not acceptable.
4. Individual pile fibers shall be held in place by a support backing integral to the media. To facilitate proper flow of backwash water through the cloth, the medium's back side shall be of open construction consisting of 10% open area at least 50 times larger than the nominal filtration media in any direction. Media that uses sown in support structures, which have potential to prevent free flow through the media, shall not be allowed.
5. Cloth media breaking strength and elongation shall be tested in accordance with ASTM Standard D5035 2R-E method by an ISO certified laboratory specializing in textile testing. Breaking strength shall be exceed 200 lbf (890 N) in the warp and weft direction. Elongation shall be less than 10% at 60 lbf (270 N) in the warp and the weft direction. Test reports shall be provided with submittals to demonstrate compliance with this requirement.
6. Each assembly shall have an integral effluent manifold adequately sized for the application and designed to allow easy removal and replacement of the assembly.
7. Assembly restraints shall be easily accessible for removal from the top of the tank.

F. Maintenance Platform Assembly

1. The platform frame shall be welded 304 stainless steel construction allowing a maximum deflection of 1/720 of the span with a 100 lb./sq. ft. live load. The platform shall have a minimum of 36" passable width. Walkway shall be

constructed of 1/4" aluminum checkered plate. Handrails shall be of 1.5" diameter aluminum pipe along each side of the platform walkway, with removable 316 stainless steel chains across the ends.

G. Control Panel
1. Each of the two (2) Control Panels shall be a NEMA 4X, PLC, 316 Stainless Steel panel. Refer to Specification 26 29 87 Electrical Control Panels (ECPs) for additional construction details and component details.
2. Each control panel shall include the following components:
   a. Main 480 V power circuit breaker
   b. Motor starter for the Drive Motor
   c. Motor starter for the Backwash Pump Motor
   d. 480 V to 120 V control power transformer
   e. A UPS for backup power to the PLC
   f. All required fuses
   g. Circuit breakers for power to the backwash valves
   h. Circuit breakers for power to the solids wasting valve
   i. Hand-Off-Auto for the following:
      1) Backwash pump(s)
      2) Drive motor
   j. Indicator lights for “running” for the following:
      1) Backwash pump(s)
      2) Drive motor
   k. Indicator lights for fault for the following:
      1) Backwash pump(s)
      2) Drive motor
   l. E-stop
   m. PLC with I/O cards
   n. Human-Machine Interface
   o. Ethernet Switch
   p. Terminal blocks
   q. Air Conditioning Unit
   r. Any more items as required for a complete and operable system.
3. The control panel shall have the I/O modules and cards as required to connect the following field devices:
   a. Backwash pump
   b. Obstruction switches
   c. Backwash valves
   d. Solids waste valve
   e. Backwash vacuum transducer
   f. Low speed limit switch basin end of travel switch
   g. Basin level transducer
   h. Basin high level probe
4. The control panel shall be installed in the factory and pre-wired and pre-piped to all the field devices and components. This will include all 480 V power, 120 V power, controls, signals, etc. Wire and conduit shall comply with Section 26 05 19, Wires and Cables (1000 Volt Maximum) and Section 26 05 33, Raceways, Boxes, Fittings and Supports, respectively.
5. Provide I/O list of parameters to be monitored through interface with register assignments and engineering units. Provide communications with plant SCADA system via Modbus TCP/IP, with protocol gateway, if needed.

H. Backwash/Waste System and Pump Assembly

1. The backwash assembly shall consist of 304 or 316 stainless steel parts.
2. The backwash shoes shall be in direct contact with the cloth to ensure effective media cleaning. Systems utilizing media cleaning mechanisms that do not contact the filter media will not be acceptable. The cloth / support assemblies shall not include any gridwork overlays or other interferences that would prevent direct contact of the backwash shoes with the cloth fibers.
3. Solids removal piping shall be 304 stainless steel pipe supported with mounting hardware. 2” EPDM reinforced flexible hose with stainless steel hose clamps can be used to connect the solids removal piping to the solids removal header.
4. The backwash function shall incorporate a pump that draws filtered effluent through the cloth, thereby removing accumulated solids from the cloth surface. Each disk shall be cleaned by a minimum of two backwash shoes, one on each side. Each backwash/solids discharge assembly shall include one backwash pump, valves, and gauges. The piping assembly shall be Sch. 80 PVC or 316 stainless steel.
5. Filtering shall not be interrupted during normal backwashing and solids withdrawal.
6. The backwash assembly shall be designed as to not inhibit the removal of filter elements for routine service or maintenance.
7. The backwash pumps for each filter shall serve that filter independently and shall be a self-priming, solids handling, centrifugal pump designed for domestic wastewater applications. The pump will have an integrated 5 HP, 480V/3-phase/60Hz drive shall be a Gorman Rupp Model 12B20-B externally mounted centrifugal pump or approved equal. Backwash pumps shall not use a belt drive. Refer to Specification 26 34 13 NEMA Frame Induction Motors, 600 Volts and Below for additional details.
8. Backwashing shall be initiated by tank water level, timer, or manually through the operator interface. Operator shall have the ability to specify backwash time interval elapses through the operator interface. The backwash water shall be pressurized by the filter’s backwash pump for discharging from the filter system. Systems utilizing non-pressurized backwash flow will not be accepted.
9. The backwash pump shall be supplied with 120V motor space heaters and winding temperature switches connected to the Control Panel.
10. One butterfly valve shall be provided by the filter supplier for each pump discharge. Valve shall be rated for 150 psi.
11. One butterfly valve shall be provided at the pump suction piping for isolation for each backwash pump. Valve shall be rated for 150 psi.
12. The backwash pump shall include vacuum gauges. The vacuum gauges shall have a minimum 3.5” dial with all stainless steel welded construction, 0-30” Hg vacuum range, liquid filled, ¼” NPT process connection, 316 stainless steel bourdon tube and tip material, and bronze socket material, Ashcroft or approved equal.
13. The pressure gauges shall have a minimum 2.5” dial with a black painted steel case, 0-15 psi, heat resistant polycarbonate window, ¼” NPT process connection, “C” shaped bronze bourdon tube, and brass socket material, Ashcroft or approved equal.
14. Provide flexible rubber couplings between piping and pumps.
15. Backwash piping following the pumps shall be supplied by the installing Contractor. Installing Contractor shall supply unions or flanges for service,

wiring, and factory installed conduit shall be provided within 3 feet of the pumps.

16. All piping for connection of the backwash valves and sludge withdrawal valve to the suction of the backwash pump shall be sch. 80 PVC or 316 stainless steel and shall be supplied by Manufacturer.
17. Each filter shall include a solids waste removal system in the floor of the filter tank. The manifold shall be designed to siphon settled solids waste for discharge through the backwash pump. The operation of the solids waste removal system shall be automatic with user adjustable intervals and duration through the operator interface. Filters that are designed without a solids waste removal system will not be acceptable.

I. Valves
   1. Backwash valves shall be 3-piece, groove end, ASTM A351 Grade CF8M stainless steel body, 316 stainless steel ball and stem, full port, with a 115 volt, single phase, 60 Hz, open/close service electric actuator.
   2. Electrically actuated valves shall be installed at each backwash connection on each filter tank and at the solid waste removal connection on each filter tank. Individual valves shall be removable for maintenance with minimal effort and without having to remove piping. Valves shall be operated and controlled automatically from the control panel.
   3. Valve actuators shall be housed in a NEMA 4X enclosure and incorporate an internal brake, thermal overload monitor and heater.

J. Pressure Transmitter shall have stainless steel wetted parts and provide a 4-20 mA signal over a range of 0 to 5 psi. Unit shall monitor the water level of each filter tank. Transmitter shall be flush mounted to the tank wall. Transmitter shall be an IFM Effector PX series or approved equal.

K. Float Switch shall be furnished to indicate emerging overflow level. The float switch shall be Anchor Scientific Model GSI 40NONC-STO or approved equal. The float shall contain a non-mercury switch, chemical resistant polypropylene casing and a PVC #18 AWG three conductor cable. Switch rating shall be minimum 4.5 amps non-inductive at 120 VAC.

L. Vacuum Transmitter shall have stainless steel wetted parts and provide a 4-20 mA signal over a vacuum range of -30 to 0 inHg. Transmitter shall be an IFM Effector PX series or approved equal.

M. Control System
   1. The automatic and manual controls for operation of the filter system shall be furnished fully assembled, wired and pre-programmed in a UL 508A Certified Industrial Control Panel. Controls shall be provided to control or monitor equipment as described in the contract drawings. The control system shall include the following control components and practices:
      a. Control Panel Wiring and Assembly
         1) All control enclosures shall be custom assembled and wired in an Underwriters Laboratories (UL) certified cabinet shop using quality materials and labor. Short circuit rating of control enclosure shall be 5 kA RMS symmetrical @ 480VAC maximum.
         2) All control panel single conductor wire shall be 16 AWG multi-strand machine tool wire (MTW) minimum, with PVC insulation.

3) All wires shall be clearly marked with an identification number consistent with the wiring schematic drawing. Wire markers shall be a thermal transfer printable type. The material shall be a self-laminating vinyl. Labels shall be Brady THT-9-427-10 or approved equal.
4) Wiring inside the control panel shall be run in PVC wiring duct rated for continuous temperatures up to 122° F (50°C). Devices mounted in the enclosure door shall have wires run in spiral wrap to avoid pinch points when opening and closing the door.
5) Control components mounted internal and external to the enclosure shall be mounted with stainless steel hardware and clearly labeled with a plastic identification nametag.

b. Control Panel Quality Assurance
1) All control panels shall be UL certified. Testing by manufacturer's electrical engineering prior to releasing for shipment shall be completed. Testing shall consist of the following:
a) Point to point testing of all wiring prior to application of power.
b) Intended supply voltage shall be applied to enclosure.
c) All components shall be tested for proper operation and calibration.
d) The PLC and operator interface program shall be loaded and functionally checked.
e) All components shall be checked to confirm proper mounting specifications have been followed.
f) Enclosure shall be inspected for defects and repaired if necessary.
g) All labeling of wires and devices are correct, properly installed, and clean.
2) The manufacturer shall finalize the factory checkout by completing a control panel checklist to document all testing completed above.
3) Upon the successful completion of the control testing of the enclosure assembly, all applicable documentation (i.e., finalized drawing set, signed control checklist cover page, device data sheets, etc.) shall be placed in the drawing pocket of the enclosure.

c. PVC Non-Metallic Conduit
1) All wiring of pre-assembled and mounted external electrical components to control panels or junction boxes shall be protected with rigid PVC nonmetallic schedule 40 conduit and fittings. Conduit shall be sized for adequate spare capacity. All conduit unions and fittings shall be solvent cemented in accordance with instructions from the manufacturer. All conduits shall be supported at maximum 3 foot intervals.
2) Conduit shall be impact, corrosion and sunlight resistant and be rated for a maximum ambient temperature of 122°F (50°C). It shall be rated for use with 194°F (90°C) conductors and shall be UL Listed for exposed or outdoor usage. Conduit shall be manufactured by Carlon or approved equal.

d. Control Enclosure
1) The automatic controls shall be provided in a UL listed, NEMA Type 4X 316 stainless steel (14 gauge) wall mounted enclosure that provides insulation and protection for electrical controls and components from highly corrosive environments indoors and

outdoors. Enclosure shall include a seamless foam-in-place gasket to assure watertight and dust-tight seal. An internal 3-point latch and 316SS padlocking PowerGlide® handle shall be provided. Enclosures shall be unpainted, with a smooth #4 brushed finish. Enclosure shall be manufactured by Hoffman or approved equal.

2) The control panel will be factory installed, wired, tested then removed for shipping. The installing Contractor shall mount the control panel with 316 hardware and neoprene gaskets and reconnect the wiring.

e. Corrosion Inhibitor

1) Each control enclosure assembly shall be provided with corrosion inhibitors to protect interior electrical components from damage caused by high humidity. The corrosion inhibitors shall be installed prior to shipment to provide protection during shipment and storage of the enclosure. The corrosion inhibitor shall be Hoffman AHCI5E or approved equal.

f. Air Conditioner

1) A thermostat-controlled air conditioner with noise suppression shall be supplied to protect control components mounted inside the enclosure from high temperatures, humidity and ambient air contaminants. The air conditioner shall be constructed of brushed finish stainless steel 304 material and provide NEMA 4X Type protection from outdoor and hose-down applications. The air conditioner unit shall use CFC-free or environmentally safe refrigerant that is universally accepted. The air conditioner shall be manufactured by Hoffman or approved equal.

g. Main Disconnect Circuit Breaker

1) A UL listed, automatic molded case 3-pole disconnect breaker shall be provided in the control enclosures. The primary function of the disconnect switch shall be to provide a means to manually open a circuit and automatically open a circuit under overload or short circuit conditions. The disconnect breaker shall have a door mounted operating mechanism with trip indication. Power distribution connectors shall be mounted integrally to the circuit breaker for multiple load connections. Integral connectors shall be provided. The disconnect circuit breaker shall be a Square D/HDL, JDL, LDL, MDL, PDL or approved equal.

h. Motor Starter

1) A full voltage non-reversing Integrated Motor Starter-Controller shall be provided for motor applications up to 15 kW. Each starter shall provide control, protection and monitoring functions for the motor. The starter shall be IEC rated and shall have certifications according to UL and CSA standards and shall bear the CE marking. The starter shall have a maximum rated operational voltage of 690V and provide a 42kA @ 480 VAC rated breaking capacity on short circuit. The starter shall have a mechanical durability of 15 million operations. The starter shall provide short circuit trip, thermal overload trip with selectable tripping class, under current trip and phase imbalance trip.

2) A full voltage non-reversing IEC Style motor starter shall be provided for motor applications over 15 kW. Each starter shall consist of a circuit breaker, contactor and overload relay. The starter shall be IEC rated and shall have certifications according to UL and CSA standards and shall bear the CE marking. The starter shall have a

maximum rated operational voltage of 690V and provide a minimum 18 kA @ 480VAC and 25 kA @ 240 VAC interrupt rating on short circuit when used in combination with a PowerPact circuit breaker. The starter shall have a mechanical durability of 15 million operations. The solid state overload relay shall have class 10 tripping characteristics with trip current adjustment, phase loss and unbalance protection.

i. Circuit Breaker
   1) All single phase branch or supplementary circuits shall be protected with a single-pole, C-Curve rated circuit breaker. Circuit breakers shall be rated for 240 VAC maximum, 50/60 Hz and UL 489 listed. Supplementary and branch protection circuit breakers shall be Merlin Gerin Multi 9 or approved equal.

j. Fuse
   1) Properly rated fuses and fuse holders shall be provided for protection of individual control devices (discrete and analog signals) mounted outside of the enclosure. Each fuse shall be housed in a hinged type fuse block to protect against contact with the fuse. Fuses shall be rated up to 250 VAC and be Littelfuse or approved equal. Fuse holders for discrete devices shall be rated to 600 VAC and 30 Amps. Fuse holders for analog devices shall be rated to 300 VAC and 15 Amps. Fuse holders shall be Allen Bradley 1492 or approved equal.

k. Operator Device
   1) Operator devices (pushbuttons and selector switches) shall be mounted through the control enclosure door for manual operation of the filter. Transformer type pilot lights and illuminated pushbuttons shall be provided for indication of an operation status. Lights shall be a 6 VAC incandescent type lamp.
   2) All operator devices shall be UL Listed, 30.5mm style, NEMA Type 4X rated, oil and water tight with finger safe guards located on the contact blocks to prevent accidental contact with wire connections. Operator device function shall be identified with an engraved white Gravoply nameplate with black letters. Operator devices shall be Square D 9001 or approved equal.

l. Ground Fault Duplex Receptacle
   1) A UL listed ground fault circuit interrupter (GFCI) duplex receptacle shall be provided within the panel for instrument (e.g. programming terminal, modem, etc.) use only. The receptacle shall be protected with a 5 Amp circuit breaker. The receptacle shall carry a 20A / 120VAC rating. The electro-mechanical circuit interrupter shall be double-pole and trip free (GFCI protection and shall not be overridden by holding reset button). Built-in transient suppression shall protect GFCI's internal circuitry from voltage transients. Receptacle shall be Hubbell DRUBGFI20 or approved equal.

m. 24 Volt DC Power Supply
   1) A UL listed, industrial grade, compact power supply shall be supplied to provide 24 VDC power to such rated components. The power supply shall be DIN rail mounted and functional with input voltage of 100 to 240 VAC (single-phase) incoming control power. The power supply shall have a green LED which shall be illuminated when output voltage is "OK". The power supply shall be an Allen Bradley 1606 or approved equal.

