CITY OF GEORGETOWN, TEXAS

CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

FOR THE CONSTRUCTION OF

VOLUME 2 OF 2

San Gabriel WWTP Rehabilitation

PROJECT NO. PRJ000165

JANUARY 2023

RFP No. 202305

Contract No. 23-0041-CIP

CONFORMED CONSTRUCTION SET
MAY 2023

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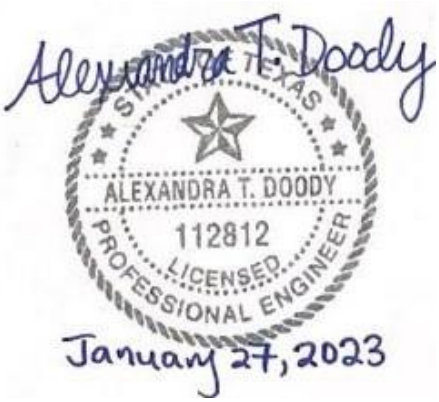
CERTIFICATIONS

Division 0	(All Sections)
Division CIP	(All Sections)
Division G	(All Sections)
Division W	(All Sections)
Division WW	(All Sections)
Division 1	(All Sections)
Division 13	(All Sections)
Division 22	(All Sections)
Division 33	(All Sections)
Division 40	(Sections 400506 thru 404213 except Section 404113.13)
Division 43	(All Sections)
Division 46	(All Sections)



Division 2	(All Sections)
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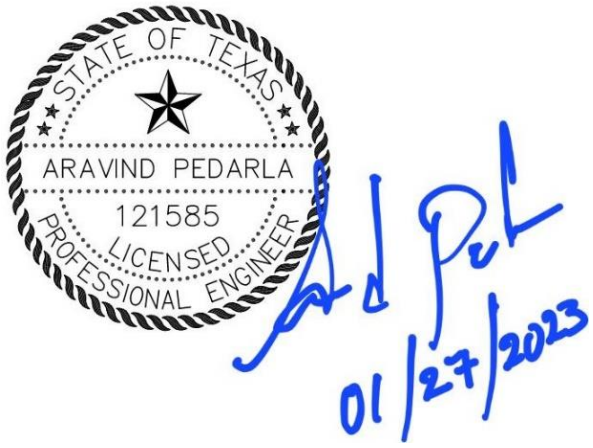

Division 3	(All Sections)
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CITY OF GEORGETOWN, TEXAS

San Gabriel WWTP Rehabilitation

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SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. 9/125 micrometer single-mode, indoor-outdoor optical fiber cable (OS1).
2. Optical fiber cable connecting hardware, patch panels, and cross-connects.
3. Cabling identification products.

B. Related Requirements:

1. Section 262726 "Wiring Devices."
2. Section 260529 "Hangers and Supports for Electrical Systems”

1.3 DEFINITIONS

A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Catalog data on fiber-optic cable, termination devices, patch panels, breakout enclosures, splice kits, pigtails, and fan-outs where applicable. Product data sheets shall include the manufacturer's name and catalog number for each item, the manufacturer's descriptive literature, catalog cuts, and any power supply requirements.
2. Certification of compliance in writing stating the fiber optic cable, anticipated layout, and components are compatible, acceptable for use, and in compliance with these specifications.
3. Detailed bill of materials for fiber-optic cable, terminations, patch panels, breakout enclosures, splice kits, connectors, pigtails, and fan-outs.
4. Drawings indicating the locations of all patch panels, termination points, or breakout enclosures.

5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

C. Optical fiber cable testing plan.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Product Certificates: For each type of product.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For optical fiber cable, splices, and connectors to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Patch-Panel Units: One of each type.
2. Plugs: Ten of each type.
3. Jacks: Ten of each type.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings by an Technician.
2. Installation Supervision: Installation shall be under the direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical loss test set.
2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.11 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

D. Grounding: Comply with TIA-607-B.

2.2 9/125 MICROMETER SINGLE-MODE, INDOOR-OUTDOOR OPTICAL FIBER CABLE (OS1)

A. Description: Single mode, 9/125-micrometer, 12 fibers, single loose tube, optical fiber cable.

B. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Corning Optical Communications; Corning Incorporated.

C. Standards:

1. Comply with TIA-492CAAA for detailed specifications.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with ICEA S-104-696 for mechanical properties.

D. Jacket:

1. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.

2. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

E. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

1. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
2. Plenum Rated, Nonconductive: Type OFNP in listed plenum communications raceway.
3. Plenum Rated, Nonconductive: Type OFNP, or Type OFNR in metallic conduit.
4. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262; Type OFNP in listed plenum communications raceway; or Type OFN, Type OFNG, Type OFNP, or Type OFNR in metallic conduit.
5. Riser Rated, Nonconductive: complying with UL 1666.
6. Riser Rated, Nonconductive: Type OFNP or Type OFNR in listed riser or plenum communications raceway.
7. Riser Rated, Nonconductive: Type OFNP, or Type OFNR in metallic conduit installed per NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."
8. Plenum Rated, Armored (Conductive): Type OFCP, complying with NFPA 262.
9. Plenum Rated, Armored (Conductive): Type OFCP or Type OFNP in listed plenum communications raceway.
10. Plenum Rated, Armored (Conductive): Type OFCP, Type OFNP, Type OFCR, or Type OFNR in metallic conduit installed per NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."
11. Riser Rated, Armored (Conductive): Type OFCR; complying with UL 1666.
12. Riser Rated, Armored (Conductive): Type OFCP, Type OFNP, or Type OFCR or Type OFNP in listed riser or plenum communications raceway.
13. Riser Rated, Armored (Conductive): Type OFCP, Type OFNP, Type OFCR, or Type OFNR in metallic conduit.

2.3 OPTICAL FIBER CABLE HARDWARE

A. Approved Manufacturers:

1. Corning Splice Module CCH-CS12-6C-P00RE.
2. Corning Connector Housing CCH-04U.
3. Belden CDT Networking Division/NORDX.

B. Standards:

1. Comply with Fiber Optic Connector Intermateability Standard (FOCIS) specifications of the TIA-604 series.
2. Comply with TIA-568-C.3.

C. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Patch Panel to be 2U Rackmount Fiber Cabinet.
2. Cabinet is constructed of high-quality 16-gauge cold-rolled steel and finished with a black electrostatically applied powder coat.

3. Provide adapters that work with multi-mode fibers, and they are constructed with high retention phosphor bronze alignment sleeves.

D. Patch Cords: Factory-made, dual-fiber cables in 36-inch lengths.

E. Connector Type: Type LC complying with TIA-604-10-B, connectors.

F. Plugs and Plug Assemblies:

1. Male; color-coded modular telecommunications connector designed for termination of a single optical fiber cable.
2. Insertion loss not more than 0.25 dB.
3. Marked to indicate transmission performance.

G. Jacks and Jack Assemblies:

1. Female; quick-connect, simplex and duplex; fixed telecommunications connector designed for termination of a single optical fiber cable.
2. Insertion loss not more than 0.25 dB.
3. Marked to indicate transmission performance.
4. Designed to snap-in to a patch panel or faceplate.

2.4 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.5 SOURCE QUALITY CONTROL

A. Factory test multimode optical fiber cables according to TIA-526-14-B and TIA-568-C.3.

B. Factory test pre-terminated optical fiber cable assemblies according to TIA-526-14-B and TIA-568-C.3.

C. Cable will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES

A. Comply with NECA 1, NECA 301.

B. General Requirements for Optical Fiber Cabling Installation:

1. Terminate all cables; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
2. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
3. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
4. Bundle, lace, and train cable to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified by the manufacturer. Use lacing bars and distribution spools.
5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
7. In the communications equipment room, provide a 10-foot- long service loop on each end of cable.
8. Pulling Cable: Comply with manufacturer recommendations. Monitor cable pull tensions.
9. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

C. Group connecting hardware for cables into separate logical fields.

3.4 IDENTIFICATION

A. The individual fibers shall be color coded for identification. The optical fiber color coding shall be in accordance with EIA/TIA-598, “Color Coding of Fiber Optic Cables.” The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color coded buffered fibers shall not adhere to one another. When fibers are grouped into individual units, each unit shall be numbered in the unit jacket for identification. The number shall be repeated at regular intervals.

B. The outer cable jacket shall be marked with the manufacturer's name or UL file number, date of manufacture, fiber type, flame rating, UL symbol, and sequential length markings every two feet. The markings shall be in contrasting color to the cable jacket.

C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

E. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

F. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA 606-B, for the following:

1. Flexible vinyl or polyester that flexes as cables are bent.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections:

1. Visually inspect optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Optical Fiber Cable Tests:

a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
b. Link End-to-End Attenuation Tests:

1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in one direction according to TIA-526-14-B, Method B, One Reference Jumper.
2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than those calculated according to equation in TIA-568-C.1.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. Remove and replace cabling where test results indicate that it does not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 271323

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Category 6 twisted pair cable.

B. Related Requirements:

1. Section 260529 "Hangers and Supports for Electrical Systems”
2. Section 262726 "Wiring Devices."

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. FTP: Shielded twisted pair.

C. F/FTP: Overall foil screened cable with foil screened twisted pair.

D. F/UTP: Overall foil screened cable with unscreened twisted pair.

E. IDC: Insulation displacement connector.

F. LAN: Local area network.

G. Jack: Also commonly called an "outlet," it is the fixed, female connector.

H. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.

I. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

J. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

K. S/FTP: Overall braid screened cable with foil screened twisted pair.

L. S/UTP: Overall braid screened cable with unscreened twisted pairs.

M. UTP: Unscreened (unshielded) twisted pair.

1.4 COPPER HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.

1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft. and includes the components that extend from the equipment outlets to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration Drawings and printouts.
4. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:

    a. Telecommunications rooms plans and elevations.
    b. Telecommunications pathways.
    c. Telecommunications system access points.
    d. Telecommunications grounding system.
    e. Telecommunications conductor drop locations.
    f. Typical telecommunications details.
    g. Mechanical, electrical, and plumbing systems.

C. Twisted pair cable testing plan.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, installation supervisor, and field inspector.

B. Product Certificates: For each type of product.

C. Source quality-control reports.

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Connecting Blocks: One of each type.
2. Faceplates: One of each type.
3. Jacks: Ten of each type.
4. Multiuser Telecommunications Outlet Assemblies: One of each type.
5. Patch-Panel Units: One of each type.
6. Plugs: Ten of each type.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings, cabling administration Drawings, and field testing program development by a Technician.
2. Installation Supervision: Installation shall be under the direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified [by BICSI] as a [RCDD][Technicain] to supervise on-site testing.

B. Testing Agency Qualifications: Testing agency must have personnel certified on staff.

1. Testing Agency's Field Supervisor: Currently certified as a Technician.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test each pair of twisted pair cable for open and short circuits.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.12 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Electrical Contractor.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

2.2 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:

1. Communications, Non-plenum: Type CMP or Type CMR in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. RoHS compliant.

2.3 CATEGORY 6 TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250MHz.

B. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.

C. Conductors: 100-ohm, 23 AWG solid copper.

D. Shielding/Screening: Shielded twisted pairs (FTP).

E. Cable Rating: Riser.

F. Jacket: Blue thermoplastic.

2.4 TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. General Requirements for Twisted Pair Cable Hardware:

1. Comply with the performance requirements of Category 6.
2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables shall be terminated with connecting hardware of same category or higher.

C. Source Limitations: Obtain twisted pair cable hardware from single source from single manufacturer.

D. Patch Cords: Factory-made, four-pair cables with 36-inch lengths as required for the application and service; terminated with an eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.
3. Jacket rated for 600V or higher when used in proximity in panels with 480V.

E. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Standard: Comply with TIA-568-C.2.
3. Marked to indicate transmission performance.

F. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

2.5 CABLE MANAGEMENT SYSTEM

A. Description: Computer-based cable management system, with integrated database capabilities.

B. Document physical characteristics by recording the network, TIA details, and connections between equipment and cable.

C. Information shall be presented in database view, schematic plans, or technical drawings.

1. AutoCAD drawing software shall be used as drawing and schematic plans software.

D. System shall interface with the following testing and recording devices:

1. Direct upload tests from circuit testing instrument into the personal computer.
2. Direct download circuit labeling into labeling printer.

2.6 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.7 SOURCE QUALITY CONTROL

A. Factory test cables on reels according to TIA-568-C.1.

B. Factory test twisted pair cables according to TIA-568-C.2.

C. Cable will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters. Conceal raceway and cables, except in unfinished spaces.

1. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems." Section 260528 "Pathways for Electrical Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF PATHWAYS

A. Comply with Section 270528 "Pathways for Communications Systems."

B. Comply with Section 270529 "Hangers and Supports for Communications Systems."

C. Comply with Section 270536 "Cable Trays for Communications Systems."

D. Drawings indicate general arrangement of pathways and fittings.

3.3 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. General Requirements for Cabling:

1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Consolidation points may be used only for making a direct connection to equipment outlets:

    a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    b. Locate consolidation points for twisted-pair cables at least 49 feet from communications equipment room.

6. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified by the manufacturer. Use lacing bars and distribution spools.
9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
11. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
12. Pulling Cable: Comply with manufacturer recommendations. Monitor cable pull tensions.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.

3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 FIRESTOPPING

A. Comply with TIA-569-D, Annex A, "Firestopping."

B. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

3.5 GROUNDING

A. Install grounding according to the NEC.

B. Comply with TIA-607-B and NECA/BICSI-607.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.

D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

A. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

B. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
    b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

C. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections:

1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA-568-C.1.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

4. Verify cable length does not exceed the manufacturer’s recommendations or 295ft, whichever is smaller.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 271513

SECTION 31 05 15 - SOILS AND AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Soils: Soil materials and topsoil materials.
2. Aggregates: Coarse aggregate materials and fine aggregate materials.

B. Related Sections:

1. City of Georgetown Standard Specifications.
2. Section 31 20 00 “Earthwork.”
3. Section G4 “Pipe Excavation, Trenching, Embedment, Encasement and Backfilling.”
4. Section G5 “Granular Fill Materials.”
5. Section G6 “Sedimentation and Temporary Erosion Control.”

1.3 ACTION SUBMITTALS

A. Samples - Soils: Submit in 5-gallon air-tight containers, 50 lbs. sample of each type of fill to testing laboratory when requested by the Owner or Engineer.

B. Samples - Aggregates: Submit, in 5-gallon air-tight containers, 50 lbs. sample of each type of aggregate fill to ENGINEER at least 15 days prior to placement of backfill or fill when requested by the Owner or Engineer.

C. Quality Control Testing: Submit conformance testing performed by a certified independent laboratory engaged by Contractor for all fill materials. Verify maximum density, gradation, Atterberg limits, sand equivalent, and other applicable criteria at least 72 hours prior to importing or placing any fill. Perform additional conformance testing at a minimum frequency of 1 per every 2,000 cubic yards or change in material.

1.4 INFORMATIONAL SUBMITTALS

A. Materials Source: Submit name and location of imported materials suppliers.

B. Source’s Certificate: Certify materials meet or exceed specified requirements.

C. Material Test Reports: For each on-site and borrow soil and aggregate material proposed for fill and backfill as follows:

1. Classification according to ASTM D2487.
2. Laboratory compaction curve according to ASTM D698 and TEX-113-E.
3. Grain size analyses according to ASTM D422.
4. Atterberg limits (liquid limit, plastic limit, and plasticity index) per ASTM D4318.
5. Test Reports: Submit any test reports required by this Section to the Engineer.

1.5 QUALITY ASSURANCE

A. Furnish each subsoil and topsoil material from single source throughout the Work, unless an alternate source is approved by the Engineer.

B. Furnish each coarse and fine aggregate material from single source throughout the Work, unless an alternate source is approved by the Engineer.

C. Perform Work according to City of Georgetown Standard Specifications.

D. Quality Control and Quality Assurance consists of laboratory conformance testing of samples supplied from each coarse and fine aggregate source and quality control during installation.

1. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

1.6 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Tree and Plant Protection Zones: Comply with requirements and measures specified in Section 015639 "Temporary Tree and Plant Protection."

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Common Fill:

1. Meet all requirements of “common fill” in Section G5 “Granular Fill Materials” and supplemented herein.
2. Approved onsite excavated material or imported fill material that is composed of durable soil free of debris, organic matter, or other deleterious materials.

3. Not contain stones larger than 4 inches in largest diameter, have a maximum of 75 percent passing the No. 200 sieve, and a maximum dry density of at least 85 pounds per cubic foot (pcf) as determined by ASTM D698.
4. Not contain granite blocks, broken concrete, masonry rubble, asphalt pavement or other similar materials and have physical properties such that it can be readily spread and compacted during filling.

B. Select Common Fill:

1. Meeting all requirements of "select common fill" in Section G5 "Granular Fill Materials" and as specified above for common fill

C. Select Structural Fill:

1. Consist of SC, SM, GC or SP classified soil free of organic material, loam, debris, frozen soil or other deleterious material which may be compressible, or which cannot be properly compacted., and meeting the following requirements:

Sieve Size	Percent Finer by Weight
1-1/4-inches	100
1-inch	95 to 100
3/4-inch	70 to 95
3/8-inch	30 to 90
No. 4	30 to 80
No. 40	15 to 70

2. Maximum liquid limit of 35 percent, maximum plasticity index of 12 percent, and a maximum dry density of at least 95 pcf as determined by ASTM D698.
3. No on-site mixing of various materials shall be permitted.
4. Non-expansive material with sufficient soil binder for proper compaction.
5. Crushed fines or scalpings are not acceptable for select structural fill.

Alternate material: flexible base material complying with TxDOT Item 247, Type A or B, Grade 3 or better.

D. Impervious Fill (Clay Cap):

1. Be classified as CL or CH soil according to the Unified Soil Classification System (USCS) in accordance with ASTM D2488.
2. Have a liquid limit of at least 30 percent and a plasticity index between 20 and 60 percent.
3. Have less than 5 percent organic content in accordance with ASTM D2974.
4. Percent passing per Sieve Size:

   a. 1.5 inches 100 percent
   b. No. 200 50 percent

2.2 TOPSOIL MATERIALS

A. Topsoil: Conforming to City of Georgetown Standard Specification G7.03.

1. Excavated and reused material or imported borrow.
2. Fertile, friable, natural topsoil typical of topsoil of the locality.
3. Free of roots, rocks larger than 1/2-inch, subsoil, debris, large weeds, and foreign matter.

    a. Screening: Single screened.

4. Containing minimum of 3 percent and maximum of 25 percent inorganic matter.

2.3 AGGREGATE MATERIALS

A. Coarse Aggregate - Crushed Stone: Natural stone; washed, free of clay, shale, organic matter; conforming to ASTM C33 standard.

1. Coarse Aggregate Designation: No. 57.

B. Coarse Aggregate – Roadway Base: Natural stone; washed, free of clay, shale, organic matter; conforming to State of Texas DOT standard Item 247, Type A, Grade 1.

1. Coarse Aggregate Designation: Type A Flexible Base.

C. Coarse Aggregate - Screened Gravel: Natural stone; washed, hard, durable, rounded, or sub-angular particles of proper size and gradation, and shall be free from sand, loam, clay, excess fines, and other deleterious materials, and contain no more than 5 percent by weight of any one or combination of slate, schist, or soft particles of sandstone. Screened gravel is to conform to the following gradation limits:

1. Percent Passing per Sieve Size:

    a. 5/8- inch: 100 percent.
    b. 1/2-inch: 40 to 100 percent.
    c. 3/8-inch: 15 to 45 percent.
    d. No. 10: 0 to 5 percent.

D. Coarse Aggregate - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter; graded according to ASTM C136; to the following limits:

1. Percent Passing per Sieve Size:

    a. 1/2- inch: 100 percent.
    b. 3/8-inch: 90 percent.
    c. No. 4: 30 percent.
    d. No. 8: 10 percent.
    e. No. 16: 5 percent.

E. Fine Aggregate - Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter; graded according to ASTM C33; within the following limits:

1. Percent Passing per Sieve Size:

    a. 3/8-inch: 100 percent.
    b. No. 4: 95 to 100 percent.

c. No. 8: 80 to 100 percent.
d. No. 16: 50 to 85 percent.
e. No. 30: 25 to 60 percent.
f. No. 50: 10 to 30 percent.
g. No. 100: 2 to 10 percent.

2.4 SOURCE QUALITY CONTROL

A. Testing and Inspection Services: Submit test result reports to the Engineer.

B. Subsoil Material - Testing and Analysis: Perform in accordance with ASTM D698.

C. Topsoil Material - Testing and Analysis: Perform in accordance with ASTM D698.

D. Aggregate Material - Testing and Analysis: Perform according to ASTM D698 and TEX-113-E, as specified elsewhere.

E. When tests indicate materials do not meet specified requirements, change material and retest.

F. Furnish materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavate subsoil and topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.

B. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.

C. Remove excess excavated materials not intended for reuse, from site.

D. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from site.

3.2 STOCKPILING

A. Stockpile materials on site at locations designated by Engineer or Owner’s representative.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different soil and aggregate materials with dividers or stockpile individually to prevent mixing. Prevent intermixing of soil types or contamination.

D. Stockpile topsoil 8 feet high maximum.

E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION 31 05 15

SECTION 310519.13 - GEOTEXTILES FOR EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Woven geotextile material.
2. Nonwoven geotextile material.

B. Related Requirements:

1. City of Georgetown Standard Specifications
2. Section 31 05 15 “Soils and Aggregates for Earthwork” for fill and grading materials.
3. Section G5 “Granular Fill Materials” for fill and grading materials.
4. Section 31 20 00 “Earthwork” for excavation and backfilling procedures.
5. Section G4 “Pipe Excavation, Trenching, Embedment, Encasement and Backfilling” for trenching and backfilling procedures.
6. Section G6 “Sedimentation and Temporary Erosion Control” for erosion and sedimentation control devices.

1.3 ACTION SUBMITTALS

A. Submit items in this Article at least 30 days prior to installation.

B. Product Data: Submit certified test results from the manufacturer including tensile strength, elongation, thickness, UV resistance, and other material properties.

C. Shop Drawings: Indicate fabric layout, seam locations, and overlap details in installation drawings. Provide installation schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures and quality control and quality assurance.

C. Manufacturer’s quality control program and manual, including a description of laboratory facilities.

D. Source Quality-Control Submittals: Provide results of factory tests and inspections, including test results that indicate materials meet the requirements of PART 2.

E. Field Quality-Control Submittals: Provide results of Contractor-furnished tests and inspections.

F. Qualifications Statements:

1. Submit qualifications for manufacturer and installer.
2. Submit manufacturer's approval of installer.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of geotextile material, including placement depth.

1.6 QUALITY ASSURANCE

A. Perform Work according to City of Georgetown standards and the recommendations of the Manufacturer.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging that identifies the manufacturer/supplier’s name, style, and roll number. Inspect for damage.

B. Comply with ASTM D4873.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture, dust, chemicals, UV radiation or other environmental conditions that might damage the geotextile by storing at least 3 inches off the ground in a clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 MATERIALS - NONWOVEN GEOTEXTILES

A. Description:

1. Non-biodegradable, non-reactive (for pH of three to eleven), UV-resistant, insect/rodent-resistant nonwoven needle punched material consisting of filaments formed into a stable network.
2. Edges: Selvaged or finished to prevent separation of outer material.

B. Performance and Design Criteria:

1. When tested in accordance with ASTM D4759, test results from any sampled roll in the lot shall meet or exceed the values listed in Table 2. Strength values are in the weaker principal direction.

TABLE 2: NONWOVEN GEOTEXTILE MINIMUM AVERAGE ROLL VALUES

PROPERTIES	TEST METHOD	UNIT	MINIMUM AVERAGE ROLL VALUES
Thickness	ASTM D5199	mils	55
Grab Strength	ASTM D4632	lbs	120
Grab Elongation	ASTM D4632	percent	50
Trapezoid Tear Strength	ASTM D4533	lbs	50
Puncture Strength	ASTM D4833/D6241	lbs	310
Water Flow Rate	ASTM D4491	gpm/ft2	135
Permittivity	ASTM D4491	sec-1	1.7
Apparent Opening Size (Max)	ASTM D4751	inch US Std. Sieve	0.008 70
UV Resistance	ASTM D4355	percent strength retained	70

2.2

2.2 MATERIALS - ACCESSORIES

A. Use products to secure geotextile fabrics as recommended by geotextile manufacturer.

2.3 SOURCE QUALITY CONTROL

A. If requested by the Owner, provide materials for Quality Assurance Laboratory (QAL) testing by an independent GRI accredited laboratory to confirm conformance testing results.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. The Engineer or Owner’s representative shall inspect subgrade to verify that underlying surface is smooth and free of ruts or protrusions that could damage geotextile material and that subgrade has been properly prepared.

B. Subgrade Material and Compaction Requirements: As specified in Section G4 “Pipe Excavation, Trenching, Embedment, Encasement and Backfilling” or 312000 “Earthwork”.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's published installation instructions. Do not install damaged materials.

B. Geotextile Material:

1. Lay and maintain smooth and free of tensile stresses, folds, wrinkles, or creases.
2. Ensure that material is in direct contact with subgrade.
3. Orientate with long dimension of each sheet parallel to direction of slope and in accordance with the manufacturer’s recommendations and approved shop drawings.
4. Minimum Unseamed Joints Overlap: 24 inches unless otherwise indicated.

C. Securement Pins or Staples:

1. Insert through geotextile midway between edges of overlaps and minimum 6 inches from free edges.
2. Minimum Spacing:

    a. Slopes Steeper than 3 Horizontal on 1 Vertical: 24 inches o.c.
    b. Slopes 3 Horizontal on 1 Vertical to 4 Horizontal on 1 Vertical: 3 feet o.c.
    c. Slopes Flatter than 4 Horizontal on 1 Vertical: 5 feet o.c.

3. Ensure that washer bears against geotextile.

D. Field Seams:

1. Minimum Seamed Joints Overlap: 12 inches at longitudinal and transverse joints.
2. Seams across Slope: Lap upper panel over lower panel.
3. Sewn Seams:

    a. Continuously sew seams on slopes steeper than 1 vertical on 3 horizontal.
    b. Stitch Type: As recommended by geotextile manufacturer.
    c. Tie off thread at the end of each seam to prevent unraveling.

4. Thermal Seams:

a. As recommended by geotextile manufacturer.
b. Comply with ASTM D4886.

E. Penetrations: As recommended by geotextile manufacturer.

F. Repairing Damaged Geotextiles:

1. Repair torn or damaged geotextile by placing patch of same type of geotextile over damaged area minimum of 12 inches beyond edge of damaged area and fasten as recommended by geotextile manufacturer.
2. Remove and replace geotextile rolls which cannot be repaired.

G. Fill and Cover:

1. Place fill to prevent tensile stress or wrinkles in geotextile.
2. Place fill from bottom of side-slopes upward.
3. Do not drop fill from height greater than 3 feet.

3.3 FIELD QUALITY CONTROL

A. Acceptance:

1. The Engineer or Owner’s representative will inspect installation and identify repairs or modifications necessary to perform as specified.
2. Make final adjustments and repairs under direction of The Engineer or manufacturer's representative.

3.4 PROTECTION

A. Ballast: Adequate to prevent uplift of material by wind.

B. UV Exposure: Do not leave material uncovered for more than 14 days after installation.

C. Do not use staples or pins to hold geotextiles in place where located adjacent to other geosynthetic layers that could be damaged.

D. Do not operate equipment directly on top of geotextile.

END OF SECTION 310519

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SECTION 31 09 00 - GEOTECHNICAL INSTRUMENTATION AND MONITORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes performing pre-construction surveys and installing and monitoring geotechnical instrumentation and survey markers to measure.

1. Performance of excavation support systems.
2. Groundwater levels inside and outside excavation limits.
3. Vertical deformation of ground surface adjacent to and directly over the Work.
4. Vertical and horizontal deformation of existing utilities and structures adjacent to and over the Work.
5. Ground vibration levels at adjacent facilities due to Contractor activities, including but not limited to demolition, pile installation, blasting, and rock excavation.

B. Related Requirements:

1. Section 312000 "Earthwork" for backfilling and compaction in open areas.
2. Section 312319 "Dewatering" for controlling surface and groundwater and disposing of water during construction.
3. Section 312333 “Trenching and Backfilling” for trenching, backfilling, and compaction in trench excavations.
4. Section 315000 "Excavation Support and Protection" for temporary support of excavations.

1.3 DEFINITIONS

A. Crack Gauges: Transducers mounted across cracks identified on existing structures during the preconstruction survey to monitor the crack width.

B. Deformation Monitoring Points (DMPs): Fixed markers placed on existing utilities and structures to measure both vertical and horizontal movement. Initial coordinate locations and vertical controls are determined by optical survey methods.

C. Excavation Support Monitoring Points (ESMPs): Inscribed marking or fixed makers placed on excavation support systems to measure horizontal movement of the excavation support system.

D. Groundwater Observation Wells: Screened or slotted pipe with solid riser pipe installed in a drilled hole with the annulus around the pipe backfilled with sand. Near surface groundwater levels are measured in the well.

E. Seismographs: Electronic recording device with vibration transducer capable of monitoring and recording ground vibrations induced by construction activity.

F. Surface Monitoring Points (SMPs): Inscribed marking or approved surveyor's nail installed to measure vertical (elevation) movement.

G. Utility Monitoring Points (UMPs): Steel rod inside fully cased hole that is resting on existing utilities or underground structures to measure movement of the existing underground structure or utility.

1.4 ACTION SUBMITTALS

A. Submit in accordance with Section 013300 “Submittal Procedures”.

B. Submit for Engineer’s review four weeks prior to instrument installation:

1. Installation Plan and Schedule: Full details and plan/layout of proposed instruments/points, schedule for installing and monitoring instruments/points, equipment types, installation methods, reference points, and monitoring and data reporting schedule for instruments/points, and instrumentation protection.
2. Description of methods for installing and protecting all instrumentation including but not limited to seismographs, observation wells, crack gauges, monitoring points, and reference points.
3. Groundwater observation well construction details including casing type, filter gradation, screen interval, grout mix, drilling methods, and well depths.
4. For instrumentation installed in borings, submit a detailed procedure for installation, including post-installation acceptance test, together with a sample installation record sheet that include:

    a. Method to be used for cleaning inside of casing or augers.
    b. Drill casing or auger type and size.
    c. Depth increments for backfilling boreholes with sand and bentonite.
    d. Method for overcoming buoyancy of instrumentation components during grouting.
    e. Method of sealing joints in pipe casing to prevent ingress of grout.

C. Installations Records: Within five working days of installing each instrument, submit to Engineer, specified as-built instrument location and its corresponding installation record sheet.

1. Include in installation record sheet, location with instrument identification numbers, established elevations, initial elevations and coordinates (baseline readings), boring log, installation, and monitoring date and time.
2. Furnish details of installed instruments showing dimensions, materials used, and as-built drawings of each instrument.
3. Submit field calibrations.

D. Reports and Records: Provide reports of monitoring data to Engineer. Include following minimum information:

1. Preconstruction survey.
2. As-installed location plan, installation records, and baseline values for instrumentation.
3. Monitoring data for instruments with plots against threshold values.

4. Weekly records of crack monitors and including photographs with readings.
5. Event reports and summary from vibration monitoring.
6. Discussion and associated action related to results exceeding threshold values.

E. Submit proposed remedial measures to Engineer of action to be taken in event that instrument Threshold Values are reached.

1.5 INFORMATIONAL SUBMITTALS

A. Submit names, qualifications, and experience of personnel who will install instruments, perform optical level survey and vibration monitoring, read instruments, and report data to Engineer demonstrating compliance with “Quality Assurance” Article in this Section.

B. Certificates: Submit for each seismograph or other necessary instrument that manufacturer has inspected and tested each instrument before it leaves the factory confirming that it is working correctly without defects or missing parts and current calibration records.

1.6 QUALITY ASSURANCE

A. Geotechnical Instrumentation Engineer Qualifications: Professional engineer licensed in the State of Texas with at least 5 years’ experience in installation of specified instrumentation and will supervise and direct technicians and be responsible for instrument installation. Be present at installation sites to direct and supervise installations, oversee instrumentation reading, and supervise geotechnical instrumentation data interpretations.

B. Surveyor Qualifications: Professional Land Surveyor licensed in the State of Texas with at least 3 years’ experience in surveying of similar instruments. Establish Deformation Monitoring Points, Surface Monitoring Points, Utility Monitoring Points, and Excavation Support Monitoring Points and take baseline readings.

C. Manufacturer Qualifications: Provide instruments and components from an approved manufacturer currently engaged in manufacturing specified geotechnical instrumentation hardware.

D. Preconstruction Survey Engineer Qualifications: Professional engineer licensed in the State of Texas with at least 5 years’ experience in structural evaluations and condition surveys.

E. Technicians Qualifications:

1. Minimum 3 years’ experience for personnel responsible for optical level surveys, instrument readings, and report data.
2. Trained in use of seismograph along with reporting results of analyzing and reporting frequency content of seismograph record.
3. Experienced in installation and reading of specified geotechnical instrumentation and equipment.

F. Factory Calibration: Conduct factory calibration on instruments prior to shipment with certification submitted to indicate that test equipment used for this purpose is calibrated and maintained in accordance with test equipment manufacturer's calibration requirements and that,

where applicable, calibrations are traceable to U.S. National Institute of Standards and Technology.

1. Include a calibration curve with data points clearly indicated and a tabulation of data. Mark each instrument with a unique identification number.

G. Perform instrument installations in presence of Engineer or their designated representative.

H. Be responsible for installation, maintenance, and monitoring of geotechnical instrumentation.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE REQUIREMENTS

A. Project Requirements:

1. Install geotechnical instrumentation to monitor ground conditions, ground response, and facilities to achieve specified project requirements and prevent damage to facilities potentially affected.
2. Install instrumentation in accordance with approved Instrumentation Schedule.
3. Engineer's monitoring of installed instruments does not relieve Contractor of its obligation to complete project within the requirements specified herein taking necessary additional measurements.

B. Pre-Construction Survey:

1. Prior to start of demolition, excavation work, installation of excavation support and dewatering work, engage the services of an independent licensed professional engineer, to conduct a pre-construction survey of existing structures and conditions within 100 feet of the anticipated demolition, excavation work,,, installation of excavation support, and dewatering work.

    a. Coordinate activities, issue notices, obtain clearances and provide photographic and secretarial assistance necessary to accomplish the survey.
    b. Give notice in writing, to property owners and representatives of local authorities required to be present at such survey. Notify in writing the dates on which surveys are planned so that representatives are present during the examination. Provide copies of notices to Owner and Engineer

2. Record observations of the existing conditions for residences, buildings and other structures, which are affected.

    a. Provide the survey consisting of a description of interior and exterior conditions. Locate cracks, damage or other defects existing and include information to make it possible to determine the effect, if any, of the construction operations on the defect. Where significant cracks or damage exists, or for defects too complicated to describe in words, photographs shall be taken and made part of the record.
    b. Records of each property examined must be signed by the representatives present and, if practicable, by property owners, whether or not they are present at the examinations.

3. Record of the pre-construction survey shall consist of written documentation, video and photographs of the conditions identified. At the completion of the survey, submit copies of the documentation to Owner.
4. Upon completion of all demolition work, installation of excavation support and dewatering work, the complete a similar examination of properties and structures where complaints of damage have been received or damage claims have been filed. Give notice to interested parties so that they may be present during the final examinations. Records of the final examination shall be signed and distributed as the original pre-construction survey.
5. Retain records in Contractor's file for at least 3 years after completion of the Contract. In the event of damage claims, prepare a report on the particular structures as requested by Engineer from those notes and photographs and submitted to Owner. Repair damage attributed to Contractor’s activity promptly and completely to property owners’ satisfaction to restore the conditions of the property to that existing prior to work.