n. Control Relay
   1) UL listed control relays for general control purposes shall be supplied with a pilot light to indicate when the coil is in an energized state. The relay socket shall be panel or DIN rail mounted inside the enclosure. he relays shall provide the following ratings: 120VAC coil, 10A contact rating (thermal), 250 VAC insulation rating and 5 million mechanical life cycles. Relays shall be Allen Bradley 700-HK, Square D, or approved equal.
o. Terminal Block
   1) Standard feed-through screw terminal blocks, DIN rail mounted, shall be supplied for all point to point wiring connections. All terminals shall be numbered per the wiring schematic with printed markers. Terminals shall carry a 600V AC/DC voltage rating. Terminal blocks shall be Allen-Bradley 1492-J4 (35A max) and 1492-J16 (85A max) or approved equal.
p. Programmable Logic Controller
   1) Automatic operation of the Filter shall be controlled through an Allen Bradley MicroLogix 1400 programmable logic controller (PLC) or approved equal mounted inside the main control panel. The PLC components shall consist of a base unit, expansion I/O modules, and memory module. All input and output points supplied (including unused) shall be wired to terminal blocks. The PLC user memory shall consist of a minimum of 20K words of program and data. All PLC hardware shall be UL listed and operate at an ambient temperature of -4° to 140° F (-20° to 60° C).
q. Base Unit
   1) The base unit shall house embedded inputs, outputs, power supply, and communication (Ethernet, RS-232, RS-485) ports. The base unit shall also provide the interface to expansion I/O when required by an application.
   2) The power supply input range shall be 100 to 240V AC at 47 to 63 Hz with a maximum power consumption of 100 VA.
   3) The embedded discrete inputs shall be rated for 120V AC and the discrete (relay) outputs shall be rated for 265V AC/125V DC. Embedded analog I/O shall be voltage (±10 V) inputs and outputs. Each I/O point shall have LED status indication.
   4) The base unit shall have one (1) RS-232-C serial port, one (1) RS-485 serial port, and one (1) RJ-45 port which supports 10/100 Mbps Ethernet/IP. These ports shall be capable of local and remote programming, troubleshooting, and data manipulation.
   5) The PLC base unit shall be Allen Bradley 1766-L32AWAA or approved equal.
r. Digital Expansion Input Module
   1) The expansion digital input module shall have an operating voltage of 79 to 132V AC at 47 to 63 Hz. The module shall have an LED status indication of each point. The digital expansion input module shall be an Allen Bradley 1762-IA8 or approved equal.
s. Memory Module
   1) The controller shall be shipped with a memory module for user program and data backup. The memory module shall be an Allen Bradley 1766-MM1 or approved equal.
t. Ethernet Switch

1) An unmanaged Ethernet switch shall be provided inside the control enclosure to provide connectivity between the PLC, operator interface and plant networking. The switch shall support both 10 and 100 Mbit/s operation. The switch shall have five (5) 10/100Base-T ports with RJ-45 sockets and shall support auto-crossing, auto-negotiation and auto-polarity. Maximum distance between devices shall be 100m.
2) The unit shall be DIN rail mounted and require 24VDC power. Diagnostic LEDs for power and connection status shall be included. The Ethernet switch shall be UL listed and manufactured by Allen-Bradley Stratix 2000 1783-US5T, or approved equal.

u. Human Machine Interface
1) The control system shall be equipped with a UL listed operator interface that provides control display screens. These screens shall be used by the Operator to monitor and control filter status, setpoint and alarm information.
2) The Interface shall allow the Operator access to adjust the following operating parameters:
   a) Backwash interval
   b) Backwash duration
   c) Sludge waste interval
   d) Sludge waste duration
   e) Number of backwashes between sludge wasting
3) The operator interface shall provide information to assist the Operator in assessing the status of the filter system. The interface screen shall display, at minimum, the following parameters:
   a) Water level in the filter
   b) Time since last backwash
   c) Time since last sludge withdrawal
   d) Elapsed time on the drive motor
   e) Elapsed time on the backwash pump
   f) Total backwash time and cycles
   g) Total sludge withdrawal time and cycles
4) The interface shall display the alarm history. The alarm history shall include the time and date of the most recent 25 alarms along with the description of the alarm.
5) The interface shall also display current alarms, including the date, time and a description of the alarm.
6) As a diagnostic aid to the Operator, the interface shall display the time between backwashes for the most recent 40 backwashes.
7) The operator interface shall be a NEMA Type 12, 13, 4X rated, 6.5” diagonal, color touchscreen display with Ethernet and serial communications. The interface shall be a liquid crystal display (LCD). The display type shall be color active matrix thin-film transistor (TFT) with 640 x 480 pixel resolution. The rated operating temperature shall be 32° to 131° F (0° to 55° C). The operator interface shall be an Allen Bradley PanelView Plus 7 Performance 7” or approved equal.
8) A sun shield constructed of 316 stainless steel shall be mounted over the operator interface to provide protection and visibility of operator screens in outdoor applications.

N. Finishes

1. All paintings, coatings, and finishes shall comply with Section 09 91 00 – Coatings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all equipment in complete accordance with the plans, approved shop drawings, and the manufacturer's instructions and recommendations.

B. Align and adjust equipment in accordance with Manufacturer's instructions and leave equipment in proper operating condition.

C. Make all necessary connections for electrical conduit and wiring.

3.02 FIELD QUALITY CONTROL

A. Verify that structures, pipes and equipment are compatible.

B. Place system in proper operating condition.

C. Manufacturer's representative shall:
   1. Approve installation before operation.
   2. Test and operate system in presence of Engineer and Owner's personnel and provide certified test reports as required by Specification 01 33 00, Submittals.
   3. Verify conformance to requirements.
   4. Instruct plant personnel on care and maintenance.
   5. Verify each I/O point on each panel.
   6. Revisit job site as often as necessary to correct deficiencies in equipment provided by manufacturer to satisfaction of Engineer.

3.03 PERFORMANCE ACCEPTANCE TEST

A. General
   1. Filter unit shall be demonstrated to meet the performance standards in this paragraph. The Contractor shall assist the manufacturer in installing temporary piping, valves, meters, and equipment necessary for conducting Performance Acceptance Test.
   2. Final acceptance will not be issued by the Owner until after successful completion of the performance acceptance test. Successful completion of the performance acceptance test requires that the test results meet the specified performance requirements. Before the Owner can issue the final acceptance, the manufacturer must submit the installation report that includes the methods, results, and conclusions from the performance acceptance test.
   3. Filter equipment shall be operated for a minimum of 30-days after equipment startup before final acceptance of a given filter unit.
   4. If the filter equipment does not perform as specified, manufacturer shall replace or modify equipment as necessary at no additional cost to the Owner.
   5. Owner will take and analyze samples at agreed upon intervals and locations to verify solids concentrations in influent, effluent, and backwash.

B. Verify the removal of influent TSS:

1. At the peak flow, the filter effluent TSS shall be less than 10 mg/l given a filter influent TSS of maximum 30 mg/l. The test shall be performed over a full day for three (3) consecutive days and averaged over the time period. Each 24-hour day sample shall be a composite sample consisting of a minimum of 12 grab samples. Evenly spaced over each 24-hour period. Failure of the test will be construed as any one of the composite daily samples exceeding the above listed effluent quality.

C. Verify the operating headloss using the following procedure.
   1. Run filter in filtration mode at the peak flow as defined in the “Performance Requirements” of this specification and influent TSS between 15 mg/l and 30 mg/l. Influent/Effluent TSS shall be sampled at 15-minute intervals over a two-hour period. Effluent TSS shall be less than 10 mg/l.
   2. Record time between the start of the filtration mode and start of the succeeding backwash mode. Run in filtration mode until the water surface level reaches the maximum allowable operating limit and initiates the backwash mode.

   3. The initial headloss upon switching to filtration mode shall not exceed the maximum filter headloss described in the “Performance Requirements” of this specification.

3.04 FILTER PLC PRGRAMMING AND CONFIGURATION FOR PLANT HMI MONITORING AND CONTROL

A. Provide PLC I/O mapping table to the Control System Integrator for SCADA HMI development.

B. CONTRACTOR shall verify each analog signal engineering range and provide Contractor range and engineer unit to the Integrator.

C. Refer to instrumentation Division 40 for Plant HMI related filter PLC/OIT programming and configuration requirements.

END OF SECTION

46 66 56 ULTRAVIOLET DISINFECTION SYSTEM

1.00 GENERAL

1.01 SUMMARY

A. Furnish all labor, materials, equipment, and appurtenances required to provide an open-channel, gravity-flow, inclined, UV light disinfection system complete with an automatic cleaning system. The UV system is to be complete and operational with all needed control and appurtenant equipment. UV Disinfection System Supplier (heretofore called Supplier) shall provide installation, start-up, and operator and maintenance training as described in this Section. The Supplier shall assist with commission testing and performance testing as described in this Section.

B. Related Sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

C. Provide a complete UV Disinfection System that meets all the water quality requirements and all the UV reactor testing and design requirements as set forth by the Texas Commission on Environmental Quality (TCEQ) and the specifications in this section. In the event of a conflict between regulations and this section, the UV System Supplier shall meet the more restrictive standard.

D. Third Party Reactor Validation Testing and the related Engineering Report for the UV reactor to be installed must be completed at the time of Proposal.

1.02 REFERENCES

A. National Water Research Institute (NWRI), Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse, August 2012 Edition.

B. United States Environmental Protection Agency (EPA). Ultraviolet Disinfection Guidance Manual (UVDGM). 2006.

C. TCEQ: Texas Commission on Environmental Quality.
   1. TCEQ Chapter 217 – Design Criteria for Domestic Wastewater Systems.
   2. TCEQ Chapter 309 – Effluent Limitations

1.03 DEFINITIONS

A. General: The terms listed below are used in this specification and shall have the following definitions.
   1. <u>UV Bank</u>: One or more UV modules that the entire flow for a given reactor train must pass through.
   2. <u>UV Channel (synonymous with UV Train)</u>: The independent combination of the UV bank, and inlet isolation and outlet level controlling arrangements located in a concrete channel.
   3. <u>UV Disinfection Equipment System (synonymous with UV Disinfection System)</u>: The combination of all UV channels with associated controls and instrumentation.

4. UV Intensity Control: The use of calibrated UV sensors to continuously monitor UV intensity within the reactor. The measured UV intensity is used to indicate relative lamp output due to effluent quality, lamp aging, fouling, and ballast power settings, and is used as an input for UV dose-pacing algorithm programmed into the UV system's PLC.
5. Attenuated Lamp Conditions: Conditions where the lamps are at the end of their guaranteed lives and the quartz sleeves are fouled (i.e., consistent with the Lamp Age Factor and Sleeve Fouling Factor)
6. Lamp Age Factor: Reduction in available UV output at the end of the UV lamp life, as compared to a new UV lamp after 100 hours burn-in.
7. Lamp Life: Total guaranteed operational time that the UV lamp can deliver a UV output that is greater than or equal to the Lamp Age Factor
8. Sleeve Fouling Factor: The sleeve-fouling factor is a measure of the sleeve's loss of irradiance over time (expressed as a percentage of the irradiance from a new and clean quartz sleeve). Periodic automatic and manual cleaning of the system is performed to achieve a factor greater than the Sleeve Fouling Factor.
9. UV Intensity (UVI): The power per unit area passing through an area perpendicular to the direction of propagation. UV intensity is used to describe the magnitude of UV light in a UV reactor or in a bench-scale UV test.
10. UV Transmittance (UVT): A measure of the fraction of incident light transmitted through the water column. The UVT is the ratio of the light entering the effluent to that exiting the effluent. UVT is represented as a percentage. UVT is typically quantified by spectrophotometric measurement at a wavelength of 253.7 nm using a one-centimeter path length.
11. UV Module: The basic building block of a UV disinfection system. It is comprised of more than one UV lamp with a common electrical feed.
12. UV Dose:
    a. Delivered UV Dose: The dose that is assigned to the UV reactor under a given set of operating conditions that is based on Third-Party Reactor Validation Testing. The delivered UV dose is equivalent to that measured with the collimated-beam apparatus for the same degree of inactivation of the target microorganism. UV dose is typically reported in milli-joules per square centimeter (mJ/cm^2).
    b. Design UV Dose: The UV dose delivered for a specific log inactivation of the target microorganism at the peak design flow at the design UVT and attenuated lamp conditions. The design UV dose is used to size the UV Disinfection System.
13. UV Reactor: An independent combination of single or multiple UV bank(s) in series with a common mode of failure (e.g., electrical, cooling, cleaning system, etc.).
14. UV Testing, Reports and References:
    a. Bioassay: A microbiological procedure used to determine the inactivation of a specific microorganism after exposure to UV light.
    b. Engineering Report: A bioassay testing report prepared and stamped by an independent, third party licensed civil engineer, registered in the United States. The Report is in accordance with Third Party Reactor Validation Testing. The Report summarizes the results of the third party bioassay testing and documents the dose equation used to size and operate the proposed UV Disinfection System.
    c. Initial Performance Test: A 30-day continuous test to demonstrate the installed UV Disinfection System meets the performance test

requirements specified herein and produces an effluent in complete compliance with requirements as specified herein.

15. Third-Party Reactor Validation Testing: Testing completed on a pilot scale or full scale UV system in accordance with a test protocol per Third Party Reactor Validation Testing, in compliance with the NWRI UV Guidelines (2012), with the confidence ratio set to 1.00, or the US EPA's UVDGM (2006) Testing is conducted to develop reactor dose delivery for various operational conditions. A third party licensed civil engineer in the United States must perform the testing.
16. Project Manager/ Product Manager: Supplier's personnel having a minimum of 5 years of experience in design and execution of wastewater UV systems to utilities.

1.04 PROJECT MANAGEMENT AND QUALITY ASSURANCE

A. The Supplier shall assign a qualified and experienced project manager or product manager for the duration of the project from initial selection through start-up. This project manager or product manager shall remain the same throughout the duration of the project. Any changes in project management will require approval from the Owner and Engineer after they review the qualifications of the proposed candidates.
   1. The project manager or product manager shall act as the main point of communication between Owner, Engineer, Contractor, and Supplier regarding the administration of the procurement contract, payment requests, interpretations of contract terms and conditions, warranty, technical aspects of the UV Disinfection Equipment System, including design criteria, materials selection, equipment, control systems, and coordination between Supplier and other parties during the design, bidding, shop drawing submission and reviews, RFIs, and scheduling deliveries, field inspections, start-up, and performance testing during construction.

1.05 SYSTEM DESCRIPTION

A. Provide a UV disinfection system complete with UV Banks and lifting mechanism, a control system, UV intensity sensors, automatic on-line cleaning system, power distribution system with transformers as required, and accessories as specified herein or as required to have a complete and fully functioning system.

B. The UV Disinfection System shall be able to continuously provide disinfection at the Permitted Peak 2-hour Flow at the design UVT and attenuated lamp conditions, under the following circumstances:
   1. While the automatic on-line cleaning system is in operation.
   2. While the UV lamps, quartz sleeves, and/or ballasts are being replaced on one out of service UV bank in any channel.

C. Design Criteria:
   1. Supplier shall provide UV disinfection equipment which meets the Performance Requirements, specified in this Section, based on the following conditions:
      a. Influent Water Quality:
         1) Description: Filter effluent.
         2) Peak Hour Flow: 9.0 million gallons per day (MGD)
         3) Daily Average Flow: 2.25 MGD

4) Ultraviolet Transmittance (UVT) at 253.7 nm: 65 percent.
5) Average 5-day CBOD: < 5 mg/L.
6) Total Suspended Solids: < 10 mg/L.
7) Water Temperature: 18 – 27 degrees Celsius.

b. The UV Disinfection System shall meet the design criteria as specified herein and in Form 1:
1) One redundant bank at Daily Average Flow.
2) The UV Disinfection System shall maintain a minimum MS2 Design UV Dose of 30 mJ/cm^2 at the design UVT and attenuated lamp conditions at the peak hour flow of 4.5 MGD per channel.
3) The basis for evaluating the dose delivered by the UV disinfection system shall be the Supplier's bioassay results as determined by the Third Party Reactor Validation Testing. The Engineer can apply the required correction factor to the Supplier's bioassay results based upon the Engineer's analysis of the Validation Testing.
4) The UV Dose produced by the system shall not be less than the Design UV Dose at the end of the design time period with attenuated lamp conditions. Lamps required to deliver the design dose for the approximate maximum instantaneous flow shall be turned on. Power to those lamps shall be modulated as required to deliver the design dose as the flow fluctuates between the approximate maximum and minimum flow.
5) Hydraulic Constraints:
a) Supplier shall specify the maximum water surface elevation at which the UV system can operate (based on Third Party Reactor Validation Testing).
b) Supplier shall specify the minimum water surface elevation that must be maintained at all times, in any channel that contains UV lamps that are turned "ON." The minimum water surface elevation shall be set such that the quartz sleeves of the UV banks are completely submerged.
c) Finger Weir Elevation: Shall be set as recommended by the selected Supplier.
d) Maximum Acceptable Normalized Lamp Velocity (gpm/lamp): To be specified by Supplier and shall not exceed maximum value proven effective during Third Party Validation Testing.
e) Minimum Acceptable Normalized Lamp Velocity: To be specified by Supplier and shall not exceed minimum value proven effective during Third Party Validation Testing.
6) Minimum Lamp Life: As stated in paragraph 1.10.
7) Lamp Age Factor: As stated in Form 1, Maximum Value – 0.89.
8) Sleeve Fouling Factor: As stated in Form 1, Maximum Value – 0.95
9) The UV sensors employed by Supplier must track the combined intensity loss due to lamp aging and sleeve fouling (attenuated lamp condition).
10) Number of channels: Channel requirement is specified in Form 1.
11) Banks per channel: Banks requirement is specified in Form 1.

D. Performance Requirements:
1. The UV disinfection system performance shall be guaranteed by the Supplier to produce an effluent that meets or exceeds the following:

a. Total *E. coli* count of less than 126 organisms per 100 ml, based on a 1-day grab sample.
   1) Grab samples shall be taken in accordance with the Microbiology Sampling Techniques found in Standard Methods for the Examination of Water and Wastewater, Latest Edition
b. Minimum 2.5-$\log_{10}$ *E. coli* reduction.
   1) The system shall produce a UV dose equal to or greater than the minimum MS2 Design UV Dose of 30 mJ/cm^2 specified herein at 65 percent UVT, under Attenuated Lamp Conditions. The basis for evaluating the dose delivered by the UV disinfection system shall be the Supplier's bioassay results as determined by Third- Party Reactor Validation Testing per the NWRI UV Guidelines (2012) with the Confidence Ratio set to 1.00. The Engineer can apply the required correction factor to the Supplier's bioassay results.

2. The power factor shall be 98 percent or greater. Harmonic distortion shall be in accordance with IEEE 519-1992 Tables 10.1, 10.2, and 10.3 as measured at the input terminals to the Power Distribution Center.
3. The requirements stated in Form 1 are minimum requirements. If the UV supplier determines more equipment is needed then the UV Supplier must provide the additional equipment to meet the performance requirement.

E. The proposed UV channels shall be outdoors and covered under canopy. Refer to attached Drawings for specific constraints of the flow channels.

1.06 SUBMITTALS

A. Product Data and Shop Drawings: Equipment Supplier shall submit, per Section 01 33 00, the following:
   1. Product data, including, but not limited to, the following:
      a. Complete description in sufficient detail to permit an item-by-item comparison with the Specifications.
      b. Descriptive information including catalog cuts and Supplier's specifications for all components.
      c. Written field electrical termination requirements and instructions as required for the Contractor to install a complete and operational system.
      d. Sources for replacement lamps.
      e. Third Party Reactor Validation Testing results and corresponding Engineering Report(s).
      f. Number of lamps per module.
      g. Number of modules per bank.
      h. Total number of UV lamps.
      i. Lifetime disinfection performance guarantee.
      j. Electrical schematics and layouts.
      k. Hydraulic calculations demonstrating compliance with the required hydraulic characteristics.
      l. Dimensions and installation requirements.
   2. General Shop drawing submittal including, but not limited to:
      a. Details of the UV Bank, ballast enclosure, power distribution system with transformers as required, and control system.
      b. Dimensions and installation requirements.

c. Information on the channel configuration, including but not limited to: widths, depths, lengths, and any other items necessary to confirm the proposed system will fit into the proposed UV channels.

3. Electrical data and shop drawings per Division 26:
   a. Electrical Shop Drawings including but not limited to:
      1) Front exterior and interior panel layout drawings with bill of materials for all electrical and control panels. Coordinate with Division 40.
      2) Control schematics with wire numbers per Section 26 05 53.
      3) Detailed interface and interconnection drawings that indicate all UV system and external component and equipment connections.
      4) Detailed electrical wiring diagrams as required for the Contractor to install a complete operational system. Electrical wiring diagrams shall include, but not be limited to:
         a) Source power feeder conductor quantities and sizes.
         b) Control wiring quantities and sizes.
         c) Signal cable quantities and sizes.
         d) Power (kW), power factor and apparent power (kVA) for each UV Bank.
         e) Master UV PLC power requirements for UPS sizing by Contractor.
         f) Cut sheets for each electrical power and control device.
4. Instrumentation and Controls data and shop drawings per Division 40, including but not limited to:
   a. Loop drawings.
   b. Control philosophy narrative with integration of the Third-Party Reactor Validation Testing results, including the use of the sensors to monitor and alarm the combined effect of lamp aging and sleeve fouling and/or the use of the sensors to continuously monitor UV dose based on inputs of flow, sensor intensity, and UV transmittance (UVT).
   c. Provide system block diagram complete with all inter-equipment wiring and conduit requirements.
   d. Hardcopy and electronic copy on a CD-ROM of the UV PLC system program.
   e. Hardcopy and electronic copy on a CD-ROM of the HMI program.
   f. Detailed memory map of data to be transferred from or to the Plant SCADA system via Modbus TCP-IP protocol.
5. List of spare parts to be provided by Supplier.

B. Operation and Maintenance Manuals:
   1. UV equipment Supplier shall submit operation and maintenance manuals in accordance with Section 01 78 23.
      a. In addition to the requirements listed in the above referenced Section, the Operation and Maintenance Manuals shall include:
         1) Name, address, and telephone number of nearest supplier and spare parts warehouse.
         2) Special tools required for operation and maintenance.
         3) Reproducible prints of the Contract diagrams, schematics, and installation drawings for electrical and instrumentation work.
   2. The Engineer will not approve an equipment unit before its manual has been accepted.

3. UV equipment Supplier's copy of complete manuals shall be available at the site of the work for use by field personnel and Engineer during Alarm Testing, and Performance Testing of equipment.
4. Step by step instructions for operation and maintenance of all equipment provided by Supplier.

C. Quality Certification:
1. Supplier shall submit Engineering Report of the proposed UV Disinfection System, including:
   a. All raw data used to justify the conclusions of the Third-Party Reactor Validation Testing
   b. Test reactor configuration including tested parameters (e.g., flow rates, UV transmittance, number of reactors/lamps in operation, and type of water tested).
   c. Collimated beam results.
   d. Reactor validation results with regard to inactivation of the test organism.
   e. Test results from head loss testing.
   f. Recommended normalized lamp velocity range (flow/lamp) to meet the required Design UV Dose.
   g. Delivered UV Dose equation developed based on Supplier's Third-Party Reactor Validation Testing.
   h. Hydraulic calculations demonstrating compliance with the hydraulic constraints specified herein.
2. Representative harmonic analysis calculations and reports for both voltage and current at the point of common coupling, as defined as the input terminals to the power distribution center. Certification that voltage and current harmonic distortion levels are within IEEE 519 Standard limits at the point of common coupling when powered from utility power supply in accordance with paragraph 2.03.
3. Supplier's UV equipment warranty including lamps, ballasts, quartz sleeves, wipers, and UV sensors, as specified herein.
4. Supplier's performance warranty as specified herein.
5. Documentation of the successful completion and results of the Underwriter's Laboratory (UL) or equivalent testing shall be provided.
6. Initial Performance Test protocol to fulfill requirements outlined herein.

D. Closeout Submittals:
1. Written certification of proper UV system installation as outlined in paragraph 3.02, B herein.
2. Two copies of all UV PLC, operator interface, and other programs required for the maintenance of the UV system in native format on CD-ROM. Also, two hardcopies of annotated software.

E. Other Qualification Requirement Submittals:
1. A statement listing any deviations or exceptions taken to these specifications. Include specification reference and proposed alternative with reason stated for exception.

1.07 QUALITY ASSURANCE

A. Qualification Requirements:

1. The Supplier will be regularly engaged in the design, manufacture, and servicing of UV systems for municipal wastewater disinfection. Manufacturer to submit evidence of a proven track record with at least twenty (20) operating inclined UV installations at municipal wastewater treatment plants with a design peak flow greater than 5 MGD in the United States.
2. The UV equipment Supplier shall demonstrate that the dose required in the performance specification can be met with the amount of equipment proposed. The UV equipment Supplier shall base sizing of UV system on a Third-Party Reactor Validation Testing calculation to meet the minimum UV design dose as specified herein. The bioassay calculation shall be based on protocol for bioassay testing in accordance with NWRI UV Guidelines (2012) or with a different method pre-approved by the Engineer. The UV equipment Supplier's data and results shall be reviewed by the Engineer. The Engineer can apply the required correction factor to the Supplier's bioassay results. The Engineer's review and opinion of the test protocol, pilot data, and pilot report conclusions shall be deemed final and shall be just cause for the rejection of the proposed equipment. In addition, bioassay calculations shall use one method for the calculation of gpm per lamp for all data, as defined herein as the "Normalized Lamp Velocity".
3. A statement by the UV equipment Supplier listing any deviations or exceptions taken to these specifications shall be provided to the Engineer for the Engineer's review, opinion, and acceptance. The Engineer's final decision regarding the acceptance or denial of any deviations or exceptions shall be just cause for the rejection of the proposed equipment and require that the equipment Supplier supply the disinfection equipment as specified herein.
4. Provide equipment labeled and listed by Underwriters Laboratory (UL) or another nationally recognized testing laboratory, furnished by a single Supplier qualified and experienced in the production of similar equipment.
5. All stainless steel components and enclosure panels shall be cleaned, pickled and passivated as specified in Section 05 50 00 to protect the stainless steel.

1.08 DELIVERY, STORAGE AND HANDLING

A. If required by the Contractor's schedule, the Supplier shall provide equipment in multiple separate freight shipments.

B. Provide notification in writing to the Owner and Contractor of approximate delivery dates 12 weeks before delivery. Notify same of actual delivery date at least 7 days before delivery. Provide description and approximate weight of shipping container and required equipment for unloading. Supplier shall coordinate delivery, unloading, and storage with Contractor.

C. Moisture sensitive products shall be stored in weather tight enclosures. Weather tight enclosures must be a cargo container suitable for transport either by train or cargo ship. Supplier will designate those items that need to be store in a moisture controlled environment. Tarped crates are not acceptable. All damaged materials related to storage shall be replaced with new materials.

D. Supplier shall coordinate the delivery of equipment with Contractor. Supplier shall revise schedule for delivering equipment packages if requested by Contractor without additional cost to Contractor.

E. Storage:
   1. General: Contractor shall store, and handle in accordance with the Supplier's printed instructions.
   2. Packing and Shipping: Supplier shall deliver equipment to the project site in the original containers with seals unbroken and labeled with Supplier's identification and number.
   3. Delivery: Supplier shall deliver materials dry and undamaged to the Contractor. During the delivery process materials must be stored out of contact with the ground.
   4. Unpacking: The Contractor shall not destroy shipping containers. Shipping containers shall be given to the Owner for storage of UV equipment.

1.09 SEQUENCING AND SCHEDULING

A. Coordinate with restrictions specified in Section 01 14 00.

1.10 SUPPLIER'S WARRANTY

A. The equipment Supplier shall warrant the Owner against defects in materials and workmanship in accordance with the following:
   1. General Warranty:
      a. The equipment furnished under this section shall be free of defects in materials and workmanship, including damages that may be incurred during shipping, storage, and installation, for a period of 3 years which shall commence after successful completion of the Initial Performance Test (Substantial Completion of the UV system).
      b. All wiring in the channel exposed to UV light shall be warranted for 15 years by the Supplier. If the wiring fails before 15 years have elapsed, the Supplier shall be responsible for the replacement of the wires and the labor.
      c. Supplier shall guarantee that for components manufactured by the Supplier, replacement parts shall continue to be available to the Owner for a minimum of 20 years from date of successful completion of Initial Performance Test. Supplier shall guarantee that, if Supplier or Supplier's product line is sold, Supplier shall make provisions such that all guarantees, warrantees, and bonds will remain in effect and that replacement parts and operational support shall continue to be available to the Owner for the time period specified above.
      d. All warrantees shall include all costs associated with required site visits, inspections, equipment removal costs, and equipment installation costs. For pro-rated warranties, cost of equipment replacement during the minimum guaranteed equipment life shall be fully covered by the Supplier. Cost of guaranteed replacement during the warranty but after the minimum guaranteed equipment life shall be credited by the Supplier proportional to the time not used from the warranty.
      e. All warrantees and support shall be provided directly by the Supplier and not the local manufacturer's representative.
   2. UV Lamp Warranty:
      a. The UV lamps shall be warranted by the Supplier against lamp failure as specified herein. Lamp failure occurs when the ratio of the available UV light output of the lamp to the UV light output of a new lamp after 100 hours of burn-in is less than the lamp age factor. The Supplier shall

provide a warranty for the performance of the UV lamp for a minimum period of 14,000 operating hours per lamp, which shall commence after successful completion of the Initial Performance Test (Substantial Completion).

b. The Supplier shall replace any lamp that fails before the end of the minimum guaranteed life of 9,000 operating hours per lamp at no cost to the Owner, with freight and insurance paid by Supplier.

c. This guarantee shall be limited by the guaranteed number of start/stop cycles. The guaranteed lamp start/stop cycle shall be 4 stop/start cycles per 24-hour period over the life of the lamp. The automation associated with the UV equipment shall be programmed to prevent more than 4 start/stop cycles per day. Additionally, the automation system must log the operational hours for each individual lamp.

d. The guaranteed lamp life shall not be limited by time periods when the plant is not in operation and/or when the UV system is shut down.

3. UV Ballast Warranty:

a. The UV ballasts shall be warranted by the Supplier against failure as specified herein. The Supplier shall provide a warranty for the performance of the UV ballasts for a minimum period of 5 operating years per ballast, which shall commence after successful completion of the Initial Performance Test (Substantial Completion).

b. The Supplier shall replace any ballast that fails before the end of the minimum guaranteed life of 2 operating years per ballast at no cost to the Owner, with freight and insurance paid by Supplier.

c. Installation of the failed ballast can be performed by Owner.

4. UV Quartz Sleeves Warranty

a. The UV quartz sleeves shall be warranted by the Supplier against failure as specified herein. Sleeve failure is defined as permanent loss of 10 percent sleeve transmittance relative to new sleeve transmittance. The Supplier shall provide a warranty for the performance of the UV quartz sleeves for a minimum period of 20 operating years per sleeve, which shall commence after successful completion of the Initial Performance Test (Substantial Completion).

b. The Supplier shall replace any sleeve that fails before the end of the minimum guaranteed life of 2 operating years per sleeve at no cost to the Owner, with freight and insurance paid by Supplier.

5. UV Sensor Extended Warranty:

a. The UV sensors shall be warranted by the Supplier against failure as specified herein. Sensor is deemed to have failed when the sensor no longer measures UV intensity or sensor does an accuracy within 0.5% +/-. The Supplier shall provide a warranty for the performance of the UV sensors for a minimum period of 10 operating years per sensor, which shall commence after successful completion of the Initial Performance Test (Substantial Completion).

b. The Supplier shall replace any sensor that fails before the end of the minimum guaranteed life of 2 operating years per sensor at no cost to the Owner, with freight and insurance paid by Supplier.

6. Performance Warranty:

a. The equipment furnished under this section, when operated within the conditions specified in the Contract Documents, will meet or exceed the performance requirements specified herein for a period of 3 years. This is the base bid requirement.

b. If the UV equipment fails to meet design and performance criteria, the UV equipment Supplier shall modify, change, or add equipment as necessary to meet performance criteria. Supplier shall be responsible for any additional costs to Contractor or Owner due to changes (including but not limited to piping, mechanical, structural, or electrical changes) or additional equipment as necessary to meet performance requirements. This includes design, engineering, construction, as well as equipment.
c. The Owner shall make available the UV Disinfection System electronic data records of historical performance for Supplier's review. The automation system shall log all relevant performance data and store it in the historical database.
d. If the system fails to meet specified performance criteria during the Initial Performance Test, or the warranty period following the date of successful completion of the Initial Performance Test, and the Supplier is unable to modify the system through the addition of UV banks or other elements, then the Supplier shall be responsible for complete removal of nonconforming system and subsequent installation of UV disinfection products that are capable of meeting specified performance conditions. Payments for replacement or corrections not paid by Supplier in accordance with the Procurement Contract shall be paid from the Supplier's Performance Bond.

B. End of Warranty Inspection:
1. Inspection:
2. Supplier's representative shall perform a two-day (eight hour) inspection of Supplier's UV equipment, within 30 days prior to the 3-year anniversary date of the equipment warranty.
3. Supplier shall ascertain or appraise the following:
4. Status of equipment and installation after normal usage.
5. Adherence to Supplier's recommended maintenance and operation of equipment.
6. Quality of sleeve cleaning and recommended sleeve cleaning interval.
7. All electrical connections.
8. Calibration of duty UV sensors using reference UV sensors.
9. Operation of alarms.
10. UV transmittance monitors.
11. Supplier shall make adjustments as necessary to restore equipment within original tolerances.
12. Supplier shall submit a written letter report to the Owner covering the inspection items and including recommendations where applicable.

1.11 MAINTENANCE

A. Procedures: Per Section 01 78 23.

B. Special Tools: Provide 1 set of all special tools required for operation and maintenance, and complete assembly or disassembly of the UV disinfection system.

C. Spare Parts: The UV Disinfection System Supplier shall furnish, at a minimum, the following spare parts and safety equipment:
1. UV Lamps: Five (5) percent additional.
2. UV Ballasts (complete): Two (2) percent additional.

3. Lamps Sleeves: Five (5) percent additional.
4. Proprietary Printed circuit boards: Five (5) percent additional of each type supplied with a minimum quantity of one (1).
5. The spare parts listed above must be placed in a wooden container and labeled in a manner that is acceptable to the Owner.

D. Safety Equipment, Face Shields:
1. Quantity: Two (2).
2. Design: Block UV light wavelengths between 200 and 400 nm.

1.12 WORK BY CONTRACTOR

A. The following items are provided by Contractor but shall be coordinated by the Supplier during the Design Assistance provided by Supplier to Engineer. These items will include:
1. Structural:
a. Concrete channels for the UV reactors.
b. Foundation/housekeeping pads and additional housing for supplied UV disinfection equipment.
c. Protective coatings for concrete.
d. Anchor bolts will be provided and installed by Contractor; anchor bolt design by UV Supplier.
2. Electrical:
a. Electrical wiring interconnections (including wiring, conduit and other appurtenances required to provide power connections as needed) from the electrical power source to the UV disinfection equipment and master and system control panels. Contractor shall also be responsible for determining the correct wire sizing and coordinate this information with the UV supplier.
b. Ethernet TCP/IP communications connection to the Owner's Plant Control System.
3. Other:
a. Receiving, unloading, and safe storage of equipment at site or a storage facility until ready for installation.
b. Raw materials and utilities during equipment testing.
c. Laboratory services, operating and maintenance personnel during equipment checkout, startup and operations.
d. Any onsite painting or touch-up painting of equipment supplied.