C. Secure required permits prior to the installation or removal of observation wells.

D. Provide and facilitate safe access to the instruments at all times. Engineer may perform additional monitoring in a manner that will minimize unnecessary work delays. Allow and facilitate instrument monitoring as required by the Engineer. No claim for lost production time due to this activity will be allowed.

E. Maintain instrumentation. Report damaged or non-functional instrumentation to Engineer within 24 hours. Replace damaged instruments within 24 hours.

F. Availability of Data:

1. Instrumentation readings shall be collected by Contractor’s Geotechnical Instrumentation Monitoring Firm. Contractor may take their own supplementary readings in addition to those specified.
2. Monitoring data is the property of Owner and is not to be disclosed or published to third parties without Owner’s written permission.
3. Contractor is expected to make their own interpretations for their own purposes without additional compensation.
4. Coordinate with Engineer to verify consistency of collected data.

2.2 INSTRUMENTATION - GENERAL

A. Instruments and materials, including readout units, installation tools, materials, and miscellaneous instrumentation components.

B. Provide surface protection for instruments flush with surface in paved or other ground surface areas at the time that work is completed.

C. Minimum Quantity of Instruments: While quantities in following Paragraph are considered minimums, obtain data from instrumentation in quantity to monitor construction, performance, and safety aspects of the Work.

D. Following subparagraphs identify instrument type, minimum number to be provided, and approximate installed depth from bottom of excavation:

	Instrument Type:	Number:	Depth:
1.	Observation Wells:	1	15 feet
3.	Seismographs:	As Needed	N/A.
4.	Surface Monitoring Points:	12	N/A.
5.	Deformation Monitoring Points:	6	N/A.
6.	Utility Monitoring Points:	As Needed	N/A.
7.	Excavation Support Monitoring Points:	As Needed	N/A.
8.	Crack Gauges	(as req'd to monitor existing cracks)	

E. Locate instruments and obtain approval from the Engineer.

2.3 GROUNDWATER OBSERVATION WELLS

A. Pipe: ASTM D1785, Schedule 40 PVC pipe, 1 inchminimum inside diameter.

B. Maximum Screen Size: 0.020 inch, unless otherwise approved by Engineer.

C. Use observation wells to monitor groundwater levels outside excavations.

2.4 MONITORING POINTS

A. Surface Monitoring Points (SMPs):

1. Use to monitor vertical deformation at or near ground surface, clearly identifying points with permanent easily readable letters and numbers as approved by Engineer.
2. Paved Areas: 2 inches long masonry nail, manufactured from hardened zinc–plated steel and driven into an asphalt covered surface. Identify each nail individually with an identification tag or surface marking.
3. Non-Paved Areas: 3 feet¾ inch diameter steel rod driven into ground or set in concrete such that no more than 3 inchesof rod is exposed above ground surface. Round top of rod and punch-mark it at its center. Identify each rod with a surface marking.
4. Utility Manholes: Observable cross mark or welded bead on top horizontal surface of manhole rim. Clean surface within 3 inchesof point and mark it using fluorescent spray paint adjacent to point to permit easy identification of exact location.

B. Deformation Monitoring Points (DMPs):

1. Use to monitor vertical and horizontal movement of adjacent utilities and structures with following approved by Engineer.
2. Materials: Nails, screws, reinforcing bars, bolts, and similar materials with well-defined measurement points.
3. Firmly attach and protect from damage and vandalism. Remove or cover points protruding more than ¼ inchwith a protective box or cap.
4. Clearly identify with permanent easily readable letters and numbers.

C. Utility Monitoring Points (UMPs):

1. Use to monitor vertical and horizontal deformation of selected utilities and underground structures. Include following at a minimum:

a. Steel Pipe: ASTM A53/A53M Grade B, 3-1/2 inchextra strong steel sleeve and 1 inchextra strong steel riser, threaded and coupled.
b. PVC Centralizers: ASTM D1785, Schedule 40 PVC pipe, sized to provide a tight fit on riser pipe, and spring-formed to a larger diameter to provide a loose fit in sleeve pipe.

2. Install to top of utility or underground structure by vacuum excavation method. Set monitoring rod with centralizers on top of the utility or underground structure and extending to within 1 foot of ground surface.
3. Install with a flush mount roadbox casing at grade, clearly identified by surface marking.

D. Excavation Support Monitoring Points (ESMPs):

1. Use as fixed markers on vertical elements of excavation support system and to monitor horizontal deformation of excavation support system designed by Contractor.
2. Clearly identified points with permanent easily readable letters and numbers as approved by Engineer.
3. Clean surface within 3 inchesof each point and clearly identify using fluorescent spray paint adjacent to point.

E. Non-Shrink Cement Grout: Suitable for intended application.

2.5 SEISMOGRAPHS

A. Portable for monitoring ground vibrations velocities resulting from construction activities, calibrated within the previous six months, and having following characteristics:

1. Measure three mutually perpendicular components of particle velocity in directions vertical, radial, and perpendicular to vibration source.
2. Measure and display maximum peak particle velocity continuously during vibration-generating activities.
3. Have a low frequency omnidirectional transducer for measuring air blast overpressure with a flat frequency response within the limits of 2 Hertz to 200 Hertz with a tolerance equal to or better than plus or minus 10 percent.
4. Seismic Range: 0.01 inchto4 inchesper second with an accuracy of plus or minus 5 percent of measured peak particle velocity or better at frequencies between 10 Hertz and 100 Hertz, and with a resolution of 0.01 inchper second or less.
5. Acoustic Range: 110 dBto 140 dB (referenced to 20 micro-Pascals) with an accuracy and resolution of plus or minus 1 dB.
6. Frequency Response (plus or minus 3 dB: 2 Hertz to 200 Hertz.
7. Two Power Sources: Internal rechargeable battery and charger capable of supplying power to monitor vibrations continuously for up to 24 hours at 115 volts AC.
8. Self-triggering wave form capture mode that provides plot of wave forms, peak particle velocities, peak overpressure, and frequencies of peaks.
9. Continuous monitoring mode capable of recording single-component peak particle velocities and frequency of peaks with an interval of 1 minute or less.

B. Provide for full-time use on the project during vibration causing construction activities.

2.6 CRACK MONITORS

A. Crack Gauges:

1. Threaded Anchors: Include ball joints which can be grouted to each side of crack in any orientation.
2. Transducer: Range of at least 1 inch and an accuracy of less than 0.1 percent and a non-linearity of no more than 0.5 percent.
3. Gauge: Capable of operating in temperatures ranging from minus 68 degrees F to 176 degrees F.

C. Provide a solid steel cover over each gauge which does not touch or otherwise interfere with gage operation.

D. Basis-of-Design Manufacturer - Crack Gauges: Provide Model 4420 as manufactured by Geokon, Inc., or equal for monitoring width of existing cracks and joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Engineer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Existing Conditions: Locate vaults, structures, conduits and underground utilities in areas where observation wells are to be drilled and installed. Conduct utility clearance and contact utility companies prior to any drilling.

1. Modify instrument locations, as approved by Engineer, to avoid interference with existing vaults, structures, conduits and utilities.
2. Repair damage to existing facilities resulting from instrument installations without additional compensation.

B. Prior to commencing installation of demolition, excavation support, excavation for open trench crossings,,, and dewatering work, furnish instrumentation and related components that are to be installed during construction and conduct pre-construction surveys.

C. Protect from damage and maintain instruments. Repair or replace damaged instruments.

D. Drilling from Ground Surface: Obtain necessary permits for each instrument and conform to permit requirements during drilling and installation.

E. Implement remedial measures based on interpretations of monitoring data program.

3.3 GENERAL REQUIREMENTS

A. Perform a pre-construction survey prior to any dewatering, excavation, demolition, or installation of excavation support.

B. Install instruments at Engineer approved locations in accordance with approved installation procedures. Engineer may modify instrument locations depending on field conditions and monitoring objectives. Install instrumentation in accordance with approved installation schedule. Install instruments and obtain baseline data before construction starts.

C. Allow Engineer access to instrument locations and assistance required in obtaining monitoring data.

D. Clearly mark and label instruments and protected to avoid being obstructed or otherwise damaged by construction operations or general public. Immediately following installation, survey location and top of instruments to provide horizontal and vertical coordinates.

1. Resurvey if Engineer questions instrument locations

E. Assign a unique identification number to each instrument and each point that is clearly marked in a non-destructible manner.

F. Initial Reading: Immediately following instrument installation take two sets of initial readings in Engineer’s presence to provide baseline readings and to demonstrate adequacy of completed installation.

3.4 MONITORING POINTS

A. Monitoring Points: Include but not be limited to SMPs, DMPs, UMPs and ESMPs. Monitor these control points using surveying methods. Modify locations to meet site constraints with Engineer’s approval.

B. SMPs, DMPs and UMPs: Install as described below near excavations and and open trench locations. Additional SMPs, DMPs, and UMPs may be required by the Engineer.

C. Additional SMPs:

1. Install in pavement or ground surface within 10 feet along each side of trench excavations that is within 50 feet of structures. Install at spacing not exceeding 50 feet.
2. Install on rim of utility manhole covers located within 50 feet of trenchless crossings or within 30 feet of open excavations.

D. DMPs:

1. Install on exterior walls of buildings or structures located within 30 feet of open excavations, 100 feet of pile installation, or 50 feetof shafts or trenchless crossing alignments. Preferred installations are on supporting walls or columns. Avoid installation in brick, unless no other option exists.
2. As a minimum, install on exterior wall corners of buildings, structures, or property boundary walls at not more than 50 feetspacing. Install additional DMPs to monitor building movement at other locations when determined by Engineer.

3. Install DMPs in cooperation with property Owners so that installations are inconspicuous and acceptable to them. Existing features of building foundations that are permanent and can be repeatedly surveyed may be substituted for DMPs, if approved by Engineer.

E. UMPs: Install on existing utility over 36 inch in diameter and located within 15 feet from excavation or directly over trenchless crossing. Locate at a spacing of not more than 50 feet.

F. ESMPs:

1. Install on excavation support systems other than trench box along support walls at spacing not more than 25 feet.
2. Install prior to excavation within exaction support system.
3. Read results at least daily during associated excavation and twice a week until backfill is completed.

G. SMPs, UMPs, and DMPs:

1. Obtain two sets of measurements for each monitoring point to establish baseline data within three days of installation. Make at least 24 hours apart, but not more than 48 hours.
2. Check monitoring points with initial surveyed elevations differing by more than 0.08 inch for secure installation and resurvey.
3. Read monitoring points prior to installing excavation support, beginning demolition, excavation, operation of groundwater control system, , or start of installation of excavation support at the site.
   Read daily during demolition, excavation, dewatering, filling and backfilling,,, and excavation support installation located within 50 feetof the work, then at least twice a week until excavation, dewatering, and backfill has been completed.

H. Crack Gauges:

1. Install on exterior walls of buildings or structures with existing cracks located within 30 feet of open excavations.
2. Install DMPs in accordance with manufacturer’s recommendations and in cooperation with property Owners so that installations are inconspicuous and acceptable to them.

3.5 VIBRATION MONITORING

A. Take seismograph readings during demolition and excavation support installation or other activities causing ground vibrations within 50 feetof existing structures to document that peak particle velocities do not exceed specified limit criteria.

B. Install seismographs near existing structures when vibratory or impact hammers are used for the installation of excavation support within 50 feetof existing structures, and as directed by the Engineer.

3.6 GROUNDWATER OBSERVATION WELLS

A. Install at least one observation well at the site.

B. Set screened interval of each well to monitor groundwater levels.

C. Drill 4 inchminimum diameter holes for observation wells of required size and depth and case with temporary casing. Do not use bentonite drilling mud in drilling holes for observation wells.

D. Flush cased holes with clean water through an approved bit. Flush until discharge water is free of soil particles.

E. Construct observation well with 10 feetof slotted PVC well screen, filter sand, bentonite seal, couplings, a pipe cap, and a locking cover.

1. Place two feet of filter sand in bottom of drilled hole. Then place well screen and surround it with filter sand, as temporary casing is carefully withdrawn.
2. Insert solid PVC casing and cap and fill annular space with bentonite pellets then non-shrink cement grout.
3. Protect observation wells at ground surface by providing a roadway box or outer protective casing with lockable top and padlock. Design surface protection to prevent damage by vandalism or construction operations and to prevent surface water from infiltrating.

    a. Provide two keys for each padlock to Engineer for access to each well.
    b. Develop observation wells to provide a reliable indication of groundwater levels. Re-developed wells if well clogging is observed, in event of apparent erroneous readings, or as directed by Engineer.
    c. Submit observation well installation logs, top of casing elevation, and well locations to Engineer within 24 hours of completion of well installation.

F. Observation Well Maintenance:

1. Maintain each observation well until adjacent structures, and pipelines are completed and backfilled. Clean out or replace any observation well which ceases to be operable before adjacent work is completed.
2. Maintain observation wells and repair or replace them without additional compensation, whether or not observation wells are damaged by Contractor's operations or by third parties.

G. Monitoring and Reporting of Observation Well Data:

1. Begin daily monitoring of groundwater levels in work areas prior to initial operation of drainage and dewatering system. Continue daily monitoring in areas where groundwater control is in operation until time that adjacent structures, and pipelines are completed and backfilled and until time that groundwater control systems are turned off.
2. Be responsible for processing and reporting observation well data to Engineer daily. Submit data to Engineer on a form that includes following information.

    a. Observation well number.
    b. Depth to groundwater.
    c. Top of casing elevation.
    d. Groundwater level elevation.
    e. Date and time of reading.
    f.

H. Following construction, abandon new observation wells as directed by Engineer.

1. Abandon observation wells by removing materials within original borehole, including casing, filter, and grout seal in accordance with applicable permits.
2. Using approved tremie methods, completely fill hole and voids with non-shrink cement grout prior to removal of drill casing, such that formation materials do not move into hole prior to grouting.
3. Restore ground surface to its original condition.
4. Abandon wells within paved areas by removing vaults and well caps to pavement subgrade.
5. Remove wells with as discussed above and repair or patch pavement with same surface type.

3.7 INSTRUMENT PROTECTION, MAINTENANCE AND REPAIR

A. Protect instruments from damage. Replace damaged or destroyed instruments within 72 hours of damage, without additional compensation. If necessary, suspend work in areas being monitored by damaged instrument and take remedial action.

B. Maintain instruments by draining water and flushing debris from under protective covers and always keeping covers locked and sealed.

3.8 MONITORING

A. Collect, tabulate, plot, and interpret survey monitoring data and provide Engineer with tabulated and plotted data. Report status of demolition, excavation, bracing, groundwater levels,,, and backfilling at time of data collection with each report.

B. Monitoring frequency may be modified as directed and approved by Engineer.

C. Submit data from readings of monitoring points to Engineer within 24 hours of reading. Communicate verbally with Engineer immediately after visual observations or data collection if excessive movements or other anomalies are indicated.

D. For seismograph data, submit a summary report with event summary of peak particle velocity and frequency. Submit a strip chart indicating time and magnitude of maximum single-component peak particle velocity measured during each 5-minute interval of monitoring period. List a summary of vibration producing activities for that week along with specific events causing anomalous readings.

E. Make visual observations of ground conditions and building conditions in site vicinity and communicate immediately with Engineer if signs of ground or building movements are observed.

F. Engineer may take independent instrumentation measurements. Cooperate with Engineer during instrumentation monitoring by providing access to instrumentation locations in a timely manner and by providing and maintaining safe means of access to instrumentation locations for data collection. Data acquired by Engineer will be made available to Contractor in a timely manner.

G. Contractor may make their own interpretations of monitoring data for their own purposes. Do not publish or disclose data or interpretations to other parties without advance written permission of Owner.

H. For data collected from an instrument that has been installed to replace a damaged instrument, use formal initial reading as an initial reading for replacement instrument so that data are continuously plotted, without an offset at time of damage. Note time of damage and replacement on plot.

3.9 INTERPRETATION AND RESPONSE VALUES

A. Make interpretations of data resulting from monitoring programs.

B. Threshold and Limiting Values for Instruments:

	Instrument	Threshold Value	Limiting Value
1.	Seismographs:	1.0 in/sec over 40 Hz 0.75 in/sec at 30 to 40 Hz 0.50 in/sec at 20 to 30 Hz 0.25 in/sec under 20 Hz	2.0 in/sec over 40 Hz 1.5 in/sec at 30 to 40 Hz 1.0 in/sec at 20 to 30 Hz 0.5 in/sec under 20 Hz
2.	Surface Monitoring Points:	0.5 inch	1.0 inch.
3.	Deformation Monitoring Points:	0.25 inch	0.5 inch.
4.	Utility Monitoring Points:	0.25 inch	0.5 inch.
5.	Excavation Support:	1.0 inch	2.0 inches.

C. Observation Wells: 2 feet 2 feet below bottom of excavation (unless in rock) Values are subject to adjustment by Engineer as indicated by prevailing conditions or project circumstances. Crack Gauge criteria will be established based upon existing conditions identified during preconstruction survey.

D. If a Threshold Value is reached:

1. Engineer and Contractor will meet to discuss remedial measures.
2. Increase instrument monitoring frequency as directed by Engineer.
3. Install and monitor additional instruments as directed by Engineer.
4. Implement remedial measures in event Threshold Value is reached, so Limiting Value is not reached.

E. Take necessary steps so Limiting Value is not exceeded. Engineer may direct Contractor to suspend activities in affected area with exception of those actions necessary to avoid exceeding Limiting Value.

3.10 TOLERANCES

A. Survey Measurements: Initial location of each instrumentation elements consisting of determining elevation and horizontal positions with respect to the Engineer approved benchmarks.

B. Monitoring Points (SMPs, DMPs, UMPs and ESMPs):

1. Instrumentation Elevations: Determine to accuracy of plus/minus 0.01 foot.Horizontal Position of Surface Monitoring Points: Determine to accuracy of plus/minus 0.1 foot Horizontal Position of Deformation Monitoring Points and Excavation Support Monitoring Points: Determine to accuracy of plus/minus 0.01 foot.

C. If actual field conditions prohibit installation at location and specified elevations, obtain prior acceptance from the Engineer for new instrument location and elevations.

3.11 DISPOSITION OF INSTRUMENTS

A. Monitoring Points and Crack Gauges: Remove monitoring points and crack gauges during cleanup and restoration work, unless directed otherwise by Engineer.

B. Observation Wells and Utility Monitoring Points: When required by Engineer, abandon and remove protective housings and caps in accordance with required permits. Restore surfaces affected by installation of instruments to their original condition prior to completion of work.

1. Leave in place any casings located within plan limits of new or existing structures or pipelines or within zone below 1H:1V planes extending downward and out from edges of foundation elements, from downward vertical footprint of pipe, or where removal would otherwise result in ground movements causing adverse settlement to adjacent ground surface, utilities or structures.
2. Where casings are pulled, fill holes with sand. Where left in place, fill casings with non-shrink cement grout and cut off a minimum of 3 feetbelow finished ground level or 1 footbelow foundation level so as not to interfere with finished structures or pipelines.
3. Following backfilling, remove precast boxes or vaults and reconstruct pavement in paved areas. Restore surface to conditions existing prior to instrument installation.

C. Seismographs: Remove units following completion of demolition installation of excavation support and excavation

END OF SECTION 310900

SECTION 312000 – EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. General: Earthwork includes clearing and stripping, procurement of on-site and imported fill material, excavating, placing, and compacting fill and backfill, structural excavating and backfilling, transportation and storage of excess earthwork materials; disposal of unsuitable, waste, and surplus materials; restoration of excavation and trench surfaces; and subsidiary work necessary to complete the grading of developed areas to conform with required lines, grades, and slopes.

B. Work includes but is not necessarily limited to; excavation for structures, tanks, foundations, manholes, vaults, electrical manholes, conduits, cables, raceways and ducts, pipes, paving; embankments; grading; and related work such as sheeting, bracing and dewatering.

C. Provide services of a licensed Professional Engineer, registered in the State of Texas, to prepare temporary excavation support system, dewatering system designs, and submittals.

D. Provide temporary excavation support systems, including sheeting, shoring, and bracing, to ensure the safety of personnel and protect adjacent structures, piping, and other materials in accordance with Federal, State and local laws, regulations, and requirements. Temporary excavation support systems are specified in Section 315000 “Excavation Support and Protection.”

E. Provide temporary dewatering, surface water control systems, and operate to dewater and maintain excavations in a dry condition. Control drainage into excavations and remove seepage water and rainwater. Dewatering and surface water control are specified in Section 312319 “Dewatering.”

F. Examine site and review available geotechnical report prior to submitting a proposal, taking into consideration project conditions that may affect the work. Owner and Design Engineer do not assume responsibility for variations of subsurface conditions at locations other than places shown and at the time investigations were made.

G. Owner to provide field testing for compaction of subgrade and fill materials by an independent testing laboratory. The costs of this testing to confirm compliance with this Section will be paid by the Owner. Should any test fail to meet the requirements of this section, that work shall be repaired and retested. Retesting will be at the Contractor’s expense.

H. Do not initiate extra work without written notification to Owner and Engineer and receiving Owner’s written approval in response.

I. Excavation includes material of every description and of whatever substance encountered regardless of the methods or equipment required to remove the materials.

J. Protect existing structures and utilities that remain.

K. Related Requirements:

1. Section G5 “Granular Fill Materials” for fill materials.
2. Section 310515 “Soils and Aggregates for Earthwork” for fill materials.
3. Section G3 "Site Clearing" for site preparation work, including stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
4. Section G4 “Pipe Excavation, Trenching, Embedment, Encasement and Backfilling” for stated work.
5. Section 312319 "Dewatering" for controlling surface and groundwater and disposing of water during construction.
6. Section G6 “Sedimentation and Temporary Erosion Controls” for temporary stated work.
7. Section 315000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

C. Coverage: Pass of compaction equipment over the complete surface area of exposed lift or subgrade to receive compaction.

D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Additional Excavation: Excavation as directed by Engineer to correct Contractor’s work not in compliance with Contract Documents, which will be performed without additional compensation.
3. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
4. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be provided without additional compensation.

E. Finished Grade: Required final grade elevation indicated on Drawings. Spot elevations take precedent over proposed contours.

F. In-the-Dry: An excavation subgrade where groundwater level: has been lowered to at least 2 feet below lowest level of excavation; is stable with no ponded water, mud, or muck; is able to support construction equipment without rutting or disturbance; and is suitable for placement and compaction of fill material, pipe, or concrete foundations.

G. Objectionable Material: Includes topsoil, organic matter, contaminated soil, construction debris, perishable materials, snow, ice, frozen earth, and rocks or lumps of cemented soils over 6 inches in maximum dimension.

H. Optimum Moisture Content: Moisture content (percent by dry weight) corresponding to maximum dry density of the same material as determined by ASTM Test Method D698.

I. Overexcavation: Removal of unsuitable soil or objectionable material at or below the normal grade of excavation or subgrade as indicated on Drawings.

J. Percent Compaction: Required in-place dry density of the material, expressed as a percentage of the maximum dry density of the same material, as determined in the laboratory by ASTM Test Method D698.

K. Structural Fill: Backfill which is placed against the exterior side of the structure walls.

L. Structures: Buildings, wet wells, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, manholes and vaults, or other man-made stationary features constructed above or below the ground surface.

M. Subgrade: Required surface of subsoil, borrow fill, or compacted fill that is immediately beneath site improvements, especially dimensioned fill, paving, or other surfacing material.

N. Unsuitable Soil: Includes existing fill materials, organic soils, weak native soils, or clays with a plasticity index of greater than 30, and any materials that cannot be properly placed and compacted as specified.

O. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

P. Zone of Influence: A line extending at least 2 feet beyond foundation or pipeline edge, then outward and downward at a slope of 1 horizontal to 1 vertical. Do no excavation below foundation of existing structures or pipeline.

Q. Professional Engineer: Registered Professional Engineer meeting project qualifications and who is hired by Contractor.

R. Professional Geologist: Registered Professional Geologist meeting project qualifications and who is hired by Contractor.

S. The Engineer: The Engineer or designated representative hired by Owner.

1. Approval given by the Engineer shall not relieve Contractor of its responsibilities for performing the work in accordance with Contract Document requirements.

1.4 ACTION SUBMITTALS

A. Coordinate various submittal types required by this Section with requirements of dewatering, support of excavation, rock removal, and geotechnical instrumentation submittals specified in other Sections.

B. Slope Stability Evaluation: Submit a temporary excavation slope stability evaluation in accordance with OSHA for temporary slopes over 20 feet in height or where existing or proposed facilities or property limits are located at the top of the slope and within a distance from the top of the slope equal to the slope height.

1. Prepare evaluation by a licensed Professional Engineer registered in the State of Texas.

C. Site Characterization Data: Submit following information regarding off-site source and material:

1. Site location.
2. Present and past usage of the source site and material.
3. Previously existing reports associated with an assessment of source site relating to presence of oil or other hazardous materials.
4. Location within the site from which the material will be obtained.

D. Samples: Submit a representative sample weighing approximately 50 pounds of each fill material, filter sand, and crushed stone contained in sealed 5 gallon containers, at least 30 calendar days prior to date of anticipated use of each material.

E. Submit laboratory test results for fill materials that include maximum density, gradation, Atterberg limits, sand equivalent, and other applicable criteria, at least 72 hours prior to importing or placing fill.

F. Prepare excavation support system designs by a licensed Professional Engineer, registered in State in which the work is located and having a minimum of 5 years of professional experience in design and construction of excavation support systems.

1. Submit an original and three copies of licensed Professional Engineer's certification, on PE form specified in Section 01 33 00 “Submittal Procedures,” stating excavation support systems designs have been prepared by Professional Engineer who is responsible for their execution.

1.5 INFORMATIONAL SUBMITTALS

A. Construction and Operations Plan: Submit proposed methods of construction, including earthwork operations, excavation limits, slopes, fill material moisture conditioning and handling, compaction equipment, excavation support systems designs, backfilling and filling and compaction, and material sources.

1. Include additional submittal requirements related to schedule, work sequence, and on-site and off-site storage when necessary based on project conditions.
2. Submit excavation support system plan as prepared by registered Professional Engineer complying with requirements stated in previous Article.

B. Submit copies of field daily reports by soil technician at the end of each work day that earthwork and grading operations occur.

C. Upon completion of earthwork and grading operations, submit an as-graded map showing density test numbers and locations, a table of density test results and depths, and a certification of compliance by geotechnical engineer in charge.

D. Qualification Data: For qualified testing agency to conduct geotechnical observation, testing and documentation. include qualifications of firm, resumes of soil technicians assigned to the project, and licensed geotechnical engineer in charge.

1. Firm Qualifications: Meet ASTM D3740.
2. Soil Technicians: Have minimum three years demonstrated experience in earthwork and grading operations and satisfy certification requirements of agency having local jurisdiction.

    a. The Engineer reserves right to request substitution of soil technicians assigned to field work. Do not substitute assigned soil technicians without prior approval of the Engineer.

E. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.6 QUALITY ASSURANCE

A. Excavation, trenching, sheeting, bracing, and similar work shall comply with requirements of OSHA excavation safety standards, 29 CFR Part 1926 Subpart P and State and local authorities having jurisdiction. Where conflict between OSHA, State and local regulations exists, apply most stringent requirements.

B. At least three working days prior to starting any excavation, notify the appropriate regional notification center for underground utilities and underground utility owners who are not members of notification center. To obtain area specific information for project site, refer to www.texas811.com.

C. Quality Control Testing for Off-site Borrow Materials:

1. Chemical testing will not be required where site characterization of off-site borrow sources indicates that soils are acceptable for use. If site characterization data or materials are suspected of being contaminated, perform chemical testing as directed by The Engineer with no additional compensation.
2. Chemical Test Data: Test each material source requiring testing by a person experienced in sample collection who is a registered Professional Engineer or geologist, or certified groundwater or environmental professional registered in the State of Texas. Submit samples of each proposed material to a chemical analytical laboratory, certified by the governing agency, for following analyses:

    a. Volatile Organic Compounds: EPA 8240 plus Hazardous Substance List (HSL) Parameters.
    b. Acid and Base Neutral Extractable Organic Compounds: EPA 8270.

c. Pesticides and PCBs: EPA 8080.
d. Total Petroleum Hydrocarbons: Infrared Method, EPA 9071/418.1.
e. Thirteen Priority Pollutant Metals: EPA 7000 Series.
f. Total Cyanide: EPA 9012.

3. Obtain and test off-site borrow samples in accordance with criteria established by the Engineer. Submit results for review and approval prior to use on site.

1.7 FIELD CONDITIONS

A. Be responsible for construction layout and reference staking necessary for proper control and satisfactory completion of structures, cutting, filling, grading, drainage, fencing, embankment improvements, curbing, and other appurtenances.

B. Perform construction layout and staking by a Professional Surveyor or Professional Engineer registered in State of Texas, experienced and skilled in construction layout and staking requirements.

C. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earthwork operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

D. Utility Locator Service: Notify utility locator service "One Call" for area where Project is located before beginning earthwork operations.

E. Do not commence earthwork operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section G6 "Sedimentation and Temporary Erosion Control" and Section G3 "Site Clearing" are in place.

F. Do not commence earthwork operations until plant-protection measures are in place.

G. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

H. Do not direct vehicle or equipment exhaust towards protection zones.

I. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Fill materials designated for use in this Section are specified in Section G5 “Granular Fill Materials” and Section 310515 “Soils and Aggregates for Earthwork.”

B. On-Site Fill Material: Earth and rock material obtained at project site during excavation, following clearing and stripping, from which any Unsuitable Soil or Objectionable Material has been removed.

C. General: Provide imported fill materials when sufficient satisfactory soil materials are not available from excavations.

D. Provide fill or bedding material as noted on the Drawings or as referenced in the Contract Documents.

E. Lean concrete fill used for a working mat, seal slab or to replace over excavated material: Cast-in-Place concrete meeting requirement of Section 033000, with the concrete compressive strength equal to a minimum of 3,500 psi.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, tanks, utilities, sidewalks, pavements, fencing, landscaping, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

1. If necessary, remove and restore or replace curbing, driveway aprons, and fencing after performing backfilling work.
2. Replace existing facilities damaged by construction with new material fully equal to existing without additional compensation.

B. Prior to and During Earthwork Operations:

1. Provide, monitor, and maintain geotechnical instrumentation regarding settlement; coordinate with Section 310900 “Geotechnical Instrumentation and Monitoring.”.
2. Provide, monitor, and maintain excavation support; coordinate with Section 315000 “Excavation Support and Protection.”

a. Use excavation support system for excavations within the zone of influence for existing structures or utilities.
b. Do not permit excavations below base level of adjacent foundations or retaining walls, unless excavation design and bracing includes an analysis of structure’s stability supported by the foundation. When necessary due to project conditions, incorporate required bracing and foundation underpinning.

3. Provide, monitor, and maintain dewatering and drainage systems; coordinate with Section 312319 “Dewatering.”

C. Test Pits:

1. Perform exploratory excavation work, test pits, for purpose of verifying the location of underground utilities and structures and to check for unknown utilities and structures, prior to commencing excavation work.
2. Backfill and compact test pits as soon as desired information has been obtained. Stabilize backfilled surfaces in accordance with approved erosion and sedimentation control plans.

D. Clearing and Stripping. Initially clear and strip ground surfaces beneath planned structures and in areas requiring excavation or filling of organic material and debris. Do not use those materials as On-Site Fill Material; remove from the site and properly disposed or reuse as topsoil in landscape areas.

E. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

F. Saw cut existing pavement with a saw, wheel, or pneumatic chisel along straight lines before excavating.

3.2 DEWATERING AND DRAINAG

A. Provide dewatering and drainage in accordance with Section 312319 “Dewatering”. This Article supplements those requirements.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff and groundwater seepage away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

D. Prior to excavation, verify groundwater will be at required level indicated on approved dewatering and drainage submittal.

E. Accomplish dewatering by methods that preserve undisturbed state of subgrade soils. Dewater in a manner to prevent boiling, detrimental under-seepage, or disturbance at excavation base.

3.3 SUPPORT OF EXCAVATION

A. Provide excavation support as required by federal, state, or local laws, ordinances, regulations, and safety requirements and in accordance with Section 315000 “Excavation Support and Protection.” This Article supplements those requirements.

B. Install excavation support in accordance with reviewed Shop Drawings prior to beginning excavation work.

C. Construct temporary excavation slopes in accordance with the requirements of OSHA excavation safety standards and approved Shop Drawings.

D. Where allowed, carefully remove excavation supports in a manner without endangering the Work or other adjacent structures, utilities, or property. Immediately fill voids left or caused by withdrawal of supports with sand and compact.

3.4 EXCAVATION

A. Include material of every description and of whatever substance encountered as an unclassified excavation.

B. General: Excavate on-site soils using standard earthmoving equipment. Excavation in dense soil or rock may require special equipment. Do not plough, scrape, or dig earth with machinery so near to finished subgrade to result in excavation of or disturbance of below grade material.

C. Seal slabs or working mats are specifically required in areas indicated on the Drawings. In areas not specifically indicated, seal slabs may be used at the Contractor's option.

D. Make excavations to grades indicated on Drawings and in widths sufficient for laying of pipe, construction of the structure, installing bracing, excavation supports, dewatering and drainage facilities, and working clearances.

E. Perform excavation in-the-dry and accomplished by methods which preserve the natural undisturbed condition of subgrade soils.

F. Moisture Sensitive Soils: Use a smooth-edge bucket to excavate last one foot of depth when excavation is to end in such soils.

G. If excavation bottom is removed below the limits shown on Drawings, specified, or directed by the Engineer, refill with structural fill, lean concrete or other material satisfactory to the Engineer without additional compensation.

H. When excavation has reached prescribed depths, notify the Engineer who will observe the conditions. If materials and conditions are not satisfactory, the Engineer will issue instructions for corrective procedures. The Engineer will be the sole judge as to whether the work has been accomplished satisfactorily.

I. Subgrade soils that have become soft, loose, quick, or otherwise unsatisfactory due to inadequate excavation, dewatering, or other construction methods in the opinion of the Engineer, remove existing soil and replaced with structural fill or other material as acceptable to the Engineer at Contractor's expense.

J. Exposed subgrades for foundations shall be proof rolled with at least two overlapping coverages of a vibratory drum roller with a minimum static drum weight of 20 ton. Conduct proof-rolling in presence of the Engineer or the Engineer’s designated representative. The Engineer will waive this requirement, if in its opinion the subgrade will be rendered unsuitable by such proof-rolling.

1. Confined Areas: Proof-roll with hand operated vibratory equipment that is approved by the Engineer.

K. Perform overexcavation at the Engineer's request to remove unsuitable soil, objectionable material, or other materials as determined by the Engineer and to such depth and width as directed. Replace with suitable material as directed by the Engineer.

1. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

L. Perform excavation for pipelines beneath structures and excavation for footings with excavating equipment operating from the subgrade for the structure, while in-the-dry and in a manner preserving the undisturbed state of subgrade soils.

M. When excavations have reached the required subgrade, including any allowances for working mats or base materials and prior to their placement, notify soils testing laboratory to verify suitability of existing subgrade soils for anticipated foundation and structural loadings.

1. If existing subgrade soils are determined to be unsuitable, follow direction provided by the Engineer regarding removal and replacement with suitable materials.
2. Notify the Engineer if the revised work scope would modify Contractor's cost and thereby entitle a change to the Contract Sum. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

N. Replace overexcavation beyond the limits and depths required by Contract Documents using structural fill, lean concrete or other material satisfactory to the Engineer without additional compensation.

O. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots.

3.5 SUBGRADE PREPARATION

A. Notify Engineer or the Engineer's designated representative when excavations have reached required subgrade.

B. Maintain excavated subgrade in-the-dry condition.

C. Prior to fill placement, remove objectionable material which includes, but not be limited to, pavement, topsoil, organic matter, contaminated soil, construction debris, perishable materials, snow, ice, frozen earth, and rocks or lumps of cemented soils over 6 inches in maximum dimension.

D. For subgrades consisting of granular soils, proof roll the final subgrade using at least four coverages of a vibrator plate compactor.