2.00 PRODUCTS

2.01 SUPPLIERS

A. The UV Disinfection System shall be manufactured by one of the following equipment manufacturers:
1. Wedeco, Duron 6

B. Basis of Design: The drawings and specifications are based on Wedeco Duron equipment. Any costs resulting from changes to the structure, piping, electrical, instrumentation, etc. shall be borne by the Contractor. The Contractor shall submit drawings to the Engineer for acceptance, showing proposed changes in the structure, piping, equipment, etc.

2.02 GENERAL PRODUCT REQUIREMENTS

A. General:
   1. Unless otherwise specified, all components in contact with the effluent and/or UV light shall be Type 316 stainless steel, Type 214 quartz glass, Viton or Teflon.
   2. All fasteners in contact with the effluent shall be Type 316 stainless steel.
   3. Unless otherwise specified, all metal components above the effluent shall be Type 316 stainless steel.
   4. All wiring exposed to UV light shall be Teflon-coated.
   5. System shall include automatic cleaning system, system control panel, and accessories as specified.

B. Performance Requirements
   1. The ultraviolet disinfection system will produce an effluent conforming to the microbiological discharge limit as specified in paragraph 1.05.D. Grab samples will be taken in accordance with the Microbiology Sampling Techniques found in *Standard Methods for the Examination of Water and Wastewater, 19th Ed.*
   2. Standard disinfection of secondary effluents (best fit design): The UV system shall be designed to deliver a minimum validated dose of 30 mJ/cm² at peak flow and UVT conditions as described in paragraph 1.05.D after reductions for sleeve fouling and end of lamp life and including the validation factor. The basis for evaluating the UV dose delivered by the UV system will be the manufacturer's biodosimetric performance validation testing conducted by a recognized independent Third-Party expert. Validation testing shall have been conducted with an appropriate challenge organism reflecting the UV sensitivity of the targeted pathogens. For example, challenge organisms of T1 and Qß are appropriately matched for fecal coliforms and E. coli. For systems designed based on the MS2 challenge organism, a RED bias factor of at least 2.5 shall be applied in order to prevent under design. Site specific UV sensitivity of the targeted organism shall be determined via collimated beam tests.
   3. At a minimum the following parameters shall have been considered during validation testing:
      a. UVT
      b. Measured UV intensity
      c. Flow rate per lamp
      d. Power consumption
      e. UV sensitivity of challenge organism
      f. Head loss across UV banks
   4. Validation testing that does not utilize all the above parameters is considered inadequate as it does not allow for appropriate system sizing. Bids based on inadequate validation testing shall not be considered. To be acceptable, UV sensor data must be collected during the biodosimetry validation testing.
   5. The UV system shall be capable of dose pacing to reduce electrical energy consumption in response to the disinfection demand based on a minimum of effluent flow signal (provided by others through either SCADA communications or 4-20mA signal, considering if one or two channels are online), the UV sensor signals and the online measured UV transmittance.
   6. For determining UV dose during operation and for dose pacing, the UV intensity signal shall be incorporated into the UV control system's validated

operating equation: this provides the most reliable method of monitoring and controlling the UV disinfection process during operation.

7. To avoid misrepresentation and possible over-reporting of UV dose during operation, equipment that does not utilize the UV sensor signal in determination of operational dose shall not be accepted.
8. Lamp aging and sleeve fouling factors shall not be allowed in lieu of UV sensor signals for determination of UV dose.

2.03 DESIGN, CONSTRUCTION AND MATERIALS

A. General:
1. The system shall be designed for immersion of the UV lamps in the effluent within their protective quartz sleeve.
2. The UV lamp connectors shall be located above the water level and shall be accessible without removing the UV module from the disinfection channel.
3. All UV bank metal components in contact with effluent shall be Type 316 stainless steel.
4. All wiring exposed to UV light shall be Teflon™ coated.
5. All materials exposed to UV light shall be 316 stainless steel, quartz glass, PTFE, FKM, or other suitable long-term UV resistant materials.

B. Lamp Array Configuration:
1. The lamp array configuration shall be in a staggered inclined arrangement.
2. The system will be designed for complete submersion of the UV lamps under all flow conditions including both electrodes and the full length of the lamp arc.

C. UV Bank:
1. Each UV bank shall consist of UV lamps, quartz sleeves and an automatic mechanical cleaning system mounted in a Type 316 stainless steel frame.
2. Equipment must be provided by the UV manufacturer to enable lifting a complete bank of lamps from the channel at once for inspection and servicing.
   a. The automatic raising mechanism shall facilitate lifting a UV bank form the channel without use of ancillary equipment.
   b. The automatic raising mechanism shall provide access to components without having to break electrical connections thus reducing wear on connectors.
3. Each UV bank shall prevent possible short-circuiting at the side walls of the reactor.

D. UV Lamps:
1. Lamps shall be low pressure mercury amalgam “doped”, high intensity type. Lamps containing liquid mercury shall not be allowed.
2. The lamp filaments shall be pre-heated prior to striking of the arc in order to promote lamp longevity.
3. Lamp types with a polychromatic UV output or UVC output efficiency of less than 30% at 254nm are not acceptable.
4. Each lamp shall be tested in UV-output, lamp current and lamp voltage from supplier. All results shall be stored in a database referencing to the individual batch number. The lamp batch number shall be printed on the lamp surface.
5. UV output energy of the lamp shall be variable from 50 -100% of UV-C ballast power input.

6. Useful lamp life shall be guaranteed at 14,000 operating hours for each lamp under normal operation conditions. Normal operation conditions include a maximum of four on/off cycles per 24 operating hours.
7. UV lamps shall not require a long cool down period (>10 minutes) prior to re-start should the power to the UV system fail or be interrupted for a short period of time.
8. Each lamp base shall incorporate a dielectric barrier or pin isolator. The pin isolator shall consist of a non-conductive divider placed between the lamp pins to prevent direct arcing across the pins in moist conditions. The barrier shall be dielectrically tested for 2500 volts.
9. The UV manufacturer shall ensure disposal of returned lamps (old/used) at no costs to the Owner upon receipt of the returned lamps at the manufacturing headquarters.

E. UV Module:
1. The UV modules shall be designed for submergence without causing failures or damage to the system or components.
2. All electrical connectors and motors located on the module and above nominal channel water level shall either rated at IP67 or located within IP67 enclosures suitable for temporary submersion.
3. Each UV module shall be equipped with an interlock switch, which will automatically disconnect power to its associated UV bank if the module is raised from the UV channel or the quick disconnect plug is removed.
4. The UV module design and mounting shall provide plug and socket quick disconnect facilities enabling non-technical personnel to carry out lamp replacement, wiper insert replacement, etc. without the need for any tools or specialist isolation procedures.
5. Lamps shall be removable with the quartz sleeve and wiper system remaining in place.
6. The UV lamp sleeve shall be a single piece of clear fused quartz circular tubing, which shall not be subject to degradation over the life of the system.
7. The lamp socket shall be centered against the inside of the quartz sleeve and shall be retained by a cap nut with a ribbed exterior surface providing a positive handgrip for tightening / loosening without the need for any tools. This connection includes a self-contained o-ring, sealing the lamp and socket module (independently from the quartz sleeve).
8. Each module be designed to allow lifting from the operating position in the channel to a maintenance / storage position above the channel using an integral electric motor. Mechanisms that utilize pressurized hydraulic fluid in the vicinity of the UV channel shall not be allowed due to risk of oil leakage.

F. Wiping System
1. Each UV module shall be equipped with an automatic wiping system with selectable wiping frequency and number of strokes.
2. Systems requiring chemicals or removal of the module from the channel for cleaning will not be acceptable.
3. The wiping system shall be controlled by the UV system controller and provide a fully automatic, unattended operation.
4. The number of wiping strokes per interval shall be factory preset for optimum effect and shall be easily reset by the Owner with time intervals being user adjustable.

5. Actuation mechanisms for the automatic wiping system shall be driven by either an electric motor or pneumatic cylinder integral with the module. Mechanisms that utilize pressurized hydraulic fluid in the vicinity of the UV channel shall not be allowed due to risk of oil leakage.
6. When in the raised position, all module wetted components shall be accessible.

2.04 FINGER WEIR LEVEL CONTROL

A. Contractor shall provide Effluent Level Control Finger Weir at the end of each channel for effluent level control within the UV channel.

B. Manufacturer to review design of finger weir and inform the Engineer of any potential problems.

2.05 INSTRUMENTATION, ELECTRICAL AND CONTROLS

A. General
1. Sensitive electronic components such as electronic ballast cards shall not be exposed to the risk of being flooded.
2. All heat sensitive components shall be adequately cooled with dry air utilizing forced or natural ventilation.
3. Systems or designs that expose sensitive electrical or electronic components to excess humidity or poor air quality for cooling are not acceptable.
4. Systems that lack positive mechanical heat transfer such as fans or air conditioning for the sensitive electronic components are not acceptable.
5. The electrical enclosures for the UV system shall be Type 12/ IP54 painted (nano coated) steel where inside a building. The UV system electrical enclosures shall be 304 SS Type 4X with air conditioning/ appropriate fan cooling to be installed outdoors under a protective roof/ sunshade.
6. UV manufacturer to supply all cabling between lamps and electrical cabinets.

B. UV Monitor System
1. A submersible UV sensor shall continuously sense the UV intensity produced in each bank of UV lamp modules.
2. The UV sensor shall be according to ÖNORM M 5873-1 and shall measure only the germicidal portion of the light emitted by the UV lamps as measured at 254 nm.
3. The UV intensity monitoring system shall be field calibrated. Regular UV sensor field calibration shall be possible via a separate UV reference radiometer to ensure reliable monitoring of UV dose delivery.
4. The measured UV intensity signal shall be used for continuous monitoring and control of UV dose. In automatic mode the UV Control System shall automatically adjust to draw the minimum electrical power while maintaining the prescribed minimum dose required for disinfection. The UV dose shall be displayed on the operator interface as an absolute value in mW/cm^2.
5. Systems that use theorical data or data from laboratories to determine lamp aging or fouling in the control logic shall not be allowed. Only measured intensity and flow rate to be used to determine the actual disinfection performance / dose applied.

6. The UV sensor shall be automatically cleaned at the same frequency as the lamp sleeves to prevent fouling of the sensor and resulting false alarms for low intensity.
7. The UV sensor design shall be such that sensor removal can be easily conducted without complete removal of a module from the channel.
8. There shall be no fewer than one UV sensor for every bank of UV lamps.

C. UV System Control
1. The UV system shall be supplied with one UV Control Panel (ICA) to house the UV system PLC, operator interface, control and instrumentation equipment and plant interface termination points. All UV monitoring and control functions shall be carried out by the ICA.
2. The ICA shall be a NEMA 12, painted steel panel. Refer to Section 26 29 87 Electrical Control Panels (ECPs) for additional construction details and component details.
3. Electrical power supply (by Contractor) to the ICA is to be one single phase 120V / 15A / 50/60Hz.
4. Full application software will be generated by the UV equipment manufacturer to operate the UV system, using the PLC manufacturers proprietary software package.
5. Low UV intensity alarms shall be provided to detect possible water quality problems or fouling of the system. Alarm set point shall be field adjustable.
6. The ICA shall monitor individual lamp status and provide specific location of any faulted lamps.
7. The ICA shall monitor hardwired protection circuits, e.g. Module lifted, Module unplugged, Module over current, Bank isolation, etc. which will shut the appropriate area of plant down directly, to aid rapid fault finding.
8. The ICA shall include the following components:
   a. Hand-Off-Auto switch
   b. Indicator lights for "Running”
   c. Indicator light for alarm
   d. A UPS for backup power to the PLC
   e. Human-Machine Interface
   f. Alarm reset pushbutton
   g. Ethernet Switch
   h. PLC with I/O cards
   i. Any more items as required for a complete and operable system.
9. The UV system shall be supplied with a Module Lift Control Box which contains the following:
   a. Lift module pushbuttons (one for each module)
   b. Lower module pushbuttons (one for each module)
   c. Indicator light for module lift failure
   d. Module lift failure reset pushbutton
   e. Any more items as required for a complete and operable system.

D. Ballast Cabinets
1. Each ballast cabinet shall house all control gear, and electronic ballasts associated with one or two UV banks.
2. Each ballast cabinet shall be equipped with a temperature control device, which will shut off this part of the UV system in case of surpassing the critical limit of 50°C = 122°F. UV systems which do not have temperature control protection shall not be acceptable.

3. Electrical power supply (by Contractor) to each ballast cabinet shall be for 480/277 volts / 50/ 60 Hz (3) three phase 5 wire (WYE) including ground. Allowable voltage tolerance is +/- 10%.

E. Electronic Ballasts
1. The electronic ballasts shall comply with the CE & UL requirements, specifically the IEEE519 and the IEC 6100-3-2.
2. The ballasts shall be electronic microprocessor controlled, designed as slot cards fitting into a rack system with a plug connector for ease of maintenance.
3. Each ballast shall drive a pair of lamps with independent control and monitoring circuits and provide individual lamp status information to the system control.
4. The ballast shall detect lamp failure and initiate a re-strike sequence, independently from any external influence. The ballast shall attempt three re-starts before shutting off.
5. The ballast shall incorporate a galvanic separation of the input and output circuits. In case of the output circuit operating in abnormal conditions regarding voltage and/or amperage, the ballast shall shut off the lamp concerned. Ballasts without this feature shall be equipped with one GFC per ballast.
6. The ballast shall incorporate a pre-heat circuit to heat lamp filaments prior to striking the lamp arc to promote lamp longevity.
7. The operating power factor for the ballasts shall be minimum 0.99 over the entire power range of the ballast.
8. One power factor correction circuit shall power a maximum of two UV lamps in order to increase system reliability.
9. The ballast efficiency shall be a minimum of 95% at maximum power and greater than 94% across the entire range.
10. The ballast shall be capable of varying power between 50 – 100%.
11. The lamps shall be square wave driven by the ballasts for optimum UVC output efficiency and lamp life.
12. In order to avoid radiated interferences, the electronic ballasts shall be equipped with a harmonic filter.
13. The ballasts shall be tested for online disturbances up to 4000 V.
14. The ballasts shall be capable to operate down to 208 V to increase system reliability with regards to voltage fluctuations.
15. Ballasts requiring liquid closed loop re-circulating heat exchanger systems, e.g. propylene glycol, for cooling shall not be permitted.
16. Ballasts, for which replacement requires a watertight seal to be broken, shall not be permitted.

F. Control and Instrumentation
1. A UV Disinfection Management System shall control the on/off cycling and lamp power of the UV banks based upon a dose pacing philosophy.
2. The Management System shall utilize a UV sensor located within the UV banks to accurately sense any change in UV intensity. The sensor signal together with the flow rate signal and UVT shall be fed to the PLC as input parameters to accurately control and adjust UV lamp output to the required level under all operation conditions.

G. On-line Transmittance Monitor

1. The UV system shall be equipped with an on-line transmittance measurement device, specifically designed for continuous monitoring of the effluent UV transmittance.
2. The measurement device shall consist of a stainless steel housing designed to be installed in the UV channel for monitoring of the effluent transmittance in the channel.
3. Transmittance monitors requiring pumping of the effluent out of the channel to the monitor shall not be permitted due to their fouling tendency and maintenance requirement.
4. In addition, “manual” systems, which require the operator to take samples or perform lab work, are not acceptable.

3.00 EXECUTION

3.01 INSTALLATION

A. Installation of the UV equipment shall be by the Contractor in accordance with the Contract Documents, and Supplier’s engineering drawings and instructions. Supplier shall supervise the installation of the UV equipment.

B. All labor, materials and test apparatus necessary for completing the installation shall be furnished by the Contractor.

3.02 FIELD EQUIPMENT CHECKS

A. Equipment Checks: Prior to the Field Testing (as detailed below, including Alarm Testing, Initial Performance Test, and other testing), the Supplier shall check that all equipment is installed properly and functions as specified herein. Separate equipment checks will be required for each UV Channel in accordance with the construction sequencing. The equipment checks shall include, but not be limited to:
1. Proper installation and alignment of UV support structure defined as the concrete channels containing the UV banks.
2. Water tightness of all submerged equipment.
3. Proper placement of UV lamp banks to assure specified water levels relative to the lamps.
4. Electrical wiring and connections.
5. Proper operation of instrumentation, alarms, and operating indicators associated with the UV equipment.
6. Proper placement and operation of ballast and other equipment in the control panels.
7. Adequate ventilation in the control panels.
8. Proper operation of lamp bank shutoff switches and ground fault circuit interrupters.

B. Upon completion of equipment checks, the Supplier shall submit to the Owner written certification that all UV equipment and accessory equipment associated with the UV disinfection system have been properly installed, are in good condition, are functioning properly, and are in accordance with the Contract Documents.

3.03 FIELD TESTING

A. Following the Supplier's calibration of instruments, the Supplier shall perform Component, System, and Operational Tests on the UV Disinfection Equipment System. It is the responsibility of the Supplier and Contractor to jointly coordinate and arrange the times for testing and startup activities; however, the Contractor must confirm that these times are acceptable to the Owner.

B. Calibration:
   1. Approximately 30 days prior to the Initial Performance Test, the Supplier shall calibrate all instrumentation associated with the performance testing.
   2. If retesting is required, the Supplier shall recalibrate instruments associated with the retest if they have not been calibrated within the previous 90 days and submit that information to the Engineer prior to retesting.

C. Data Collection:
   1. Direct readings from the instruments shall be used in the calculations to determine conformance with the guaranteed performance requirements.
   2. Readings shall be obtained from digital trends from the UV Disinfection Equipment System PLCs and by manually recording the values directly from the instrument.
   3. Record (and round if necessary) to the level of accuracy of the instrument before any calculations.
   4. Collect manual instrument readings at 4-hour intervals during the Initial Performance Test.
   5. There shall be no adjustment to readings or calculations due to random or systematic instrumentation error or accuracy limitations.
   6. The Supplier shall document all modifications, changes, or additions and amend the operations and maintenance manuals and record drawings to reflect the modifications.
   7. All modifications required as a result of Initial Performance Test failure must be completed within 90 days of the start of the original testing period.