E. If subgrade slopes more than 10 percent, step subgrade to produce a stable, horizontal surface for placement of fill materials. Scarify existing subgrade slope to a depth of at least 6 inches. Adjust the moisture content of the scarified zone to or slightly above optimum, and compact the subgrade as specified.

F. Where existing subgrade contains a significant amount of clay or cohesive soils, over-excavate sufficiently below the bottom of structure for placement of a lean concrete working mat. Remove loose or soft material from the subgrade immediately prior to placing lean concrete working mat (seal slab).

G. Remove and replace soft subgrades or unusable material with structural fill, lean concrete or other material satisfactory to the Engineer.

H. During wet or freezing weather, or in areas where exposed subgrade consists of moisture-sensitive soils, take measures to protect foundation excavations once they have been approved by the Engineer. Protective measures include, but are not limited to, placing insulation blankets, placing a layer of fill, pea gravel, crushed rock, or lean concrete on the exposed subgrade, or covering the exposed subgrade with a plastic tent.

1. If additional overexcavation is required due to the subgrade not being protected against wet or freezing weather, perform additional work without additional compensation.

I. Notify the Engineer to observe conditions following subgrade preparation and prior to fill placement. If existing subgrade soils are determined to be unsuitable, follow direction provided by the Engineer regarding removal and replacement with suitable materials.

1. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

3.6 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust. Protect from precipitation.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.7 FILL PLACEMENT AND COMPACTION PROCEDURES

A. Fill and Backfill: Place materials in lifts to suit specified compaction requirements to required lines and grades, making allowances for settlement and placement of cover materials, such as topsoil or sod. Correct soft spots or uncompacted areas.

B. Do not place or compact fill and backfill when materials are too wet to properly compact.

1. In-place Soil Moisture Content: Maximum of three percentage points above optimum moisture content of soil, as determined by laboratory test of moisture-density relation appropriate to specified level of compaction.

C. Structural Fill and Embankment Fill: Construct to required lines and grades, making allowances for settlement and placement of cover materials, such as topsoil and sod. Correct soft spots or uncompacted areas.

D. Fill material shall be free of snow, ice, frost, and frozen earth. Do not place fill materials on frozen surfaces or surfaces covered by snow, ice, or frost.

E. Complete structure water-tightness tests and installation of dampproofing or waterproofing systems prior to placing various types of fill or backfill around structures.

F. Do not backfill against walls or grade beams until the structures bracing them at the top and bottom have been installed and, in the case of cast-in-place concrete, have achieved their 28-day compressive strength as specified in Section 033000 “Cast-in-Place Concrete." Place fill so that its depth is increased uniformly and gradually around the perimeter of any structure.

G. Compact filled slopes by slope rolling and trimming or overfill and trim back to plan grade to expose a firm, smooth surface free of loose material.

H. Do not allow fill lifts to contain stones with a dimension larger than 2/3 the specified loose measure lift thickness.

I. Stones or rock fragments larger than 4-inches in their greatest dimensions will not be permitted within the finished grade of fills and embankments.

J. Perform compaction in open areas using compaction equipment by any of the following methods:

1. Fully loaded ten-wheel trucks or front-end loaders.
2. Tractor dozers weighing minimum of 30,000 pounds.
3. Heavy vibratory rollers.

K. Confined Compaction: Perform compaction in confined areas, including areas within a 45-degree angle extending upward and outward from the base of a wall, and in areas where the use of large equipment is impractical, using hand-operated vibratory equipment or mechanical tampers. Do not allow heavy roller compaction equipment closer than 6-foot from the wall of any structure.

1. Do not exceed lift thickness of 6 inches, measured before compaction, when using hand operated equipment.

L. Moisture condition on-site fill material prior to placement, unless Contractor demonstrates to the Engineer in-place moisture conditioning methods can achieve the required moisture content.

M. Conduct compaction of each specified lift of fill materials by a minimum of four complete coverages with acceptable compaction equipment to a specified density as a percentage of maximum dry density as determined by ASTM D698, unless otherwise specified. Backfill compaction by means of "puddling" is not allowed.

N. Use select structural fill required beneath foundations or slabs on grade, except sidewalks, unless shown or otherwise specified. Place and compact structural fill in even lifts having a maximum thickness of 8 inches, measured before compaction.

O. Use select fill material placed within 10 feet of all structures, unless shown or otherwise specified. Uniformly place and compact select fill around the structure in even lifts having a maximum thickness of 8 inches, measured before compaction.

P. Use common fill in areas beyond those designated for select structural fill or select fill, unless shown or otherwise specified. Place in even lifts having a maximum thickness of 8 inches, measured before compaction.

Q. Place impervious fill in controlled, even lifts having a maximum thickness (measured before compaction) of 6 inches.

1. Permeability: Compact to attain a reading of less than 1×10^{-7} cm/sec.
2. Moisture Content: Compact to minus 2 percent to plus 3 percent of optimum moisture content.

3.8 COMPACTION REQUIREMENTS

A. Perform in-place testing of compacted fill lifts to measure in-place density and water content according to ASTM D6938, ASTM D698, TEX-113-E, and TEX-114-E.

B. Beneath Foundations and Slabs-on-Grade, except sidewalks: Compact top 12 inches of existing subgrade and each layer of fill, if applicable to:

1. Maximum Dry Density: For fills less than or equal to 5 feet in depth, minimum of 98 percent for ASTM D698. For fills greater than 5 feet in depth, minimum of 100 percent for ASTM D698.
2. Moisture Content: At or near its optimum moisture content, minus 2 percent to plus 3 percent.

C. Area Around Structures (within 10 feet): compact each fill or backfill layer to:

1. Maximum Dry Density: Minimum of 95 percent for ASTM D698.
2. Moisture Content: At or near its optimum moisture content, minus 2 percent to plus 3 percent.

D. Embankments, Lawn, or Unimproved Areas: Does not include embankments under roadways. Compact each fill or backfill layer to:

1. Maximum Dry Density: Minimum of 95 percent for ASTM D698.
2. Moisture Content:

a. For soils with plasticity index less than or equal to 25: At or near its optimum moisture content, minus 3 percent to plus 3 percent.
b. For soils with plasticity index greater than 25: At its optimum moisture content to plus 4 percent.

E. Sidewalks: Compact each fill layer to:

1. Maximum Dry Density: Minimum of 95 percent for ASTM D698.
2. Moisture Content: At or near its optimum moisture content, minus 2 percent to plus 3 percent.

F. Roads, Paved Areas, and Roadway Embankments: Compact each layer of fill or backfill to:

1. Maximum Dry Density: Minimum of 98 percent for TEX-113-E.
2. Moisture Content: At or near its optimum moisture content, minus 2 percent to plus 3 percent.

3.9 DISPOSAL OF UNSUITABLE, WASTE, AND SURPLUS EXCAVATED MATERIALS

A. Unsuitable soil, objectionable material, waste, and surplus excavated material shall be removed and disposed of off-site. Materials may be temporarily stockpiled in an area within the limits of construction that does not disrupt construction activities, create any nuisances or safety hazards, or otherwise restricts access to work site.

B. Topsoil or loam excavated under this Section may be salvaged for use as specified under Section G7 “Loaming, Hydroseeding and Permanent Erosion Control”, as approved by the Engineer.

3.10 GRADING

A. Perform grading to lines and grades shown on Drawings. Remove objectionable materials encountered within the limits indicated and disposed of off-site. Completely and continuously drained and dewatered subgrades throughout the grading process. Install temporary drains and drainage ditches to intercept or divert surface water that may affect the execution or condition of grading work.

B. If it is not possible at the time of grading to place material in its proper section of the Work, stockpile it in approved areas for later use. No additional compensation will be made for stockpiling or double handling of excavated materials.

C. Stones or rock fragments larger than 4-inches in their greatest dimensions will not be permitted within the top 6-inches of the finished grade of fills and embankments.

D. In cut areas, remove loose or protruding rocks in slopes to line or finished grade of the slope. Uniformly dress, cut, and fill slopes to slope cross-section and alignment shown on Drawings, unless otherwise directed by the Engineer.

3.11 RIPRAP AND SLOPE STABILIZATION

A. Prior to installation of riprap, install erosion control blankets on slopes in accordance with manufacturer's instructions.

1. Properly prepare area to be covered before the blanket is applied.
2. When the blanket is unrolled, place netting on top with fibers in contact with the soil over the entire area.

3. Butt blankets snugly at ends and sides, placing blankets a minimum of three rows, each four-foot wide, for a total width of 12 feet.
4. Staple blankets together in accordance with manufacturer's instructions.
5. Secure blankets by driving staple vertically into the ground, spaced approximately 6 feet apart, on each side and one row in the center, alternately spaced between each side.
6. Do not overlap adjoining blankets. Utilize a common row of staples to attach to ground.

B. Place riprap in conjunction with embankment construction with only sufficient lag in construction of riprap protection necessary to allow for proper construction of the portion of embankment protected and to prevent mixture of embankment and riprap material.

1. Place and grade bank run gravel to a depth of 6 inches to obtain a continuous uninterrupted bed of required thickness within the required limits.
2. Compact by a minimum one coverage by a crawler-type tractor with a total weight, including blade and equipment, of not less than 30,000 pounds.

C. Hand-place riprap on compacted gravel bed; do not dump materials. Lay stones so maximum dimension is perpendicular to the bed. Place stones so weight of each stone is carried by underlying material and not by adjacent stones. Place large stones at the bottom of slope. Fill spaces between stones with spalls of suitable size to construct a solid, stable slope, free from large voids and defects, and to protect embankments against erosion.

3.12 FIELD QUALITY CONTROL

A. Test and observe materials as described in this Article. Cooperate by allowing free access to work for selection of test materials and observations.

B. General Testing Requirements:

1. At Structures: Prior to placement of bedding material, concrete work mats, structural fill or structural concrete, coordinate with the Owner’s representative to verify suitability of existing subgrade soil.
2. Backfill and Fill: Prior to and during the placement of backfill and fill coordinate with the Owner’s representative to perform in-place soil density tests to verify that backfill and fill material has been placed and compacted in accordance with specified compaction requirements.

    a. Provide minimum 48 hours’ notice prior to placement of backfill and fill.

3. Subgrade: Do not cover with fill without observation, testing, and approval by the Owner’s representative.

    a. Earthwork activities performed without properly scheduled inspection are subject to removal and replacement or additional testing as directed by the Engineer without additional compensation.

C. Test materials as described in CIP7.

D. If field test results are not in conformance with project requirements, costs involved in correcting deficiencies in compacted materials to satisfaction of the Engineer without additional compensation.

E. Earthwork activities performed without properly scheduled inspection are subject to removal and replacement or additional testing as directed by the Engineer without additional compensation.

F. Testing methods shall comply with latest ASTM or equivalent AASHTO Standards applicable during bidding.

G. During placement of bedding, backfill, and fill, perform in-place soil density testing to confirm that fill material has been compacted in accordance with project requirements. The Engineer or Owner's representative may designate areas to be tested. Notify the Engineer and Owner's representative at least 72 hours in advance of scheduled compaction testing. In place soil density tests on backfill and fill material shall be as required by authorities having jurisdiction, project geotechnical report, but in no instance, shall less than those listed:

1. Structures, Pavements and Embankments: At least one density and moisture content test for each 5,000 square feet of surface area for each lift of fill at embankment, structure, pavement and manhole locations.
2. Trench Excavations: At least one nuclear density and one moisture content test at a maximum of 100 feet intervals for each lift of fill placed or as directed by the Engineer.
3. The Engineer may designate supplemental areas to be tested at additional compensation.

H. Materials which have been previously tested may be subjected to further testing from time to time and may be rejected, if it is determined that results do not conform to project requirements. Immediately remove rejected materials when directed by the Engineer, notwithstanding results of previous testing.

I. The Engineer or Owner may conduct additional soil testing. Cooperate fully in allowing additional test to be made, including free access to the work.

3.13 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by the Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

END OF SECTION 312000

SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Temporary construction dewatering and surface water control and incorporates the design, equipment, materials, installation, operation, protection, monitoring and removal of dewatering and drainage system. Provide dewatering system sufficient to lower groundwater and collect surface water, regardless of groundwater level or rainfall at any time during the work.
2. Delegated Design.

B. Obtain and pay for permits required for dewatering and drainage systems. Implement measurements to comply with dewatering and discharge permits requirements.

C. Related Requirements:

1. Section 310515 “Soils and Aggregates for Earthwork” for soil and aggregate materials.
2. ground and groundwater.
3. Section 312000 "Earthwork" for excavating and backfilling in open areas.
4. Section G4 “Pipe Excavation, Trenching, Embedment, Encasement and Backfilling” for trenching, backfilling, and compaction.
5. Section G6 “Sedimentation and Temporary Erosion Control” for controlling surface-water runoff and ponding.
6. Section 315000 “Excavation Support and Protection” for temporary support of excavations.

1.3 DEFINITIONS

A. In-the-Dry: An excavation subgrade where all of the following are met:

1. Groundwater level has been lowered to at least 2 feet below lowest excavation level (or to top of rock).
2. Subgrade is stable with no ponded water, mud, or muck.
3. Subgrade is able to support construction equipment without rutting or disturbance.
4. Subgrade is suitable for placement and compaction of fill material, pipe, or concrete foundations.

B. Contractor's Engineered Design: Design prepared on behalf of Contractor by a registered Professional Engineer.

C. Professional Engineer: Licensed Professional Engineer meeting project qualifications and who is hired by Contractor.

D. The Engineer: Engineer hired by Owner.

1. Approvals given by The Engineer shall not relieve Contractor of its responsibilities for performing the work in accordance with Contract Document requirements.

1.4 DELEGATED DESIGN SUBMITTALS

A. Design Plan: Submit written dewatering and drainage system design plan, prepared by a qualified Professional Engineer, that includes:

1. Description of proposed dewatering system and installation methods to be used for system elements and observation wells.
2. Description of equipment, drilling methods, holes sizes, filter sand placement techniques, sealing materials, development techniques, number and location of dewatering points and observations wells.
3. Dewatering system design calculations demonstrating that the proposed system meets all requirements herein and elsewhere.
4. Sequence of well and well-point placement coordinated with support of excavation system installation and control procedures to be adopted, if dewatering problems arise.
5. Identification of anticipated area influenced by dewatering system and address impacts to adjacent existing and proposed structures.
6. Coordinate dewatering and drainage submittals with excavation and support of excavation submittals.

B. Shop Drawings: For dewatering system, prepared by a qualified Professional Engineer.

1. Include plans, elevations, sections, and details.
2. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
3. Include pump capacity and anticipated discharge rate.
4. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
5. Show areas and depths of excavation to be dewatered and adjacent structures or facilities within the anticipated area influence.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Professional Engineer.

B. Field quality-control reports.

C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.

D. Record Drawings: Identify locations and depths of capped wells and well points and other abandoned-in-place dewatering equipment.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in installation of dewatering systems and dewatering work and having a minimum of 5 years' experience.

B. Professional Engineer Qualifications: Licensed Professional Engineer registered in the State of Texas; having a minimum of 5 years' experience in design and construction of dewatering and drainage systems; and having completed not less than 5 successful dewatering and drainage projects of equal type, size, and complexity to that required for the work.

C. Land Surveyor Qualifications: Land Surveyor licensed in State of Texas.

D. Comply with authorities having jurisdiction for the following:

1. Drilling and abandoning of well-points used for dewatering systems.
2. Water discharge and disposal from dewatering operations.

E. Obtain required permits for storm water discharge from construction sites.

1.7 FIELD CONDITIONS

A. Project-Site Information: Geotechnical data has been prepared for this Project and is available for information only. Owner is not responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.
2. Groundwater levels may vary during the work and should not be assumed to be accurately represented by groundwater level readings reported in the geotechnical data.
3. The geotechnical data is included elsewhere in Project Manual.

B. Survey Work: Engage a qualified land surveyor or Professional Engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Delegated Design: Engage a qualified professional engineer, as defined in Sections 013300 “Submittal Procedures” and 014000 “Quality Requirements”, to submit the items listed in the DELEGATED DESIGN SUBMITTALS Article.

B. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of surface and ground water and permit excavation and construction to proceed in-the-dry in accordance with the requirements herein and elsewhere.

1. Design dewatering system, including comprehensive engineering analysis by the Contractor’s Design Engineer.
2. Continuously monitor and maintain dewatering operations to ensure required groundwater lowering, erosion control, stability of excavations, excavation support, and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
5. Remove dewatering system when no longer required for construction.

C. Primary Purpose of Work: Preserve natural undisturbed condition of subgrade soils in areas of proposed excavations.

1. Prior to excavation, lower groundwater to at least 2 feet below lowest excavation subgrade elevation.
2. Additional groundwater lowering may be necessary beyond 2 feet requirement, depending on construction methods, equipment used, and prevailing groundwater and soil conditions. Lower groundwater as necessary to complete construction in accordance with Contract Documents without additional compensation

D. Design well points and sumps, and other groundwater control system components to prevent loss of fines from surrounding soils. Use sand filters with dewatering installations, unless screens are properly sized by Contractor's design engineer to prevent passage of fines from surrounding soils.

E. Maintain standby pumping systems and sources of standby power at various sites.

F. Design dewatering system to prevent damage to adjacent properties, buildings, structures, utilities, and facilities from dewatering operations. Be responsible for damage to properties, buildings or structures, sewers and other utility installations, pavements, and work that may result from dewatering or surface water control operations.

G. Regulatory Requirements: Comply with governing regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

2.2 MATERIALS

A. Equipment: Piping, pumping, and other equipment and materials to provide control of surface water and groundwater in excavations.

B. Grout: Mixture of portland cement and bentonite clay or sand suitable for sealing abandoned well-points and piping.

PART 3 - EXECUTION

3.1 GENERAL

A. Control surface water and groundwater such that:

1. Excavation to final grade is made in-the-dry.
2. Natural undisturbed conditions of subgrade soils are maintained.
3. Softening, instability, or disturbance due to presence or seepage of water does not occur.
4. Construction and backfilling proceeds in-the-dry.
5. Floatation of completed portions of work shall be prohibited.

B. Methods of groundwater control may include but are not limited to perimeter trenches and sump pumping, perimeter groundwater cutoff, well points, ejectors, or any combination.

C. Where groundwater levels are above proposed bottom of excavation level, provide a pumped dewatering system for pre-drainage of soils prior to excavation and for maintaining lowered groundwater level until construction has been completed such that structure, pipeline, or fill will not be floated or otherwise damaged.

D. Vary type of system, spacing of dewatering units, and other details of the work depending on soil and water conditions at each location.

E. Do work in a manner to protect adjacent structures and utilities without causing loss of ground or disturbance to pipe bearing soils or soils supporting overlying or adjacent structures.

F. Install, monitor, and report data from observation wells. Evaluate collected data relative to groundwater control system performance and modify systems necessary to dewater site.

G. Locate groundwater control system components where they will not interfere with construction activities adjacent to the work area or interfere with installation and monitoring of geotechnical instrumentation including observation wells. Do not make excavations for sumps or drainage ditches within or below 1H:1V slopes extending downward and out from edges of existing or proposed foundation elements or from downward vertical footprint of pipe without approval by the Engineer.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and groundwater from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways, if required by authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.

D. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section G7 “Sedimentation and Temporary Erosion Control” during dewatering operations.

3.3 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

1. Space well points or wells at intervals required to provide sufficient dewatering.
2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.

C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.4 SURFACE WATER CONTROL

A. Construct surface water control measures, including dikes, ditches, sumps and other methods to prevent flow of surface water into excavations and to allow construction to proceed without delay.

B. Grade excavation to divert surface water and seepage water within excavation areas into sumps and dewatering well-points.

3.5 EXCAVATION DEWATERING

A. Provide and maintain equipment and facilities to promptly remove and properly dispose of water entering excavations. Maintain excavations in-the-dry.

B. Excavation dewatering shall maintain the subgrade in a natural undisturbed condition and be in operation until the fill, structure or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.

C. Do not place pipe, masonry, and concrete in water or submerge within 24 hours after being installed. Prevent water from flow over new masonry or concrete within four days after placement.

D. Prevent water from rising to cause unbalanced pressure on structures until concrete or mortar has set at least 24 hours. Prevent pipe flotation by promptly placing backfill.

E. Conduct dewatering to preserve natural undisturbed condition of subgrade soils at bottom of excavation.

F. If trench subgrade or excavation bottom becomes disturbed due to inadequate dewatering or drainage, excavate below normal grade as directed by the Engineer and refill with structural fill, screened gravel, or other material as approved by the Engineer without additional compensation.

G. It is expected that initial dewatering plan may be modified to suit variable soil and water conditions encountered. Dewater and excavate in a manner without causing loss of ground or disturbance to pipe bearing soil or soil that supports overlying or adjacent structures.

H. If methods do not properly dewater excavation, install additional groundwater observation wells as directed by the Engineer. Do not place pipe or structure until readings obtained from observation wells indicate that groundwater has been lowered to specified minimum of below bottom of final excavation.

I. Surround dewatering units with suitable filter sand with no fines being removed by pumping. Pump continuously from dewatering system until pipe or structure is adequately backfilled. Provide stand-by pumps.

J. Collect water entering excavations from precipitation or surface runoff in shallow ditches around excavation perimeter, drained to a sump, and pump from excavation to maintain a bottom free from standing water.

K. Dispose of drainage to an approved area. Do not use existing or new sanitary sewers to dispose of drainage.

3.6 WELL-POINT SYSTEMS

A. Where necessary, install a vacuum well-point system around excavation for dewatering purposes. Surround each well-point and riser pipe by a sand filter. Use sand of gradation that after initial development of well-points, quantity and size of soil particles discharged shall be negligible. Provide well-point systems capable of operating continuously under highest possible vacuum. Include sufficient valves and gauges to accurately monitor and control the system. Develop and redevelop well-points to provide reliable performance throughout the duration of the work.

B. Install well point systems in the Engineer’s presence according with approved submittal.

3.7 OBSERVATION WELLS

A. Install observation wells in accordance with the approved submittal to monitor groundwater levels beneath and around excavated areas until adjacent structures and pipelines are completed and backfilled.

B. Observation well locations and depths to be sufficient to confirm operation of groundwater control system designed under Delegated Design is performing as intended. Locations and depths are subject to approval by Engineer.

C. Protect observation wells at ground surface by providing a lockable box or outer protective casing with lockable top and padlock. Design surface protection to prevent damage by vandalism, construction operations, and surface water infiltration.

1. Provide two copies of padlock keys at each well for the Engineer’s access.
2. Develop observation wells to provide a reliable indication of groundwater levels. Re-developed wells: if well clogging is observed; in event of apparent erroneous readings; or as directed by the Engineer.
3. Submittal observation well installation logs, top of casing elevation, and well locations to the Engineer within 24 hours of completing well installation.

D. Observation Well Maintenance:

1. Maintain each observation well until adjacent structures and pipelines are completed and backfilled. Clean out or replace any observation well which ceases to be operable before adjacent work is completed.
2. Repair or replace wells without additional compensation, whether damage is caused by Contractor's operations or third parties.

E. Monitoring and Reporting of Observation Well Data:

1. Begin monitoring of groundwater levels in work areas prior to initial operation of drainage and dewatering system. Continue monitoring in areas where groundwater control is in operation until time that adjacent structures and pipelines are completed and backfilled or until time that groundwater control systems are turned off.
2. Be responsible for processing and reporting observation well data to the Engineer on a regular (minimum monthly) basis. Provide data to the Engineer on a form that includes following information: observation well number, depth to groundwater, total depth of well, top of casing elevation, groundwater level elevation, and date and time of reading.

F. Keep groundwater level at a minimum of 2 feet below lowest subgrade level for a given excavation, or to top-of-rock where applicable.

3.8 REMOVAL OF SYSTEMS

A. At completion of excavation and backfilling work and when approved by the Engineer, remove from site various pipe, well-points, pumps, generators, observation wells, other equipment, and accessories used for groundwater and surface water control systems.

1. Removed materials and equipment become property of Contractor.

B. Restore areas disturbed by installation and removal of groundwater control systems and observation wells to their original condition.

C. Leave in place well-points and observation wells located:

1. Within plan limits of structures or pipelines.
2. Within zone below 1H:1V planes extending downward and out from edges of foundation elements or from downward vertical footprint of pipe.
3. Where removal would result in ground movements causing adverse settlement to adjacent ground surface, utilities, or existing structures.

D. Fill pulled casings holes with sand. Where left in place, fill casings with cement grout and cut off a minimum of 3 feet below finished ground level or 1 foot below foundation level to prevent interference with finished structures or pipelines.

E. When directed by the Engineer, leave observation wells in place for continued monitoring. Cut casings flush with final ground level when directed and provide protective lockable boxes with locking devices. Provide protective boxes suitable for traffic and other conditions to which observation wells will be exposed.

F. All required regulatory permits and notifications are to be made by the Contractor’s licensed well driller upon removal/abandonment of wells.

END OF SECTION 31 23 19

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SECTION 312323.33 - FLOWABLE FILL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Flowable fill for:

a. Structure backfill.
b. Utility bedding.
c. Utility backfill.
d. Filling abandoned utilities.

B. Related Requirements:

1. Section G9 “Structural Excavation” for general building excavation.
2. Section G5 "Granular Fill Materials" for soil and aggregate backfill.
3. Section G7 "Loaming, Hydroseeding and Permanent Erosion Control" for filling of topsoil over backfilled trenches to finish grade elevation.
4. Section G4 "Pipe Excavation, Trenching, Embedment, Encasement and Backfilling" for piping and bedding.

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, manhole, tank, or cable.

B. Excavatable Flowable Fill: Lean cement concrete fill used where future excavation may be required, such as fill for utility trenches, bridge abutments, and culverts.

C. Non-excavatable Flowable Fill: Lean cement concrete fill used where future excavation is not anticipated, such as fill below structure foundations and filling abandoned utilities.

1.4 ACTION SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Submittals:

1. Mix Design:

a. Furnish flowable fill mix design for each specified strength.
b. Furnish separate mix designs when admixtures are required for the following:

1) Flowable fill Work during hot and cold weather.
2) Air entrained flowable fill Work.

c. Identify design mix ingredients, proportions, properties, admixtures, and tests.
d. Sieve analysis of aggregate.

2. Furnish test results to certify flowable fill mix design properties meet or exceed specified requirements.

B. Delivery Tickets:

1. Furnish duplicate delivery tickets indicating actual materials delivered to Project Site.

C. Qualifications Statements:

1. Submit qualifications for supplier.

1.6 QUALITY ASSURANCE

A. Perform Work according to City of Georgetown standards.

B. Maintain a copy of each standard affecting the Work of this Section on Site.

C. All testing and inspection services required, unless otherwise specified, shall be provided and paid for by the Contractor. Testing necessary to establish the mix shall be performed by and at the expense of the Contractor. Methods of testing shall comply with the latest applicable ASTM Methods except as specified herein.

1.7 QUALIFICATIONS

A. Supplier:

1. Company specializing in supplying products specified in this Section with minimum three years' experience.
2. Product source approved by authority having jurisdiction.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Store or stockpile fly ash, aggregate and cement in conformity with the recommendations of ACI 301.

B. Minimum Conditions: Do not install flowable fill during inclement weather or when ambient temperature is less than 40 degrees F.

1.9 FIELD MEASUREMENTS

A. Verify field measurements before installing flowable fill to establish quantities required to complete the Work.

PART 2 - PRODUCTS

2.1 FLOWABLE FILL

A. Furnish materials according to City of Georgetown standards.

B. Flowable Fill: Excavatable type and non-excavatable type.

2.2 MATERIALS

A. Portland Cement: ASTM C150 Type I - Normal; Type II - Moderate; Type III - High Early Strength.

B. Fine Aggregates:

1. Inert natural sand.

    a. Aggregate sizes not greater than 3/8-inch.
    b. Satisfactory flowability, strength and setting time when used in comparable flowable fill mixes.
    c. Non-expansive or reactive aggregates.

C. Water: Clean and not detrimental to concrete.

2.3 ADMIXTURES

A. Manufacturers:

1. Furnish materials according to City of Georgetown standards.

B. Admixtures manufactured specifically for use in flowable fills will be considered for approval.

1. Free of chlorides and alkalis (except for those attributable to water).
2. Compatible with the mix.
3. Suitable for use in contact with potable water after curing.
4. Admixtures causing retarded or accelerated setting of the mix require written approval from the Engineer.

C. Air Entrainment: ASTM C260.

D. Chemical Admixture: ASTM C494/C494M.

1. Type A - Water Reducing.
2. Type B - Retarding.
3. Type C - Accelerating.
4. Type D - Water Reducing and Retarding.
5. Type E - Water Reducing and Accelerating.
6. Type F - Water Reducing, High Range.
7. Type G - Water Reducing, High Range and Retarding.

E. Fly Ash: ASTM C618 Class C or F obtained from residue of electric generating plant using ground or powdered coal.

F. Plasticizing: ASTM C1017/C1017M Type I, plasticizing. Type II, plasticizing and retarding.

2.4 MIXES

A. Mix and deliver flowable fill according to ASTM C94/C94M, Option C.

B. Flowable Fill Design Mix:

ITEM	EXCAVATABLE	NON-EXCAVATABLE
Cement Content	75 to 100 lb/cu yd	100 to 150 lb/cu yd
Fly Ash Content	None	150-600 pcf
Water Content	As specified	As specified
Air Entrainment	5 to 35 percent	5 to 15 percent
28-Day Compressive Strength	Maximum 100 psi.	Minimum 125 psi
Unit Mass (Wet)	80 to 110 pcf	100 to 125 pcf
Temperature, Minimum at Point of Delivery	50 degrees F	50 degrees F

C. Provide water content in design mix to produce self-leveling, flowable fill material at time of placement.

D. Design mix air entrainment and unit mass are for laboratory design mix and source quality control only.

2.5 SOURCE QUALITY CONTROL

A. Test and analyze properties of flowable fill design mix and certify results for the following:

1. Design mix proportions by weight of each material.
2. Aggregate: ASTM C33 for material properties and gradation.
3. Properties of plastic flowable fill design mix including:

    a. Temperature.
    b. Slump.
    c. Air entrainment.
    d. Wet unit mass.
    e. Yield.
    f. Cement factor.

4. Properties of hardened flowable fill design mix including:

    a. Compressive strength at 1 day, 7 days, and 28 days. Report compressive strength of each specimen and average specimen compressive strength.
    b. Unit mass for each specimen and average specimen unit mass at time of compressive strength testing.

B. Prepare delivery tickets containing the following information:

1. Project designation.
2. Date.
3. Time.
4. Class and quantity of flowable fill.
5. Actual batch proportions.
6. Free moisture content of aggregate.
7. Quantity of water withheld.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify excavation and trenching is complete.

B. Verify utility installation is complete and tested before placing flowable fill.

C. Verify excavation is dry.

3.2 PREPARATION

A. Support and restrain utilities to prevent movement and flotation during installation of flowable fill.

B. Protect structures and utilities from damage caused by hydraulic pressure of flowable fill before fill hardens.

C. Protect utilities and foundation drains to prevent intrusion of flowable fill.

3.3 INSTALLATION - FILL, BEDDING, AND BACKFILL

A. Engineer approval required for the condition of subgrade and method of placement.

B. Remove all debris and foreign matter from the excavation before depositing flowable fill.

C. Do not place flowable fill in water or submerge within 24 hours after placing.

D. Do not place flowable fill through flowing water.

E. Place flowable fill by chute, pumping or other methods approved by Engineer.

F. Place flowable fill in lifts to prevent lateral pressures from exceeding structural capacity of structures and utilities.

G. Place flowable fill evenly on both sides of utilities to maintain alignment.

H. Place flowable fill to elevations indicated on Drawings without vibration or other means of compaction.

3.4 INSTALLATION - FILLING ABANDONED UTILITIES

A. Verify pipes and conduits are not clogged and are sufficiently empty to permit gravity installation of flowable fill for entire length indicated to be filled.

B. Seal lower end of pipes and conduits by method to contain flowable fill and to vent trapped air caused by filling operations.

C. Place flowable fill using method to ensure there are no voids.

1. Fill pipes and conduits from high end.
2. Fill manholes, tanks, and other structures from grade level access points.

D. After filling pipes and conduits seal both ends.

3.5 FIELD QUALITY CONTROL

A. Perform inspection and testing according to ASTM C94/C94M.

1. Take samples for tests for every 150 cu yd of flowable fill, or fraction thereof, installed each day.

2. Prepare sample and test four compressive strength test cylinders per ASTM D4832. Test one specimen at 3 days, one at 7 days, and two at 28 days.
3. Measure temperature at point of delivery when samples are prepared.

B. Perform in place penetration (density) tests using handheld penetrometer to measure penetration resistance of hardened flowable fill according to ASTM C403.

1. Perform tests at locations as directed by Engineer**.**

C. Defective Flowable Fill: Fill failing to meet the following test requirements or fill delivered without the following documentation.

1. Test Requirements:

a. Minimum temperature at point of delivery.
b. Compressive strength requirements for each type of fill.

2. Documentation: Duplicate delivery tickets.

3.6 CLEANING

A. Remove spilled and excess flowable fill from Project Site.

B. Restore facilities and Site areas damaged or contaminated by flowable fill installation to existing condition before installation.

END OF SECTION 312323.33

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SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes temporary excavation and trench support and protection systems.

B. Related Requirements:

1. City of Georgetown Standard Specifications.
2. Section 312000 "Earthwork" for excavating and backfilling.
3. Section G3 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
4. Section 312319 "Dewatering" for lowering and disposing of ground water during construction and dewatering excavations.

1.3 DELEGATED DESIGN SUBMITTALS

A. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified professional engineer, meeting the minimum performance requirements in Part 2 of this Section.

1. Include overall system plan, indicating clearances, dimensions, material properties, member sizes, locations, spacing and member penetrations depths, and locations of various types of lateral supports.
2. Show details, layout, arrangement, equipment requirements, and method of construction of proposed excavation support system.
3. Indicate existing and proposed utilities, structures or other obstructions.
4. Show wall elevations and locations of bracing.
5. Show overall installation sequence and removal of bracing. Indicate work levels to be performed before bracing is installed or removed.
6. Method of preloading bracing, if required, including preload for each member, and method of locking-off the preload. Submit detailed drawings of connections, jacking supports, and method of shimming.
   Include procedures for resolving difficulties arising from misalignment of members exposed during excavation and criteria for implementing those procedures.

B. Design Calculations: For excavation support and protection system. Include analysis data prepared, signed, and sealed by professional engineer responsible for their preparation.

1. Include loads on excavation support system for all stages of excavation, bracing removal, and concrete placement, including material and equipment loads on adjacent ground during construction.
2. Include design of wall and bracing members including details for all construction stages.
3. Include theoretical deflections of excavation support system and deformation of structures, pipelines, and other improvements located within areas influencing excavations.

C. Submit to the Engineer for review and acceptance, a plan of action to be implemented in the event any deformation threshold value is reached. Identify positive measures in action plan to further limit wall movement, including but not limited to trenching for struts and wales, placement of granular earth berms against the wall, installation of additional struts, or combinations thereof.

1. Include description and details of mitigating measures, work schedule, location and availability of materials, and structural details for connections to wall and support elements.
2. Be prepared to work 24 hours per day to implement such measures.
3. Perform remedial work and mitigating measures at no additional cost to Owner.

1.4 INFORMATIONAL SUBMITTALS

A. Submit quality control measures to ensure that performance of excavation support system complies with project requirements.

B. Submit welder qualifications and weld procedures in accordance with AWS D1.1.

C. Qualification Data: For land surveyor.

D. Maintain at least one copy of design at job site during excavation that includes a plan indicating sizes, types, and configurations of the materials to be used in protective system. Identity registered Contractor’s design engineer who stamped the design.

E. Do not proceed with excavation support or protection activities until submittals have been reviewed by the Engineer.

1.5 QUALITY ASSURANCE

A. Contractor Qualifications: Minimum 5 years’ experience compatible to indicated Work, and who employs labor and supervisory personnel similarly experienced in Work of this Section.