D. Retesting: The Supplier shall be responsible for all retesting. Supplier shall recalibrate all instrumentation associated with the retest in accordance with this Section, if the instrumentation has not been calibrated within the 90 days immediately prior to the retest.
   1. Reimburse the Owner for all Owner's costs associated with the retesting, including engineering fees and administration costs.

3.04 ALARM TESTING

A. After the Owner accepts the Supplier's written certification of proper installation of the UV Disinfection System as specified herein, the Alarm Testing shall be performed to determine whether the equipment meets the alarm conditions specified herein. Alarm Testing protocol shall be submitted to the Engineer for approval a minimum of 30 days prior to the scheduled UV system startup.
   1. Alarm Testing will occur over a period of several days and shall be performed by the Supplier with the assistance of the Owner.
   2. Alarm Testing shall include simulation of flow and water quality change, lamp and bank failures, sensor performance alarms and the proper maintenance of

the minimum UV dose over a range of flow and water quality conditions, in accordance with this specification.

3.05 INITIAL PERFORMANCE TEST

A. Following completion of the Alarm Testing and calibration of all instruments, the Supplier and the Contractor shall conduct the Initial Performance Test (IPT). The IPT shall be conducted to determine whether the equipment meets the Performance Test Requirements specified herein.

B. The Supplier and the Contractor shall provide the IPT Report within 15 working days of completion of the test period.

C. To perform the test, the Supplier and the Contractor shall operate the system continuously over a two day test period (minimum one day per channel), and collect and summarize data to demonstrate that the system meets the following Performance Test Requirements:
   1. Net Production Capacity: System meets average daily flow and peak flow rate requirements as defined in this specification.
   2. Minimum Design Dose: System can deliver the minimum design UV dose as defined in this specification.
   3. UV Disinfected Effluent Water Quality: UV Disinfection system produces an effluent in complete compliance with requirements as specified in this specification.
   4. Cleaning: The on-line, automatic cleaning system cleans the lamps as thoroughly and frequently as is required for the system to deliver the minimum design dose at all times. The cleaning system maintains the Sleeve Fouling Factor.
   5. No major changes in equipment or apparatus will be permitted during this test period. However, minor adjustments of equipment that would normally be expected during regular operation of the equipment in plant use may be made.

D. Supplier shall submit a detailed protocol to be followed for the IPT at least 21 days in advance. This protocol requires written approval by the Owner before initiating the tests. The protocol shall specifically detail the operational mode of the system, sampling program, method and schedule, equipment and system monitoring data to be collected with each sampling, the daily (manual) log format, and all sampling and analytical procedures. Upon acceptance of the protocol by the Owner, the Supplier shall commence the performance test. The Supplier shall collect and process influent and effluent samples 2 times, 2 times per channel, and test for suspended solids, turbidity, influent, and effluent *E. coli*, and transmittance for the test period.

E. Successful completion of the IPT shall be defined as continuous operation over the IPT test period without a major failure in the system and demonstration that system meets all performance requirements established herein. Downtime resulting from Owner's operation will not be counted against the criteria of "continuous days of operation." If an individual train has a production capacity below 50 percent of its design production capacity for more than 24 hours, the IPT will be considered a failure.

F. If during the IPT, the system fails or shuts down, the IPT shall then be rerun, as described above, and additional testing, labor, materials, equipment, etc.,

associated with correcting deficiencies in the UV system, including the repeated performance test, shall be borne by the Supplier. Each repetition of the IPT shall be for a continuous period unless failure to meet performance requirements as defined in this specification has been documented and modifications have been accomplished.

G. During the IPT, the Owner shall have the option of collecting samples for independent analyses to confirm measurements and analyses conducted by the Supplier and the Contractor. The Engineer and the Owner shall have the option of witnessing all testing performed by the Supplier and the Contractor. The Supplier shall notify the Engineer a minimum of 2 weeks in advance of testing.

H. If the UV Disinfection Equipment System fails to successfully complete the IPT, the Supplier shall have the option of repeating the test two more times, with all costs borne by the Supplier.

I. Consequences to the Supplier for failure to successfully complete the IPT are specified are listed in paragraph 1.10.A.6.d.

3.06 TRAINING OF OWNER'S PERSONNEL AND SUPPORT SERVICES

A. General Requirements:
1. Provide operations and maintenance training for items of mechanical, electrical and instrumentation equipment. Utilize Supplier's representatives to conduct training sessions.
2. Coordinate training sessions to prevent overlapping sessions.
3. Provide Draft Operation and Maintenance Manual for specific pieces of equipment or systems prior to training session for that piece of equipment or system.
4. Satisfactorily complete Alarm Testing before beginning operator training.
5. Following Owner’s acceptance of Certificate of Proper Installation, the Supplier shall perform a comprehensive training of Owner’s personnel at the site or a classroom designated by the Engineer.
6. The training provided by the Supplier’s representative shall consist of both classroom and field training:
7. The Supplier shall give the Owner a minimum of 15 days' notice prior to initiation of training.
8. The Supplier shall record all training sessions and provide a DVD copy for the Owner.
9. The Supplier shall designate and provide one or more persons to be responsible for coordinating and expediting training duties. The person or persons so designated shall be present at all training coordination meetings with the Owner.
10. The Supplier’s coordinator shall coordinate the training periods with Owner personnel and shall submit a training schedule for each component of the UV Disinfection Equipment System for which training is to be provided. Such training schedule shall be submitted not less than 15 calendar days prior to the time that the associated training is to be provided and shall be based on the current plan of operation.

B. Specific Requirements:

1. In addition to the time necessary to complete the requirements established elsewhere within these Specifications, the Supplier's representative shall also provide onsite services at times designated by the Owner, for the minimum person-days listed in this section, travel time excluded.
2. Installation Supervision and Inspection: Minimum 4 person-days to handle various requests by the Owner, including during the unloading of UV disinfection equipment system (assume one trip) and for providing installation assistance for the UV Disinfection Equipment System (assume two trips, one per channel),
3. Start-Up and Field-Testing: Minimum 5 person-days to handle various requests by the Owner, for assistance during startup activities (assume two trips, one per channel).
4. Operator Training: Training shall consist of a minimum of total of 12 hours of hands-on lectures on the UV Disinfection Equipment System operation and the maintenance requirements, including lamp cleaning and replacement and repair processes for lamps, ballasts, wipers, sleeves and ancillary equipment. Training shall take place before the Initial Performance Test. The field training shall cover all shifts.
5. Maintenance Service – Service Scheduling:
   a. By Owner request any time during warranty period as specified on the Warranty Form
6. Supplier shall return for 2 additional days (these 2 additional days are excluded from the time mentioned above), 1 year and 2 years after final acceptance to review UV Disinfection System performance, operations, and maintenance.
7. Factory representatives of the Supplier who have complete knowledge of the proper operation and maintenance of the equipment, shall be provided to instruct representatives of Owner on the proper start-up, operation, and maintenance.

C. The Supplier shall include in proposal a price for the time and expenses listed above.

D. The Supplier’s representative shall be a qualified individual who has previously provided onsite services for the installation, testing, and startup of the Supplier’s identical system at a minimum of five wastewater treatment plant of similar size.

E. Telephone: Include the following in lump sum price:
   1. Provide telephone support by means of a toll-free phone number for a minimum period of 3 years following installation and startup.
   2. Provide a list of three or more names of individuals qualified to support operation, and provide cell phone numbers for these individuals. At least one of the listed individuals shall be available at all times including nights, weekends, and holidays in the event of an emergency.

F. Service Scheduling:
   1. By Owner, on request any time during warranty period as specified.
   2. Factory representatives of the Supplier who have complete knowledge of the proper operation and maintenance of the equipment, shall be provided to instruct Owner on the proper start-up, operation, and maintenance.

Form 1

Parameter	Value
System Configuration for Peak Hour Flow:	
Peak 2-Hour Flow, MGD	9.0
Average Design Flow, MGD	2.25
Total Number of Channels	2
Minimum number of duty banks per channel	2
Minimum number of redundant banks per channel	1
Minimum total number of banks per channel	3
Minimum total number of lamps per bank	16
Minimum number of lamps	96
UVT (%)	65
Lamp Aging Factor	0.89
Sleeve Fouling Factor	0.95
Lamp Characteristics:	
Lamp Orientation	Inclined
Ballast Characteristics:	
Type of Ballast	Electronic
Method of Control/Pacing:	
Method of Control/Pacing	Flow and UVT Pacing

SECTION 46 76 27 DEWATERING SCREW PRESS

PART 1 GENERAL

1.1 SUMMARY

A. The work specified shall include furnishing and testing of all equipment and materials necessary to provide a completely operational Screw Press System for dewatering of wastewater thickened sludge.

B. The Dewatering Screw Press System shall consist of screw press, screw conveyor, internal piping and valves, polymer feed system, sludge pumps, in-line flocculation tank or inline mixer, equipment supports to concrete floor, process control system control panel, and any other equipment or accessories required to provide a complete and functioning dewatering screw press system.

C. The Screw Press Manufacturer has sole responsibility for the design, fabrication, furnishing, delivery, start up, and testing of the Dewatering System.

D. Contractor shall be responsible for all structural, electrical, instrumentation and other alterations required to accommodate equipment differing in dimensions, weight, or other characteristics from these specifications and drawings.

1.2 REFERENCES

A. American Bearing Manufacturers Association (ABMA)

B. American Gear Manufacturers Association (AGMA)

C. American Society of Mechanical Engineers (ASME)

D. Institute of Electrical and Electronics Engineers, Inc. (IEEE)

E. American Welding Society (AWS) D1.1, Structural Welding Code.

F. National Electric Code (NEC).

G. National Electrical Manufacturers Association (NEMA).

H. American National Standards Institute (ANSI).

1.3 SCREW PRESS DESCRIPTION

A. Screw press system shall be capable of municipal waste activated sludge described.

B. Al equipment as required for a complete and functional screw press system shall be provided by the Manufacturer. Screw press components include:

1. Screw press with all 304 stainless steel wetted parts.

2. Sludge inlet headbox.

3. Removable drums.

4. Removable drum covers.

5. Three screen spray showers.

6. Speed reducer.

7. Galvanized carbon steel base.

8. Flanged filtrate outlet.

9. Back pressure cone.

10. Flocculation tank with mixer or inline mixer.

11. Equipment motors.

12. Pressure transducer type level element with indicating transmitter and high-level probe.

C. Performance Requirements:

1. Each dewatering screw press shall be capable of dewatering thickened municipal wastewater sludge thickened between 0.6 and 1.8-% and meet the performance requirements outlined below:

a.	Solids Loading Rate	700 lb/hr at 0.7% feed solids
b.	Cake Solids	16-20 %, with polymer addition
c.	Capture Rate	95 %
d.	Polymer Dose	< 35 lb active polymer per dry ton of solids

1.4 SUBMITTALS

A. Submit as specified in Section 01 33 00, Submittals.

B. Product Data:

1. Submit data completely describing product including plan and section views and listings of materials of construction.

2. Submit surface preparation and finishes to be applied to all equipment.

C. Shop Drawings:

1. Complete manufacturer fabrication/assembly drawings stamped by a registered Engineer.

2. Certified drawings showing dimensions, weights, loading information and location of all components; Include details on interconnecting piping, supports, and control panel

3. Wiring, control schematics, and control logic diagrams for all electrical and control components furnished.

4. Manufacturer's Drawings shall be coordinated with the Contract Drawings, including equipment numbers and piping designations.

5. List of Recommended Spare Parts with price information

D. Structural Calculations

1. Structural anchor points to concrete foundation.

2. Seismic loads on frame and anchor bolts.

E. Resume of Technician to perform thickener screw press adjustments, inspections, observations of test operations, supervision of functional and performance testing, and training.

F. Training Course Outline

G. Operating and Maintenance Manuals: Include complete lubrication, maintenance, and operation instructions, including initial start-up instructions, and unloading and handling methods. See Section 01 78 33 for the content, mechanics and administration of the submittal process.

H. Manufacturer's references

I. Quality Control Submittals:

1. Special shipping storage, protection, and handling instructions

2. Manufacturer's Installation Instructions

3. Factory Test Results

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Consideration will be given only to the equipment of Manufacturers who are regularly engaged in such work and thoroughly experienced in the design and manufacture of screw press equipment specifically manufactured for municipal, secondary treated, waste activated sludge. Manufacturer shall meet the following requirements:

1. Have a minimum of 10 years of experience of producing substantially similar equipment, and show evidence of satisfactory operation in North America for presses dewatering municipal activated sludge.

2. Must have a company-owned service and parts facility within the continental United States.

B. Screw Press Manufacturer shall list exceptions, deviations or changes necessary to accommodate the proposed products. It shall be at the Owner's sole discretion to accept or reject deviations. If "NONE" is listed, it shall be understood and agreed that the vendor meets or exceeds the specification requirements.

a. Provide justification for exceptions, variations, deviations, or changes (such as advancements in technology that benefit the Owner, changes in design or material sources that have no impact on overall

performance of the unit, or changes made necessary due to differing conditions noted in the specification).

b. Owner and Engineer will determine whether exceptions, deviations, and changes are acceptable. Exceptions, variations, deviations, and changes may result in rejection of submittal and original specified requirements must be met.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall unload, store, and handle the equipment per the manufacturer's instructions.

B. Deliver screw press as completely assembled as practical to minimize field assembly. Contractor shall be responsible for unloading and any necessary field assembly. Contractor shall contact manufacturer for screw press field assembly requirements during bid.

1.7 WARRANTY

A. Warranty shall extend for two years after acceptance of all of equipment provided under this Section.

B. Warranty shall include all parts, labor, and coatings for repairing or replacing equipment that fails during the warranty period. Defects occurring within the warranty period shall be repaired or replaced by the manufacturer at no cost to the Owner.

1.8 MAINTENANCE

A. Special Tools: Provide standard manufacturer supplied toolbox with all tools needed to assemble and disassemble the screw press.

B. Provide list of recommended spare parts and current cost of each spare part.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Design shown on the drawings is based on two listed manufacturers. Costs for structural, electrical, mechanical and all other design and construction changes required to accommodate a design different from those detailed shall be included in bid.

B. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

1. FKC Co., LTD.
2. Andritz
3. Huber
4. Schwing Bioset

2.2 MATERIALS

A. Wetted Parts: Stainless Steel, Type 304, unless otherwise indicated.

B. Drive Unit: As scheduled.

C. Galvanized carbon steel base

D. Other parts: Coated carbon steel

E. Miscellaneous hardware, including bolts, nuts, washers, and fastener clips in the wetted area: Type 316 Stainless Steel.

F. All stainless steel components and structures shall be submersed in a chemical bath of nitric acid and hydrofluoric acid (pickling bath) to remove any residues that may be present on the material because of forming, manufacture, or handling. After removal from the pickling bath, the equipment must be washed with a high-pressure wash of cold water to remove any remaining surface debris and promote the formation of an oxidized passive layer, which is critical to the long life of the stainless steel.

2.3 HOUSING

A. Housing shall be rigid Type 304 stainless steel weldment, supported by structural carbon steel base and shall have removable Type 304 stainless steel covers for screen access.

B. Sludge feed connections and filtrate discharge connections shall be Type 304 stainless steel 6-inch pipe stub and 4-inch (respectively) flanged meeting ANSI/ASME B 16.1, Class 125, or ANSI/ASME B 16.5, Class 150; provide higher pressure class as required to meet Design Working Pressure.

C. Press shall have Type 304 stainless steel discharge box with hinged lid. Dimensions as indicated on the Drawings.

D. Housing shall be designed for noise reduction, to act as a protective guard and to provide a complete enclosure for odor containment.

E. The screw press shall be provided with Type 304 stainless steel spray covers on the top and sides of the screw press drums where necessary for sanitation and personnel protection. Side covers shall be easily removable by a single person.

F. If applicable, include 304 stainless steel foul air connections suitable for flexible duct connections with clamps for as shown on the Drawings.

G. Headbox shall include hinged top inspection doors (12-inch by 12-inch min). The whole dewatering section and basket area shall be easily accessible through inspection doors.

2.4 DRIVE SYSTEM

A. Drive system shall consist of an electric motor suitable to use with a variable speed drive system as required to provide full load capacity and also to withstand the full starting torque of the system. VFD shall be provided as part of the Dewatering Control Panel.

B. Screw speed shall be electronically controlled by means of a VFD in a NEMA 4X enclosure. Maximum screw speed shall be 1.1 rpm or lower.

C. Speed Reducer:

1. Provide speed reducer rated for uniform shock load classification with a SUM ITOMO-CYCLO reducer service factor of 1.00.

2. Speed reducer shall be Sumitomo Cyclo Reducer or equal.

D. Shaft Seals shall be Musashi double lip spring-loaded Nitrile oil seal or equal.

E. Bearings:

1. Bearings:

a. Screw press shall be designed so that the entire rotating assembly is supported on the discharge end by a grease lubricated ball or spherical roller type bearing. The bearing shall be conservatively designed to withstand all stresses of the service specified. Main bearings shall have a minimum B-10 life rating of 500,000 hours at standard operating speeds.

b. Bearings for the screw shall be anti-friction with grease lubrication.

F. Flexible connectors for the drive motor and screw press junction boxes shall be furnished by the installing Contractor such that all local electrical codes are met.

G. Screw Press Motor:

1. Provide inverter rated, severe duty motor, 1.15 SF, NEMA Premium Efficiency, cast iron frame with manufacturer's standard, corrosion resistant, epoxy finish.

2.5 SCREW ASSEMBLY

A. Screw Shell: Stainless steel, Type 304.

B. Helical flight welded to screw shell: Stainless steel Type 304 Brushless Flight.

C. The screw supported in the head by a radial bearing.

2.6 SCREEN ASSEMBLY

A. Type 304 stainless steel panels with punched holes.

B. Wedge wire screens are not acceptable.

2.7 DRUM ASSEMBLY

A. Drums shall be designed to split into two, removable drum halves.

B. Drum configuration shall allow maintenance work in the screw press flight area without removal of the screw from the press.

2.8 PRESS ASSEMBLY

A. Screw press assembly shall be such that clearances around the entire perimeter of the unit for maintenance work shall not exceed 36 inches.

2.9 FLOCCULATION TANK (IF APPLICABLE)

A. Flocculation tank wetted parts shall be constructed of 304 stainless steel throughout.

B. Flocculation tank shall be designed with sufficient retention time under the normal design flow rate. The inlet of the tank shall be located at the bottom of the tank and conditioned sludge shall overflow from the discharge pipe located near the top of the tank. Provide discharge pipe stub with flexible rubber hose sleeve connection.

C. Flocculation tank shall be supplied complete with an agitator. The agitator drive shall be an SEW Eurodrive Varimot speed reducer/mechanical variator or equal. Agitator speed shall be adjusted manually at the flocculation tank.

D. Flocculation tank, agitator, and agitator drive shall be designed to handle the entire flow capacity range of the screw press.

E. Motor shall have an aluminum cast frame. Motor efficiency will be 77% or greater. Motor bearings shall be 6306 C3-2RS or equal on the drive end and 6205 C3-2RS or equal on the fan end.

F. Provide split flocculation tank cover with a hinged inspection port. Include a 4-inch pipe stub vent connection on the fixed portion of the cover.

2.10 LIQUID POLYMER SYSTEM

A. Liquid polymer blending system by Velodyne, Clean Water UGSI, or approved equal.

B. Polymer system shall be designed for the preparation, aging and dosing of polymer solution having an active polymer concentration between 0.05 and 0.25-%

C. The polymer system shall be self-contained with pumps, piping, fittings, and accessories, and shall be factory assembled and tested to eliminate field assembly work. The frame shall be 304 stainless steel and the piping SCH.80 PVC.

D. A polymer mixing chamber shall be provided. A high energy, multi zoned, hydro-mechanical mixing device shall be provided. The mixing chamber shall have a translucent front cover.

E. The hydro mechanical impeller shall be designed to produce variable intensity, back flow mixing action to optimize polymer performance without damaging polymer molecular structure.

F. Motors shall be 1750rpm, 90 V, 60Hz, wash down duty with keyless shaft and left hand impeller mounting screw.

G. Materials: Impeller - 304 SS; body of mixing device – 304 SS; cover – clear Lexan; fastener – 316 SS; seals – Viton; pressure rating – maximum 100 PSI.

H. A neat polymer metering pump with hose connector shall be provided and connected through a 1/2 in barbed hose to the polymer mixing device. The neat polymer pump shall be a progressive cavity type pump.

I. Polymer tote mixer shall be specifically designed to effectively mix neat polymer. Tote mixer shall be designed with a stainless-steel mixer bridge with adjustable brackets.

J. Polymer tote level sensor shall be the non-intrusive capacitance type with two level points, each fully adjustable.

2.11 CONVEYOR

A. The screw conveyor shall be designed to discharge directly at the middle of the sludge dumpster and to handle the maximum load of the screw presses.

B. The screw conveyor shall be capable of processing spherical objects with a diameter of 3-1/8". Such objects shall be conveyed through the auger and shall be discharged with the sludge.

C. Operation of the screw conveyor shall be automatically initiated and stopped. The sludge shall be transported up the screw conveyor and shall discharge into the center of a dumpster.

D. Screw Conveyor Materials: Unless otherwise specified in these specifications, the entire equipment shall be manufactured from AISI 304L austenitic stainless steel shapes (rods, angles, and channels), pipes, and sheets. All mechanical parts shall be designed to handle the forces that may be exerted on the unit during fabrication, shipping, erection, and proper operation.

E. Screw Conveyor Design: The spiral shall have a center shaft. Minimum flight thickness shall be 3/16 inch (5 mm). The spiral flight shall have sufficient stability to prevent distortion and jumping in the trough.

F. Screw Conveyor Trough Design

1. Each conveyor trough shall be U-shaped, fabricated from a minimum thickness of 1/8" (3 mm) AISI 304L stainless steel plate. Each trough shall be equipped with inlet and discharge connections, as indicated on the drawings. The outlet openings in the trough bottom shall be sized to prevent screw conveyor plugging.

2. The entire length of the screw conveyor, with the exception of the filling chute, shall be covered by a bolted cover. Covers shall be manufactured from a material thickness of 5/64" (2 mm) AISI 304L stainless steel plate. The covers shall be manufactured in sections with a maximum of 5 foot lengths to allow for easy access.

3. A wear liner shall be provided for the trough. The wear liner shall be made of ultra-high-molecular-weight polyethylene. The wear liners shall be manufactured in sections with a maximum length of 39 inches to allow for easy replacement.

G. Screw Conveyor Supports Design

1. Each conveyor shall be furnished complete with supports suitable for mounting as required by the supplier's design.

2. The supports shall be shop fabricated from structural AISI 304L stainless steel shapes and plates. At a minimum, each screw conveyor trough shall have supports at the drive end and other end of the trough plus intermediate supports at a maximum of 11-1/2 foot intervals.

3. The supports shall be designed to avoid interference with other equipment or equipment supports. The supports shall be designed to prevent excessive vibration of any portion of the conveyor unit under all loading conditions.

H. Screw Conveyor Drive Design

1. The screw conveyor mechanism shall be driven by a shaft mounted gearbox and motor assembly. The gear reducer shall be bolted to a machined flange welded to the upper end of the conveyor trough.

2. The gear reducer shall be driven by a 1,760 rpm, 3-phase, 60 Hertz, 230/460 volt, continuous-duty motor with a conduit box suitable for outdoor operation.

2.12 INSTRUMENTATION AND CONTROLS

A. Screw Press Manufacturer shall provide the entire control system including panel, PLC, and field instrumentation.

B. Screw Press Manufacturer to program PLC and HMI and is responsible to direct all programming changes required to meet the system performance standards.

C. Main control panel, one for each Screw Press, shall include NEMA 4X stainless steel enclosure with:

1. Main power disconnect switch (pad-lockable)

2. Control power transformer

3. Surge arrester

4. Door Mounted Operators and Status:

a. Sludge Pump
   1) HOA Switch
   2) System Reset
   3) Start/Stop Push Buttons
   4) Speed Control
   5) VFD Fault Alarm
   6) High Temperature Alarm
   7) E-Stop

b. Polymer System
   1) HOA Switch
   2) System Reset
   3) Start/Stop Push Buttons
   4) Speed Control
   5) VFD Fault Alarm

6) Low Polymer Flow Alarm
7) Low of Water Pressure Alarm
8) High Discharge Pressure Alarm
9) E-Stop

c. Screw Press
1) HOA Switch
2) System Reset
3) Start/Stop Push Buttons
4) Speed Control
5) Washwater SOV HOA
6) VFD Fault Alarm
7) High Temperature Alarm
8) E-Stop

d. Conveyor
1) HOA Switch
2) System Reset
3) Start/Stop Push Buttons
4) High Temperature Alarm
5) E-Stop

e. Provide other controls as shown on the process and instrumentation diagrams and as needed for a fully functioning system.

5. Non-reversing motor starter including over-current and over-heat protection for conveyor drive motor.

6. Reversing motor starter including over-current and over-heat protection for wash water spray drive.

7. Programmable logic controller (PLC) with Operator Interface (OIU), with color touch screen. OIU shall be protected with hinged window.

8. AProvide I/O list of parameters to be monitored through interface with register assignments and engineering units. Provide communications with plant SCADA system via Modbus TCP/IP, with protocol gateway, if needed.

9. OIU shall also work as a data logger. The data logger shall document all important process parameters, not limited to the following list:

a. Operation mode: OFF, dewatering, back wash, shutdown

b. Drive operation: forward, reverse

c. Sludge flow (gpm)

d. Screw Speed

e. Polymer pacing signal

f. Pressure screw press inlet

g. Press Motor amperage draw

h. Set points: feed solids, polymer consumption, solid loading

10. OIU shall provide maintenance reminder alarms for mechanical components which require replacement over-time. The OIU shall have a maintenance summary screen that displays the remaining hours of runtime until each mechanical component is recommended to be replaced. The OIU should produce an alarm banner for the specific component that needs replacement once the system has operated for the amount of hours the equipment manufacturer recommends. The maintenance summary screen shall also include the option to reset the alarm banner once the component has been replaced. Manufacturers not providing this functionality shall provide service trips every two years for maintenance operations.

D. Screw Press Manufacturer shall provide a pressure sensing type level indicating transmitter as follows:

1. Manufacturer: One of the following or equal:

   a. Rosemount

   b. Fischer and Porter

   c. Leeds and Northrup

   d. Foxboro

2. Level Indicating Transmitters: Pressure sensing, 24-volt direct current 2 wire type with the following:

   a. 3-inch ANSI B16.5, Class 150 carbon steel mounting flange

   b. 1/2-inch National Pipe Tread pressure or reference connection

   c. No mechanical fulcrum points.

   d. Electronic span

   e. Zero adjustments

   f. Adjustable damping feature

   g. Positive over-range protection

   h. Field adjusted zero elevation or suppression.

   i. 3 valve manifolds

3. Transmitters Housings: NEMA 4X corrosion resistant and weatherproof, with operation temperature range of from 0 to 175 degrees Fahrenheit with relative humidity of 0 to 100 percent.

4. Wetted Material: Cadmium-plated carbon steel, stainless steel, or other corrosion-resistant materials, compatible with process fluid.

5. Accuracy: Within 0.25 percent of span with repeatability of 0.10 percent.

6. Output: 4 to 20 milliampere direct current without need for external load adjustments.

7. Calibrate transmitters to required range.

8. Provide flange on headbox for mounting the level element.

E. Conductivity Level Probe: Omega LVC-E511 or equal.

2.13 ACCESSORIES AND FINISHES

A. Anchor bolts will be sized by the screw press Manufacturer and provided by the Contractor.

B. Each major component of equipment shall have the manufacturer's name, address and product identification on a corrosion-resistant nameplate securely affixed to the equipment.

C. Surface preparation of carbon steel surfaces on the screw press and flocculation tank shall be in accordance with SSPC-SP6 standards and shall be coated as follows:

1. Prime Coat: 5 mils of Carboline 890

2. Top Coat: 2 mils of Carboline 890 (if outdoors & exposed to direct sunlight), 5 mils (if indoors or covered outdoors)

D. Motors and gearboxes for the screw press and flocculation tank shall be prepared and coated with the manufacturer's standard surface preparation, prime coat and top coat for corrosion resistance.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. The Contractor shall provide all hardware and accessories required for installation.

C. Manufacturer's Field Services

1. Include the following:

a. Inspection and Functional/Operational Testing: One trip with 3 days service.

b. Performance Testing/Training: One trip with 2 days service.

2. Additional trips resulting from failed tests shall be the sole responsibility of the manufacturer.

3.2 EQUIPMENT STARTUP AND TESTING

A. Perform start-up and functional testing for entire dewatering system, with all units operating in AUTO mode. The Contractor shall complete all electrical/instrumentation and loop testing prior to functional performance testing.

B. Provide Major Certificate of Proper Installation.

C. Operational Test:

1. Functional/operational tests may be performed in the same trip.

D. Guaranteed Performance Testing:

1. Include the minimum number of trips and duration of service as previously indicated.

2. Include demonstration that dewatering system meets minimum specified performance requirements of this specification.

3. Manufacturer’s representative shall supervise all performance testing and be solely responsible for operating the dewatering and ancillary equipment (e.g., sludge and polymer feed systems). The OWNER shall furnish personnel to assist in operating the equipment and take samples. Manufacturer shall provide certified test reports.

4. After adjustments are made to achieve the operating requirements, the dewatering system will be operated at the design conditions to demonstrate consistent performance. Samples of feed, filtrate, and cake shall be collected by Engineer's appointed representative or Owner and evaluated by the Owner. The test will be deemed successful if average test results meet or exceed those specified.

5. Sample testing and analysis costs shall be the responsibility of the Owner.

6. Polymer shall be as selected by the polymer representative and supplied by the Owner for testing.

7. Data collected during each test run used to complete guaranteed performance testing shall include, as a minimum:

a. Run number.

b. Date.

c. Time.

d. Feed sludge percent total solids, %TS

e. Sludge feed rate, gpm.

f. Polymer name.

g. Polymer percent active, %.

h. Polymer feed rate (neat), gph.

i. Screw press speed, rpm.

j. Amperage draw by the screw press drive.

k. Cake percent total solids, %TS.

8. Provide calculated values for the following:

a. Solids throughput, lbs TS/hr.

9. Solids concentrations will be determined using “Standard Methods.”

10. Guaranteed Performance Test Runs:

a. Test runs shall consist of two 5-hour steady state runs performed on two consecutive days. Maintain the design solids throughput throughout the test runs.

b. All test data and values and previously described and required to demonstrate compliance shall be recorded at the start of each run and every hour thereafter. The averaged results for each sample shall meet or exceed the minimum and guaranteed performance standards.

c. The units shall be operated in AUTO mode at all times during the Guaranteed Performance test runs.

d. Should the installed equipment fail to meet the specified minimum performance requirements, the manufacturer shall within 30 days make all necessary changes to the equipment and/or operation at no cost to the Owner. The equipment shall be retested using the same procedure indicated above. If after the second test the equipment still does not meet the minimum performance requirements and/or guaranteed performance standards, damages will be assessed and/or equipment replaced. If assessed, damages will be limited to ten percent (10%) retention, if performance requirements are not met.

e. The screw press dewatering system shall meet every item of the performance criteria as specified prior to acceptance of the Owner.

11. Screw Press Manufacturer shall prepare and submit a written report documenting the test data listed above.

12. Provide a computer spreadsheet compatible with Microsoft Excel (latest version) with the test data listed above.

E. Witnessing: All field testing shall be witnessed by the Engineer.

F. A representative of the Screw Press Manufacturer shall be provided for the following:

1. To inspect the equipment and installation.

2. To make any field adjustments to ensure proper equipment operation.

3. To furnish affidavit stating that the dewatering system has been tested and is ready for installation as specified.

4. To inspect start-up

G. Manufacturer shall inspect system before initial start-up and certify that system has been correctly installed and prepared for start-up.

H. Training:

1. Provide operator training for at least 2 days on-site by factory trained representative. Operator training to include:

a. Operations and inspection training.

b. Safety instruction.

c. Preventative maintenance instruction.

d. Calibration and other pertinent services.

END OF SECTION

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Receive a report, hold a discussion, and take action on a Professional Services Agreement with Plummer Associates for Construction Management and Resident Project Representative Services for the construction of the wastewater treatment plant, in the amount not to exceed $1,997,504 and authorize the City Manager to execute necessary documents.

Staff Contact
Leanne Wilson, Director of Public Works and Development Services
lwilson@aubreytx.gov

Summary
This agreement is for professional engineering services related to the construction management and inspection of work for the construction of a 2.25 MG Wastewater Treatment Plant at a project cost of approximately $40,000,000.

Plummer will provide a construction manager for the overall oversight of performance issues. The manager will be responsible for day-to-day construction observations, schedule review, and coordinating quality assurance testing of the contractor and construction activities and will keep Joe Hernandez, City Project Manager, informed and up-to-date on construction progress. A resident project representative will also be provided and work directly under the construction manager to observe and document performance in accordance with the contract documents. Additionally, comments and advice will be provided to the city on the contractor's performance with regard to industry standard practices.

These two full-time positions cover civil, mechanical, electrical, and instrumentation and control disciplines. Procore inspections software will be used to manage the project and document inspections. Plummer will establish the construction management team, develop and maintain a construction management plan, store all project related records for required document retention purposes and provide quality assurance and quality control.

Communication will include at a minimum weekly construction progress meetings. Agendas will be provided for the meetings and notes will be posted. A full detailed list of responsibilities and management elements is included in the agreement in the council packet.

This project is expected to take 26 months to complete and include 9,050 work hours of construction-management.

Financial Summary

Staff Recommended Motion
Approve

Conditions
N/A

AGREEMENT
BETWEEN OWNER AND ENGINEER
FOR PROFESSIONAL SERVICES

THIS IS AN AGREEMENT effective as of _____("Effective Date") between the **City of Aubrey, Texas** ("Owner") and **Plummer Associates, Inc.** ("Engineer").

Owner's Project, of which Engineer's services under this Agreement are a part, is generally identified as follows: **Construction Management and RPR Services for City of Aubrey WWTP Expansion to 2.25 MGD** ("Project").

Engineer's services under this Agreement are generally identified as follows: Construction Management and Resident Project Representative (RPR) Services ("Services"). Refer to Exhibit A for detailed scope of Services.

Owner and Engineer further agree as follows:

1.01 *Basic Agreement and Period of Service*

A. Engineer shall provide or furnish the Services set forth in this Agreement. If authorized by Owner, or if required because of changes in the Project, Engineer shall furnish services in addition to those set forth above ("Additional Services").