B. Contractor's Design Engineer: Registered Professional Engineer in State where the work is located with at least 5 years’ professional experience in design and construction of support of excavation systems and having completed a minimum of 5 successful excavation support projects of equal type, size, and complexity to specified work.

C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

D. Regulatory Requirements: Comply with authorities having jurisdiction, including OSHA requirements.

E. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.6 FIELD CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Contact utility companies and other responsible authorities to locate and mark underground utilities.
2. Notify Owner no fewer than two days in advance of proposed interruption of utility.
3. Do not proceed with interruption of utility without Owner's written permission.

B. Project-Site Information: Geotechnical data has been collected for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent soil borings and tests, conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection according to the performance requirements.
2. The geotechnical data is included elsewhere in Project Manual.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Delegated Design: Engage a qualified professional engineer, as defined in Sections 013300 “Submittal Procedures” and 014000 “Quality Requirements”, to submit the items listed in the DELEGATED DESIGN SUBMITTALS Article.

B. Provide, design, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads within specified movement criteria.

1. Contractor Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Install excavation support and protection systems to minimize horizontal and vertical movements without damaging existing buildings, structures, and site improvements adjacent to excavation.

4. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

C. Do not permit excavations below the level of the base of adjacent existing foundations or retaining walls, unless excavation design and bracing includes an analysis of stability of structure supported by foundation and if necessary, incorporates required bracing or underpinning of foundation.

D. For support systems in which bracing is installed between opposite sides of the excavation, design excavation support of both sides to be nearly the same as feasible.

E. Where necessary to resist point loads, fill pipe piles used as soldier piles with concrete. Do not consider concrete strength in design of pipe pile for bending stress.

F. Design, install, operate, and maintain ground water control system to control ground water inflows, prevent piping or loss of ground, and maintain stability of the excavation. Refer to the requirements of Section 312319 “Dewatering.”

G. Design review and field monitoring activities by Owner or the Engineer does not relieve Contractor of its work responsibilities.

2.2 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Provide all material and equipment as required to install, monitor and maintain the excavation support system as designed by the Contractor’s Professional Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that instrumentation is installed and initialized prior to start of work required by this Section.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Obtain permits from local authority having jurisdiction prior to initiating excavation work.

B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

C. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
2. Install fencing, gates, lights, and signs around excavations and staging areas to provide for public safety.

D. Locate excavation support and protection systems clear of permanent construction so that construction and finishing of other work is not impeded.

3.3 GENERAL

A. Install excavation support systems in accordance with the shop drawings and applicable permits.

B. Fill voids between excavation support system and earth with materials acceptable to the Engineer.

C. If unstable material is encountered during excavation, take immediately measures to contain it in place and prevent ground displacement.

D. If settlement or deflections of supports indicate that support system requires modification to prevent excessive movements, redesign and resubmit revised shop drawings and calculations to the Engineer without additional compensation.

E. Maintain sufficient quantity of material on site for protection of work and for use in case of accident or emergency.

3.4 PORTABLE TRENCH BOXES

A. Use portable trench boxes or sliding trench shields only for worker protection.

B. Do not use trench boxes as tunnel launch and exit shafts unless specifically approved by Contractor’s Professional Engineer. Additional excavation, backfilling, and surface restoration required as result of trench box use shall be provided without additional compensation.

C. Design, construct, and maintain trench boxes or shields to meet acceptable engineering and industry standards.

D. Install shields in a manner to restrict lateral or other hazardous movement of the shield in the event of sudden lateral loads.

E. Maintain a written copy of trench box manufacturer's specifications, recommendations, and limitations at job site during excavation work.

3.5 SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation.

1. Install using impact hammer or vibratory hammer in predrilled holes.
2. Soldier Piles in Predrilled Holes:

    1. Provide casing or other methods of support to prevent caving of holes and loss of ground.
    2. Backfill with concrete from elevation of bottom excavation to pile tip elevation. Backfill remainder of predrilled hole with lean concrete or sand.
    3. Predrilled hole of sufficient diameter allowing for proper alignment and concrete backfilling of pile.

3. Install driven piles with driving shoes where hard driving is anticipated.
4. Advance driven soldier piles without aid of a water jet.

B. Extend soldier piles below excavation grade level to depths shown on reviewed Shop Drawings. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

C. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging.

1. Install lagging so ground loss does not occur between adjacent or below lowest board. As excavation proceeds, do not maximum height of 4 feet for unlagged face of excavation.
2. Do not exceed unlagged face of 2 feet, if water seeps or flows from excavation face or excavation face becomes unstable.

D. Fill voids behind lagging with soil, and compact.

E. Install wales at locations indicated on Drawings and secure to soldier piles.

3.6 STEEL SHEET PILING

A. Thoroughly cleaned and inspect sheet piles for defects and proper interlock dimensions prior to installation. Provide a tool for checking interlock dimensions.

B. Before starting excavation, drive one-piece sheet piling lengths in plumb position and tightly interlock vertical edges for its entire length to form a continuous barrier. Form a continuous diaphragm throughout length of each run of wall, bearing tightly against original ground.

1. Exercise care in driving so interlocking members can be extracted without damaging adjacent structures or utilities.
2. Use driving, cutting, and splicing methods conforming to approved Shop Drawings.
3. Use templates or other temporary alignment facilities to maintain piling line.

C. Accurately place piling, using templates and guide frames unless otherwise recommended in writing by sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 5 feet . Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

D. Install each sheet pile having sufficient clearance in interlocks to slide under its own weight into interlock of previously placed sheet pile.

E. Do not excavate in advance of steel sheet piling installation.

F. Where obstructions are anticipated, pre-excavate or pre-drill along sheet pile wall alignment without additional compensation. Do not extend pre-excavation and pre-drilling below lowest excavation level or into bearing soils for existing or future structures.

G. Remove obstructions encountered before the specified embedment for piles. Where obstructions cannot be removed, re-evaluate sheet pile system by Contractor's design Professional Engineer to show reduced embedment and additional toe stability measures to be implemented for sheet pile wall realignment. Submit proposed design measures to the Engineer for review.

H. Withdraw damaged or faulty aligned pilings with provide new piling, driven properly in its place without additional compensation.

I. Cut tops of sheet piling to uniform elevation at top of excavation.

3.7 LINER PANELS

A. Install liner plates as soon as excavation has progressed sufficiently to install next complete circumferential ring of liner plates. Complete ring of liner plates prior to continuing excavation.

1. Do not install more than one ring of liner plates at any time.

B. Stagger plates in vertical direction to facilitate shaft strength and leakage resistance.

C. Grout liner plates in accordance with approved Shop Drawings.

3.8 INTERNAL BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work, unless otherwise approved by the Engineer.
2. Install internal bracing if required to prevent spreading or distortion of braced frames.
3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

B. Provide internal bracing to carry maximum design load without distortion or buckling.

C. Include web stiffeners, plates, or angles required to prevent rotation, crippling, or buckling of connections and points of bearing between structural steel members. Allow for eccentricities caused by field fabrication and assembly.

D. Install and maintain bracing support members in tight contact with each other and with the surface being supported.

E. Coordinate excavation work with installation of bracing. Extend excavation no more than 2 feet below any brace level prior to installation of the bracing.

F. Use procedures that produce uniform loading of bracing member without eccentricities, overstressing, or distortion of system members.

3.9 FIELD QUALITY CONTROL

A. Survey-Work Benchmarks: Resurvey benchmarks regularly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Engineer if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.

C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

3.10 REMOVAL

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.

1. Fill voids immediately with approved backfill compacted to density specified in Section 312000 "Earthwork."
2. Repair or replace, as approved by Engineer, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Do not remove vertical support members that were installed within zone of influence of new or existing structures. Cut off support members installed within this zone at 5 feet below finished grade and abandon in place.

C. Do not remove internal bracing or transfer loads to permanent structure without prior acceptance of the Engineer.

D. Begin removal at excavation bottom and progress upward. Slowly release members noting indication of possible failure of remaining members or possible cave-in of excavation sides.

E. Progress backfilling together with removal of support systems from excavations.

F. Remove all portions of excavation support, unless otherwise indicated by approved Shop Drawings.

1. Zone of Influence Definition: Zone extending down and away from outer edge of the structure at 1 horizontal to 1 vertical.

G. Do not leave wood as part of abandoned portion of the work.

H. When removing excavation support system, do not disturb or damage adjacent buildings, structures, waterproofing material, or utilities. Fill voids immediately with lean concrete or well-graded cohesionless sand or as directed by the Engineer.

I. Immediately remove excavation support system material from site.

END OF SECTION 315000

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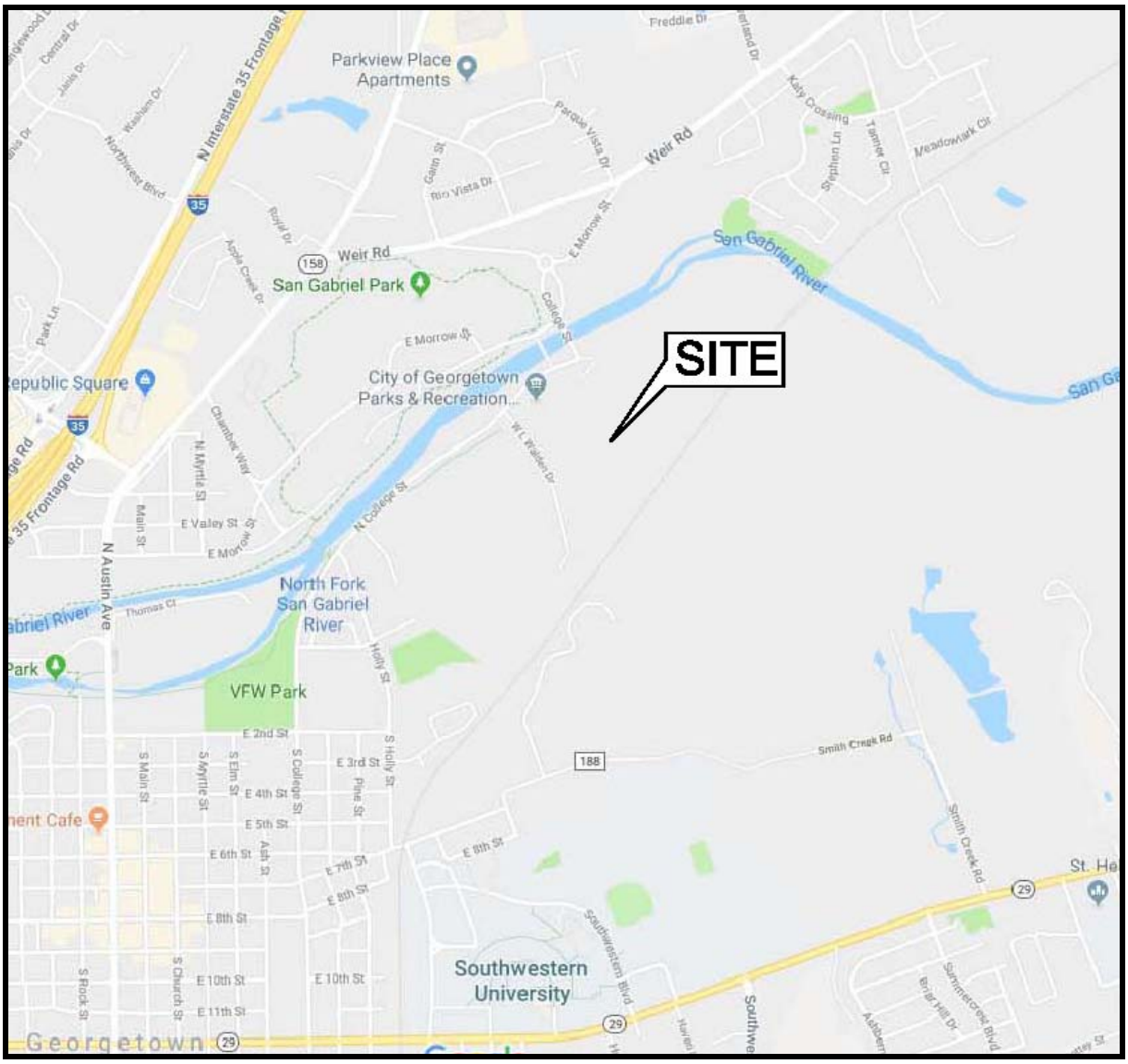
Division 31 Earthwork

Appendix A – Boring Logs



Site Location Map
Proposed Improvements to the
San Gabriel WWTP
North College Street
Georgetown, Texas
Project No. 218189.004

SCALE: NOT TO SCALE

PLAN OF BORINGS
PROPOSED IMPROVEMENTS TO
THE SAN GABRIEL WWTP
NORTH COLLEGE STREET
GEORGETOWN, TEXAS
PROJECT NO. 218189.004

Kohutek Engineering & Testing, Inc.

BORING NUMBER B-1

Kohutek Engineering & Testing, Inc.

CLIENT CDM Smith **PROJECT NAME** Proposed Improvements to the San Gabriel WWTP

PROJECT NUMBER 218189.004 **PROJECT LOCATION** North College Street, Georgetown, Texas

DATE STARTED 11/6/18 **COMPLETED** 11/6/18 **NOTES**

LOGGED BY LB **CHECKED BY** GLK **GROUND ELEVATION** **HOLE SIZE** 6 inches

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY (RQD) %	N VALUE	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	SIEVE ANALYSIS: MINUS #4 (%)	SIEVE ANALYSIS: MINUS #200 (%)
0		FILL, clayey SAND with gravel, damp, dense, light brown				14					
		(SC) clayey SAND with gravel, damp, dense, light brown				7	25	17	8		
		...very gravelly (<25%, 1")									
5				N = 50/4"		5					
		(GC) clayey GRAVEL, sandy, damp, dense, light brown				2					
						3					
		(SC) clayey SAND with gravel, damp, dense, light brown									
10				N = 38		7					
						8					
15				N = 72		6					
		▼ ...ground water stabilized				9					
		...more clayey									
						9					
20		(CL) lean CLAY, sandy and gravelly, very moist, stiff, brown Qt		N = 50/4"		13					
		Bottom of borehole at 20.5 feet.									
25											

GEOTECH BH WITHOUT LINES - GINT STD US LAB.GDT - 11/7/18 16:48 - T:\LABSRPT\2018\218189.004\218189.004.GPJ

BORING NUMBER B-2

Kohutek Engineering & Testing, Inc.

CLIENT CDM Smith **PROJECT NAME** Proposed Improvements to the San Gabriel WWTP

PROJECT NUMBER 218189.004 **PROJECT LOCATION** North College Street, Georgetown, Texas

DATE STARTED 11/6/18 **COMPLETED** 11/6/18 **NOTES**

LOGGED BY LB **CHECKED BY** GLK **GROUND ELEVATION** **HOLE SIZE** 6 inches

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY (RQD) %	N VALUE	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	SIEVE ANALYSIS: MINUS #4 (%)	SIEVE ANALYSIS: MINUS #200 (%)
0		FILL, clayey SAND with gravel, damp, dense, brown				14					
		(SC) clayey SAND with gravel, damp, dense, light brown				8					
5		...more sandy		N = 17		13					
		...light reddish brown				10	21	12	9		
						12					
10		...more clayey		N = 13		14					
						15					
		...very sandy and gravelly									
15				N = 36		17					
		...ground water stabilized				16					
		(CL) lean CLAY with sand, gravelly, wet, stiff, light brown				10					
20		Qt		N = 50/4"		16					
		Bottom of borehole at 20.5 feet.									
25											

BORING NUMBER B-3

Kohutek Engineering & Testing, Inc.

CLIENT CDM Smith **PROJECT NAME** Proposed Improvements to the San Gabriel WWTP

PROJECT NUMBER 218189.004 **PROJECT LOCATION** North College Street, Georgetown, Texas

DATE STARTED 11/6/18 **COMPLETED** 11/6/18 **NOTES**

LOGGED BY LB **CHECKED BY** GLK **GROUND ELEVATION** **HOLE SIZE** 6 inches

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY (RQD) %	N VALUE	POCKET PEN. (tsf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	SIEVE ANALYSIS: MINUS #4 (%)	SIEVE ANALYSIS: MINUS #200 (%)
0		(CL) lean CLAY with sand, gravelly, moist, stiff, brown				9					
						8	36	16	20		
5		...very gravelly, reddish brown		N = 78		10					
						7	26	13	13		
		...light brown									
10				N = 50+		4					
						5					
15		...wet		N = 74		9					
						9					
20		...damp, very stiff, tan Qt		N = 100		9					
		Bottom of borehole at 20.5 feet.									
25											

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EXPLORATION PLAN

City of Georgetown – San Gabriel WWTP Improvements ■ Georgetown, Texas
November 9, 2022 ■ Terracon Project No. 96215180

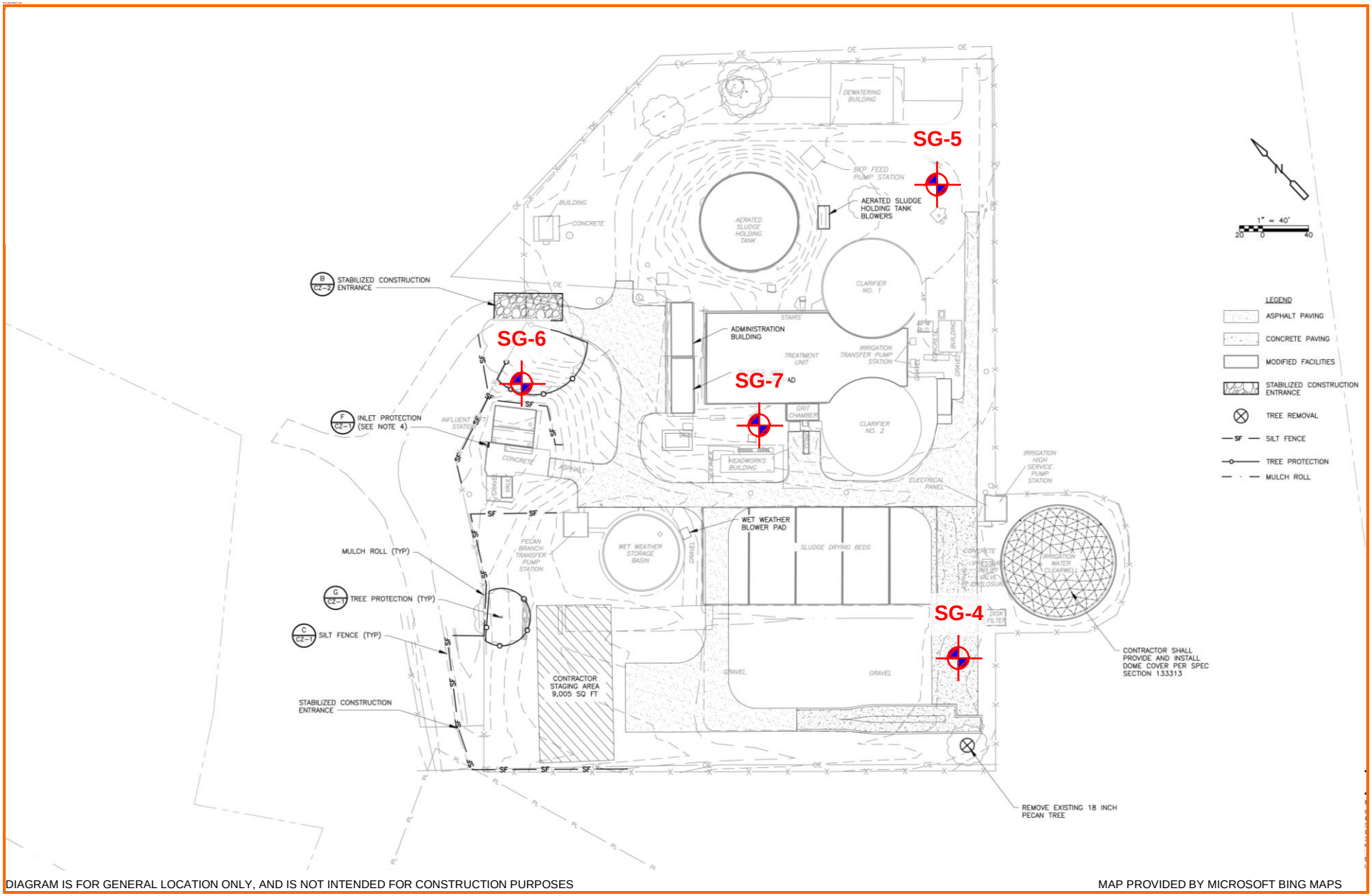

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Note: All attachments are one page unless noted above.

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BORING LOG NO. SG-4

PROJECT: CoG San Gabriel WWTP Rehabilitation

CLIENT: CDM Smith Inc
Houston, TX

SITE: N College St
Georgetown, TX

LOCATION See Exploration Plan

Latitude: 30.6487° Longitude: -97.6623°

Approximate Surface Elev.: 686.5 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%) RQD (%)	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
1		0.0	686.5+/-												
							14-35-15 N=50					7.3			
		2.0	684.5+/-												
2							6-6-10 N=16					12.5		56-19-37	43
							44-50/6"					4.0			
		6.0	680.5+/-	5			50/4"					4.4			
3							50/5"					13.7			
				10				33/7							
		16.0	670.5+/-	15					UC	5.35	4.4	12.6	126		
4								100/20							
				20				85/27	UC	110.86		3.0	142		
		25.0	661.5+/-	25											

FILL - CLAYEY SAND WITH GRAVEL (SC), light brown to light gray, dense

CLAYEY GRAVEL WITH SAND (GC), reddish brown to light brown, medium dense to very dense

- with limestone fragments below ~4 feet

WEATHERED LIMESTONE, light tan to pale brown, extremely fractured, with frequent marly/clayey seams

LIMESTONE, gray to light gray, highly fractured, with marly/clayey seams

Boring Terminated at 25 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered to 10 feet; Air Rotary thereafter

Abandonment Method:
Boring backfilled with Auger Cuttings and/or Bentonite

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations obtained via Google Earth Imagery.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
5307 Industrial Oaks Blvd Ste 160
Austin, TX

Boring Started: 07-12-2022 | Boring Completed: 07-12-2022

Drill Rig: CME 45 | Driller: Austin Geo-Logic

Project No.: 96215180

BORING LOG NO. SG-5

PROJECT: CoG San Gabriel WWTP Rehabilitation

CLIENT: CDM Smith Inc
Houston, TX

SITE: N College St
Georgetown, TX

LOCATION See Exploration Plan

Latitude: 30.6496° Longitude: -97.6614°

Approximate Surface Elev.: 688.5 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%) RQD (%)	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
2		0.0	688.5+/-												
							10-11-24 N=35					2.4		55-20-35	31
							38-41-47 N=88					2.7			
				5			24-23-14 N=37					3.0			
							10-8-9 N=17					5.0		17-13-4	23
							3-3-6 N=9					13.1			
		13.0	675.5+/-	10											
3							50/5"					15.6			
				15											
							50/6"								
		21.0	667.5+/-	20											
4							50/4"								
		25.0	663.5+/-	25											

2 — **CLAYEY GRAVEL WITH SAND (GC)**, light brown to light tan, dense to very dense

SILTY CLAYEY SAND WITH GRAVEL (SC-SM), brown to tan, loose to medium dense

3 — **WEATHERED LIMESTONE**, light tan to pale brown

4 — **LIMESTONE**, gray to light gray

Boring Terminated at 25 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered to 25 feet

Abandonment Method:
Boring backfilled with Auger Cuttings and/or Bentonite

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations obtained via Google Earth Imagery.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
5307 Industrial Oaks Blvd Ste 160
Austin, TX

Boring Started: 07-13-2022 | Boring Completed: 07-13-2022

Drill Rig: CME 45 | Driller: Austin Geo-Logic

Project No.: 96215180

BORING LOG NO. SG-6

PROJECT: CoG San Gabriel WWTP Rehabilitation

CLIENT: CDM Smith Inc
Houston, TX

SITE: N College St
Georgetown, TX

LOCATION See Exploration Plan

Latitude: 30.6499° Longitude: -97.6626°

Approximate Surface Elev.: 682.0 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%) RQD (%)	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
2		0.0	682.0												
							13-13-50/6"					3.2		45-16-29	38
							50/6"					2.4			
				5	▽		10-29-30 N=59					12.0			
							16-20-50/6"					15.5		33-16-17	89
							12-50/5"					13.8			
				10											
		4.0	678+/-				50/4"								
3				15				20/0							
		20.0	662+/-												
4				20				88/7	UC	43.38		7.6	133		
		25.0	657+/-	25											

CLAYEY GRAVEL WITH SAND (GC), light brown to light gray, very dense

LEAN CLAY (CL), tan to gray, hard

WEATHERED LIMESTONE, gray to light gray, extremely fractured, with frequent marly/clayey seams

LIMESTONE, gray to light gray, extremely fractured, with marly/clayey seams

Boring Terminated at 25 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered to 15 feet; Air Rotary thereafter

Abandonment Method:
Boring backfilled with Auger Cuttings and/or Bentonite

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations obtained via Google Earth Imagery.

Notes:

WATER LEVEL OBSERVATIONS

▽ *5.0 feet while Drilling*

Terracon
5307 Industrial Oaks Blvd Ste 160
Austin, TX

Boring Started: 07-12-2022 | Boring Completed: 07-12-2022

Drill Rig: CME 45 | Driller: Austin Geo-Logic

Project No.: 96215180

BORING LOG NO. SG-7

PROJECT: CoG San Gabriel WWTP Rehabilitation

CLIENT: CDM Smith Inc
Houston, TX

SITE: N College St
Georgetown, TX

LOCATION See Exploration Plan

Latitude: 30.6495° Longitude: -97.6622°

Approximate Surface Elev.: 688.5 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%) RQD (%)	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
1		2.0	686.5+/-				11-36-36 N=72					6.7			
2		13.0	675.5+/-				14-12-10 N=22								
				5			5-5-4 N=9					3.0		23-14-9	11
							3-5-5 N=10					2.2			
				10			4-5-9 N=14					7.8			
3		25.0	663.5+/-	15			3-6-50/4"								
				20			12-7-50/4"					13.4			
				25			20-50/2"								

1 FILL - CLAYEY SAND WITH GRAVEL (GC), light brown to light gray, very dense

2 POORLY GRADED GRAVEL WITH CLAY AND SAND (GP-GC), light tan to pale brown, loose to medium dense

3 WEATHERED LIMESTONE, tan to light tan

Boring Terminated at 25 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered to 25 feet

Abandonment Method:
Boring backfilled with Auger Cuttings and/or Bentonite

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations obtained via Google Earth Imagery.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
5307 Industrial Oaks Blvd Ste 160
Austin, TX

Boring Started: 07-13-2022 | Boring Completed: 07-13-2022

Drill Rig: CME 45 | Driller: Austin Geo-Logic

Project No.: 96215180

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General building applications of concrete are included in Section 033000 “Cast-in-Place Concrete.”

C. Joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction are included in Section 321373 “Concrete Paving Joint Sealants.”

D. Pavement Markings are included in Section SD5 “Striping.”

1.2 SUMMARY

A. Section Includes:

1. Aggregate base course.
2. Concrete paving: Constructing Portland cement concrete pavement, plain or reinforced in accordance with these specifications and with the lines, grades and dimensions shown on the plans. Specifically, the work includes:

    a. Designing the concrete mix.
    b. Preparation of subgrade and subbase material.
    c. Installation of steel reinforcement, dowel bars and tie bars.
    d. Furnishing, transporting, placing, consolidating, finishing and texturing of concrete.
    e. Furnishing concrete admixtures and additives.
    f. Constructing all joints and furnishing joint materials.
    g. Marking the pavement.
    h. Curing the pavement and furnishing all curing materials.

3. Quality Control of Concrete paving includes:

    a. Furnishing concrete necessary for making test beams and/or cylinders.
    b. Performing maturity testing.
    c. Coring and patching the pavement.
    d. Calibrating and checking the operation of batching equipment.
    e. Taking actions necessary to prevent or to repair cracking.
    f. Sawing and sealing joints.
    g. Verifying dowel bar alignment.
    h. Removing and replacing, or repair of defective pavement.

B. Related Requirements:

1. Section 033000 “Cast-In-Place Concrete” for general building applications of concrete.
2. Section 321373 “Concrete Paving Joint Sealants” for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
3. Section SD5 “Striping” for pavement markings.

1.3 PRE-INSTALLATION MEETINGS

A. Pre-installation Meeting: Conduct meeting at Project site.

1. Review methods and procedures related to concrete paving, including but not limited to, the following:

   a. Concrete mixture design.
   b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete paving Subcontractor.
   e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

1.4 ACTION SUBMITTALS

A. Submit detailed information on materials proposed and installation methods.

B. Product Data: Submit data on material and equipment to be used in concrete pavement including:

1. Sources of aggregate, manufacturer data sheets for cement and concrete admixtures used in the concrete mix design.
2. Dowels and dowel bar assemblies.
3. Reinforcement or welded wire mesh.
4. Equipment to be used for placement, consolidation finishing, texturing and curing of concrete pavement.
5. Material and equipment to be used for joint installation including joint fillers, joint sealants, and saw-cutting and joint cleaning equipment.

C. Proposed Techniques: submit proposed techniques for placement, consolidation, finishing texturing and curing of concrete, and methods of concrete joint installation.

D. Pavement jointing plan showing joint types based on the proposed methods of installation.

E. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

F. Samples for Verification: For each type of product or exposed finish, prepared as Samples of size indicated below:

1. Exposed Aggregate: 10 lb Sample of each mix.

G. Concrete Mix Design Data:

1. Submit concrete mix design for each concrete strength.
2. Identify mix ingredients and proportions, including admixtures.
3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

H. Source Quality Control Submittals: Indicate results of factory tests and inspections.

1.5 PRECONSTRUCTION TESTING

A. Construct a test section consisting of minimum three panels in length by one panel width, including or as approved by the Engineer. Include paving, joints, surface texture, exposed aggregate, and specified slope in test section.

B. Locate the test section as directed or approved by the engineer**.** The test section will be part of the actual pavement area.

C. Incorporate accepted test section as part of Work.

1.6 FIELD CONDITIONS

A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

B. Do not begin placement of concrete unless the ambient temperature is at least 35 degrees F and rising.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Mix Design Requirements: Design concrete mix in accordance with 325.14R-17 (Guide for Design and Proportioning of Concrete Mixtures for Pavements).

B. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

D. Steel Reinforcement

1. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from as-drawn steel wire into flat sheets.
2. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.
3. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884/A884M, Class A, plain steel.
4. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.
5. Galvanized Reinforcing Bars: ASTM A767/A767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A615/A615M, Grade 60 deformed bars.
6. Epoxy-Coated Reinforcing Bars: ASTM A775/A775M or ASTM A934/A934M; with ASTM A615/A615M, Grade 60 deformed bars.
7. Steel Bar Mats: ASTM A184/A184M; with ASTM A615/A615M, Grade 60 deformed bars; assembled with clips.
8. Plain-Steel Wire: ASTM A1064/A1064M, as drawn.
9. Deformed-Steel Wire: ASTM A1064/A1064M.
10. Epoxy-Coated-Steel Wire: ASTM A884/A884M, Class A; coated..
11. Dowel Bars: ASTM A615/A615M, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.
12. Epoxy-Coated, Joint Dowel Bars: ASTM A775/A775M; with ASTM A615/A615M, Grade 60 plain-steel bars.
13. Tie Bars: ASTM A615/A615M, Grade 60; deformed.
14. Hook Bolts: ASTM A307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
15. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
16. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
17. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
18. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.
19. Zinc Repair Material: ASTM A780/A780M.

2.2 CONCRETE MATERIALS

A. Cementitious Materials: Provide cementitious materials consisting of portland cement, blended, cement or only portland cement in combination with supplementary cementitious materials (SCM), that conform to appropriate specifications listed below. Use cementitious materials, of same type, brand, and source throughout Project.

1. Portland Cement: ASTM C150/C150M, gray portland cement Type I.

2. Blended Hydraulic Cement: Provide blended cement conforms to ASTM C595/C595M, Type IP or IS. Type IP blend shall only include ASTM C618 Class F or Class N pozzolan. Include in written statement from the manufacturer that the amount of pozzolan in the finished cement does not vary more than plus or minus 5 mass percent of the finished cement throughout production for the project.
3. Supplementary Cementitious Materials (SCMs):

    a. Fly Ash: ASTM C618, Class F.
    b. Raw or Calcined Natural Pozzolan: ASTM C618, Class N.
    c. Slag Cement: ASTM C989/C989M, Grade 120.

B. Aggregates:

1. Normal-Weight Aggregates: ASTM C33/C33M, Class 4M, uniformly graded. Provide aggregates from a single source.
2. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Admixtures:

1. Air-Entraining Admixture: ASTM C260/C260M.
2. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
3. Water-Reducing Admixture: ASTM C494/C494M, Type A.
4. Retarding Admixture: ASTM C494/C494M, Type B.
5. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
6. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
7. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
8. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

2.3 CURING MATERIALS

1. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.
2. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
3. Water: Potable.

B. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BASF Corporation-Construction Systems.
    b. Bon Tool Co.
    c. Brickform; a division of Solomon Colors.
    d. ChemMasters, Inc.
    e. Dayton Superior.

f. Euclid Chemical Company (The); an RPM company.
g. Kaufman Products, Inc.
h. L&M Construction Chemicals, Inc.
i. Lambert Corporation.
j. Metalcrete Industries.
k. Nox-Crete Products Group.
l. Sika Corporation.
m. SpecChem, LLC.
n. TK Products.
o. Vexcon Chemicals Inc.
p. W.R. Meadows, Inc.
q. Or equal.

C. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork in preformed strips.

D. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

E. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

F. Epoxy-Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

G. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ChemMasters, Inc.
b. Dayton Superior.
c. Euclid Chemical Company (The); an RPM company.
d. Kaufman Products, Inc.
e. Nox-Crete Products Group.
f. QC Construction Products.
g. Scofield, L. M. Company.
h. Sika Corporation.
i. SpecChem, LLC.
j. TK Products.
k. Vexcon Chemicals Inc.
l. W.R. Meadows, Inc.
m. Or equal.

H. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Anti-Hydro International, Inc.
    b. BASF Corporation-Construction Systems.
    c. Bon Tool Co.
    d. Brickform; a division of Solomon Colors.
    e. Butterfield Color.
    f. Dayton Superior.
    g. Decosup Inc.
    h. Dynamic Color Solutions, Inc.
    i. Euclid Chemical Company (The); an RPM company.
    j. H&C Concrete Care Products.
    k. Kaufman Products, Inc.
    l. L&M Construction Chemicals, Inc.
    m. Lambert Corporation.
    n. Metalcrete Industries.
    o. Proline Concrete Tools, Inc.
    p. QC Construction Products.
    q. Scofield, L. M. Company.
    r. Specialty Concrete Products, Inc.
    s. Stampcrete International, Ltd.
    t. SuperStone, Inc.
    u. SureCrete Design Products.
    v. Or equal.

2. Color: As indicated by manufacturer's designation.
3. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8 inchsieve and 85 percent retained on a No. 8 sieve.

2.4 STAMPED DETECTABLE WARNING MATERIALS

A. Detectable Warning Stamp: Semi-rigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ADA Solutions, Inc.
2. Advanced Surfaces Inc.
3. Butterfield Color.
4. Stampcrete International, Ltd.
5. Transpo Industries, Inc.
6. Or equal.

C. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation designed to facilitate release of stamp mats.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advanced Surfaces Inc.
b. Artcrete, Inc.
c. Bon Tool Co.
d. Brickform; a division of Solomon Colors.
e. Butterfield Color.
f. Decosup Inc.
g. Matcrete Inc.
h. Proline Concrete Tools, Inc.
i. QC Construction Products.
j. Scofield, L. M. Company.
k. Southern Color N.A., Inc.; a division of Rockwood Pigments.
l. Specialty Concrete Products, Inc.
m. Stampcrete International, Ltd.
n. SuperStone, Inc.
o. Or equal.

2.5 CONCRETE MIXTURES REQUIREMENTS

A. General:

1. Prepare design mixtures, proportioned according to ACI 325.14R-17, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
2. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
3. Design the mix to achieve a 28-day compressive strength of 4000 psi.
4. Design the mix with 0.50 maximum W/C ratio at the point of placement.
5. Maximum slump at the point of placement: 4 inch.
6. Provide a concrete mix with minimum cementitious material (i.e. Portland cement + supplemental cementitious material) content meeting the requirements of Table 5.4.5.1a of ACI 325.14R-17.

B. Aggregate:

1. Provide coarse and fine aggregate for the concrete mix from sources approved by Texas DOT.
2. Provide coarse and fine aggregate consisting of clean, hard, durable particles meeting the requirements of ASTM C33/C33M.
3. Provide coarse aggregate with 1-1/2 inch nominal maximum aggregate size.
4. Coarse and fine aggregate shall consist of particles that are generally spherical or cubical in shape.
5. Coarse aggregates shall be clean and free of deleterious material as follows:

a. Clay lumps and friable particles (ASTM C142/C142M) < 0.25 percent by mass.

b. Material finer than 0.075 mm No. 200 sieve (ASTM C117): < 1.0 percent.
c. Lightweight particles (ASTM C123/C123M): < 1.0 percent.
d. Total of all deleterious substances, exclusive of material finer than 0.075 mm No. 00 sieve: < 5.0 percent.

6. Fine aggregates shall be clean and free of deleterious material as follows:

a. Clay lumps and friable particles (ASTM C142/C142M) < 1.0 percent by mass.
b. Material finer than 0.075 mm No. 200 sieve (ASTM C117): < 3.0 percent.
c. Lightweight particles ASTM C123/C123M: < 0.5 percent.

7. The aggregate shall not have potential for alkali-silica reactivity (ASR) with cement as determined by ASTM C1778 or AASHTO PP65.
8. Provide coarse aggregate with no more than 40 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C131/C131M.
9. The combined coarse and fine aggregate grading shall be optimized in accordance with the guidelines of Section 5.4.10 of ACI 325.14R-17.

C. Portland Cement:

1. Provide ASTM C150/C150M Portland Cement Type I or II.

D. Supplementary Cementitious Materials (SCMs): Supplementary Cementitious Materials used in paving concrete shall conform to the following requirements:

1. Fly Ash: Provide fly ash that conforms to ASTM C618, Class F.
2. Natural Pozzolan: natural pozzolan that is raw or calcined shall conform to ASTM C618, Class N.
3. Slag Cement: Provide slag cement (ground-granulated blast-furnace slag) that conforms to ASTM C989/C989M, Grade 100 or Grade 120.
4. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

a. Fly Ash + Natural Pozzolan: 35 percent.
b. Slag Cement: 50 percent.
c. Combined Fly Ash and Slag Cement: 50 percent, with fly ash not exceeding 25 percent.
d. Combined Pozzolan and Slag Cement: 50 percent, with Pozzolan not exceeding 25 percent.

E. Concrete Admixtures:

1. General: Concrete chemical admixtures may include water reducers, retarders, accelerators, air-entrainers. When multiple admixtures in the same mixture, incompatibility issues should be avoided by using admixtures from the same manufacturer.
2. Air Entrainment Admixture (ASTM C260): Add air-entraining admixture to result in normal-weight concrete at point of placement having an air content of 4.5+/-1.5 percent. The amount of air entrainment admixtures to be added shall be determined based on the admixture’s manufacturer recommendations and trial mixes.

3. Water-Reducing Admixtures (WRAs): Use water-reducing admixture when required to increase strength and improve workability. Normal WRAs, ASTM C494/C494M Type A and water-reducing and retarding admixtures, Type D. High-range water-reducing admixtures (HRWRAs) shall be of Types F or G.
4. Retarding Admixtures: When used, retarders shall be ASTM C494/C494M Type A or Type D.

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Furnish batch tickets for each batch discharged and used in the Work.

B. When air temperature is between 85 and 90 degrees F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.

C. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

2.7 SOURCE QUALITY CONTROL

A. Provide mix design for concrete roadway pavement, concrete driveway pavement, and concrete sidewalk.

B. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of Work.

C. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.

D. Test samples according to ASTM C94/C94M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

C. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.

D. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.

E. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

G. Ensure that sufficient area is prepared and compacted beyond the edge of paving. This area will be used as a wheel track for the paver or as a foundation for the side forms.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. The grade must be kept uniformly moist immediately before concrete is placed. Verify that the base is sprinkled sufficiently ahead of the paving train to keep the material moist without ponding water.

3.3 INSTALLATION

A. Edge forms and screed:

1. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
2. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

B. Steel Reinforcement:

1. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
2. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
3. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
4. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
5. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.
6. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D3963/D3963M.

7. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2 inch overlap of adjacent mats.
8. Install dowel bars and support assemblies at joints as shown on the plans. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint. Ensure that dowel bars and tie bars are placed in accordance with the dimensions and provisions of the Contract Plans. Ensure that dowels are of the correct size and length. Apply lubricant to one half of the dowel length but not to the tie bars. Ensure that joint locations are properly and accurately marked for the saw crew.

C. Joints:

1. Construct joints that conform to the locations and details in the plans. Joints shall be constructed perpendicular to the finished grade of the pavement. Provide joints that are straight and continuous from edge to edge or end to end of the pavement with no abrupt offset and no gradual deviation greater than 1/2 inch.
2. Change from the jointing pattern shown on the design drawings or the approved shop drawings is not allowed without written approval.
3. Seal joints immediately following curing of the concrete or as soon thereafter as weather conditions permit.
4. When Joints intersect each other, it should be at a right angle. Also, joints should form 90-degree angles with free pavement edges. When the alignment of a joint is less than 90 degrees with a free edge, route the last 3 feet of the joint to run perpendicular to the free edge.
5. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated on the plans. When new joints mismatch existing joints, provide steel reinforcement for the first row of panels in the new concrete pavement.
6. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
7. Provide tie bars at sides of paving strips where indicated.
8. Contraction (Control) Joints: The purpose of contraction joints is to relieve early shrinkage stress within the pavement.

    a. Contraction joints must be cut as soon as the concrete has hardened enough to support the saw equipment and allow cutting without excessive chipping, spalling or tearing of the cut.
    b. Require immediate correction of the operation if excessive raveling occurs during sawing.
    c. If a sharp edge joint is being obtained on control cutting, it can generally be regarded that the concrete has hardened excessively, and sawing is being conducted late.

9. Verify that joints are centered over dowels.

    a. Saw the joints at the required spacing consecutively in the sequence of the concrete placement.
    b. Immediately after the joint is sawed, thoroughly flush the saw cut and adjacent concrete surface with water and vacuumed until all waste from sawing is removed from the joint and adjacent concrete surface.
    c. Respray the surface around the joint with curing compound as soon as free water disappears.

d. Take necessary precautions to ensure that the concrete is properly protected from damage and cured at sawed joints.
e. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, or as shown on the plans. Construct contraction joints by grooving or saw-cutting as follows:

10. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8 inch radius. Repeat grooving of contraction joints after applying surface finishes.

    a. Tolerance: Ensure that grooved joints are within 3 inch either way from centers of dowels.

11. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

    a. Tolerance: Ensure that sawed joints are within 3 inch either way from centers of dowels.

12. Construction Joints: Set construction joints at side forms and at end terminations of paving where paving operations are stopped for more than one-half hour. Provide construction joints at a planned joint location. Install dowels, tie bars in the construction joints, or thicken the edges as indicated.
13. Isolation/ Expansion Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

    a. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
    b. Terminate joint filler not less than 1/2 inch or more than 1 inchbelow finished surface if joint sealant is indicated.
    c. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
    d. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

14. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8 inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

D. Concrete Hauling and Placement:

1. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
2. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

3. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
4. Provide transporting equipment designed and operated to deliver and discharge the required concrete mixture completely without segregation.
5. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
6. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing is completed.
7. Deposit and spread concrete in a continuous operation inside formed area. Transporting equipment is not to be allowed to operate on the prepared and compacted underlying material. Do not push or drag concrete into place or use vibrators to move concrete into place.
8. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Insert vibrators into the concrete to a depth that provides the best full-depth consolidation but not closer to the underlying material than 2 inches (50 mm). Insert hand-operated vibrators between 6 to 15 inches (150 to 400 mm) on centers. Excessive vibration is not permitted. Any evidence of inadequate consolidation (honeycomb along the edges, large air pockets, or any other evidence) requires the immediate stopping of the paving operation and approved adjustment of the equipment or procedures.
9. Consolidate concrete along face of forms with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.
10. Screed paving surface with a straightedge and strike off.
11. Initial floating stage between screeding and final float finish is included in this article rather than in "Concrete Protection and Curing" Article.
12. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
13. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

E. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

F. Detectable Warning Installation:

1. Blockouts: Form blockouts in concrete for installation of detectable paving units.
2. Tolerance for Opening Size: Plus 1/4 inch, no minus.
3. Cast-in-Place Detectable Warning Tiles: Form blockouts in concrete for installation of tiles. Screed surface of concrete where tiles are to be installed to elevation, so that edges of installed tiles will be flush with surrounding concrete paving. Embed tiles in fresh concrete immediately after screeding concrete surface.

4. Stamped Detectable Warnings: Install stamped detectable warnings as part of a continuous concrete paving placement and according to stamp-mat manufacturer's written instructions.

    a. Before using stamp mats, verify that the vent holes are unobstructed.
    b. Apply liquid release agent to the concrete surface and the stamp mat.
    c. Stamping: While initially finished concrete is plastic, accurately align and place stamp mats in sequence. Uniformly load, gently vibrate, and press mats into concrete to produce imprint pattern on concrete surface. Load and tamp mats directly perpendicular to the stamp-mat surface to prevent distortion in shape of domes. Press and tamp until mortar begins to come through all of the vent holes. Gently remove stamp mats.
    d. Trimming: After 24 hours, cut off the tips of mortar formed by the vent holes.

5. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.
6. Insert requirements for concrete stain, pigmented sealer, or pigmented curing and sealing compound if pigment is required. Pigmented mineral dry-shake hardener is not used for stamped detectable warnings.

3.4 TOLERANCES

A. Comply with tolerances in ACI 117 (ACI 117M) and as follows:

B. ACI 117 (ACI 117M) establishes few paving tolerances; those in subparagraphs below are based on ACI 330.1. Revise to suit Project.

C. Elevation: 3/4 inch.

D. Thickness: Plus 3/8 inch, minus 1/4 inch.

E. Surface: Gap below 10 feet long; unleveled straightedge not to exceed 1/2 inch.

F. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.

G. Lateral Alignment and Spacing of Dowels: 1 inch.

H. Vertical Alignment of Dowels: 1/4 inch.

I. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inchesof dowel.

J. Joint Spacing: 3 inch.

K. Contraction Joint Depth: Plus 1/4 inch, no minus.

L. Joint Width: Plus 1/8 inch, no minus.

3.5 FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.6 SPECIAL FINISHES

A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:

1. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

B. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on paving surface. Tamp aggregate into plastic concrete and float finish to entirely embed aggregate with mortar cover of 1/16 inch.

1. Spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. of dampened, slip-resistive aggregate over paving surface in two applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.
2. Uniformly distribute approximately two-thirds of slip-resistive aggregate over paving surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage and embed by power floating.
3. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
4. After curing, lightly work surface with a steel-wire brush or abrasive stone and water to expose nonslip aggregate.

D. Rock-Salt Finish: After initial troweling, uniformly spread rock salt over paving surface at the rate of 5 lb/100 sq. ft..

1. Embed rock salt into plastic concrete with roller or magnesium float.
2. Cover paving surface with 1-mil- thick polyethylene sheet and remove sheet when concrete has hardened and seven-day curing period has elapsed.
3. After seven-day curing period, saturate concrete with water and broom-sweep surface to dissolve remaining rock salt, thereby leaving pits and holes.

E. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surface according to manufacturer's written instructions and as follows:

1. Uniformly spread dry-shake hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer to match paving color required.
2. Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color and embed hardener by final power floating.
3. After final power floating, apply a hand-troweled finish followed by a broom finish.
4. Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 5000 sq. ft. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg Fand below and when it is 80 deg Fand above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.
7. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three-consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.

F. Coring: provide concrete cores at least 4 inch in diameter by full depth cut from points selected in the test section by the Engineer. The cores will be evaluated for surface paste, uniformity of aggregate distribution, segregation, voids, and thickness.

G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.

H. Concrete paving will be considered defective if it does not pass tests and inspections.

I. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

J. Prepare test and inspection reports.

K. Strength Test Samples:

1. Sampling Procedures: ASTM C172.
2. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, standard cured.

3. Sample concrete and make one set of three cylinders for every 150 cu yds or less of each class of concrete placed each day and for every 5,000 sf of surface area paving.
4. Make one additional cylinder during cold weather concreting, and field cure.

L. Field Testing:

1. Slump Test Method: ASTM C143/C143M or Tex-415-A.
2. Air Content Test Method: Tex-414-A, Tex-416-A or ASTM C457.
3. Temperature Test Method: ASTM C1064/C1064M or Tex-422-A.
4. Measure slump and temperature for each compressive strength concrete sample.
5. Measure air content in air entrained concrete for each compressive strength concrete sample.

M. Cylinder Compressive Strength Testing:

1. Test Method: ASTM C39/C39M or Tex-418-A.
2. Test Acceptance: according to TxDOT standards.
3. Test one cylinder at 7 days.
4. Test two cylinders at 28 days.
5. Dispose remaining cylinders when testing is not required.

N. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.8 PROTECTION

A. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Coordinate minimum requirements for concrete strength with expected traffic conditions.

C. Do not permit pedestrian or vehicular traffic over paving for 7 days minimum after finishing.

D. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Engineer.

E. Drill test cores, where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

F. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

G. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

H. Concrete Protection:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
2. Comply with ACI 306.1 for cold-weather protection.

I. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

J. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

K. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12 inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inch, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.
4. Maintain temperature of air next to concrete above 40 degrees F for the full curing periods.

3.9 ATTACHMENTS

A. Concrete Sidewalks and Median Barrier: 3,000 psi 28 day concrete, 4 inches thick, gray color Portland cement, exposed aggregate finish.

B. Concrete Area Paving: 4,000 psi 28 day concrete, 6 inches thick, 6/6 - 6 x 6 inch mesh reinforcing, wood float finish.

C. Concrete Roadways and Parking Areas: 4,000 psi 28-day concrete, with thickness and reinforcing as specified on drawings, wood float finish.

END OF SECTION 321313

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Hot-applied joint sealants.
3. Cold-applied, fuel-resistant joint sealants.
4. Hot-applied, fuel-resistant joint sealants.
5. Joint-sealant backer materials.
6. Primers.

B. Related Requirements:

1. Section 321313 “Concrete Paving” for surface concrete pavement is pedestrian and traffic areas.

1.3 UNIT PRICES

A. Quantity of sealant will be paid based on actual measurement of the number of linear feet of in-place material that has been approved.

1.4 ACTION SUBMITTALS

A. Product Data: submit manufacturer certificate (data sheet) for each type of product and installation recommendations.

B. Copies of test reports.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Paving-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.

4. Joint-sealant color.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Perform testing of materials in an approved independent laboratory and submit certified copies of test reports for approval 15 days prior to use of materials at the job site.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When temperature within the joint wall is outside limits permitted by joint-sealant manufacturer or is below 40 degrees F.
2. When moisture is observed within joint.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
5. On same day as sawing occurred.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Provide joint sealants for various areas of types indicated in drawings and summarized below.

C. Hot-Applied Joint Sealants:

1. Hot-Applied, Single-Component Joint Sealant: ASTM D6690, Type I or Type II.

D. Cold-Applied Joint Sealants:

1. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D5893/D 5893M, Type NS.
2. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D5893/D 5893M, Type SL.
3. Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use T.
4. Single Component, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C920, Type S, Grade P, Class 25, for Use T.

E. Hot-Applied, Fuel-Resistant Joint Sealants:

1. Hot-Applied, Fuel-Resistant, Single-Component Joint Sealants: ASTM D7116, Type I or Type II.

F. Joint-Sealant Backer Materials:

1. Provide backer material that is a compressible, nonshrinking, nonabsorbing material. Use backer material that is 20 to 30 percent larger in diameter than the nominal width of joint. Backer material shall be nonreactive with proposed joint sealant. Material shall have a melting point at least 5 degrees F (3 degrees C) greater than pouring temperature of sealant being used when tested in accordance with ASTM D789. Material shall also have a water absorption of not more than 5 percent of sample weight when tested in accordance with ASTM C1016.
2. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
3. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.
4. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

G. Primers:

1. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Inspect application equipment to ensure conformance to temperature requirements, proper proportioning and mixing (if two-component sealant) and proper installation. Evidences of bubbling, or improper installation will result in suspending operations until causes of deficiencies are determined and corrected.

3.2 PREPARATION

A. Removal of existing sealant: cut loose in-place sealant from both joint faces and to depth indicated on drawings, using routing equipment, concrete saw, or waterblaster. Prior to further

cleaning operations, remove loose old sealant remaining in joint opening by blowing with compressed air.

B. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions. Thoroughly clean joints to remove laitance, curing compound, and protrusions of hardened concrete.

1. Remove foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

C. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION

A. Seal joints immediately following final cleaning of joint walls and following placement of backup material. Open joints, that cannot be sealed under conditions specified, or when rain interrupts sealing operations shall be recleaned and allowed to dry prior to installing sealant.

B. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless installation instructions are modified by Engineer.

C. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions.

D. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability:

1. Do not leave gaps between ends of joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact joint substrates.
2. Completely fill joint from the bottom up to 1/4 inch plus or minus 1/16th inch (6 mm plus or minus 2.0 mm) below pavement surface.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
4. Remove and discard excess or spilled sealant from pavement by approved methods.
5. Install sealant in such a manner as to prevent formation of voids and entrapped air.
6. Do not permit traffic over newly sealed pavement until authorized.

F. Tooling of Non-sag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:

1. Remove excess joint sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3.4 PROTECTION

A. Clean off excess joint sealant as Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from original work.

END OF SECTION 321373

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SECTION 330517 - PRECAST CONCRETE VALVE VAULTS AND METER BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Precast concrete valve vaults.
2. Precast concrete meter boxes.

B. Related Requirements:

1. Section 310515 "Soils and Aggregates for Earthwork" for bedding fill type.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Precast Concrete Valve Vaults:

1. Description: Includes excavation, valve vault, accessories, tests, and backfill.
2. Basis of Measurement: By each.

B. Precast Concrete Meter Boxes:

1. Description: Includes excavation, meter box, accessories, test, and backfill.
2. Basis of Measurement: By each.

1.3 COORDINATION

A. Coordinate Work with City Standards and utilities within construction area.

1.4 ACTION SUBMITTALS

A. Shop Drawings:

1. Base sections, riser sections, eccentric and concentric conical top sections, flat slab tops, grade rings with notarized certificate indicating compliance with ASTM C478.
2. Cut sheets indicating location, orientation size and elevation of finished inverts for all penetrations for each structure.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate:

1. NPCA Plant Certification.

2. Concrete test cylinder reports from an approved testing laboratory certifying conformance with this Section.
3. Manufacturer Instructions: Submit special procedures for precast concrete valve vaults and meter boxes installation and method of repair for minor damage to precast concrete sections.

B. Product Data:

1. Pipe connections to structure.
2. Structure frame and cover, access hatch, rungs and or ladders with notarized certificate indicating compliance with the specified ASTM standard and Class designation.
3. Submit concrete mix design for each different mix.

C. Submit signed and sealed Shop Drawings with design calculations and assumptions for custom fabrications.

1. Precast concrete manholes and structures.
2. Sectional plans and elevations showing dimensions and reinforcing steel placement.
3. Structural calculations including assumptions.
4. Concrete design mix.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and inverts of buried pipe, components, and connections.

1.7 QUALITY ASSURANCE

A. Perform Work according to City standards.

B. Perform structural design according to ACI 318.

C. Perform Work in a plant certified by NPCA – National Precast Concrete Association.

D. Conform to following material and fabrication requirements:

1. Three Sided Structures: ASTM C1504.
2. Other Structures: ASTM C913, Standard Specification for Precast Concrete Water and Wastewater Structures.

E. Perform welding according to following:

1. Structural Welding Code - Steel: AWS D1.1.
2. Structural Welding Code -Reinforcing Steel.

F. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the Engineer, or other representative of the Owner. Such inspection may be made at the place of manufacture, or on the work after delivery, or at both places and the materials shall be subject to rejection at any time on account of failure to meet any of the requirements specified herein; even though samples may have been accepted as

satisfactory at the place of manufacture. Material rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All materials which have been damaged after delivery will be rejected, and if already installed, shall be acceptably repaired, if permitted, or removed and replaced.

G. At the time of inspection, the materials will be carefully examined for compliance with the ASTM standard specified below and this Section and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch-strength", blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.

H. Imperfections in sections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4000 psi at 7 days and 5000 psi at 28 days, when tested in 3 by 6 inch cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the Engineer.

I. Maintain one copy of each standard affecting Work of this Section on Site.

J. Qualifications:

1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
2. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.
3. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Texas.
4. Welders and Welding Procedures: AWS qualified within previous 12 months for employed weld types.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver products until concrete has cured 5 days or has attained minimum 75 percent of specified 28-day compressive strength.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Comply with precast concrete manufacturer instructions for unloading, storing, and moving precast structures.

D. Transport and handle precast concrete units with equipment designed to protect units from damage. Lift structures from designated lifting points.

E. Storage:

1. Store precast concrete valve vaults and meter boxes according to manufacturer instructions.
2. Do not place concrete units in position to cause overstress, warping, or twisting.
3. Repair property damaged from materials storage.

1.9 AMBIENT CONDITIONS

A. Subsequent Conditions: Maintain materials and surrounding air temperature at minimum 50 degrees F prior to, during, and 48 hours after completion of masonry Work.

PART 2 - PRODUCTS

1.10 DESIGN REQUIREMENTS

A. Performance and Design Criteria:

1. Watertight, Precast, Reinforced, Air-Entrained Concrete Structures:

a. Design to ASTM C890 Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures,
b. Design live loading and installation conditions per Drawings.
c. Manufactured to conform to ASTM C913 Standard Specification for Precast Concrete Water and Wastewater Structures.

2. Minimum 28-Day Compressive Strength: 5,000 psi.
3. Honeycombed or retempered concrete is not permitted.

1.11 PRECAST CONCRETE VALVE AND METER BOXES

A. Precast reinforced concrete doghouse vault shall conform to the requirements shown on the Drawings for inside dimensions.

B. Manufacturers:

1. Substitutions: As specified in Section 016000 – Product Requirements.

C. Valve Vault and Meter Box Frames and Covers:

1. Ductile Iron Castings: ASTM A536, Standard Specification for Ductile Iron Casting.
2. Contact Surfaces: Machined and matched.
3. Cast cover inscription with pipeline service and Owner's name.

D. Access Hatch:

1. Construction: Aluminum, welded.
2. Door: Double.
3. Cover: Diamond plate, reinforced with structural stiffeners to support required loads.
4. Frame:

a. Channel type, with integral seat to support cover stiffeners.
b. Anchor flange around frame perimeter.

5. Hinges: Stainless steel.

6. Lift Handle: Flush drop handle, non-removable type mounted in cover.
7. Lifting Mechanism:

    a. Stainless steel compression springs with automatic hold-open and dead stop to retain cover in open position.
    b. Cover springs to prevent contact by personnel entering utility structure.

8. Latch Mechanism: Stainless steel lock with removable external handle and permanent internal release mechanism.
9. Hardware: Stainless steel.
10. Finishes: Galvanized after fabrication.

E. Access Steps:

1. Steel reinforced copolymer polypropylene:

    a. ASTM C478.
    b. Method of Test: ASTM C497 Standard Test Methods for Concrete Pipe, Concrete Box Section, Manhole Sections, or Tile.
    c. ASTM D4104, Standard Test Method (Analytical Procedure) for Determining Transmissivity of Nonleaky Confined Aquifers by Overdamped Well Response to Instantaneous Change in Head (Slug Tests): PP0344B33534Z02 copolymer polypropylene.
    d. ASTM A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement, Grade 60, 1/2 inch reinforced rod.

2. Aluminum: ASTM B221, ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
3. Alloy 6061-T6.

1.12 MATERIALS

A. Portland Cement:

1. ASTM C150, Standard Specification for Portland Cement: Type II.

B. Coarse Aggregates:

1. ASTM C33.
2. Graded 1 inch to No. 4 sieve.

C. Sand:

1. ASTM C33 Standard Specification for Concrete Aggregates.
2. Fineness Modulus: 2.35.

D. Water:

1. Potable.
2. Clean and free of injurious amounts of acids, alkalis, salts, organic materials, and substances incompatible with concrete or steel.

E. Air-Entraining Admixtures: ASTM C260.

F. Reinforcing Steel:

1. Deformed Bars: ASTM A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement: Grade 60.
2. Welded Wire Fabric: ASTM A185 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

G. Joint Sealant:

1. ASTM C990, Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

1.13 FABRICATION

A. Fabricate precast reinforced concrete structures according to ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures, to dimensions indicated on Drawings, and to specified design criteria.

B. Construct forms to provide uniform precast concrete units with consistent dimensions.

C. Clean forms after each use.

D. Reinforcing:

1. Install reinforcement by tying or welding to form rigid assemblies.
2. Position reinforcement to maintain minimum 2 inch cover.
3. Secure reinforcement to prevent displacement while placing concrete.

E. Position and secure embedded items to prevent displacement while placing concrete.

F. Deposit concrete in forms and consolidate concrete without segregating aggregate.

G. Provide initial curing by retaining moisture using one of following methods:

1. Cover with polyethylene sheets.
2. Cover with burlap or other absorptive material and keep continually moist.
3. Apply curing compound according to manufacturer instructions.

H. Provide final curing according to manufacturer's standard.

I. Remove forms without damaging concrete.

1.14 MIXES

A. Design concrete mix to produce required concrete strength, air-entrainment, watertight properties, and loading requirements.

B. Concrete:

1. Select aggregate proportions for lightweight concrete according to ACI 318 and ACI 211.2.

2. Concrete Criteria:

   a. Compressive Strength: 5,000 psi at 28 days.
   b. Water-Cement Ratio:

      1) Concrete Exposed to Freezing and Thawing: Maximum 0.45 percent by mass.
      2) Watertight Concrete Not Exposed to Freezing and Thawing: Maximum 0.45 percent by mass.
      3) Concrete Exposed to Corrosive Conditions: 0.40 percent by mass.

   c. Air Content:

MAXIMUM AGGREGATE SIZE, INCHES	AIR CONTENT, PERCENT	
	SEVERE EXPOSURE	MODERATE EXPOSURE
3/8 inches	6.0 to 9.0	4.5 to 7.5
1/2 inches	5.5 to 8.5	4.7 to 7.0
3/4 inches	4.5 to 7.5	3.5 to 6.5
1 inches	4.5 to 7.5	3.0 to 6.0
1-1/2 inches	4.5 to 7.0	3.0 to 6.0

3. Admixtures:

   a. Include admixture types and quantities indicated in concrete mix designs approved through submittal process.
   b. Do not use calcium chloride.

1.15 FINISHES

A. Reinforcing Steel:

1. Galvanized Finish: Comply with ASTM A767, Standard Specification for Zinc-Coating (Galvanized) Steel Bars for Concrete Reinforcement, Class I.
2. Epoxy Coating Finish: Comply with ASTM A775.

B. Wire and Wire Fabric:

1. Epoxy Coated Finish: Comply with ASTM A884, Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement, coating requirements, concrete reinforcement, corrosion resistance, epoxy Class A.

C. Concrete:

1. Formed Surfaces Not Exposed to View: As formed.

2. Unformed Surfaces:

a. Finish with vibrating screed or hand float.
b. Permitted: Color variations, minor indentations, chips, and spalls.
c. Not Permitted: Major imperfections, honeycomb, or other defects.

3. Exposed to View Finishes:

D. Medium broom Steel:

1. Galvanizing:

a. Comply with ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
b. Hot dip galvanize after fabrication.

1.16 ACCESSORIES

A. Membrane Curing Compound: ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete, Type I, Class B.

B. Membrane Curing Compound: ASTM C1315 Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete, Type I, Class B.

C. Steps:

1. Formed aluminum rungs.
2. Diameter: 3/4 inch.
3. Width: 12 inches.
4. Spacing: As indicated on Drawings.

D. Inserted and Embedded Items:

1. Structural Steel Sections:

a. Comply with ASTM A36 Standard Specification for Carbon Structural Steel.
b. Finish: Galvanized.

E. Joint Sealants and Joint Gaskets:

1. Gasket Joints:

a. ASTM C443 Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
b. Gaskets: Standard rubber.

2. External Sealing Bands:

a. Comply with ASTM C877 Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections
b. Material: Type I, rubber and mastic.

3. Preformed Joint Sealants: Comply with ASTM C990 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
4. Elastomeric Joint Sealants:

    a. Comply with ASTM C920 Standard Specification for Elastomeric Joint Sealants.
    b. Material: Silicone.
    c. Grade NS, Class 25.

F. Pipe Entry Connectors: Comply with ASTM C923.

G. Grout:

1. Cement Grout: Portland cement, sand, and water mixture with stiff consistency to suit intended purpose.
2. Non-Shrink Grout:

    a. Description: Premixed compound consisting of non-metallic aggregate, cement, and water-reducing and plasticizing agents.
    b. Conform to ASTM C1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
    c. Minimum Compressive Strength: 2,400 psi in 48 hours, and 7,000 psi in 28 days.

H. Bituminous Coating:

    a. Furnish materials according to City standards.

I. Touch-Up Primer for Galvanized Surfaces:

1. SSPC Paint 20, Type I Inorganic.
2. Comply with ASTM A780.

1.17 SOURCE QUALITY CONTROL

A. Testing:

1. Perform following tests for each 150 cu. yd. of concrete placed with minimum one set of tests each week:

    a. Slump: Comply with ASTM C143 Standard Test Method for Slump of Hydraulic Cement Concrete.
    b. Compressive Strength: ASTM C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field ASTM C192 Standard Practice for Making and Curing Concrete Test Specimens in the Field and ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
    c. Air Content: Comply with ASTM C231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method, or ASTM C173 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
    d. Unit Weight: Comply with ASTM C138 Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

2. Make test results available to Engineer upon request.

B. Inspection:

1. Visually inspect completed precast structures for defects.
2. Repair defects on surfaces exposed to view to achieve uniform appearance.
3. Repair honeycomb by removing loose material and applying grout to produce smooth surface flush with adjacent surface.
4. Repair major defects only if permitted by Engineer.

C. Owner Witnessing:

1. Allow witnessing of factory inspections and test at manufacturer's test facility.
2. Notify Owner at least seven days before inspections and tests are scheduled.

PART 3 EXECUTION

1.18 EXAMINATION

A. Verify that piping connections, sizes, locations, and inverts are as indicated on Drawings.

1.19 PREPARATION

A. Ream pipe ends and remove burrs.

B. Remove scale and dirt from components before assembly.

C. Establish invert elevations for each component in system.

D. Hand trim excavation to suit valve vaults and meter boxes; remove stones, roots, and other obstructions.

E. Do not install structures if site conditions induce loads exceeding weight capacity of structures.

F. Inspect precast concrete structures immediately prior to placement in excavation to verify that they are internally clean and free from damage; remove and replace damaged units

1.20 INSTALLATION

A. Excavation and Bedding:

1. Excavate as specified in Section G9 “Structural Excavation” for Work of this Section.
2. Hand trim excavation for accurate placement of vaults and meter boxes to elevations indicated.
3. Place bedding material level in one continuous layer not exceeding 6 inches compacted depth and compact to 95 percent maximum density.
4. Backfill around sides of vaults and meter boxes, tamp in place, and compact to 95 percent maximum density.

5. Maintain optimum moisture content of bedding material to attain required compaction density.
6. Install vaults and meter boxes and related components on bedding.

B. Assembly of Multi-section Structures:

1. Lower each section into excavation.
2. Clean joint surfaces.
3. Install watertight joint seals according to manufacturer instructions using gasket joints, external sealing bands, preformed joint sealants, or elastomeric joint sealants.

C. Remove knockouts or cut structure to receive piping without creating openings larger than required to fit pipe; fill annular space with grout.

D. Pipe Connections:

1. Connect pipe to structure and seal watertight.
2. Cut pipe flush with interior of structure.

E. Base:

1. Grout to achieve slope to drain.
2. Trowel smooth.
3. Contour as indicated on Drawings.

F. Paint interior with two coats of bituminous interior coating at rate of 120 sq. ft. per gal. for each coat.

G. Frame and Cover and Access Hatch:

1. Set level, without tipping, to elevations as indicated on Drawings.
2. Set cover and access hatch 2 inches above finished grade for structures located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.
3. Connect drain from access hatch frame to storm drainage system or as shown on the Drawings.

H. Touch up damaged galvanized coatings.

I. Installation Standards: Install work according to City standards.

1.21 FIELD QUALITY CONTROL

A. Compaction Testing: Conform to ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

B. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

C. Frequency of Compaction Tests: minimum of 2 tests per structure.

END OF SECTION 330517

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SECTION 331210 - TEMPORARY BYPASS PUMPING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Furnish all labor, materials, equipment and incidentals required and install, field test, and operate temporary bypass pumping systems as proposed by the Contractor for the purpose of diverting flow around work areas as required by the provisions specified in Section CIP3 “Summary of Work”.

B. The design, installation and operation of temporary bypass pumping systems shall be the Contractor's responsibility. The Contractor shall provide the services of a professional bypass company who can demonstrate to the Owner and Engineer that the company specializes in the design and operation of temporary bypass pumping systems. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

C. Maintain temporary bypass pumping systems so that they are completely functional throughout the required period of service.

D. Following the required period of service, remove temporary bypass pumping systems from site.

E. Provide all maintenance including manufacturer recommended preventive maintenance and on-call repair services. Contractor shall provide repair services and/or replacement equipment 24 hours per day, seven days per week within 4 hours of being called.

F. Should the Contractor elect to use diesel fuel for temporary bypass pumping, the storage and handling of fuel shall be in strict accordance with the rules and regulations of the City of Georgetown, and the State of Texas. Provide a refueling service to maintain continuous 24-hours per day, seven days per week pumping system operation.

G. Related Requirements:

1. Section CIP3 “Summary of Work”.
2. Section WW3, “Connections to and Work on the Existing Wastewater System”

1.3 DELEGATED DESIGN SUBMITTALS

A. Submit the following:

1. A detailed description of each proposed temporary bypass pumping system including pumps, pump drives, piping, hoses, valves, fittings, controls, wiring and any other related

accessories required to provide a complete operating system in conformance with the requirements of this Section.

2. Detailed plans and sections showing the proposed pumping system layout including dimensions and elevations. Plan shall include but not be limited to the following:

    a. Staging area and access requirements for all pumps.
    b. Number, size, material, location and method of installation of suction piping.
    c. Number, size, material, location and method of installation of discharge piping.
    d. Pump size, capacity, number of units, diesel engine specifications, fuel tank capacity, fuel consumption requirements, and method of refueling.
    e. Calculations of static lift, pipe size selection, friction losses, flow velocity and pump selection.
    f. Pump curves showing pump operating range and the anticipated operating point at the anticipated pump on and pump off liquid elevations in the pump manhole.
    g. Proposed method of freeze protection.
    h. Proposed method of noise control for each pump.
    i. Temporary pipe supports, anchorage, cover material and other accessories as required to stabilize the piping system.
    j. Installation schedule and maintenance schedule.
    k. Vendor phone number and pager number for 24-hour service.
    l. A minimum of five reference installations of projects with similar size in wastewater pumping applications. Include contact names and phone numbers.
    m. List of recommended spare parts to be stored on-site for emergency maintenance.