B. Engineer shall complete its Basic Services within the time period specified in Exhibit A.

C. If, through no fault of Engineer, such periods of time or dates are changed, or the orderly and continuous progress of Engineer's Services is impaired, or Engineer's Services are delayed or suspended, then the time for completion of Engineer's Services, and the rates and amounts of Engineer's compensation, shall be adjusted equitably.

2.01 *Payment Procedures*

A. *Invoices:* Engineer shall prepare invoices in accordance with its standard invoicing practices and submit the invoices to Owner on a monthly basis. Invoices are due and payable within 30 days of receipt. If Owner fails to make any payment due Engineer for Services, Additional Services, and expenses within 30 days after receipt of Engineer's invoice, then (1) the amounts due Engineer will be increased at the rate of 1.0% per month (or the maximum rate of interest permitted by law, if less) from said thirtieth day, and (2) in addition Engineer may, after giving seven days written notice to Owner, suspend Services under this Agreement until Engineer has been paid in full all amounts due for Services, Additional Services, expenses, and other related charges. Owner waives any and all claims against Engineer for any such suspension.

B. *Payment:* As compensation for Engineer providing or furnishing Services and Additional Services, Owner shall pay Engineer as set forth in Paragraphs 2.01, 2.02 (Services), and 2.03 (Additional Services). If Owner disputes an invoice, either as to amount or entitlement, then Owner shall promptly advise Engineer in

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writing of the specific basis for doing so, may withhold only that portion so disputed, and must pay the undisputed portion.

2.02 *Basis of Payment—Hourly Rates Plus Reimbursable Expenses*

A. Owner shall pay Engineer for Services as follows:

1. An amount equal to the monthly cumulative hours charged to the Project by each class of Engineer's employees times standard hourly rates for each applicable billing class, plus reimbursement of monthly expenses incurred in connection with providing the Services and Engineer's consultants' charges, if any.

2. Engineer's Standard Hourly Rates are attached as Appendix 1.

3. The total compensation for Services and reimbursable expenses is estimated to be **$1,997,504.00**.

2.03 *Additional Services:* For Additional Services, Exhibit B will be used. Owner shall pay Engineer an amount equal to the cumulative hours charged in providing the Additional Services by each class of Engineer's employees, times standard hourly rates for each applicable billing class; plus reimbursement of expenses incurred in connection with providing the Additional Services and Engineer's consultants' charges, if any. Engineer's standard hourly rates are attached as Appendix 1.

3.01 *Termination*

A. The obligation to continue performance under this Agreement may be terminated:

1. For cause,

a. By either party upon 30 days written notice in the event of substantial failure by the other party to perform in accordance with the Agreement's terms through no fault of the terminating party. Failure to pay Engineer for its services is a substantial failure to perform and a basis for termination.

b. By Engineer:

1) upon seven days written notice if Owner demands that Engineer furnish or perform services contrary to Engineer's responsibilities as a licensed professional; or

2) upon seven days written notice if the Engineer's Services are delayed for more than 90 days for reasons beyond Engineer's control, or as the result of the presence at the Site of undisclosed Constituents of Concern, as set forth in Paragraph 5.01.I.

c. Engineer shall have no liability to Owner on account of a termination for cause.

d. Notwithstanding the foregoing, this Agreement will not terminate as a result of a substantial failure under Paragraph 3.01.A.1.a if the party receiving such notice begins, within seven days of receipt of such notice, to correct its substantial failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of notice; provided, however, that if and to the extent such substantial failure cannot be reasonably cured within such 30 day period, and if such party has diligently attempted to cure the same and thereafter continues diligently to cure the same, then the

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cure period provided for herein shall extend up to, but in no case more than, 60 days after the date of receipt of the notice.

2. For convenience, by Owner effective upon Engineer's receipt of written notice from Owner.

B. In the event of any termination under Paragraph 3.01, Engineer will be entitled to invoice Owner and to receive full payment for all Services and Additional Services performed or furnished in accordance with this Agreement, plus reimbursement of expenses incurred through the effective date of termination in connection with providing the Services and Additional Services, and Engineer's consultants' charges, if any.

4.01 *Successors, Assigns, and Beneficiaries*

A. Owner and Engineer are hereby bound and the successors, executors, administrators, and legal representatives of Owner and Engineer (and to the extent permitted by Paragraph 4.01.B the assigns of Owner and Engineer) are hereby bound to the other party to this Agreement and to the successors, executors, administrators, and legal representatives (and said assigns) of such other party, in respect of all covenants, agreements, and obligations of this Agreement.

B. Neither Owner nor Engineer may assign, sublet, or transfer any rights under or interest (including, but without limitation, money that is due or may become due) in this Agreement without the written consent of the other party, except to the extent that any assignment, subletting, or transfer is mandated by law. Unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under this Agreement.

C. Unless expressly provided otherwise, nothing in this Agreement shall be construed to create, impose, or give rise to any duty owed by Owner or Engineer to any Contractor, other third-party individual or entity, or to any surety for or employee of any of them. All duties and responsibilities undertaken pursuant to this Agreement will be for the sole and exclusive benefit of Owner and Engineer and not for the benefit of any other party.

5.01 *Insurance*

A. Engineer will procure and maintain the following insurance coverage for Workers' Compensation, General Liability, Professional Liability, and Automobile Liability and will provide certificates of insurance.

Coverage	**Policy limits of not less than:**
Workers' Compensation	
State	Statutory
Employer's Liability	
Each accident	$1,000,000
Each employee	$1,000,000
Policy limit	$1,000,000
Commercial General Liability	
General Aggregate	$2,000,000
Personal and Advertising Injury	$1,000,000
Bodily Injury and Property Damage—Each Occurrence	$1,000,000
Automobile Liability	

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Coverage	Policy limits of not less than:
Bodily Injury	
Each Person	$1,000,000
Each Accident	$1,000,000
Property Damage	
Each Accident	$1,000,000
Or	
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	$1,000,000
Excess or Umbrella Liability	
Each Occurrence	$5,000,000
General Aggregate	$5,000,000
Professional Liability	
Each Claim	$3,000,000
Annual Aggregate	$3,000,000

6.05 Additional Insureds:

A. Subconsultant shall cause Engineer and Owner to be listed as additional insureds on any liability policies required to be carried by Subconsultant, and which allow for additional insureds. Engineer shall list Subconsultant as an additional insured under any liability policies required to be carried by Engineer, and which allow for additional insureds. In addition, the parties will also name any other individual or entity as set forth below:

1. The following individuals or entities are to be listed on Owner's general liability policies of insurance as additional insureds:

Plummer Associates, Inc.
Engineer

_____
Engineer's Consultant

_____
Engineer's Consultant

2. During the term of this Agreement the Engineer shall notify Owner of any other Consultant to be listed as an additional insured on Owner's general liability policies of insurance.

3. The Owner shall be listed on Engineer's general liability policy.

6.06 General Considerations

A. The standard of care for all professional engineering and related services performed or furnished by Engineer under this Agreement will be the care and skill ordinarily used by members of the subject profession practicing under similar circumstances at the same time and in the same locality. Engineer makes

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no warranties, express or implied, under this Agreement or otherwise, in connection with any services performed or furnished by Engineer. Subject to the foregoing standard of care, Engineer and its consultants may use or rely upon design elements and information ordinarily or customarily furnished by others, including, but not limited to, specialty contractors, manufacturers, suppliers, and the publishers of technical standards.

B. Engineer shall not at any time supervise, direct, control, or have authority over any Contractor's work, nor shall Engineer have authority over or be responsible for the means, methods, techniques, sequences, or procedures of construction selected or used by any Contractor, or the safety precautions and programs incident thereto, for security or safety at the Project site, nor for any failure of a Contractor to comply with laws and regulations applicable to such Contractor's furnishing and performing of its work. Engineer shall not be responsible for the acts or omissions of any Contractor.

C. Engineer neither guarantees the performance of any Contractor nor assumes responsibility for any Contractor's failure to furnish and perform its work.

D. Engineer's opinions (if any) of probable construction cost are to be made on the basis of Engineer's experience, qualifications, and general familiarity with the construction industry. However, because Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over contractors' methods of determining prices, or over competitive bidding or market conditions, Engineer cannot and does not guarantee that proposals, bids, or actual construction cost will not vary from OPCC(s) prepared by Engineer. If Owner requires greater assurance as to probable construction cost, then Owner agrees to obtain an independent cost estimate.

E. Engineer shall not be responsible for any decision made regarding the construction contract requirements, or any application, interpretation, clarification, or modification of the construction contract documents other than those made by Engineer or its consultants.

F. All documents prepared or furnished by Engineer are instruments of service, and Engineer retains an ownership and property interest (including the copyright and the right of reuse) in such documents, whether or not the Project is completed. Owner shall have a limited license to use the documents on the Project, extensions of the Project, and for related uses of the Owner, subject to receipt by Engineer of full payment due and owing for all Services and Additional Services relating to preparation of the documents and subject to the following limitations:

1. Owner acknowledges that such documents are not intended or represented to be suitable for use on the Project unless completed by Engineer, or for use or reuse by Owner or others on extensions of the Project, on any other project, or for any other use or purpose, without written verification or adaptation by Engineer;

2. any such use or reuse, or any modification of the documents, without written verification, completion, or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Owner's sole risk and without liability or legal exposure to Engineer or to its officers, directors, members, partners, agents, employees, and consultants;

3. Owner shall indemnify and hold harmless Engineer and its officers, directors, members, partners, agents, employees, and consultants from all claims, damages, losses, and expenses, including attorneys' fees, arising out of or resulting from any use, reuse, or modification of the documents without written verification, completion, or adaptation by Engineer; and

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4. such limited license to Owner shall not create any rights in third parties.

G. Owner and Engineer may transmit, and shall accept, Project-related correspondence, documents, text, data, drawings, information, and graphics, in electronic media or digital format, either directly, or through access to a secure Project website, in accordance with a mutually agreeable protocol.

H. To the fullest extent permitted by law, Owner and Engineer (1) waive against each other, and the other's employees, officers, directors, members, agents, insurers, partners, and consultants, any and all claims for or entitlement to special, incidental, indirect, or consequential damages arising out of, resulting from, or in any way related to this Agreement or the Project, and (2) agree that Engineer's total liability to Owner under this Agreement shall be limited to the total amount of compensation received by Engineer.

I. The parties acknowledge that Engineer's Services do not include any services related to unknown or undisclosed Constituents of Concern. If Engineer or any other party encounters, uncovers, or reveals an unknown or undisclosed Constituent of Concern, then Engineer may, at its option and without liability for consequential or any other damages, suspend performance of Services on the portion of the Project affected thereby until such portion of the Project is no longer affected, or terminate this Agreement for cause if it is not practical to continue providing Services.

J. Owner and Engineer agree to negotiate each dispute between them in good faith during the 30 days after notice of dispute. If negotiations are unsuccessful in resolving the dispute, then the dispute shall be mediated. If mediation is unsuccessful, then the parties may exercise their rights at law.

K. This Agreement is to be governed by the law of the state in which the Project is located.

L. Engineer's Services and Additional Services do not include: (1) serving as a "municipal advisor" for purposes of the registration requirements of Section 975 of the Dodd-Frank Wall Street Reform and Consumer Protection Act (2010) or the municipal advisor registration rules issued by the Securities and Exchange Commission; (2) advising Owner, or any municipal entity or other person or entity, regarding municipal financial products or the issuance of municipal securities, including advice with respect to the structure, timing, terms, or other similar matters concerning such products or issuances; (3) providing surety bonding or insurance-related advice, recommendations, counseling, or research, or enforcement of construction insurance or surety bonding requirements; or (4) providing legal advice or representation.

M. If an event or circumstance beyond the Engineer's reasonable control occurs, including without limitation an act of God, fire, flood, hurricane, wind event, storm, weather disturbance, earthquake, or other causes that are beyond the reasonable control of the Engineer, whether similar or dissimilar to any of the foregoing, that cause the Engineer delay or additional expense ("*Force Majeure* Event"), then the Engineer is entitled to an equitable adjustment in the contract price or time for performance, or both. If any Force Majeure Event renders Engineer's performance impossible or impracticable, Engineer has the right to terminate performance under this Agreement consistent with any termination requirements that might exist in this Agreement. Upon occurrence of a **Force Majeure** Event, Engineer will notify Owner within a reasonable time that a Force Majeure Event has occurred and its anticipated impact on the Engineer's performance, including its expected duration. Engineer will use reasonable good-faith efforts to mitigate the impact of any *Force Majeure* Event on Engineer's ability to perform under this Agreement.

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6.07 Total Agreement

N. This Agreement (including any expressly incorporated attachments), constitutes the entire agreement between Owner and Engineer and supersedes all prior written or oral understandings. This Agreement may only be amended, supplemented, modified, or canceled by a duly executed written instrument.

6.08 Definitions

A. *Contractor*—Any person or entity (not including the Engineer, its employees, agents, representatives, and consultants), performing or supporting construction activities relating to the Project, including but not limited to contractors, subcontractors, suppliers, Owner's work forces, utility companies, construction managers, testing firms, shippers, and truckers, and the employees, agents, and representatives of any or all of them.

B. *Constituent of Concern*—Asbestos, petroleum, radioactive material, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. ("CERCLA"); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5101 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. ("RCRA"); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, State, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

Attachments: Appendix 1, Engineer's Standard Hourly Rates.
Exhibit A, Scope of Services
Exhibit B, Amendment to Owner-Engineer Agreement

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IN WITNESS WHEREOF, the parties hereto have executed this Agreement, the Effective Date of which is indicated on page 1.

Owner: **City of Aubrey, Texas**	Engineer: **Plummer Associates, Inc.**
By: _____	By: _____
Print name:	Print name:
Title: _____	Title: _____
Date Signed: _____	Date Signed: _____
Address for Owner's receipt of notices: 107 S. Main St, Aubrey, TX 76227	Address for Engineer's receipt of notices: 1320 S. University Drive Suite 300 Fort Worth, TX 76107

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This is **Appendix 1**, **Engineer's Standard Hourly Rates,** referred to in and part of the Short Form of Agreement between Owner and Engineer for Professional Services.

Engineer's Standard Hourly Rates

A. *Standard Hourly Rates:*

1. Standard Hourly Rates are set forth in this Appendix 1 and include salaries and wages paid to personnel in each billing class plus the cost of customary and statutory benefits, general and administrative overhead, non-project operating costs, and operating margin or profit.

2. The Standard Hourly Rates apply only as specified in Paragraphs 2.01, 2.02, and 2.03, and are subject to annual review and adjustment.

Staff Description	2024 Rate
Staff Admin	$100.00
Senior Admin	$115.00
Staff CAD	$120.00
Senior CAD	$145.00
CAD Manager	$165.00
Staff CM	$135.00
Project CM	$165.00
Senior CM	$220.00
Principal CM	$300.00
Staff RPR	$115.00
Senior RPR	$160.00
Staff Geospatial	$105.00
Senior Geospatial	$130.00
Geospatial Manager	$160.00
Intern	$80.00
Staff Engineer/Scientist	$140.00
Project Engineer/Scientist	$180.00
Project Manager	$250.00
Subject Matter Expert/ Senior Project Manager	$305.00
Principal	$340.00

- Billing rates may be adjusted by up to 4 percent annually (at the beginning of each calendar year) during the term of this agreement.
- A multiplier of 1.15 will be applied to all direct expenses and subconsultant expenses.
- A technology charge will be billed at $5 per labor hour.