3. Provide information on the vendor's service staff capabilities and replacement parts inventory to show that the vendor has sufficient resources to provide emergency service and replacement equipment and/or parts to the site within 4 hours of a service call.
4. A description of system operation and controls. Include a list of all alarm conditions and procedures for correcting problems including equipment replacement.
5. A description and schedule for the proposed procedures for start-up and testing of the facilities to demonstrate compliance with specified automatic operation and maintenance of a constant discharge pressure.
6. A plan of operations for inclement weather including winter storms. The plan shall demonstrate the ability to maintain pumping system operations throughout inclement weather events.
7. A description and schedule for the proposed procedures for dismantling the system, and restoring normal operations at the WWTP.

1.4 QUALITY ASSURANCE

A. Employ the services of a vendor who can demonstrate five years of recent and continuous specialization in the design, installation, operation and removal of temporary bypass pumping systems in wastewater applications. The complete system shall be furnished from a single vendor who shall be capable of providing service staff, repair parts and replacement of any deficient system component within four hours of a service call, 24-hours per day, seven days per week.

B. Provide the services of the manufacturer's representative for physical checkout field testing and operation and maintenance instruction for a minimum of one person day per pumping system. See requirements in PART 3.

C. Provide the services of the manufacturer's representative or designated alternative, who shall be contactable 24-hours per day via telephone or pager and shall be available to be on site within four hours of being contacted at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Xylem, Inc (Godwin Pumps of America).

B. Acme Dynamics.

C. Thompson Pump and Manufacturing Co.

D. Precision Pump Systems (Gorman-Rupp Pumps).

E. Or Equal.

2.2 SYSTEM DESCRIPTION

A. All pumping units and all accessories shall be in good operating condition. Each temporary bypass pumping system shall be complete including pumps, drives, piping, piping headers, valves, flow meter, controls and appurtenances as required for a complete system.

B. The pumps, drives and controls shall be designed and built for 24-hour continuous service at any and 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 the strength, stability and stiffness and be constructed to meet the specified requirements. Methods shall be provided for inspection, repairs, and adjustment.

C. All necessary foundation bolts, nuts, and washers shall be furnished.

D. Each piece of equipment shall be furnished with a nameplate (with embossed data) securely mounted to the body of the equipment to confirm that the equipment matches that described in the submittals. As a minimum, the nameplate for the pumps shall include the manufacturer's name and model number, serial number, rated flow capacity, head, speed and all other pertinent data.

E. Noise shall not exceed 85 dBA at a distance of 5 feet from any part of the system.

F. All equipment shall be suitable for outdoor operation under adverse weather conditions. Provide protection from freezing as required to maintain system operation.

G. Pumping system control panels shall be NEMA 4 and include flow indication, a flow totalizer, indicator lamps showing which pumps are operating, selector switch for auto or manual start and stop for each pump and visual and audible alarms for indication of operation failure and alarm conditions.

H. The temporary bypass pumping system shall comply with all City of Georgetown and Texas Commission on Environmental Quality (TCEQ) requirements.

2.3 PERFORMANCE REQUIREMENTS

A. Capacities and Characteristics:

1. Pumps shall be selected specifically for the flow and total dynamic head conditions of the specific bypass pumping setup proposed.

2. The flow capacities specified for the services listed below are provided for Contractor's convenience in the event Contractor deems that temporary bypass pumping is needed to meet the Owner's requirements in Section CIP3 "Summary of Work".

3. Each application requiring temporary bypass shall be designed for the following conditions of service. All pumps shall have a rising head capacity curve for stable pump operation from the minimum head operating point to the shut-off head.

a. <u>Application #1 - Coarse Bar Screen & Influent Lift Station Temporary Bypass:</u>

1)	Number of pumps:	As required by the Application.
2)	Liquid:	Raw Unscreened Wastewater.
3)	Design capacity total peak (gpm):	1,500 gpm
4)	Typical dry weather flow (gpm):	500 gpm
5)	Type of drive:	Diesel engine or Electric.

b. <u>Application #2 – Belt Filter Press Drain Temporary Bypass:</u>

1)	Number of pumps:	As required by the Application.
2)	Liquid:	Belt Filter Press Filtrate and Washwater.
3)	Design capacity total peak (gpm):	450 gpm
4)	Type of drive:	Diesel engine or Electric.

c. <u>Application #3 – Grit Chambers Temporary Bypass from Headworks to Aeration Basins</u>

1)	Number of pumps:	As required by the Application.
2)	Liquid:	Screened Raw Wastewater.
3)	Design capacity total peak (gpm):	5,200 gpm
4)	Typical dry weather flow (gpm):	1,400 gpm
5)	Type of drive:	Diesel engine or Electric.

4. Pumping System Components:

a. All pumps shall be centrifugal, end suction, fully automatic self-priming units that do not require the use of foot-valves, vacuum pumps, diaphragm pumps, or isolation valves or float apparatus in the priming system.

b. Pump seals shall be high pressure, mechanical self-adjusting type with solid carbide faces capable of withstanding suction pressures to 100 psi without the pump running. The mechanical seal shall be cooled and lubricated in an oil bath reservoir, requiring no maintenance or adjustment. The oil bath reservoir shall not come in contact with or leak into the pumped water. Each pump shall be capable of running dry, with no

damage for extended periods of time. All pump seal metal parts shall be stainless steel. All elastomers shall be Viton.

c. Each pump shall be driven by a diesel engine or electric motor. Diesel engine shall be water cooled. If the Contractor uses electric motor driven pumps, power costs are the responsibility of the Contractor.

d. If using diesel driven pumps, each pump and diesel engine shall be skid mounted with integral fuel tank and skid lifting bracket.

e. Provide automatic start/stop controls for the pumping system to automatically maintain system flow. Controls shall be contained in a local control panel with provision to manually operate each pump, provide indication of pump operation, and indicate the total flow being pumped.

f. Provide all required suction and discharge pipe and fittings, discharge manifold pipe and fittings, shutoff valves, check valves, flow meter, pressure regulating valves, insulation, freeze protection, and all required accessories. All pipe and fittings shall be steel with flanged or quick connect coupling connections, or high density polyethylene pipe with fused joints. All joints must be 100 percent restrained. Suction piping shall be rated for 25-inch Hg vacuum. Discharge piping, fittings, connections, valves, and other discharge piping accessories shall be rated for a minimum working pressure of 150 psi.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the system supplier's recommendations and approved shop drawing submittals.

B. Install pumping units on a firm level surface.

C. Furnish the services of the pump system supplier's representative for a minimum of one day per temporary bypass system to assist equipment installation and physical checkout.

3.2 FIELD QUALITY CONTROL

A. Provide field testing in accordance with the approved shop drawing submittal. Field tests shall demonstrate conformance with system requirements.

B. The Contractor shall require that field testing be conducted by the pump system supplier's representative in the presence of the Engineer. Furnish the services of the pump system supplier's representative for a minimum of one day per temporary bypass system to conduct required testing.

C. Field testing shall demonstrate a minimum of 24-hours of continuous operation. During the 24-hours of continuous operation, the system shall demonstrate the ability to automatically start and stop pumps in response to changing flow conditions.

D. Remove and replace any system component that fails to perform in accordance with specified requirements.

3.3 SYSTEM OPERATION

A. Perform all required maintenance on the equipment to maintain the system integrity and capacity as specified.

B. Provide clean-up and disposal of contaminated material and reporting for all product spills.

3.4 EQUIPMENT REMOVAL

A. At the completion of the period of service, disconnect all temporary piping and remove all system components from the site. Restore the work site to its original condition.

END OF SECTION 331210

SECTION 400506 - COUPLINGS, ADAPTERS, AND SPECIALS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe penetrations.
2. Restrained joints.
3. Flexible connections.
4. Expansion joints.
5. Expansion loops.
6. Sleeve-type couplings.
7. Flange isolation kits.

B. Related Requirements:
1. Section 055000 “Metal Fabrications” for miscellaneous metalwork and fasteners as required by this Section.
2. Section 079200 “Joint Sealants” for sleeve sealant for pipe penetrations.
3. Section 400507 “Hangers and Supports for Process Piping” for hangers, anchors, sleeves, and sealing of piping to adjacent structures.
4. Section 400519 “Ductile Iron Process Pipe” for ductile-iron piping materials and appurtenances.
5. Section 400523 “Stainless Steel Process Pipe and Tubing” for stainless steel piping materials and appurtenances.
6. Section 400531 “Thermoplastic Process Pipe” for plastic piping materials and appurtenances.
7. Section 400551 “Common Requirements for Process Valves” for common product requirements for valves for placement by this Section.
8. Section 404213 “Process Piping Insulation” for piping insulation as required by this Section.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Submit manufacturer catalog information for each specified product, including installation instructions.
2. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per

assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.

3. Expansion Joints: Indicate maximum temperature, pressure rating, and expansion compensation.

B. Shop Drawings:

1. Identification:

a. Submit list of wording, symbols, letter size, and color coding for pipe identification.
b. Comply with ASME A13.1.

2. Indicate restrained joint details and materials.
3. Submit layout drawings showing piece numbers and location, indicating restrained joint locations.
4. Indicate layout of piping systems, including flexible connectors, expansion joints and compensators, loops, offsets, and swing joints.
5. For chemical storage and feed areas submit material compatibility charts for selected materials that may come into contact with pipe sleeve and mechanical sealing element materials. Pipe sleeve materials shall have an excellent compatibility rating.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS qualification within previous 12 months.

C. Manufacturer Instructions: Submit special procedures and setting dimensions.

D. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Qualifications Statements:
1. Submit qualifications for manufacturer, installer, and licensed professional.
2. Submit manufacturer's approval of installer.
3. Welders: Qualify procedures and personnel according to AWS D1.1/D1.1M.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping appurtenances.

B. Identify and describe unexpected variations to pipe routing or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified to NSF Standards 61 and 372.

B. Perform Work according to ASME B31.9 for installation of piping systems and according to AWS D1.1/D1.1M for welding materials and procedures.

C. Perform Work according to ASME B31.3 and manufacturer’s installation requirements for installation of piping systems and appurtenances.

D. Perform Work according to State of Texas Commission of Environmental Quality and City of Georgetown standards.

E. Surface-Burning Characteristics: Maximum 25/450 flame-spread/smoke-developed index when tested according to ASTM E84.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum five years' documented experience.

C. Welders: AWS qualified within previous 12 months for employed weld types.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Furnish temporary end caps and closures on piping and fittings and maintain in place until installation.
3. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 ROTAMETERS

A. Direct Reading Scale for Air Service

1. Provide model IF2711 by Dwyer or equal.

a. Maximum Temperature: 200 F
b. Maximum Pressure: 200 PSI
c. Accuracy: +/- 3%
d. Repeatability: +/- 0.5%
e. Turn-down Ratio: 10:1
f. Materials:

1) Flowtube: Borosilicate glass
2) Guide Rods and Floats: 316 SS
3) O-Rings: Fluoroelastomer
4) Front Shield: Polycarbonate
5) Side Panels: 304 SS

2.2 PIPE SLEEVES

A. All construction except new concrete walls:

1. Material: Schedule 40 galvanized steel conforming to ASTM A53.
2. 2-inch minimum circumference water stop welded to exterior sleeve at midpoint
3. Ends cut and ground to be:

a. Flush with ground.
b. Flush with ceiling.
c. 2 inches above finished floors.
d. Sealed with caulking.
e. Sized as required.

B. New concrete walls with pipes up to 20 inches in diameter:

1. Material: non-metallic High-Density Polyethylene Sleeves (HDPE).
2. Integral hollow molded water stops:

a. 4 inches larger than the outside diameter of the sleeve.

3. End caps for forming and reinforcing ribs.
4. Domestically manufactured by:

a. Century-Line as manufactured by Pipeline Seal & Insulator, Inc., Houston, TX, or equal.

C. New concrete with pipes 20 to 60 inches in diameter:

1. Material: molded HDPE modular interlocking discs to make the width of the wall.

    a. Corrugated.
    b. Cell-Cast as manufactured by Pipeline Seal & Insulator, Inc., Houston, TX, or equal.

D. External Wall Penetrations:

1. 36-inch diameter and less may be made by means of a ductile iron sleeve capable of being bolted directly to the formwork:
2. Seal of the annular space between the carrier pipe and the sleeve made by means of a confined rubber gasket and be capable of withstanding 350 psi.:
3. Sleeve to have an integrally cast waterstop of 1/2-inch minimum thickness, 2-1/2-inches minimum height.
4. Manufacturers: Omni-Sleeve, Malden, MA or equal.

E. Stainless Steel Wall Penetrations (Submerged service, process treatment basins containing raw water, chemical storage and feed areas, sludge or wastewater):

1. Material: Schedule 40 stainless steel Type 316L.
2. 2-inch minimum circumference water stop welded to exterior sleeve at midpoint.
3. Ends cut and ground to be:

    a. Flush with ground or ceiling.
    b. 2 inches above finished floors.
    c. Sealed with caulking.
    d. Sized as required.

2.3 WALL CASTINGS

A. Ductile iron conforming to ANSI/AWWA A21.51/C151, thickness Class 53.

B. Diameter as required.

C. Flanges and mechanical joint bells drilled and tapped for studs where flush with the wall.

D. Castings provided with a 2-inch minimum circumferential flange/waterstop integrally cast with or welded to the casting.

E. Located as follows:

1. For castings set flush with walls: Located at center of overall length of the casting,
2. For castings which extend through wall: Located within middle third of the wall.

2.4 SEALING MATERIALS

A. Mechanical Seals:

1. Of rubber links shaped to continuously fill annular space between pipe and wall opening or sleeve.

2. Link pressure plates molded of glass reinforced nylon:

    a. Colored throughout elastomer.
    b. Permanent identification of the size and manufacturer's name molded into the pressure plate and sealing element.

3. Hardware:

    a. Mild steel with a 60,000 psi minimum tensile strength.
    b. 2-part Zinc Dichromate coating per ASTM B633.
    c. Organic Coating, tested in accordance with ASTM B117 to pass a 1,500-hour salt spray test.
    d. Use Type 316 stainless steel hardware:

        1) In chemical areas.
        2) For submerged service.
        3) For penetrations in tanks containing sludge or wastewater.
        4) For Wastewater Treatment Plants.

4. Completed Sealing System:

    a. Duty pressure rated for 20 psig differential pressure.
    b. EPDM for all services.
    c. Manufacturer: PSI-Thunderline/ Link-Seal as manufactured by Pipeline Seal & Insulator, Inc., Houston, TX, or pre-approved equal.

B. Sealant:

1. A two-part foamed silicone elastomer manufactured by:

    a. Dow Corning Co., Product No. 3-6548 silicone R.T.V.
    b. 3M brand fire barrier products caulk C.P. 25 and 3M brand moldable putty MP+.
    c. Flame-Safe fire stop systems FS-900 by Rectorseal.

2. Sealant bead configuration, depth, and width in accordance with manufacturer's recommendations.

2.5 MISCELLANEOUS MATERIALS

A. Bonding Compound: Provide products by one of the following or equal:

1. Sikadur Hi-Mod epoxy by Sika Corp.
2. Euco 452 by Euclid Chemical Corp.; Master Builders Company.

B. Escutcheons plates: Hot dipped galvanized steel unless otherwise indicated on the Drawings. Provide Type 316 stainless steel hardware for treatment basins and wet submerged areas.

2.6 FLEXIBLE CONNECTIONS

A. Manufacturers:

1. For pressure pipe applications and applications with steel and copper piping: Flexicraft Industries, Chicago, IL; Hyspan Precision Products, Inc.; Metraflex Company, Chicago, IL; Victaulic Company, Easton, PA; or equal.
2. For non-pressurized applications involving plastic, clay, asbestos cement, or cast-iron applications: Fernco or equal.
3. For pressure pipe applications with ductile iron piping: Flex Lok Ball Joint Pipe by American Ductile Iron Pipe; or equal.

B. Steel Piping:

1. Inner Hose: Type 316 stainless steel.
2. Exterior Sleeve: Double-braided Type 316 stainless steel.
3. Pressure Rating: 125 psig WSP at 450 degrees F.
4. Joints: Flanged, threaded, threaded with union, or soldered.
5. Size: Use pipe-sized units.
6. Maximum Offset: 1 inch on each side of installed center line.

C. Flanged Adaptors:

1. Flanged adaptor connections for grooved or shouldered end pipe compatible with split couplings at fittings, valves and equipment shall be VIC-Flange Style 341 or 342 as by the Victaulic Company of America; Gustin-Bacon; or approved equal.
2. Flanged adaptor connections for plain end pipe at fittings, valves and equipment shall be Dresser Style 127 or 128; Uni-Flange Adapter by Ford Meter Box Co.; similar models by Smith-Blair; or approved equal.

2.7 EXPANSION JOINTS

A. Single Arch Type for Air Service

1. Provide model 1101 manufactured by General Rubber or equal.

a. Minimum Temperature Rating: 300F
b. Minimum Pressure Rating: 25 PSIG

2.8 SLEEVE-TYPE COUPLINGS

A. Manufacturers:

1. GE Oil & Gas (Dresser); Xylem (Smith-Blair); or equal.

B. Description:

1. Comply with AWWA C213, C219.
2. Middle Ring: Ductile iron.
3. Followers: Ductile iron.
4. Gaskets:

a. Material: EPDM or Compatible with service conditions.
b. Comply with ASTM D2000.

5. Bolts: Type 316 Stainless Steel.

C. Finishes:

1. Factory fusion bonded epoxy coated.

2.9 COMPOSITE FLANGE ISOLATION KITS

A. Install composite flange isolation kits for use with aqueous applications where dissimilar metallic piping flanges are joined; where metallic pipe flanges mate with valve connecting flanges and other equipment of dissimilar metallic construction; where exposed piping makes a vertical transition to buried piping; and where otherwise indicated on Drawings.

1. Pipe flange materials applicable to this section include ductile iron, cast iron, cast copper alloy, forged stainless steel alloys, forged copper-nickel alloy and forged nickel alloy (Monel, Hastelloy, etc.), all of which having an adequate difference in potential to steel for internal electro-chemical corrosion.

B. Provide insulating flange gaskets comprised of a composite retainer constructed of G-10, FR-4 glass-reinforced epoxy sheet stock in accordance with NEMA LI-1, having a dielectric strength of 400 to 500-volts/mil in accordance with UL 94.

C. Provide a full-faced Type “E” configuration retainer, 1/8 inch thick, with bolt holes cut to match ASME B16.5 drilling.

1. Provide retainer containing a precision tapered groove designed to accommodate controlled compression of an extruded elastomer sealing element. Pressure energize Quad-ring seal.
2. Provide glass-reinforced epoxy retainer with 550-volts/mil dielectric strength and a minimum 50,000-psi compressive strength.

D. Construct sealing element on one of the following materials as required for working temperatures indicated on Drawings:

1. Ethylene propylene diene monomer rubber for pipe with a working temperature of -30 to 250 degrees F.
2. Provide fluoroelastomer for pipe with a working temperature of 20 to 300 degrees F.

E. Provide insulating bolt sleeves manufactured of Mylar having a dielectric strength of not less than 4000-volts/mil.

F. Provide insulating washers manufactured of same G-10 FR-4 epoxy fiberglass materials as gasket.

1. Install insulating washers with metallic follower washers specified below to prevent damage to insulating washer during field assembly.

G. Molded sleeve washers may be used as an alternate to separate washers and sleeves, provided material of construction has equivalent properties to those specified herein.

H. Provide one of the following dielectric insulating flange gasket kits:

1. Trojan manufactured by Pipeline Seal and Insulator, Houston, Texas.
2. PSI GasketSeal® manufactured by GPT Division of EnPro Industries, Charlotte, North Carolina.
3. IsoGuard™ manufactured by Lamons Gasket Company Inc., Houston, Texas.

2.10 INSULATION

A. As indicated on Drawings and Section 404213 “Process Piping Insulation”.

2.11 FINISHES

A. Prepare piping appurtenances for field finishes.

2.12 SOURCE QUALITY CONTROL

1. Provide shop inspection and testing of completed assemblies.

B. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field dimensions are as indicated on Shop Drawings.

B. Inspect existing flanges for nonstandard bolthole configurations or design and verify that new pipe and flanges mate properly.

C. Verify that pipe plain ends to receive sleeve-type couplings are smooth and round for 12 inches from pipe ends.

D. Verify that pipe outside diameter conforms to sleeve manufacturer's requirements.

3.2 PREPARATION

A. Cleaning: Thoroughly clean end connections before installation.

B. Close pipe and equipment openings with caps or plugs during installation.

C. Surface Preparation: Clean surfaces to remove foreign substances.

3.3 INSTALLATION

A. Coating: Finish piping appurtenances as specified in Section 099676.23 for service conditions.

B. Pipe Penetrations:

1. Flashing:

a. Provide flexible flashing and metal counterflashing where piping penetrates weatherproofed or waterproofed walls, floors, and roofs.
b. Flash floor drains with topping over finished areas with lead, 10 inches clear on sides, with minimum 36-inch by 36-inch sheet size.
c. Fasten flashing to drain clamp device.

2. Sleeves:

a. Exterior Watertight Entries: Seal with mechanical sleeve seals.
b. Set sleeves in position in forms and provide reinforcement around sleeves.
c. Size sleeves large enough to allow for movement due to expansion and contraction and provide for continuous insulation wrapping.
d. Extend sleeves through floors 2 inches above finished floor level and calk sleeves.
e. Provide close-fitting metal collar or escutcheon covers at both sides of penetration.
f. Install escutcheons at finished surfaces.

C. Flexible Connections: Install flexible couplings at connections to equipment and where indicated on Shop Drawings.

D. Expansion Joints:

1. Install flexible couplings and expansion joints at connections to equipment and where indicated on Shop Drawings.
2. If expansion joint is supplied with internal sleeve, indicate flow direction on outside of joint.

E. Air Release and Vacuum Breakers: Provide vacuum breakers as indicated on Drawings.

F. Backflow Preventers:

1. Install with nameplate and test cock accessible.
2. Install according to local code requirements.
3. Do not install in vertical position.

G. Insulation: As indicated on Drawings and Section 404213 “Process Piping Insulation”.

3.4 FIELD QUALITY CONTROL

A. After installation, inspect for proper supports and interferences.

B. Repair damaged coatings with material equal to original coating.

3.5 CLEANING

A. Keep equipment interior clean as installation progresses.

END OF SECTION 400506

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SECTION 400507 - HANGERS AND SUPPORTS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Hanger and support assemblies for process piping.

B. Related Requirements:

1. Section 031000 “Concrete Forming and Accessories” for execution requirements for placement of inserts or sleeves in concrete forms specified by this Section.
2. Section 033000 “Cast-in-Place Concrete” for execution requirements for placement of concrete housekeeping pads specified by this Section.
3. Section 400506 “Couplings, Adapters, and Specials for Process Piping.”
4. Section 400519 “Ductile Iron Process Pipe.”
5. Section 400523 “Stainless Steel Process Pipe and Tubing.”

1.3 DEFINITIONS

A. Ferrous Metal: Iron, steel, stainless steel, and alloys with iron as principal component.

B. Wetted or submerged: Submerged, on the wet side of basins, below top of channel or tank wall, under cover or slab of channel or tank, or in other damp locations.

C. “Pipe” or “piping” shall mean all piping, piping system(s), hose, tube, fittings, joints, valves, and similar appurtenances.

D. Supports: wherever the word “supports” or “pipe supports” are used, they shall mean pipe supports, hangers, structural connections, concrete inserts (if allowed), anchors, guides, bolts, expansion units, restraints and all restraint, hanging, supporting, allowing controlled expansion, or other means of attaching piping along with the necessary appurtenances.

1.4 COORDINATION

A. Coordinate Work of this Section with piping and equipment connections specified in other Sections and indicated on Drawings.

1.5 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's catalog data including load capacity.

B. Shop Drawings: Submit product design data and materials for each support type and identify location to be used.

1.6 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Welders' Certificate: Submit welders' certification of compliance with AWS D1.1, verifying qualification within previous 12 months.

C. Qualifications Statements:
   1. Submit qualifications for manufacturer, fabricator, installer, and licensed professional.
   2. Submit manufacturer's approval of installer.

1.7 DELIVERY, STORAGE AND HANDLING

A. Supports and hangers shall be crated, delivered, and uncrated to protect against damage.

B. Parts shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation is completed.

C. Finished metal surfaces not galvanized, that are not of stainless-steel construction, or that are not coated, shall be grease coated, to prevent rust and corrosion.

1.8 QUALITY ASSURANCE

A. Perform Work according to AWS D1.1 for welding hanger and support attachments to building structure.

B. Perform Work according to TCEQ and City of Georgetown standards.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years' documented experience.

B. Fabricator: Company specializing in fabricating products specified in this Section with minimum three years' documented experience.

C. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

D. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Texas**.**

1.10 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on-Site in original factory packaging, labeled with manufacturer's identification.

B. Protect products from weather and construction traffic, dirt, water, chemical, and damage by storing in original packaging.

C. Finished metal surfaces not galvanized, that are not of stainless-steel construction, or that are not coated, shall be grease coated, to prevent rust and corrosion.

1.11 CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 GENERAL

A. Support pipe and appurtenances connected to equipment to prevent any strain being imposed on the equipment. Comply with manufacturer’s requirements regarding piping loads being or not being transmitted to their equipment. Submit certification stating that such requirements have been met.

B. Support and secure all pipe and tubing in the intended position and alignment to prevent significant stresses in the pipe or tubing material, valves, fittings, and other pipe appurtenances. Install all supports to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact. Any structural steel members required to brace any piping from excessive dislocation shall conform to the applicable requirements of Section 055000 “Metal Fabrications” and shall be furnished and installed under this Section.

C. Contractor may propose minor adjustments to the piping arrangements in order to simplify the supports, or in order to resolve minor conflicts in the work. Such an adjustment might involve minor change to a pipe centerline elevation so that a single trapeze support may be used.

D. Where flexible sleeve, split ring, vibration, or other couplings are required at equipment, tanks, etc., the end opposite to the piece of equipment, tank, etc., shall be rigidly supported to prevent transfer of force systems to the equipment. Do not install fixed or restraining supports between a flexible coupling and the piece of equipment.

E. Pipe supports:

1. Shall not induce point loadings but shall distribute pipe loads evenly along the pipe circumference.
2. Provide supports at changes in direction and elsewhere as shown in the Drawings or as specified herein.

3. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless specifically indicated on Drawings or authorized by the Engineer.
4. Provide pipe supports to minimize lateral forces through valves, both sides of flexible split ring type couplings and sleeve type couplings, and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.
5. Effects of thermal expansion and contraction of the pipe to be accounted for in the pipe support installation.

F. Insofar as is possible, floor supports shall be given preference. Where specifically indicated, concrete supports, as shown on the Drawings, may be used. Base elbow and base tees shall be supported on concrete pedestals.

G. Restraints, flexible connections, expansion items, and related items as included in other specifications (especially Sections 400506 “Couplings, Adapters, and Specials for Process Piping” and other individual pipe sections) and shown on Drawings.

2.2 PERFORMANCE REQUIREMENTS/DESIGN CRITERIA

A. All supports and appurtenances shall be standard products from approved manufacturers wherever possible and shall be adequate to maintain the supported load in proper position under all operating conditions. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product and shall not be considered as proprietary. Note that different materials required, as specified in Part 2 MATERIALS, may require different figures or model numbers than those shown.

1. The minimum working factor of safety for all items, with the exception of springs, shall be five times the ultimate tensile strength of the material, assuming 10 feet of water-filled pipe being supported and normal test pressures.
2. Design for all loads using a safety factor of 5.

B. Pipe Schedule is included in the Contract Drawings.

C. All items shall be designed with strength and stiffness to support, restrain, and allow expansion of the respective pipes under the maximum combination of peak loading conditions to include pipe weight, liquid weight, liquid movement and pressure forces, thermal expansion and contraction, vibrations, and all probable externally applied forces.

D. Support spacing shall be per ASME B31.3 for process piping. In addition, requirements of MSS SP 58 shall apply.

E. Complete details of the pipe system components shall be submitted for review and approval as specified in Part 1. No support shall be installed without approved support system Drawings.

F. The pipe support system shall not impose loads on the supporting structures in excess of the loads for which the supporting structure is designed.

1. Pipe will be supported by existing structures.

G.

G. Seismic Design and restraint requirements, in accordance with the Structural Design criteria.

2.3 MATERIALS

A. For support of metallic pipe:

1. Submerged, all treatment basins and facilities, Buried, or Within Outdoor Structures (vaults, etc.): Type 316 stainless steel.
2. Within Chemical Areas: Vinyl ester fiberglass reinforced plastic (FRP)
3. Other Locations: steel with galvanizing where noted.
4. Additional Requirements (including dielectric insulation): See following Paragraphs.

B. For support of non-metallic pipe:

1. Submerged, Buried, or Within Vaults: Type 316 stainless steel or FRP.
2. Within Chemical Areas: vinyl ester FRP.
3. Other Locations: steel with galvanizing where noted; all with local stress protection shields.
4. Additional Requirements (including stress protection shields): See following Paragraphs.

C. Wherever stainless steel is noted, it shall be Type 316 unless noted otherwise.

2.4 INSULATION

A. See Drawings and Section 404213.

2.5 SUPPORT AND RESTRAINT SYSTEMS

A. Steel, Stainless Steel, or Ductile Iron Piping:

1. Cast iron and ductile iron, steel, and stainless steel piping shall be supported at a maximum support spacing of 10 feet with a minimum of one support per pipe section at the joints.
2. Support spacing for ductile iron, steel, and stainless steel piping 2-inches and smaller diameter shall not exceed 5 feet.

B. Non-Metallic Piping:

1. All uninsulated non-metallic piping such as PVC, CPVC, HDPE, PVDF, etc., shall be protected from local stress concentrations at each support point. Protection shall be provided by non-metallic protection shields or other method as approved by Engineer.

    a. Where pipes are bottom supported 180 degrees, arc shields shall be furnished. Where 360-degree arc support is required, such as U-bolts, protection shields shall be provided for the entire pipe circumference. All U-bolts or clamps for non-metallic pipes shall be plastic coated.
    b. Protection shields shall have an 18-gauge minimum thickness, not be less than 12 inches in length and be securely fastened to pipe with Type 316 stainless steel straps not less than 1/2 inch wide.

2. Individually supported PVC pipes shall be supported as recommended by the pipe manufacturer except that support-spacing shall be manufacturers recommendation minus 2 feet down to 5 feet spacing recommendation, then spacing shall be 3 feet.

3. Supports for horizontal multiple PVC plastic piping:

   a. Shall be continuous wherever possible.
   b. Multiple, suspended, horizontal plastic PVC pipe runs, where possible, shall be supported by ladder type cable trays such as: Husky Ladder Flange Out by MPHusky; or equal.
   c. Rung spacing shall be 12 inches. Tray width shall be approximately 6 inches for single runs and 12 inches for double runs.
   d. Ladder type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc., required for a complete support system. Individual plastic pipes shall be secured to the rungs of the cable tray by strap clamps or fasteners similar to: Globe, Series 600; Unistrut Pipe/Conduit Clamps and Hangers; or equal.
   e. Spacing between clamps shall not exceed 9 feet. Cable trays shall provide continuous support along the length of the pipe. Individual clamps, hangers, and supports in contact with plastic PVC pipe shall provide firm support but not so firm as to prevent longitudinal movement due to thermal expansion and contraction.

C. Framing Support System:

1. Beams: Size such that beam stress does not exceed 25,000 psi and maximum deflection does not exceed 1/240 of span.
2. Column Members: Size in accordance with manufacturer's recommended method.
3. Support Loads: Calculate using weight of pipes filled with water.
4. Maximum Spans:

   a. Steel and ductile iron pipe 3 inch diameter and larger: 10 feet centers, unless otherwise shown.
   b. Other pipelines and special situations: Same as noted in previous paragraphs. Supplementary hangers and supports may be required.

D. Support vertical pipes at each floor or at intervals of not more than 12 feet by approved pipe collars, clamps, brackets, or wall rests and at all points necessary to ensure rigid construction. Secure vertical pipes passing through pipe sleeves using a pipe collar.

2.6 ANCHOR BOLTS/SYSTEMS

A. Anchoring Devices: Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor support, to withstand shear, and pullout loads imposed by loading and spacing on each particular support.

1. DO NOT USE ADHESIVE ANCHOR BOLTS ON ANY PIPE SUPPORT HUNG FROM A ROOF OR CEILING, unless specifically noted otherwise.

B. Post-installed anchors in concrete shall have current published ICC-ES Evaluation Report indicating the anchor is approved for installation in cracked concrete.

C. Latest edition of the following specification and recommended practices shall become part of this specification as if written herein. Wherever requirements conflict, the more stringent shall govern.

1. ACI 318, Appendix D.
2. ACI 355.2, Mechanical Anchors "Qualification of Post-Installed Mechanical Anchors in Concrete".
3. Anchor manufacturer's published installation requirements.

D. Expansion anchors:

1. The length of expansion bolts shall be sufficient to place the wedge portion of the bolt a minimum of 1 inch behind the steel reinforcement.
2. Manufacturers:

a. Power-Stud+ SD4 and Power-Stud+ SD6 by Powers Fasteners, Brewster, NY.
b. Kwik Bolt as manufactured by Hilti USA, Tulsa, Oklahoma.
c. Wej-it by Wej-it Expansion Products, Inc., Broomfield, Colorado.

E. Unless otherwise noted: Type 316 stainless steel for all anchors.

F. Size of anchor bolts as designed by manufacturer, 1/2 inch minimum diameter, or as shown on Drawings.

G. Anchors to concrete in chemical areas shall be epoxy secured vinyl ester FRP all thread, insertion depth and size as required by the manufacturer for the design loads. Nuts, bolts, and hardware shall all be vinyl ester FRP construction.

2.7 HANGER RODS

A. Where use of steel is allowed, hanger rods shall be hot-rolled steel, machine-threaded, and, except for stainless steel, galvanized after fabrication. The strength of the rod shall be based on its root diameter.

1. Hanger rods shall be attached to concrete structures using single or continuous concrete inserts by the named support manufacturers above. Where use of steel is allowed, inserts shall be malleable iron or steel with galvanized finish.
2. Beam-clamps, C-clamps, or welded-beam attachments shall be used for attaching hanger rods to structural steel members.

B. Minimum rod size for metallic rod hangers:

	Nominal Pipe / Tube Diameter	Minimum Hanger Rod Diameter
1	Less than 2-1/2 inch	1/4 inch*
2	3 to 8 inches	1/2 inch

3	10 to 14 inches	3/4 inch*
4	16 to 20 inches	2 at 1 inch
5	24 inches	2 at 1-1/4 inch
6	30 inches	2 at 1-1/2 inch

* For pipe diameters less than 14 inch, if using pipe roller, use 2 hanger rods with minimum diameter noted below for pipe's diameter.

2.8 SINGLE PIPE HANGERS

A. Unless otherwise indicated, pipe hangers and supports shall be standard catalogued components, conforming to the requirements of MSS-41, 58, or 69 and shall be of the following type:

1. Anvil International.
2. Equal models by: Carpenter & Patterson, Inc., Woburn, MA; Cooper B-Line; Gulf State Manufacturing; or Unistrut Northeast, Cambridge, Massachusetts.

B. Single pipes shall be supported by hangers suspended by hanger rods from structural steel members, concrete ceilings, bottom of trapeze hangers, and wall-mounted steel angle brackets.

C. Where pipes are near walls, beams, columns, etc., and located an excessive distance from ceilings or underside of beams, welded steel wall brackets similar to Carpenter and Patterson, Figure Nos. 68, 79, 84, or 139 shall be used for hanging pipe. Where single pipes rest on top of bracket pipe supports, attachments shall meet requirements as specified under multiple pipe hangers.

2.9 MULTIPLE PIPE HANGERS

A. Suspended multiple pipes, running parallel in the same horizontal plane that are adjacent to each other, shall be suspended by trapeze type hangers or wall brackets. Where use of steel is allowed, trapeze hangers shall consist of galvanized structural steel channel supported from galvanized threaded rod or attached to concrete walls, columns, or structural steel support members. See previous paragraphs about multiple PVC pipe supports.

B. Except as otherwise specified herein, pipe anchors used for attaching pipe to trapeze or multiple pipe wall brackets shall be anchor or pipe chairs similar to:

1. Anvil Fig. 175.
2. Cooper B-Line B3147A or B3147B.
3. Where use of steel is allowed, material of construction shall be galvanized steel. Chair U bolts shall be tightened to allow freedom of movement for normal expansion and contraction except where pipe must be anchored to control direction of movement or act as a thrust anchor.

2.10 SINGLE PIPE SUPPORTS FROM BELOW

A. Single pipes located in a horizontal plane close to the floor shall be Pedestal type: Schedule 40 pipe stanchion, saddle, and anchoring flange.

1. Nonadjustable Saddle: MSS SP 58, Type 37 with U-Bolt.

    a. Anvil, Figure 259.
    b. Cooper B-Line, Figure B3090.

2. Adjustable Saddle: MSS SP 58, Type 38 without clamp.

    a. Anvil, Figure 264.
    b. Cooper B-Line, Figure B3093.

B. Pipes less than 3 inches in diameter:

1. Hold in position by supports fabricated from steel C channel, welded post base similar to Unistrut, Figure P2072A, where use of steel is allowed; and pipe clamps similar to Unistrut, Figures P1109 through 26.
2. Where required to assure adequate support, fabricate supports using two vertical members and post bases connected by horizontal member of sufficient load capacity to support pipe.
3. Fasten supports to nearby walls or other structural member to provide horizontal rigidity.
4. More than one pipe may be supported from a common fabricated support.

C. Pipes 3 inches in diameter and larger:

1. Support by adjustable stanchions.
2. Provide at least 4 inch adjustment.
3. Flange mount to floor.

D. Use yoked saddles for piping whose centerline elevation is 18 inches or greater above the floor and for all exterior installations.

E. Pipe roller type supports shall be used where required to accommodate thermal movement in conjunction with axial supports.

2.11 WALL SUPPORTED SINGLE AND MULTIPLE PIPES

A. Single or multiple pipes located adjacent to walls, columns, or other structural members shall be supported using welded steel wall brackets, where use of steel is allowed, as manufactured by Carpenter and Patterson, Figure No. 69, 84, or 139.

B. Where noted, multiple pipes may be supported on C-channel with steel brackets similar to Unistrut pipe clamps; with pipe anchor chairs; or equal.

C. Individual pipes, up to 8-in diameter, where noted, may use MSS Type 8 pipe clamps as noted on the Drawings.

D. Securely fasten all members to wall, column, etc., using double-expansion shields or other method as approved by the Engineer. Provide additional wall bearing plates as required.

2.12 BASE ANCHOR SUPPORT

A. Bend Support: Where pipes change direction from horizontal to vertical via a bend, install a welded or cast base bend support to carry the load. Fasten to the floor, pipe stanchion, or concrete pedestal using expansion anchors or other method as approved by the Engineer.

B. Concrete Supports: Where indicated, securely fasten pipe bends to concrete supports with suitable metal bands as required and approved by the Engineer. Isolate piping from poured concrete with a neoprene insert.

2.13 VERTICAL PIPE SUPPORTS

A. Where vertical pipes are not supported by a Unistrut type system as specified, they shall be supported in one of the following methods.

1. For pipes 1/4 to 2 inches in diameter:

    a. Provide extension hanger ring with an extension rod and hanger flange.
    b. The rod diameter shall be as recommended by the manufacturer for the type of pipe to be supported.
    c. Where use of steel is allowed, the hanger ring shall be steel- or PVC-clad depending on the supported pipe material of construction. The hanger ring shall be equal to Carpenter & Patterson, Figure Nos. 81.
    d. Where use of steel is allowed, the anchor flange shall be galvanized malleable iron similar to Carpenter and Patterson, Figure No. 85.

2. For pipes equal to or greater than 2 inch diameter:

    a. Extended pipe clamps similar to Carpenter & Patterson, Figure No. 267 may be used.
    b. Attach hanger to concrete structures using double expansion shields,
    c. Attach hanger to metal support members using welding lugs similar to Carpenter & Patterson, Figure No. 114.

B. Pipe supports shall be provided for closely spaced vertical piping systems required to provide a rigid installation. The interval of vertical support spacing shall be as specified, but in no case shall vertical interval exceed 12 feet. The support system shall consist of a framework suitably anchored to floors, ceilings, or roofs.

C. Unless otherwise specified, shown, or specifically approved by the Engineer, vertical runs exceeding 12 feet shall be supported by base elbows/tees, clamps, brackets, wall rests, and pipe collars, all located as required to ensure a rigid installation.

D. Pipe riser clamps, per MSS SP58, shall be used to support all vertical pipes extending through floor slabs. Where use of steel is allowed, riser clamps shall be galvanized steel manufactured by:

1. Carpenter & Patterson, Figure No. 128.
2. Anvil, Figure 261.
3. Cooper B-Line, Figure B3373.
4. Or equal.

E. Copper-clad or PVC-coated clamps shall be used on copper pipes. Insulation shall be removed from insulated pipes prior to installing riser clamps. Insulation shall not be damaged by clamp installation.

2.14 SPECIAL SUPPORTS

A. Frame Work Supports:

1. Vertical and horizontal supporting members shall be U-shaped channels similar to Unistrut, Series P1000. Vertical piping shall be secured to the horizontal members by pipe clamps or pipe straps. See pipe clamp and strap requirements.
2. For piping 3 inch and smaller, framework shall be as manufactured by:

    a. Unistrut Corporation.
    b. Power-Strut (or Ackinstrut where fiberglass systems are specified).
    c. Multi-Strut by Carpenter-Paterson.
    d. Or equal.

3. For piping larger than 3 inches, the support frame shall be fabricated from structural stainless steel or steel shapes, depending upon the support location, and secured through the use of drop in, adhesive or expansion anchors.
4. Furnish assemblies complete with all nuts, bolts, and fittings required for a complete assembly including end caps for all Unistrut members.
5. Electrical Conduit Support: Under Division 26.
6. Design of each individual framing system shall be responsibility of Contractor. Submit shop drawings and show all details of installation, including dimensions and types of supports. In all instances the completed frame shall be adequately braced to provide a complete rigid structure when all the piping has been attached. See also Article SUPPORT AND RESTRAINT.

B. Supports not otherwise described in this Section shall be fabricated or constructed from standard structural stainless steel or steel shapes in accordance with applicable provisions of Section 055000 “Metal Fabrications,” or Unistrut-type frame; have anchor hardware similar to items previously specified herein; shall meet the minimum requirements listed below; and be subject to the approval of Engineer.

C. Additional Pipe Support Situations:

1. Supporting Multiple Chemical and Related Piping:

    a. Location: As indicated on Drawings or otherwise required, especially adjacent to chemical pumps.
    b. Use: Framework support.
    c. Materials: FRP, with proper local stress protection.

2.15 SHOP FACTORY FINISHING

A. Prepare and prime metallic (except stainless steel) supports.

2.16 ACCESSORIES

A. Insulation Shield: Install on insulated non-steel piping. Oversize the rollers and supports, as required. Manufacturers:

1. Anvil, Figure 167.
2. Cooper B-Line, Series B3151.

B. Welding Insulation Saddle: Install on insulated metal pipe. Oversize the rollers and supports, as required. Manufacturers:

1. Anvil, Figure 160.
2. Cooper B-Line, Series B3160.

C. Vibration Isolation Pad: Install under base flange of pedestal type pipe supports adjacent to equipment, and where required to isolate vibration.

1. Isolation pads to be neoprene, waffle type.
2. Manufacturers:

    a. Mason Industries, Type W.
    b. Korfund.

D. Dielectric Barrier:

1. Install between carbon steel members and copper or stainless-steel pipe.
2. Install between stainless steel supports and non-stainless steel ferrous metal piping.
3. Isolate stainless steel piping from ferrous materials, including galvanized steel by use of neoprene sheet material and protection shields.

E. Electrical Isolation: Install 1/4 by 3 inch neoprene rubber wrap between submerged metal pipe and oversized clamps.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify field dimensions as indicated on Drawings.

3.2 INSTALLATION

A. Obtain permission from Engineer before using powder-actuated anchors.

B. Obtain permission from Engineer before drilling or cutting structural members.

C. Inserts:

1. Install inserts for placement in concrete forms. Before setting inserts, all drawings and figures shall be checked that have a direct bearing on the pipe location. Responsibility for the proper location of pipe supports is included under this Section.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

D. Pipe Hangers and Supports:

1. Support horizontal piping as indicated on Drawings, depending upon pipe size.
2. Install support systems in accordance with MSS SP69 and MSS SP89, unless shown otherwise. Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.
3. Install hangers with minimum 1/2 inch space between finished covering and adjacent Work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment.
6. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
7. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
8. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
9. Support riser piping independently of connected horizontal piping.
10. Provide sheet lead packing between hanger or support and piping.
11. Design hangers for pipe movement without disengagement of supported pipe.
12. Support piping independently so that equipment is not stressed by piping weight or expansion in piping system.
13. Support large or heavy valves, fittings, and appurtenances independently of connected piping.
14. Provide welded steel brackets where piping is to be run adjacent to building walls or columns.
15. Use beam clamps where piping is to be suspended from building steel.
16. Insulated Piping: Provide two bolted clamps designed to accommodate insulated piping.
17. Use offset clamps where pipes are indicated as offset from wall surfaces.
18. Proceed with installation of piping and supports only after any building structural work has been completed and new concrete has reached its 28-day compressive strength.
19. The installation of pipe support systems shall not interfere with the operation of any overhead bridge cranes, monorails, access hatches, etc. No piping shall be supported from stairs, other pipes, ladders, and walkways unless authorized by Engineer.
20. Repair mounting surfaces to original condition after attachments are made.
21. Brace horizontal pipe movements by both longitudinal and lateral sway bracing.
22. Where supports are required in areas to receive chemical resistant seamless flooring, install supports prior to application of flooring system.

E. Insulation:

1. Provide clearance in hangers and from structure and other equipment for installation of insulation.

F. Equipment Bases and Supports:

1. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment. Comply with Section 033000 “Cast-in-Place Concrete.”
2. Using templates furnished with equipment, install anchor bolts and accessories for mounting and anchoring equipment.
3. Construct supports of Type 316 stainless steel members, channel, pipe, and fittings. Brace and fasten with flanges bolted to structure.
   Provide rigid anchors for pipes after vibration isolation components are installed.

G. Prime Coat:

1. Prime coat exposed steel hangers and supports.
2. Conform to Section 099676.43 “Wastewater Chemical Storage Coatings”.
3. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.3 FIELD QUALITY CONTROL

A. Test pipe support systems after installation in conjunction with respective piping pressure tests. If any part of the pipe support system proves to be defective or inadequate, it shall be repaired, augmented or replaced to the satisfaction of Engineer.

3.4 CLEANING

A. Keep equipment interior clean as installation progresses.

END OF SECTION 400507

SECTION 400519 - DUCTILE IRON PROCESS PIPE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Ductile-iron pipe.
2. Ductile-iron, malleable-iron, and cast-iron fittings.
3. Accessories.

B. Related Requirements:

1. Section 099679 “Atmospheric Protection and Plant Service Areas Coatings” for product and execution requirements for non-buried ductile iron pipe specified by this Section.
2. Section 400506 “Couplings, Adapters, and Specials for Process Piping” for piping appurtenances.
3. Section 400507 “Hangers and Supports for Process Piping” for hangers, anchors, sleeves, and sealing of piping to adjacent structures.
4. Section 400551 “Common Requirements for Process Valves” for common product requirements for valves for placement by this Section.

1.3 COORDINATION

A. Coordinate Work of this Section with piping and equipment connections specified in other Sections and indicated on Drawings.

1.4 ACTION SUBMITTALS

A. Product Data: Submit manufacturer information regarding pipe and fittings.

B. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, sizes, and materials lists.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Prior to shipment of pipe, submit a certified affidavit of compliance from the pipe manufacturer stating that the pipe fittings, gaskets, linings, and exterior coating

for this project have been manufactured and tested in accordance with AWWA and ASTM standards and requirements specified.

B. Prior to Pipe Shipment:

1. Certified copies of mill tests confirming the type of materials used in the pipe, and shop testing of pipe to show compliance with the requirements of the applicable standards, along with a sworn affidavit of compliance that the pipe complies with the referenced standards.
2. Copies of shop tests, including hydrostatic tests.

C. Qualifications Statements:

1. Submit qualifications for manufacturer, installer, and licensed professional.
2. Submit manufacturer's approval of installer.

D. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping, valves and other appurtenances, connections, and invert or centerline elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 WARRANTY

A. Provide Manufacture/Supplier warranty in accordance with CIP16, “Warranty”.

1.8 QUALITY ASSURANCE

A. Hydrostatically test each length of ductile iron pipe at the point of manufacture to 500 psi for a duration of 10 seconds per AWWA C151. Furnish certified test results in duplicate to the Engineer prior to time of shipment.

B. Inspect and test by Manufacturer the ductile-iron pipe and fittings at the foundry as required by the AWWA C600, Hydrostatic Testing; ASTM A716, Standard Specification for Ductile Iron Culvert Pipe; and ASTM A746, Standard Specification for Ductile Iron Gravity Sewer Pipe as applicable. Furnish in duplicate to the Engineer sworn certificates of such tests and their results prior to the shipment of the pipe.

C. Pipe and fittings to be installed under this Contract may be inspected at the plant for compliance with this Section by an independent testing laboratory selected by Owner at their expense.

D. Owner will inspect the pipe and fittings after delivery. Products are subject to rejection at any time on account of failure to meet any of the specified requirements, even though accepted as

satisfactory at the place of manufacture. Immediately mark pipe rejected after delivery and remove from the job site.

E. Permanently mark pipe and fittings with the following information:

1. Manufacturer name and trademark.
2. Manufacturing date.
3. Size, type, class, or wall thickness.
4. Production standard (AWWA, ASTM, etc.).
5. Apply pipe labelling per ASME A13.1-2015 Label Color Coding for Background and Lettering.

F. Perform Work according to City of Georgetown, TCEQ, and manufacturer’s standards.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum five years' documented experience.

C. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Texas.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage. Photograph and provide written documentation of damaged materials.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Coverall openings to prevent entrance of dirt, water, and debris.
3. Protect piping and appurtenances by storing off ground.
4. Limit stacking height to manufacturers specified maximum.
5. Provide additional protection according to manufacturer instructions.

1.11 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

A. Piping:

1. Comply with AWWA C115, C150 or C151 as applicable for service.
2. Ductile Iron pipe as manufactured by U.S. Pipe and Foundry Company, Inc.; American Cast Iron Pipe Company; all divisions of the McWane Company or an approved equal who is a member of the Ductile Iron Pipe Research Association (DIPRA).
3. Pressure Ratings:

	Pipe Diameter	Minimum Pressure Rating (psi)
a.	4-inches through 12-inches	350
b.	14-inches and larger	250

B. Fittings:

1. Material: AWWA C110, ductile iron AWWA C153, ductile iron.

    a. Pressure Rating: As indicated on Drawings or the same pressure rating, at a minimum, of the connecting pipe.

2. Mechanical Joints: Comply with AWWA C110 and AWWA C111.
3. Push-on Joints: Comply with AWWA C111.
4. Restrained Joints: Comply with AWWA C111.
5. Flanged Fittings (for above grade piping): Comply with AWWA C110 and ASME B16.1 Class 125

    a. Assembly bolts: square headed carbon steel machine bolts with hexagon nuts per ANSI B18.2. Threads conform to ANSI B1.1. Bolt length: 1/8 inch to 5/8 inch protrusion from nut after torquing.
    b. Flange gaskets shall be full face type per AWWA C111 to provide positive sealing for the flanged ductile iron joints. Thickness shall be 1/8-inch unless otherwise indicated.
    c. Steel flanges in conformance with AWWA C207, Class D, may be mated to iron valves, fittings, or other parts having either integral Class 125 iron flanges or screwed Class 125 companion flanges. When such construction is used, the raised face on mating flanges shall be removed.

6. Grooved joints: Comply with AWWA C606.

    a. Rigid couplings: Style 31 couplings as manufactured by Victaulic, Anvil International, or equal.
    b. For direct connection of ductile pipe to steel pipe of IPS sizes: Victaulic Style 307 transition coupling with offsetting, angle-pattern, bolt pads.
    c. Grooved end fittings for AWWA ductile iron pipe: Conform to ANSI A21.10/AWWA C110 for center-to-end dimensions and ANSI A21.10/AWWA C110 or AWWA C153 for wall thickness, with AWWA C606 grooved ends.

7. Sleeve type couplings: Dresser Style 38 or 138 as manufactured by Dresser Industries, or equivalent products of Smith-Blair, Romac Industries, Ford Meter Box Company, or equal.
8. Flanged coupling adaptors: Smith-Blair Type 913, or equivalent products of Klamflex Pipe Couplings (PTY) LTD, Robar Industries LTD, or equal.

C. Interior Linings:

1. Ductile iron pipe and fittings shall have the same type of lining as specified in the Pipe Schedule and indicated on the Drawings.
2. Glass Lining:

    a. All grit piping shall have glass lining.
    b. Manufactured by Ferrock, Permutit or equal.
    c. Glass lining: consists of vitreous and inorganic lining materials applied to the internal surfaces. The internal surface shall be prepared in strict accordance with ASTM B1000, Sections 3 and 4.
    d. Apply lining in a minimum of two coats, separately applied and separately fired to a maturing temperature of 1350 degrees F. Finished dry film average thickness: 10 mils and a minimum thickness of 8 mils. Lining thickness will be measured by a Mikrotest, Elcometer, or equal magnetic thickness gauge.
    e. Finished glass lining Acceptance Criteria:

        1) Free of visible pin holes or holidays, crazing or fish scales.
        2) Surface hardness greater than 5 on the MOHS scale and minimum density of lining shall be 2.5 grams/cc.
        3) Weight loss of not more than 3 miles/sq. in. when testing in a range of 500 degrees F in accordance with U.S. Bureau of Standards, Standard T Section Thermal Shock Tests.
        4) Minimum compressive strength of 30,000 psi.
        5) Able to withstand a strain of 0.001 inch/inch of the base metal without damage to the glass.
        6) Inspected and tested in accordance with ASTM B1000 - 15, Section 7. Certified inspection and test report to be furnished with each product shipment.

    f. Applicator Qualifications: Minimum of 5 years successful experience in the application of high temperature glass/porcelain coatings to interior of ductile pipe and fittings. Certify complete compliance with all qualification, final inspection and quality guidelines included in Sections 5 and 6 of ASTM B1000 – 15.

3. Epoxy Lining:

    a. Line ductile iron pipe and fittings with a ceramic-filled amine-cured epoxy, Protecto 401 by Induron.
    b. Lining thickness of 40 mils minimum. Applicator approved by the coating manufacturer and applied in accordance with manufacturer's instructions and under controlled conditions at the applicator's shop or the pipe manufacturer's plant.
    c. Submit a certified affidavit of compliance with manufacturer's instructions and requirements specified.

D. Exterior Coating:

1. Exposed Service: As specified in Section 099679 “Atmospheric Protection and Plant Service Areas Coatings.”
2. If required, coatings "hold-backs" to be provided at pipe and fitting ends for satisfactory installation for joint connections in the field.
3. Provide all necessary coating materials to perform field coating applications at joints compatible with or equal to the shop applied material.
4. Field repair of pipe with damaged coating shall receive prior approval of Engineer. If, in the opinion of Engineer coating damage is beyond repair, replace pipe at expense of Contractor.
5. All flange bearing surfaces shall be uncoated.
6. Mechanically clean or brush blast all surfaces to have exterior coating applied to ductile iron surfaces. Chemical cleaning or wiping with solvent is not acceptable.

2.2 ACCESSORIES

A. Thermal Insulation:

1. Pipe insulation shall be specified in Section 404213 “Process Piping Insulation” and as shown on Drawings.

B. Gaskets:

1. Full face type SBR per AWWA C111 to provide positive sealing for the flanged ductile iron joints.
2. Thickness 1/8-inch.

C. Pipe Hangers and Supports:

1. Pipe hangers and supports shall be specified in Section 400507 “Hangers and Supports for Process Piping”.
2. Pipe hangers and supports shall be provided at suitable distance along the pipeline regardless whether they are shown or not shown on the Drawings.

D. Base bends and base tees shall have machined and drilled bases.

E. Filler flanges and beveled filler flanges shall be furnished and installed as required. Filler flanges and beveled filler flanges shall be furnished faced and drilled complete with extra length bolts. Filler flanges shall be equal to Clow Figure F 1984 and beveled filler flanges shall be equal to Clow Figure F 1986.

2.3 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly. See Section 400551 “Common Requirements for Process Valves” for pipe testing requirements.

B. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field dimensions are as indicated on Drawings.

B. Inspect existing flanges for nonstandard bolt hole configurations or design and verify that new pipe and flange mate properly.

3.2 PREPARATION

A. Thoroughly clean pipe and fittings before installation.

B. Surface Preparation:

1. Clean surfaces to remove loose rust, mill scale, and other foreign substances by power wire brushing.
2. Touch up shop-primed surfaces with primer as specified in Section 099679 “Atmospheric Protection and Plant Service Areas Coatings.”
3. Solvent-clean surfaces that are not shop primed.

3.3 INSTALLATION

A. Buried Service Piping: As specified in Section W1 Ductile Iron Pipe and Fittings.

B. Exposed Service Piping:

1. According to ASME B31.3.
2. In compliance with manufacturer’s instructions.
3. Run piping straight along alignment as indicated on Drawings, with minimum number of joints.
4. Clean each length prior to installation.
5. Support per Section 400507 “Hangers and Supports for Process Piping”.
6. Do not use equipment flanges for support; support pipe separately.

C. Fittings:

1. According to manufacturer instructions.
2. Clean gasket seats thoroughly, and wipe gaskets clean prior to installation.
3. Tighten bolts progressively, drawing up bolts on opposite sides until bolts are uniformly tight; use torque wrench to tighten bolts to manufacturer instructions.
4. Flanged joints to be made using gaskets, bolts, bolt studs with a nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts to conform to the same ANSI Standard as the flanges. Bolts shall be ASTM A307, grade B, heavy hex nut.

5. Provide required upstream and downstream clearances from devices as indicated on Drawings.

D. Make taps to ductile iron piping only with service saddle, tapping boss of a fitting or valve body, or equipment casting.

E. Install piping with sufficient slopes for venting or draining liquids and condensate to low points.

F. Support exposed piping as specified in Section 400507 “Hangers and Supports for Process Piping.”

G. Provide expansion joints as specified in Section 400506 “Couplings, Adapters, and Specials for Process Piping”, and pipe guides as specified in Section 400507 “Hangers and Supports for Process Piping”, to compensate for pipe expansion due to temperature differences.

H. Dielectric Fittings: Provide between dissimilar metals.

I. Field Cuts: According to pipe manufacturer instructions. Cutting by abrasive saw only, leaving a smooth cut at right angles to the axis of the pipe. Damage to the lining repaired to the satisfaction of the Engineer. Seal Field cut ends approved epoxy coating in accordance with manufacturer's instructions.

J. Finish primed surfaces according to Section 099679 “Atmospheric Protection and Plant Service Areas Coatings.”

K. Installation Standards: Install Work according to City of Georgetown standards.

3.4 TOLERANCES

A. Deflection at joints not to exceed that recommended by the pipe manufacturer.

B. Supply and install fittings, in addition to those shown on Drawings, in areas where conflict exists with existing facilities.

3.5 FIELD QUALITY CONTROL

A. Inspection:

1. Inspect for damage to pipe lining or coating and for other defects that may be detrimental as determined by Engineer.
2. Repair damaged piping or provide new, undamaged pipe at no additional cost to the project.
3. After installation, inspect for proper supports and interferences.
4. Inspect and field test the glass lined piping and fittings to verify the delivered products meeting the criteria specified. Submit field test reports for spark testing and straightness testing showing compliance with the following criteria.

    a. Perform glass lining inspection of pipe and fitting prior to installation.
    b. Visually inspect pipe in storage on site for damage and defects.

B. Pressure Testing:

1. Test Pressure: As indicated on piping schedule.
2. Conduct hydrostatic test for minimum two hours.
3. Filling:

    a. Fill section to be tested with water slowly and expel air from piping at high points.
    b. Install corporation cocks at high points.
    c. Close air vents and corporation cocks after air is expelled.
    d. Raise pressure to specified test pressure.

4. Observe joints, fittings, and valves under test.
5. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage and retest.
6. Leakage:

    a. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
    b. Maintain pressure within plus or minus 5 psi of test pressure.
    c. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
    d. Compute maximum allowable leakage by following formula:

        1) L = SD x sqrt(P)/C.
        2) L = testing allowance in gph.
        3) S = length of pipe tested in feet.
        4) D = nominal diameter of pipe in inches.
        5) P = average test pressure during hydrostatic test in psig.
        6) C = 148,000.
        7) If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

    e. If test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.
    f. Correct visible leaks regardless of quantity of leakage.

3.6 CLEANING

A. Keep pipe interior clean as installation progresses.

B. After installation, clean pipe interior of soil, grit, and other debris.

END OF SECTION 400519

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SECTION 400523 - STAINLESS STEEL PROCESS PIPE AND TUBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Stainless steel pipe and fittings.
2. Accessories.

B. Related Requirements:

1. Section 400506 "Couplings, Adapters, and Specials for Process Piping" for pipe penetrations, restrained joints, flexible connections, expansion joints and loops, and sleeve-type couplings.
2. Section 400551 "Common Requirements for Process Valves" for common product requirements for valves for placement by this Section.
3. Section 400507 “Hangers and Supports for Process Piping” for hangers, anchors, sleeves and sealing of piping to adjacent structures.
4. Section 400564 “Butterfly Valves.”
5. Section 431118 “Vertically Split Multistage Centrifugal Blowers.”
6. Section 431133 “Rotary Lobe Blowers.”

1.3 COORDINATION

A. Coordinate Work of this Section with piping and equipment connections as specified in other Sections and as indicated on Drawings.

1.4 SUBMITTALS

A. Section 013000 – Submittals: Requirements for submittals.

B. Product Data: Submit manufacturer information on pipe materials and fittings.

C. Shop Drawings:

1. Indicate piping layouts and schedules, with dimensions, fittings, expansion joints, locations of valves and appurtenances, joint details, wall penetration details, methods, types, and locations of hangers and supports, and pertinent technical specifications for piping to be furnished.

2. Include data and information required for complete piping systems. Base pipe layout and dimensions on actual equipment to be furnished under Section 431118 and Section 431133. Show types and locations of pipe hangers and/or supports on layouts for each pipe submittal. Since not all dimensions will be checked by Engineer, nor will every detail be reviewed by Engineer, Contractor will be responsible for accurate dimensioning of piping systems.

D. Cleaning Methods:

1. Include pre-cleaning, descaling, chemicals to be used, or mechanical descaling method, post-weld cleaning to restore corrosion resistance and final cleaning/passivation/pickling.
2. Include method and schedule for drying pipe so that it is ready for service as part of proposed cleaning method.
3. Include name and qualifications of firm that will be doing cleaning.
4. Include name and qualifications of independent firm that will be doing inspection of cleaned pipe.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1. Submit ISO 900 certification for manufacturing facility.

F. Welder Certificates: Submit welders' certification of compliance with AWS D1.1/D1.1M, verifying qualification within previous 12 months.

1.5 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

B. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

C. Qualifications Statements:

1. Submit manufacturer's approval of installer.

1.6 CLOSEOUT SUBMITTALS (NOT USED)

1.7 QUALITY ASSURANCE

A. Furnish stainless steel pipe and fittings by a single manufacturer who is fully experienced, reputable, qualified and regularly engaged for the last 5 years in manufacture of materials to be furnished.

B. Permanently mark each length of pipe with manufacturer's name or trademark, and compliance with standards.

C. Furnish work in new and unused condition.

D. Perform and document quality control (QC) and quality assurance (QA) procedures performed during manufacturing at factory; during loading of Work for transport at factory; during

transport to Site; during unloading and storage of Work at Site; and during installation and startup at Site, all part of Work specified herein.

E. If there are difficulties in operation of systems included under this Contract due to defective Work, provide additional services to correct defective Work and meet acceptance testing requirements.

F. Inspection by Owner or Engineer or failure to inspect does not relieve Contractor of his responsibility to provide materials and perform Work in accordance with Contract Documents.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 5 years' documented experience.

B. Welders: ASME qualified within previous 12 months for employed weld types.

C. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Texas.

D. Welding Qualifications: Qualify procedures according to AWS D1.1/D1.1M, "Structural Welding Code – Steel."

E. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

F. Testing Agency Qualifications: Qualified according to ASTM C 1021 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC Standard 17025.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage. Document and notify Engineer if product is damaged. No piece shall be installed which is found to be defective. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe and fittings.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Protect piping and appurtenances by storing off ground.
3. Provide additional protection according to manufacturer instructions.
4. Protect stainless steel materials from contact with carbon steel including but not limited to hoisting and rigging equipment, steel tables, storage racks and hand tools.
5. Do not bundle pipe and fittings using ferrous metal banding at the factory or Supplier’s facility.

6. Do not allow contact between wear surfaces of tools used for carbon steel fabrication and the surfaces of stainless-steel pipe and fittings. These tools include abrasive grinding and cutting wheels, wheel cutters and rollers, threading taps and dies, tube bending equipment and all other bearing edge tools.
7. Use manual or powered wire brush tools for surface repair and joint preparation manufactured from stainless steel. No brushes with carbon steel wire will be used for fabrication of stainless steel.
8. Shield stainless steel pipe, tube and fittings from all on-site carbon steel pipe and structural steel cutting and blasting operations.

1.10 AMBIENT CONDITIONS

A. Section 015000 – Temporary Facilities: Requirements for ambient condition control facilities for product storage and installation.

B. Minimum Conditions: Do not store or handle uninstalled lined pipes or fittings at temperatures below zero degrees F.

1.11 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.12 WARRANTY

A. Manufacturer'sWarranty: Manufacturer and Installer agree to repair or replace components of stainless steel pipe that fail(s) in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE DESIGN CRITERIA

A. Piping shall be installed in those locations indicated and as required for the complete piping system.

B. Provide stainless steel piping for the following systems and conditions:

1. System: Low Pressure Air (LPA) for Blower Systems

   a) Fluid: Compressed Air
   b) Operating Pressure: 0 to 10 psig
   c) Test Pressure: 30 psig
   d) Flow Velocity: 0 to 4,000 feet per minute

e) Temperature: 0 to 330 degrees F

2.2 STAINLESS STEEL PIPE AND FITTINGS

A. Piping:

1. Type:
   a) Welded in compliance with ASTM A813/A813M or Seamless in compliance with ASTM A312.

2. Schedule: Schedule 10S
3. Grade: Type 304/L (dual stamp), pickled and passivated
4. Dimensions: As indicated on Drawings

B. Fittings:

1. Type:
   a) Piping 2 Inches and Smaller: Socket welding.
   b) Piping 2-1/2 inches and Larger: Butt welding.

2. Dimensions: Comply with ASTM A312/A312M.

3. Butt-Welding Fittings:

   a) Comply with ASTM A403/A403M.
   b) Grade: Type 304/L.
   c) Class: Comply with ASME B16.9 and MSS SP 43

4. Socket-Welding Fittings:

   a) Comply with ASTM A403/A403M.
   b) Grade: Type 304/L.
   c) Class: WP-W; comply with ASME B16.11.

5. Flanged Fittings:

   a) Type: Welding neck or Slip on
   b) Class: 150.
   c) Comply with ASTM A182/A182M.
   d) Grade: Type 304/L.
   e) Facing and Drilling: Comply with ASME B16.5, with 1/16-inch flat face.
      1)

C. Provide stainless steel pipe and fittings manufactured and/or distributed by:

1. Felker Brothers, Marshfield, Wisconsin.
2. Douglas Brothers, Portland, Maine.
3. Swepco Tube, Clifton, New Jersey.
4. Alaskan Copper Works, Seattle, Washington

2.3 ACCESSORIES

A. Pipe-Thread Tape:

1. Material: PTFE.
2. Comply with ASTM D3308.

B. Flange Gaskets:

1. Comply with ASME B16.5.
2. Nonmetallic Gaskets:

   a) Material: Viton; suitable for temperatures above 300 degrees F.
   b) Comply with ASME B16.21.

3. Type:

   a) Raised-Face Flanges: Flat ring.
   b) Flat-Face Flanges: Full face.

C. Anti-seize Bolting Lubricants:

1. Install flange bolts using a nickel anti-seize lubricant capable of achieving required bolt torque, sealing stress, and permitting future disassembly with minimal manual input.
2. Remove excess anti-seize compound by degreasing solvent prior to finish painting piping.
3. Anti-seize compound:

   a) Never-Seez Pure Nickel Special Lubricant manufactured by Bostik, Wauwatosa, Wisconsin.
   b) Loctite Heavy Duty Anti-Seize Lubricant Manufactured by Henkel Technologies, Rocky Hill, Connecticut.
   c) Chesterton 772 Premium Nickel Anti-Seize Compound manufactured by Chesterton Technical Products, Stoneham, Massachusetts.

4. Flange Bolts: Degreased of all corrosion inhibiting slush oil and excess anti-seize lubricant prior to field application of prime and finish coatings.

2.4 SOURCE QUALITY CONTROL

A. Section 014000 “Quality Requirements”: Requirements for testing, inspection and analysis.

B. Provide shop inspection and testing of completed assembly.

C. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field dimensions are as indicated on Shop Drawings.

B. Inspect existing flanges for nonstandard bolt hole configurations or design and verify that new pipe and flange mate properly.

C. Inspect pipe, tube and fittings upon delivery and store in a location that will prevent entry of contaminants prior to installation.
   1. Rust spots on new stainless-steel pipe and fittings are nearly always due to surface contamination of free iron and shall not be allowed.
   2. If free iron is not removed deep corrosion pits can result, especially in an aqueous process environment (water or wastewater).

3.2 PREPARATION

A. Ream pipe ends and remove burrs.

B. Bevel plain-end pipe.

C. Thoroughly clean pipe and fittings before installation.

3.3 INSTALLATION

A. Comply with ASME B31.3. Install pipe, fittings and specials true to alignment and rigidly supported. Do not exceed deflection at pipe joints recommended by Supplier. Support all pipe and appurtenances connected to equipment to prevent any strain on equipment and valves nozzles, and adjoining pipe flanges.

B. Run piping straight along alignment as indicated on Drawings, with minimum number of joints.

C. Fittings:

   1. Clean gasket seats thoroughly, and wipe gaskets clean prior to installation.
   2. Install according to manufacturer instructions.
   3. Bolting:

      a) Tighten bolts progressively, drawing up bolts on opposite sides until bolts are uniformly tight.
      b) Use torque wrench to tighten bolts to manufacturer instructions.

D. Concrete encase pipe under concrete slabs. Wrap stainless steel pipe in a protective material, such as a petrolatum tape or coat pie as needed, prior to encasement.

E. Provide required upstream and downstream clearances from devices as indicated on Drawings.

F. Install piping with sufficient slopes for venting or drainage of liquids and condensate to low points.

G. Provide expansion joints as specified in Section 400506 “Couplings, Adaptors, and Specials for Process Piping” where shown on the Drawings.