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CONSTRUCTION MANAGEMENT AND RESIDENT PROJECT REPRESENTATIVE

SCOPE OF SERVICES

a. General services:
   i. Represent the City's interests in administering a construction contract with both overall construction oversight and daily on-site representation for the construction contractor's construction activity. The requested services include documentation and reporting to the City issues and status relating to the construction Contractor's work.
   ii. Provide the Construction Manager to perform the construction management and on-site representation as outlined below and for the Project. The Construction Manager will provide these services for an anticipated period of 26 consecutive months beginning July 2024. Initial planning level assumption is for the following contract positions:
      a. Construction Manager (CM) – Overall oversight and representative of the Construction Management firm in contractual and performance issues. Responsible for day-to-day construction observations, schedule review, and coordinating quality assurance testing of Contractor, and construction activity. Detailed task coordination with Contractor, the City's project manager, City provided construction observation staff, and the Construction Materials Testing (CMT) firm.
      b. Resident Project Representative (RPR) – Work directly under the CM, and in coordination with City's Project Manager to observe and document construction performance in accordance with the Contract Documents. Also provide comments and advice to the City on the Contractor's performance with regard to industry standard practices. This scope includes up to two full-time RPRs across the following disciplines: civil, mechanical, electrical, and instrumentation and controls.
      c. Construction Materials Testing (CMT) – The CMT will not be subcontracted to the CM, but the CM will coordinate with the CMT, city Project Manager, and Contractor to provide quality assurance testing in accordance with the Contract Documents.
   iii. Establish and manage the Construction Management Team.
   iv. Develop and maintain a Construction Management Plan.
   v. Store all project related records in a Project Management Information System (PMIS), for required document retention purposes.
   vi. Quality Assurance and Quality Control:

a. Disseminate pertinent project information internally and externally, implement Quality Assurance (QA) and Quality Control (QC) measures, and submit deliverables as required per the agreed-upon project schedule.

vii. Communication:

a. Establish communication procedures and protocol with the City, Contractor, RPR, Engineer of Record (EOR), and CMT.
b. Conduct weekly construction progress meetings with City, CM, and Contractor to exchange information regarding progress of construction, safety or quality concerns, status of submittals, status of modifications, and to address any project related issues. Prepare agenda and notes related to these meetings. One of the weekly construction progress meetings will serve as the monthly project meetings with City, EOR, contractors, and CM Team for the benefit of the City Staff to provide overview of progress of construction and to discuss any major project issues. The intent of this meeting is for additional City and other staff to attend as desired without having to be involved in the weekly meetings where specific project details are discussed.
c. Develop and distribute meeting agendas, workshop planning information and handouts, and other applicable information pertaining to each specific meeting or workshop.
d. Record meeting notes, send a draft to meeting attendees for review, and distribute final meeting notes after incorporating changes and comments.
e. Provide weekly emails to City and EOR summarizing the work completed for the week including photos as appropriate and outlining work to be completed the following week.

viii. Cost Management:

a. Review proposed schedule of values and payment requests prepared by the Contractor. CM will review pay requests and recommend payments monthly.
b. Coordinate with City and Contractor to establish a basis and procedure for review of monthly quantities of work in place and payment requests.

ix. Schedule Management:

a. Review approved baseline schedules, “look-ahead” schedules, and monthly construction progress schedules prepared by the Contractor.
b. Monitor progress of actual work completed relative to planned progress and address any identified schedule slippage or other

anomalies with Contractor. Collaborate with the Contractor to develop a recovery schedule if tasks on the critical path continue to slip.

c. Review each monthly schedule submittal and provide comments related to the requirements of the Contract Documents. Analyze each schedule to identify changes over the previous month's schedule, including tasks that are behind schedule, tasks that have not yet started, changes in float, critical path, and task relationships.

d. Develop a monthly Schedule Review Memo that identifies any significant changes to the schedule (critical path, float, reporting relationships, etc.), tasks that are behind schedule, and tasks that are at risk of falling behind schedule. The memo will be transmitted to the Contractor followed by a discussion with the Contractor during the monthly coordination meetings.

e. The memo will be transmitted electronically to the City and saved to the PMIS site.

x. Project Status Reports and Invoicing:

a. Provide written project status reports to the City once per month throughout the duration of the project. Project status reports will include, at a minimum, a summary description of activities completed, description of activities planned for the next 30 days, financial status of the project, status of schedule for the project, and identification of any technical or other issues which may have an impact on the overall project budget and/or schedule. Project status reports will be provided to the City with each invoice.

b. Submit invoices monthly along with the project status report referenced above.

xi. Issues Management:

a. Provide initial interpretation of the drawings and specifications and coordinate with EOR to develop official interpretation for City and Contractor. Track and coordinate the resolution of all project related issues. An Issues Log will be saved to the PMIS site.

xii. Change Management:

a. Establish procedures for administering constructive changes to the construction contracts, which will be documented in the Construction Management Plan.

b. Prepare documentation for contract modifications required to implement modifications in the design of the project, including the summary memo. Coordinate with the EOR for technical review and approval of any design modifications, and all design modifications will have the EOR seal affixed.

c. Process contract modifications and negotiate with the Contractor in conjunction with and on behalf of the City to determine the cost and time impacts of these changes. Prepare change order documentation for approved changes for execution by the City.
d. Receive and evaluate notices of Contractor claims and make recommendations to the City on the merit and value of the claim on the basis of information submitted by the Contractor or available in project documentation. Endeavor to negotiate a settlement value with the Contractor in conjunction with and on behalf of the City.

xiii. Project Completion:
a. When Contractor requests that substantial completion be granted for the Project (or applicable portions thereof), the Construction Manager will conduct, in company with City's representative, a review of the Project for conformance with the design concept of the Project and general compliance with the construction contract documents. Coordinate with EOR as appropriate regarding any reviews of the work that are deemed necessary. Support the EOR in the development of a list of deficiencies to be corrected by the Contractor before recommending Substantial Completion be granted and/or any partial release or reduction of retainage is made.
b. Support the EOR in conducting a final review of the Project for conformance with the design concept of the Projects and general compliance with the construction contract documents.
c. Support the EOR in obtaining legal releases, permits, warranties, spare parts, O&M manuals, as-built drawings, and keys from the Contractor. Review closeout submittals and other documents and make a recommendation for final payment to Contractor when appropriate.

xiv. Record Documents
a. Receive and review as-built drawings from Contractor. Transmit drawings and other documents as needed to EOR for preparation of “Record Drawings,” indicating locations of project elements and final built conditions of project components. Drawings prepared by incorporating notes, Contractor field notes and City field notes taken at the project during the construction process.

b. Construction Management Roles
i. Construction Manager / Assistant Construction Manager:
a. Construction Managers will manage and administer the day-to-day requirements of the Projects and coordinate regularly with the City’s Project Manager.

b. CM will serve as the liaison between the City, the Contractor, and the EOR. The CM will provide leadership to the assigned RPR(s) in the performance of their observation duties.

c. Primary responsibilities of CM include the following:
   1) Serve as the primary point of contact, with primary responsibility for construction contract administration and quality assurance.
   2) Provide direction and manage the efforts of RPR(s). Manage RPR(s) as a resource across construction tasks.
   3) Manage the quality of services provided by RPR(s) to determine that their duties are performed in a timely manner.
   4) Work with City staff when needed to coordinate construction activities that may impact the City's ongoing operations. Coordinate upcoming shutdowns at the plant site and coordinate with the City's Project Manager to prepare a Shut-Down Request Form following the City's policies and procedures.
   5) Attend progress meetings and report on project progress.
   6) Review daily construction reports prepared by the RPR(s) and discuss any issues noted with the RPR(s) and other parties as required.
   7) Monitor overall construction of the project and determine that construction is in conformance with Contract Documents. Recognize when an issue might impact or improve scheduling or construction operation on another known efforts and bring this to the attention of the City’s Project Manager.
   8) Coordinate with Contractor to resolve any issues or disputes related to construction. Support the City’s Project Manager in the resolution of any disputes or claims that cannot be resolved at the field level.
   9) Support administration and negotiations of claims with Contractor with support from the EOR.
   10) Recognize risk elements of the risk management plan and initiate countermeasures as directed.
   11) Provide progress reports to the City Project Manager for updating and presentation purposes to City upper management and the Board.
   12) Manage the efforts of the construction materials testing laboratories and technicians.
   13) Coordinate with document management staff to verify that all documentation is filed properly in both digital and hard copy files as required.

14) Verify that the RPR(s) have reviewed the quantities of work in place, review the payment requests and supporting documentation, and recommend the amount the Contractor be paid on monthly and final payment requests.
15) Administer Construction Contracts: Prepare project documentation in accordance with the contract documents.
16) Manage the receipt, logging, control, tracking, and timely processing of all Project documents using the Project Management Information System (PMIS).
17) Schedule and conduct construction progress meetings with Contractor, City, EOR, and other staff.
18) Attend other on-site project related construction meetings, as needed.
19) Review Shop Drawings received from the Contractor for conformance with the Contract Documents' submittal requirements and administrative completeness. Distribute shop drawings to the appropriate EOR staff and monitor the responsiveness of the EOR during the review process.
20) Work directly with the EOR to see that documentation and submittals provided for review are returned with adequate and timely written review comments. Determine that design issues related to requests for information on construction documents, Shop Drawing reviews, and proposed contract modifications are adequately addressed.
21) Consolidate written comments on Shop Drawings and other submittals by the EOR and return to the Contractor.
22) Review Contractor Requests for Information. Distribute requests to RPR(s), City PM, other appropriate staff, and EOR when applicable and coordinate timely response. Review answers and prepare formal response to Contractor pursuant to contract documents.
23) Prepare notices of defective work. Coordinate the resolution of non-compliant work with the Contractor, and the City. Document and follow up on non-conforming work to determine that acceptable correction of defects is accomplished.
24) Initiate and review field orders. Record the changes in the record contract documents.
25) Coordinate evaluation of product substitution requests with City staff, and the EOR.
26) Administer and manage resolution of day-to-day construction issues. Coordinate with the City PM, EOR, and Contractor on

technical issues and concerns working to resolve disputes at the Project level and keep Construction Manager informed of issues.

27) Review schedules presented in accordance with the Contract Documents. Coordinate with a P6 schedule analyst monthly to review and report on the contractor's P6 schedule.
28) Review and coordinate approval of a Schedule of Values. Conduct monthly schedule and progress payment meetings with the Contractor. Work with the Contractor to have pay requests ready for City processing in accordance with the Contract Documents. Determine that documentation required for measurement for payment of work is in place.
29) Implement the Change Management process in accordance with the Contract Documents. Prepare Requests for a Change Proposals for City initiated changes to the work. Respond to Contractor's Change Proposals. Prepare written justification statements and include cost estimates for each Change Proposal. Include a description of the background explaining the reason for the change, resolution alternatives, and resolution recommendation for action by the City. Prepare and submit Change Request Form and the justification memo with all of the appropriate back-up information in accordance with the Contract Documents and City Policy. Change Orders and Contract Amendments require approval from the City.
30) Maintain a working set of record documents. Determine that measurements required for record documents are taken before work is covered.
31) Take photographs to document differing site conditions, change order and claim items, and any special or unique conditions as they arise.
32) Manage Project completion activities as required by the Contract Documents.
33) Manage the process of closing out the construction contract.
34) Recommend acceptance of the work in writing in preparation of issuance of the Certificate of Substantial Completion, recommendation to the Board, Notice of Completion, and the City's Internal Notice of Completion.
35) Prepare final Change Orders as required. Classify and summarize the change orders and include in the final construction summary report.
36) Prepare an Internal Notice of Completion addressed to the City's Operations and Maintenance Department.

37) Coordinate with the City's Project Manager to assist with the development of a list of deficiencies to be corrected by the Contractor before recommendation of final payment.
38) Coordinate with the Contractor to provide O&M Manuals to the City and training is developed and delivered to City Staff in a timely manner.

ii. On-Site Representatives:

a. Provide Civil, Structural, Electrical, and Instrumentation & Controls observation services.

b. Primary responsibilities of RPR(s) include the following:

1) Serve as point of contact for the CM, with primary responsibility for construction quality assurance.
2) Observe construction work daily to determine that construction is in general conformance with Construction Contract Documents. In this effort the On-Site Representatives will endeavor to protect the City against defects and deficiencies in the work of Contractor.
3) Prepare Daily Construction Reports (DCRs) documenting daily construction activities in PMIS, number of construction staff on site, equipment staged and/or operating on site, visitors to the site, discussions of any field issues with any parties, and any other information pertinent to or potentially impacting the Project.
4) Assist the CM and the City staff when needed to coordinate construction activities that may impact the City's ongoing operations.
5) Coordinate the efforts of CMT laboratories and technicians.
6) Verify quantities of work in place and assist CM in the review of the payment requests and supporting documentation.
7) Attend periodic project coordination meetings (semi-monthly or monthly) when requested by the CM to provide updates and inputs on construction progress and issues as appropriate.
8) Attend other project related construction meetings as needed.
9) Assist CM in preparation of notices of defective work. Assist in coordinating the resolution of non-compliant work with the contractor. Document and follow up on non-conforming work to determine that acceptable correction of defects is accomplished.
10) Maintain a working set of record documents. Determine that measurements required for record documents are taken before work is covered.

11) Take photographs to document differing site conditions, change order and claim items, and any special or unique conditions as they arise.

iii. Administrative Assistant (AA):

a. The Administrative Assistant will provide administrative support for the Construction Manager and On-site Project Representatives.

b. Edits, formats, and finalizes project-related documents, including outsourcing where necessary for binding and/or copying services.

c. Assist CM with on-boarding new on-site representatives.

d. Helps maintain inventory of office supplies.

e. Primary responsibilities of AA include the following:

1) Assist CM with scheduling and coordinating meetings and video calls. Attend progress meetings and other on-site meetings in support of the CM to assist with the development of agendas and the preparation and distribution of meeting notes.

2) Assist in the preparation of daily reports. Review reports and correct for formatting and work with RPRs and CMs to provide missing information as necessary.

3) Assist CM with development of progress reports.

4) Assist CM with contacting and coordinating CMT services.

5) Assist document management staff to verify that all documentation is filed properly in both digital and hard copy files as required.

6) Assist CM with the receipt, logging, control, tracking, and timely processing of all Project documents using the PMIS site.

7) Assist CM with collecting submittal review comments from reviewers.

8) Assist CM in preparation of notices of defective work.

c. Limitations of Authority of Construction Management:

i. The CM will not authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items), unless authorized by City and EOR via Change Order, Field Order, or other written authorization for or-equal items.

ii. The CM will not exceed the authority as set forth in Agreement or the Contract Documents.

iii. The CM will not undertake any of the responsibilities of Contractor, Subcontractor, Suppliers, or Contractor’s superintendent.

iv. On-site representative services do not relieve the Contractor of its contractual responsibility for construction quality.

v. The CM will not advise on, issue directions relative to or assume control over any aspect of the means, methods, techniques, sequences, or procedures of

construction unless such advice or directions are specifically required by the Contract Documents.

vi. The CM will not advise on; issue directions regarding or assume control over safety precautions and programs in connection with the Work or any activities or operations of City or Contractor.

d. Schedule:

i. Refer to the enclosed schedule for the assumed "Construction Management On-Site Personnel". The following list is a summary of the enclosed schedule.

Position	**Calculated Total Hours***
Construction Manager/Lead RPR	4800
Assistant CM/RPR	4250

*Assumes a work schedule of 5 days per week and 10 hours per day, and a 26-month duration.

ii. CM will include a summary of hours worked in each monthly report. The CM will notify the City if longer or additional shifts are required causing the actual work hours to exceed the total estimated hours in this proposal. CM will prepare an amendment to the contract for compensation for additional hours.

e. Deliverables:

i. Construction Management Plan (saved electronically and/or the PMIS site).

ii. Documentation and Summary Memos for Allowance, Contingency, and Change Order Requests.

iii. Monthly Schedule Review Memos (submitted electrically by email and saved to PMIS and/or the PMIS site).

iv. Monthly invoices and Project Status Reports (submitted electrically by email and saved to PMIS and/or the PMIS site).

v. Meeting Agendas and Meeting Notes.

vi. Daily Construction Reports, including photos, will be loaded into PMIS.

f. Recurring Meetings:

i. Bi-weekly construction progress meetings with City, CM, Contractor to discuss construction specific topics.

ii. Monthly project meetings with City, Contractor, EOR, and CM Team for the benefit of the City Staff to provide overview of progress of construction and to discuss any major project issues.

Estimate of Construction Time Plus Number of RPR Staff

Aubrey WWTP Expansion	2024						2025												2026							
Construction Duration - 26 months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Setup Construction Tracking Docs	A																									
Ground breaking	A																									
Construction Manager/Lead RPR		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Second RPR/Electrical&Instrumentation		B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
RPRs/Hours																										
Construction Manager/Lead RPR A	100	200	200	200	200	150	200	200	200	200	200	200	200	200	200	200	200	150	200	200	200	200	200	200	100	100
Second RPR/Electrical&Instrumentation B		50	100	200	200	150	200	200	200	200	200	200	200	200	200	200	200	150	200	200	200	200	100	100	100	100

This is **Exhibit B**, Amendment**,** referred to in and part of the Agreement between Owner and Engineer for Professional Services.

AMENDMENT TO OWNER-ENGINEER AGREEMENT

Amendment No. _____

Owner: _____

Engineer: _____

Project: _____

Effective Date of Owner-Engineer Agreement: _____

Nature of Amendment: (Check those that apply)

☐ Additional Services to be performed by Engineer

☐ Modifications to services of Engineer

☐ Modifications to responsibilities of Owner

☐ Modifications of payment to Engineer

☐ Modifications to time(s) for rendering services

☐ Modifications to other terms and conditions of the Agreement

Description of Modifications:

Agreement Summary:

1. Original agreement amount: ..... $

2. Net change for prior amendments: ..... $

3. This amendment amount: ..... $

4. Adjusted Agreement amount: ..... $

5. Change in time for services (days or date, as applicable):

Owner and Engineer hereby agree to modify the above-referenced Agreement as set forth in this

Amendment. The Effective Date of the Amendment is _____.

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This is **Exhibit B**, Amendment**,** referred to in and part of the Agreement between Owner and Engineer for Professional Services.

Owner	Engineer
_____	_____
(typed or printed name of organization)	(typed or printed name of organization)
By: _____	By: _____
(individual's signature)	(individual's signature)
(Attach evidence of authority to sign.)	(Attach evidence of authority to sign.)
Date: _____	Date: _____
(date signed)	(date signed)
Name: _____	Name: _____
(typed or printed)	(typed or printed)
Title: _____	Title: _____
(typed or printed)	(typed or printed)

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City Council Meeting
Staff Report
August 22, 2024

Agenda Item
Consideration and action on removing and/or appointing member(s) to the Aubrey Area Library Advisory Board.

Staff Contact
Brittany McLain, Library Manager
bmclain@aubreytx.gov

Summary

Consider and take action on a recommendation from the Library Advisory Board to fill two vacant seats. The Board has unanimously recommended Hallie Nix and Vicky Kao to fill these vacancies.

Staff Recommendation:
Approval of Board Recommendations

City Council & Tax Increment Reinvestment Zone No. 1 Board Meeting
Staff Report
August 22, 2024

Agenda Item
Consideration and action on appointing member(s) to the Aubrey Parks and Recreation Board.

Staff Contact
Jenny Hicks, City Secretary
jhicks@aubreytx.gov
940-440-9343

Summary
The Parks and Recreation Board has one vacancy. Peter Dwyer is currently an alternate on the board and has been present for the meetings. The board met on August 6, 2024 and unanimously recommended to appoint Peter Dwyer as a board member.

Financial Summary
N/A

Staff Recommended Motion
Approve

Conditions
N/A