H. Dielectric Fittings: Provide between dissimilar metals.

I. Field Cuts: According to pipe manufacturer instructions.

J. Field welding of stainless steel is permitted.
1. Field welding shall only be done as approved by the Engineer.
2. Field welds shall be performed by welders certified under ASME Section IX.
3. After field welding, all joints shall be thoroughly cleaned and buffed using deburring and finishing wheels.
4. Field welds shall only be done after a demonstration weld is successfully completed by each proposed welder at no additional cost to the Owner.
5. Use line-up clamps for full-penetration butt-welded field joints for pipe larger than 8-inch diameter. Alternative methods to line-up clamps proposed by the Contractor shall be submitted with welding submittals for Engineer’s approval.
6. Prepare pipe joints by a machining process without damage to the pipe exterior. Cut ends shall be smooth and at a right angle to the axis of the pipe and beveled where required in accordance with the approved welding procedure specifications. Pipe shall be deburred as part of the preparation of all joint configurations.

K. Cleaning, Descaling, and Passivation of Field Welds
1. Clean and passivate heat tint defects on the welds and the heat-affected-zone (HAZ) on the pipe exterior after welding, using a chemical cleaning system, in accordance with ASTM A967. The system will include a pre-cleaning solution, pickling paste, and neutralizing rinse. Apply cleaning system in accordance with the manufacturer’s instructions. Only use pickling and passivation products from the same manufacturer. Mixing chemicals from different manufacturers is not allowed.

2. Apply a heavy-duty stainless-steel pickling paste to clean the welds and HAZ. Apply paste using an acid resistant brush and in accordance with the product manufacturer’s instructions. The pickling paste product shall be one of the following:
   a) BlueOne® Pickling Paste 130, manufactured by Avesta Finishing Chemicals, Orchard Park, New York.
   b) Antox® 71E Plus Pickling Paste, manufactured by Chemetall US, New Providence, New Jersey.
   c) Kytex® Pickling Paste 316, manufactured by Harvard Chemical Research, Atlanta, Georgia.

3. Passivate the welds and HAZ using a neutralizing rinse to remove the pickling paste and a follow-up water rinse using purified bottled water shall be used to remove all residuals. The neutralizing rinse product shall be one of the following:
   a) Neutralizing Agent 502®, manufactured by Avesta Finishing Chemicals, Orchard Park, New York.
   b) Antox® NP, manufactured by Chemetall US, New Providence, New Jersey.
   c) Kytex® Neutralizer 408, manufactured by Harvard Chemical Research, Atlanta, Georgia.

4. Use of abrasive blasting is not permitted for passivation of the Work. This or similar physical processes as a substitute for the procedures specified herein will not be requested.

L. Joining preparation and finished welds: Under no circumstances may permanent backer-rings or other consumable inserts be used for field or shop welding of steel pipe. Non-consumable refractory inserts are allowed with Engineer's approval.

M. Prepare pipe joints by a machining process without damage to pipe exterior. Cut ends smooth and at a right angle to axis of pipe and beveled where required in accordance with approved welding procedure specifications. Deburr pipe and tube as part of preparation of all joint configurations.

N. Protect pipe, fittings and valves, and adhere to the following mandatory requirements, and others specified in paragraphs below:

1. Protect stainless steel materials from contact with carbon steel including but not limited to hoisting and rigging equipment, steel tables, storage racks and hand tools.
2. Do not bundle pipe and fittings using ferrous metal banding at factory or Supplier's facility.
3. Do not allow contact between wear surfaces of tools used for carbon steel fabrication and surfaces of stainless-steel pipe, tubes and fittings. These tools include abrasive grinding and cutting wheels, wheel cutters and rollers, threading taps and dies, tube bending equipment and all other bearing edge tools.
4. Use manual or powered wire brush tools for surface repair and joint preparation manufactured from stainless steel. Brushes with carbon steel wire cannot be used for fabrication of stainless steel.
5. Shield stainless steel pipe, and fittings from all on-site carbon steel pipe and structural steel cutting and blasting operations.
6. Remove all exterior surface scratches; surface contamination by ferrous metal grinding kerf; contamination by paint markers and crayons etc.; and labels after installation.

O. Verify Engineer examines exterior surfaces of pipe, and fittings at Site for free iron contamination by ferroxyl test or other method. Clean all contaminated surfaces at Site by pickling using a lean spray-applied pickling cleaner suitable for large surfaces system. Follow pickling with passivation of entire treated surface by a neutralizing rinse. Provide one of the following spray-applied pickling solutions:

1. Avesta Classic Cleaner 401®, manufactured by Avesta Finishing Chemicals, Orchard Park, New York.
2. Antox® 75E Pickling Cleaner, manufactured by Chemetall US, New Providence, New Jersey.
3. Kytex® Brightener 123, manufactured/distributed by Harvard Chemical Research, Atlanta, Georgia.

P. Use wire wheels, to remove defects on pipe surface after installation, constructed of same material as pipe wall or Type 316 stainless steel for super austenitic and duplex stainless steel piping. Verify surface finish on pipe meets specified mill-applied surface finish or better.

3.4 TOLERANCES

A. Piping Laying Tolerance: 5/8 inch.

3.5 FIELD QUALITY CONTROL

A. Cleaning:

1. Keep pipe interior clean as installation progresses.
2. After installation, clean pipe interior of soil, grit, and other debris.

B. Inspection:

1. Inspect for damage to piping or tubing.
2. Repair damaged piping, or provide new, undamaged pipe.
3. After installation, inspect for required supports and anchoring, interferences, and damage to pipe, tube, or fittings.

C. Pressure Testing:

1. Test Pressure: As specified in PART 2.
2. Conduct pneumatic test for sufficient time to visually inspect all joints or a minimum of 30 minutes at specified test pressure. There shall be no drop in test pressure in this time.
3. Observe joints, fittings, and valves under test.
4. Correct visible or audible leaks shall and then re-test the line.
5. After satisfactory completion of the test, vent the line and allow it to return to atmospheric pressure.

END OF SECTION 400523

SECTION 400531 - THERMOPLASTIC PROCESS PIPE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. PVC pipe.
2. PVC tube.
3. CPVC pipe.
4. Fittings.
5. Accessories for plastic piping.
6. Delegated Design.

B. Related Requirements:

1. Section 400506 “Couplings, Adapters, and Specials for Process Piping” for pipe penetrations, restrained joints, flexible connections, expansion joints and loops, and sleeve-type couplings.
2. Section 400507 “Hangers and Supports for Process Piping” for hangers, anchors, sleeves, and sealing of piping to adjacent structures.
3. Section 400551 “Common Requirements for Process Valves” for common product requirements for valves for placement by this Section.

1.3 COORDINATION

A. Coordinate Work of this Section with piping and equipment connections specified in other Sections and on Drawings.

1.4 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's catalog information regarding pipe and fittings.

B. Chemical compatibility chart demonstrating proposed products are compatible with the listed process chemicals for the specified operating conditions including concentration, pressure, and temperature.

1. Includes delivery pipe, carrier pipe, fittings, gaskets, and associated materials which could be exposed to process chemicals.

C. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, sizes, materials lists, location of all fittings, valves, and in-line accessories.

D. Chemical compatibility chart demonstrating proposed products are compatible with the listed process chemicals for the specified operating conditions including concentration, pressure, and temperature.

1. Include delivery pipe, carrier pipe, fittings, gaskets, and associated materials which could be exposed to process chemicals.
2. Identify slope, elevations of floor and wall penetrations, location of high and low points, anchorage points and method, location of expansion loops or joints, drain ports, and flushing connections.
3. Identify physical location and dimensions of all low point leak detection visual inspection ports.

E. Samples: One joint for each size pipe to be supplied that is 12-inches long and has two heat fusion welds that identifies manufacturer's minimum and maximum allowable bead thicknesses. Provide documentation that each sample was pressure tested to 150 psi or specified pressure.

1.5 DELEGATED DESIGN SUBMITTALS

A. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for pipe sizes and sizing methods.

1.6 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Manufacturer's recommended butt fusion welding procedures identifying all quality control checks during fusion procedure including minimum and maximum allowable bead formation during the heat soak process and the final weld roll back process for various size pipes.

C. Qualifications Statements:

1. Submit qualifications for manufacturer, installer, and licensed professional.
2. Submit manufacturer's approval of installer.

D. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Submit complete published design and engineering data for pipes including, at a minimum rated operating pressure, temperatures, de-rating factors for various types of pipe joints (flanges, socket welded, threaded and unions.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping, valves and other appurtenances, connections, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.8 QUALITY ASSURANCE

A. Permanently mark each length of pipe with manufacturer's name or trademark and indicate conformance to standards.

B. Materials in Contact with Potable Water: Certified according to NSF 61.

C. Maintain copy of each standard affecting Work of this Section on Site.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

C. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Texas.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Inspection:

1. Accept materials on Site in manufacturer's original packaging and inspect for damage.
2. Manufacturer's Packaging: Comply with ASTM D3892.

B. Storage: Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from puncture, abrasion, moisture, dust, and UV by storing in clean, dry location remote from construction operations areas.
2. Protect piping and appurtenances by storing off ground.
3. Provide additional protection according to manufacturer instructions.

1.11 AMBIENT CONDITIONS

A. Minimum and Maximum Temperatures: Do not install pipe when temperature is below 40 degrees For above 90 degrees F if pipe is exposed to direct sunlight.

B. UV Protection: Provide pipe installed above ground or outside with UV protection.

1.12 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PVC PIPE, TUBE, AND FITTINGS

A. PVC Pipe and Fittings:

1. Pipe and Fittings:

a. Schedule: 80.
b. Fittings: ASTM D2467, Schedule 80, socket.

2. Joints: ASTM D2855, socket, solvent welded.
3. Flanges:

a. Comply with ASME B16.5, rated for maximum 150 psig working pressure.
b. Where flanged joints are shown on the Drawings, they shall be supplied with 1/8-in thick full-faced EPDM or Viton gaskets exhibiting excellent compatibility with the process fluid.
c. Bolts, nuts and washers for flanged joints shall be for corrosive service conditions and shall be ASTM F593 and F594, Type 316 stainless steel. Anti-seize compound for stainless steel bolts and nuts shall be of a molybdenum disulfide base such as Molycoat-G or equal.
d. Fittings, specials, unions and flanges shall be of the same schedule number and manufactured of the same materials as the pipe. Provide flanged joints and adapters for connections to all in-line valves and equipment including those with unions. Whenever unions are called out on the Drawings, flanged connections may be substituted, provided that dimensional controls do not preclude use of flanges

4. Expansion Joints:

a. Fittings, specials, unions and flanges shall be of the same schedule number and manufactured of the same materials as the pipe. Provide flanged joints and dapters for connections to all in-line valves and equipment including those with unions. Whenever unions are called out on the Drawings, flanged connections may be substituted, provided that dimensional controls do not preclude use of flanges.

B. PVC Tube and Fittings:

1. Tube:

a. Type: Clear.
b. Size: As indicated on Drawings.

c. Pressure Rating: As indicated in piping schedule.

2. Fittings:

a. Type: Compression.
b. Materials: Suitable for application.

3. Threads:

a. Type: Straight.
b. Comply with ASME B1.1.
c. Thread sealer shall be tread tape, standard industrial quality Teflon, Type 1.

C. PVC Pipe and fittings shall be manufactured by Charlotte Pipe, George Fischer LLC, Spears, or approved equal.

2.2 CPVC PIPE AND FITTINGS

A. Description:

1. Pipe:

a. Comply with ASTM F441.
b. Pipe shall be manufactured from PVC compounds meeting ASTM D1784, Class 12454 in accordance with ASTM D1785, PVC 1120. The pipe shall have a minimum hydrostatic design stress of 2,000 psi at 73 degrees F and shall be suitable for field cutting and solvent welding.
c. Schedule 80 unless shown or noted otherwise and of sizes as shown on drawings.

2. Fittings:

a. Flanges: Comply with ASME B16.5; rated for a maximum 150 psig working pressure.
b. Socket Type: Comply with ASTM F438, Schedule 40 or F439, Schedule 80 as required to match pipe.
c. Threaded: Comply with ASTM F437 and ASME B1.20.1.

3. Joints: Socket welded or Flanged. Threaded connections shall not be used unless shown on the drawings.
4. Materials:

a. Comply with ASTM D1784.
b. Minimum Cell Classification: 23447.

B. Van Stone flanges shall not be used with pinch valves, industrial butterfly valves; elastomer bellows style expansion joints or other piping system components having an elastomer liner (rubber seat) that is used as a gasket.

C. CPVC Pipe and fittings shall be manufactured by Charlotte Pipe, Georg Fischer LLC, Spears, or approved equal.

2.3 FINISHES

A. Coat machined faces of metallic flanges with temporary rust-inhibitive coating.

2.4 ACCESSORIES

A. PVC Piping:

1. Solvent Cement:

a. Comply with ASTM D2564.
b. Formulated for use with sodium bisulfite solution.
c. Primers: Comply with ASTM F656; by solvent weld cement manufacturer.
d. Solvent and primer shall contain no fumed silica and shall be suitable for PVC pipe including use of NSF 61 certified primer. Solvent cement shall be Industrial GradeLow VOC EP42 Heavy Duty Gray as manufactured by Oatey Corp., Cleveland OH or equal by Weld-On, IPS Corporation.

B. CPVC Piping:

1. Solvent Cement:

a. Comply with ASTM F493.
b. Formulated for use with sodium hypochlorite and other caustic solutions.
c. Primers: Manufactured by solvent weld cement manufacturer.

2.5 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed pipe sections and tubes.

B. Owner Inspection:

1. Make completed pipe sections and tubes available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven days before inspection is allowed.

C. Owner Witnessing:

1. Allow witnessing of factory inspections and test at manufacturer's test facility.
2. Notify Owner at least seven days before inspections and tests are scheduled.

D. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field dimensions are as indicated on Drawings.

B. Inspect existing flanges for nonstandard bolt hole configurations or design and verify that new pipe and flange mate properly.

3.2 PREPARATION

A. Ream pipe and tube ends, remove burrs, and bevel plain-end pipe.

B. Thoroughly clean pipe and fittings before installation.

C. Cleaning: Clean surfaces to remove foreign substances.

3.3 INSTALLATION

A. Do not install piping until all materials compatibility of the proposed piping with the intended chemical service has been proven by the manufacturers and is certified.

B. Comply with ASME B31.3 and B31.9.

C. Run piping straight along alignment as indicated on Drawings, with minimum number of joints.

D. Fittings:

1. According to manufacturer instructions.
2. Gaskets:

    a. Clean seats thoroughly.
    b. Wipe gaskets clean prior to installation.

3. Tighten bolts progressively, drawing up bolts on opposite sides until bolts are uniformly tight; use torque wrench to tighten bolts to manufacturer instructions.

E. Provide required upstream and downstream clearances from devices as indicated.

F. Install piping with sufficient slopes for venting or drainage of liquids and condensate to low points.

G. Support exposed piping as specified in Section 400507 “Hangers and Supports for Process Piping.”

H. Provide expansion joints as specified in Section 400506 “Couplings, Adapters, and Specials for Process Piping”, and provide pipe guides as specified in Section 400507 “Hangers and Supports for Process Piping”, to compensate for pipe expansion due to temperature differences.

I. Disinfection: Disinfect potable-water piping.

J. Field Cuts: According to pipe manufacturer instructions.

K. Joining:

1. Heat Joining: Comply with ASTM D2657.

    a. Butt-fusion joints to be done by a factory-qualified joining technician as designated by the pipe manufacturer.
    b. Field Samples: join two sample welds on each size of pipe to be installed using the same fusion welding equipment that will be used for completion of the entire work. Compare sample welds to manufacturer's sample previously submitted in accordance with PART 1.
    c. Pipe joints with beads in excess of 3/16-inch will not be approved by Engineer.

2. Electrofusion: Comply with ASTM F1290.
3. Primers and Cleaners: Comply with ASTM F402.
4. PVC Solvent-Cemented Joints: Comply with ASTM D2855.

L. Insulation: As indicated on Drawings.

3.4 FIELD QUALITY CONTROL

A. Inspection:

1. Inspect for piping defects that may be detrimental as determined by Engineer.
2. Repair damaged piping, or provide new, undamaged pipe.
3. After installation, inspect for proper supports and interferences.

B. Pressure Testing:

1. Test Pressure: Not less than 150 psig or 1.5 times the system's working pressure, whichever is greater.
2. Conduct hydrostatic test for minimum two hours.
3. Filling:

    a. Fill section to be tested with water slowly and expel air from piping at high points.
    b. Install corporation cocks at high points.
    c. Close air vents and corporation cocks after air is expelled.
    d. Raise pressure to specified test pressure.

4. Observe joints, fittings, and valves under test.
5. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage and retest.
6. Leakage:

    a. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
    b. Maintain pressure within plus or minus 5 psi of test pressure.

c. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
d. Correct visible leaks and repeat test to verify no leaks at the required test pressures.

3.5 CLEANING

A. Keep pipe interior clean as installation progresses.

B. Clean pipe interior of soil, grit, shavings, and other debris after pipe installation.

END OF SECTION 400531

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SECTION 400551 - COMMON REQUIREMENTS FOR PROCESS VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Common requirements for valves.
2. Common requirements for valve actuators.
3. Valve tags.
4. Valve Schedule.
5. Delegated Design.

B. Related Requirements:

1. Section 033000 “Cast-in-Place Concrete” for execution requirements for placement of concrete as required by this Section.
2. Section 055000 “Metal Fabrications” for miscellaneous metalwork and fasteners specified by this Section.
3. Section 099679 “Atmospheric Protection and Plant Service Areas Coatings” for field painting requirements.
4. Section 400507 “Hangers and Supports for Process Piping” for product and execution requirements for valve supports specified by this Section.
5. Section 400557 “Actuators for Process Valves and Gates.”
6. Section 404213 “Process Piping Insulation” for valve insulation as required by this Section.

1.3 COORDINATION

A. Coordinate Work of this Section with individual process valve specifications.

1.4 ACTION SUBMITTALS

A. Valve Schedule:

1. Submit valve schedule populated with all Division 40 process valves specified for this project. Include all information shown on the Sample Valve Schedule included in this project.

2. Approval of valve schedule submittal to precede all individual valve submittals. All subsequent individual valve submittals to include the approved valve tag number or group on the submittal cover sheet.

B. Valve Tags:

1. Materials, dimensions and thickness of tags, materials and gauge of cable and splicing hardware.
2. Color palate for Owner selection.
3. Full scale drawing of sample with lettering dimensions and scribe depth.
4. Valve tag lettering provided with Valve Schedule above.

C. Power Actuator Data:

1. Sizing Calculations:

a. Provide fluid pressure and velocity sizing basis.
b. Provide maximum valve torque based on disc shape and flow direction.
c. Clearly indicate safety factors and mechanical ratios of any intermediate gearing.

2. Maximum output torque of actuator and intermediate gearing.
3. Details of actuator mounting, including orientation of actuator and intermediate gearing.
4. Dimensional drawing of actuator assembled on valve.
5. Pneumatic/Hydraulic pressure requirements, electrical power supply, plumbing connection sizes and locations.
6. Wiring diagram, control wiring and protocol.
7. Valve cavitation limits for positioning, modulating and control valves mated to power actuator.

D. Shop Drawings:

1. Valve and actuator model number and size, valve parts list, materials of each part including material standard designation (ASTM or other), position indicators, limit switches, actuator mounting.
2. Confirm actuator mounting location including chainwheels will be operable in the mounting locations shown on the Contractor Drawings.

E. Provide certified hydrostatic test data, per manufacturer's standard procedure or MSS-SP-61 for all valves.

1.5 DELEGATED DESIGN SUBMITTALS

A. Submit signed and sealed Shop Drawings with design calculations and assumptions for sizing of control valves.

1.6 INFORMATIONAL SUBMITTALS

A. Manufacturer Instructions: Submit installation and operation instructions for each component including valve, actuator, gearbox, and any included instrumentation.

B. Source Quality-Control Submittals: Indicate results of integrators facility tests and manufacturers factory tests and inspections.

C. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

D. Manufacturer Certification of Installation: Certify that equipment has been installed according to manufacturer instructions.

E. Qualifications Statement:

1. Submit qualifications for manufacturer and licensed professional.

1.7 QUALITY ASSURANCE

A. Maintain clearances as indicated on Drawings and Shop Drawings.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Mate valves to actuators at manufacturer’s or integrator’s facility. Fully test assembled product and certify ready for installation prior to shipment to the job site.

1. Only in special cases for extremely large assemblies where installation requires disassembly, may actuators be mounted to the valves in the field.

D. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

E. Submit affidavit of compliance with testing and manufacturing standards referred in this specification and the individual valve specifications.

F. Provide the services of a qualified and factory-trained service representative of the manufacturer to provide installation inspection and check out, and operational and maintenance instruction, for each type.

G. Obtain Manufacturer’s Certification of Proper Installation for Specified valves and valve assemblies.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing valves and actuators with minimum ten years' experience.

B. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Texas.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage

B. Deliver factory mated power actuated valves on rigid wooden skids, fully braced, and strapped to prevent damage to valve, actuator or coupling system.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Protect valve ends from entry of foreign materials by providing temporary covers and plugs.
3. Provide additional protection according to manufacturer instructions.

1.10 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to materials ordering or any fabrication.
2. Indicate field measurements on Shop Drawings.

1.11 WARRANTY

A. Furnish 2-year manufacturer's warranty for valves and actuators from date of Contractor's Substantial Completion, as described in CIP 16.

PART 2 - PRODUCTS

2.1 VALVES

A. Description: Valves, operator, actuator, handwheel, chainwheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and other accessories as required.

B. Provide all valves of the same type by same manufacturer.

C. Valve Ends: Compatible with adjacent piping system.

D. Operation:

1. Close by turning counterclockwise.
2. Cast directional arrow on valve or actuator with OPEN and CLOSE cast on valve in appropriate location.

E. Valve Marking and Labeling:

1. Marking: Comply with MSS SP-25.
2. Labeling (valve tags):

a. Fiberglass reinforced plastic, ASTM D709, 70 mil thick, 2-1/2-inch diameter or 2-1/2-inch by 1-1/4-inch.

b. Lettering 1/16-inch thick of silk screening or other permanent embedment of subsurface printed graphics, permanently sealed.
c. Colors of lettering and backing as selected by Owner.
d. Two, 1/4-inch clear opening Type 316 stainless steel grommets at each end, center of hole 3/8-inch from tag edge.
e. 3/32-inch Type 316 stainless steel cable and splice hardware.

F. Valve Construction: As Specified in Valve Specifications Sections.

G. Do not use Van Stone flanges with pinch valves, industrial butterfly valves; elastomer bellows style expansion joints or other piping system components having an elastomer liner (rubber seat) that is used as a gasket.

2.2 VALVE ACTUATORS

A. Provide actuators in accordance with the valve schedule included in specifications**.**

B. Provide mechanical position indicators for power actuated and gearbox actuated valves.

C. Comply with AWWA C541 (Pneumatic and Hydraulic actuators) and C542 (Electric Motor Actuators) as applicable.

D. Provide chain actuators for shutoff valves mounted greater than 7 feet above operating floor level.

E. Gear and Power actuators as specified in Section 400557 “Actuators for Process Valves and Gates.”

2.3 INSULATION

A. Insulate all valves installed in insulated piping systems as part of the Work.

B. As specified in Section 404213 “Process Piping Insulation.”

2.4 FINISHES

A. Valve Coating: Comply with AWWA C550.

B. Factory finishes are included in individual valve sections.

C. Exposed Valves: As specified in Section 099676.23. Stainless Body Valves: Do not coat.

D. Do not coat flange faces of valves unless otherwise specified.

2.5 SOURCE QUALITY CONTROL

A. Testing: Test valves according to manufacturer's standard testing protocol, including hydrostatic, seal, and performance testing.

B. Owner Inspection:

1. Make completed available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven days before inspection is allowed.

C. Owner Witnessing:

1. Allow witnessing of factory inspections and test at manufacturer's test facility.
2. Notify Owner at least seven days before inspections and tests are scheduled.

D. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping system is ready for valve installation.

B. Fully examine valves for debris, damage, and interior finish blemishes prior to installation. Do not install valves with soiled interior or any visible damage to seats, discs, or interior finish.

C. Identify any piping, plant, or equipment clearance issues prior to installation, bring to Engineer’s attention via job meetings, submittal process or request for information process.

3.2 INSTALLATION

A. Install valves, actuators, extensions, valve boxes, and accessories according to manufacturer instructions.

B. Inspect valve interiors before line closure for the presence of debris. At option of Engineer, internal inspection of valve and appurtenances may be required any time that the likelihood of debris is a possibility. Clean connecting pipes prior to installation, testing, disinfection, and final acceptance.

C. Disinfect valves installed in potable water lines with approved pipeline disinfection process.

D. Rigidly support valves to avoid stresses on piping.

E. Coat studs, bolts, and nuts with anti-seizing lubricant.

F. Dielectric Fittings: Provide between dissimilar metals.

G. Clean field welds of slag and splatter to provide a smooth surface.

H. Mate, adjust, and fully test gearboxes, electric, hydraulic, and pneumatic actuators to valves at manufacturer's or integrator's facility.

1. Only in special cases for extremely large assemblies where installation requires disassembly may actuators be mounted to the valves in the field. These circumstances require preinstallation meetings.

I. Do not install stems vertically downward.

J. Unless otherwise indicated on Drawings:

1. Install Gate, Globe, and Ball Valves with stem vertical in 12 o'clock position.
2. Install Plug Valves with stem horizontal and plug opening to the top of the body unless position will not allow proper actuator access, in which case stem may be vertical in 12 o'clock position.
3. Install Butterfly Valves 12 inch and smaller with stem horizontal or vertical in 12 o'clock position,
4. Install Butterfly Valves 14 inch and larger with the stem horizontal unless position will not allow proper actuator access, in which case stem may be vertical in 12 o'clock position.
5. Install Control Valves in horizontal pipelines with top works vertically upward.

K. Install brackets, extension rods, guides, and various types of operators and appurtenances as indicated. Before properly setting these items, check all drawings and figures which have a direct bearing on their location.

L. Inspect materials for defects in construction and materials. Clean debris and foreign material out of openings, etc. Verify valve flange covers remain in place until connected piping is installed. Verify operability of operating mechanisms for proper functioning. Check nuts and bolts for tightness. Repair or replace valves and other equipment which do not operate easily or are otherwise defective.

M. Where installation is covered by a referenced standard, install and certify in accordance with that standard, except as herein modified. Also note additional requirements in other parts of this Section.

N. Unless otherwise noted, provide joints for valves and appurtenances utilizing the same procedures as specified under the applicable type connecting pipe joint. Install valves and other items as recommended by the manufacturer. Verify manufacturers' torqueing requirements for all valves.

O. Coordinate direction of flow through offset type and shaped butterfly valve discs with the mated actuator torque capacity.

P. Rotate valve operators and indicators to display toward normal operation locations. Consult with Engineer prior to installing valves with handwheels to confirm final position of handwheel.

Q. Vertically center floor boxes, valve boxes, extension stems, and low floor stands over the operating nut, with couplings as required.

1. Adjust elevation of the box top to conform to the elevation of the finished floor surface or grade at the completion of the Contract.

2. Support boxes and stem guides during concrete placement to maintain vertical alignment.

R. Install brass male adapters on each side of valves in copper-piped system and solder adapters to pipe.

S. Install 1-inch ball valves with cap for drains at main shutoff valves, low points of piping, bases of vertical risers, and equipment.

T. Install valves with clearance for installation of insulation and to allow access.

U. Provide access where valves and fittings are not accessible.

V. Pipe Hangers and Supports: As specified in Section 400507 “Hangers and Supports for Process Piping.”

W. Comply with Division 40 “Process Interconnections” for piping materials applying to various system types.

X. Install insulation as specified in Section 404213 “Process Piping Insulation.”

3.3 FIELD QUALITY CONTROL

A. Valve Field Testing:

1. Test for proper alignment.
2. If specified by valve Section, field test equipment to demonstrate operation without undue noise, vibration, or overheating.
3. Engineer will witness field testing.
4. Functional Test:

    a. Prior to system startup, inspect valves and actuators for proper alignment, quiet operation, proper connection, and satisfactory performance.
    b. After installation, open and close all manual valves in the presence of Engineer to show the valve operates smoothly from full open to full close and without leakage.
    c. Cycle valves equipped with electric, pneumatic, or hydraulic actuators 5 times from full open to full closed in the presence of Engineer to exhibit operation without vibration, jamming, leakage, or overheating.
    d. Operate pressure control and pressure relief valves in the presence of Engineer to show they perform their specified function at some time prior to placing the piping system in operation and as agreed during construction coordination meetings.

5. Field test pipelines in which valves and appurtenances have been installed. During these tests, adjust, remove, or replace defective valve or appurtenance, or otherwise make acceptable to Engineer. Test regulating valves, strainers, or other appurtenances to demonstrate conformance with the specified operational capabilities. Correct deficiencies, replace device or otherwise made acceptable to Engineer.

3.4 ATTACHMENTS

A. Attachment 400551-A Table 1: Valve Schedule.

END OF SECTION 400551

SECTION 400551-A
TABLE 1
PROCESS MECHANICAL VALVE SCHEDULE

3

Tag Number	*Tag Typ*	*Valve Size (Inches)*	*End Connection*	*Working Pressure (psi)*[4]	*Service Fluid* [2]	*Actuator Type* [3]	*Notes*	*Drawing Number*	*Spec Section*
CV-2010-1	SCV1	12”	FLANGED	35	INF	MANUAL		SG-IA-1	400565.23
GV-2010-1	GV1	12”	FLANGED	35	INF	MANUAL		SG-IA-1	400561
CV-2010-2	SCV1	12”	FLANGED	35	INF	MANUAL		SG-IA-1	400565.23
GV-2010-2	GV1	12”	FLANGED	35	INF	MANUAL		SG-IA-1	400561
CV-2010-3	SCV1	12”	FLANGED	35	INF	MANUAL		SG-IA-1	400565.23
GV-2010-3	GV1	12”	FLANGED	35	INF	MANUAL		SG-IA-1	400561
PV-2130-1A	PV1	4”	FLANGED	10	GR	MANUAL	OPEN/CLOSE GLASS LINED ECCENTRIC	SG-IB-1	400562
PV-2130-2A	PV1	4”	FLANGED	10	GR	MANUAL	OPEN/CLOSE GLASS LINED ECCENTRIC	SG-IB-1	400562
PV-2130-1B	PV1	4”	FLANGED	10	GR	MANUAL	OPEN/CLOSE GLASS LINED ECCENTRIC	SG-IB-1	400562
PV-2130-2B	PV1	4”	FLANGED	10	GR	MANUAL	OPEN/CLOSE GLASS LINED ECCENTRIC	SG-IB-1	400562
CV-2130-1A	SCV1	4”	FLANGED	10	GR	MANUAL	GLASS LINED	SG-IB-1	400565.23
CV-2130-2A	SCV1	4”	FLANGED	10	GR	MANUAL	GLASS LINED	SG-IB-1	400565.23
PV-2110-1	PV	4”	FLANGED	10	ORGANICS	MOTOR	VENDOR PROVIDED	SG-IB-2	400562
PV-2700-1A	PV1	18”	FLANGED	10	ABI	MANUAL		SG-IC-1	400562
PV-2700-1B	PV1	18”	FLANGED	10	ABI	MANUAL		SG-IC-1	400562
BFV-2305-1	BFV2	8”	FLANGED	20	LPA	MANUAL	VENDOR PROVIDED	SG-ID-1	400564
BFV-2305-2	BFV2	8”	FLANGED	20	LPA	MANUAL	VENDOR PROVIDED	SG-ID-1	400564
BFV-2305-3	BFV2	8”	FLANGED	20	LPA	MANUAL	VENDOR PROVIDED	SG-ID-1	400564
BFV-2305-4	BFV2	8”	FLANGED	20	LPA	MANUAL	VENDOR PROVIDED	SG-ID-1	400564
CV-2310-1	DDCV1	12”	FLANGED	20	LPA	MANUAL		SG-ID-1	400565.29
CV-2310-2	DDCV1	12”	FLANGED	20	LPA	MANUAL		SG-ID-1	400565.29
CV-2310-3	DDCV1	12”	FLANGED	20	LPA	MANUAL		SG-ID-1	400565.29

Tag Number	*Tag Typ*	*Valve Size (Inches)*	*End Connection*	*Working Pressure (psi)*[4]	*Service Fluid* [2]	*Actuator Type* [3]	*Notes*	*Drawing Number*	*Spec Section*
CV-2310-4	DDCV1	12”	FLANGED	20	LPA	MANUAL		SG-ID-1	400565.29
BFV-2310-1	BFV2	12”	FLANGED	20	LPA	MANUAL		SG-ID-1	400564
BFV-2310-2	BFV2	12”	FLANGED	20	LPA	MANUAL		SG-ID-1	400564
BFV-2310-3	BFV2	12”	FLANGED	20	LPA	MANUAL		SG-ID-1	400564
BFV-2310-4	BFV2	12”	FLANGED	20	LPA	MANUAL		SG-ID-1	400564
BFV-2315-1A	BFV2	18”	FLANGED	20	LPA	MANUAL		SG-ID-1	400564
BFV-2315-1B	BFV2	18”	FLANGED	20	LPA	MANUAL		SG-ID-1	400564
BFV-2315-2	BFV2	18”	FLANGED	20	LPA	MANUAL		SG-ID-1	400564
BFV-2316-1	BFV2	8”	FLANGED	20	LPA	MANUAL		SG-MC-2	4000564
CV-2410-1	DDCV1	8”	FLANGED	20	LPA	MANUAL	VENDOR PROVIDED	SG-IE-1	400565.29
BFV-2410-1	BFV2	8”	FLANGED	20	LPA	MANUAL		SG-IE-1	400564
CV-2410-2	DDCV1	8”	FLANGED	20	LPA	MANUAL	VENDOR PROVIDED	SG-IE-1	400565.29
BFV-2410-2	BFV2	8”	FLANGED	20	LPA	MANUAL		SG-IE-1	400564
BFV-2410-3	BFV2	6”	FLANGED	10	LPA	MANUAL		N/A	400564
CV-2610-1	DDCV1	12”	FLANGED	10	LPA	MANUAL	VENDOR PROVIDED	SG-IG-1	400565.29
BFV-2610-1	BFV2	12”	FLANGED	10	LPA	MANUAL		SG-IG-1	400564
-	BFV2	6”	FLANGED	20	LPA	MANUAL	Basin 1, Grid A	SG-MC-1	400564
-	BFV2	8”	FLANGED	20	LPA	MANUAL	Basin 1, Grid B	SG-MC-1	400564
-	BFV2	8”	FLANGED	20	LPA	MANUAL	Basin 1, Grid C	SG-MC-1	400564
-	BFV2	8”	FLANGED	20	LPA	MANUAL	Basin 1, Grid D	SG-MC-1	400564
-	BFV2	6”	FLANGED	20	LPA	MANUAL	Basin 1, Grid E	SG-MC-1	400564
-	BFV2	6”	FLANGED	20	LPA	MANUAL	Basin 2, Grid A	SG-MC-1	400564
-	BFV2	8”	FLANGED	20	LPA	MANUAL	Basin 2, Grid B	SG-MC-1	400564
	BFV2	8”	FLANGED	20	LPA	MANUAL	Basin 2, Grid C	SG-MC-1	400564
-	BFV2	8”	FLANGED	20	LPA	MANUAL	Basin 2, Grid D	SG-MC-1	400564
-	BFV2	6”	FLANGED	20	LPA	MANUAL	Basin 2, Grid E	SG-MC-1	400564

NOTES:

(1) Scheduled valves are limited to only process mechanical valves which are manually operated valves 4-inches and larger, and all process mechanical valves that have electric motor, solenoid or pneumatic operators. No fire protection or plumbing valves are included. For Plumbing, Building Mechanical, and Fire Protection valves see Divisions 21, 22, and 23.

(2) Process Fluid Abbreviations: INF= Raw Influent; GR=Grit; LPA=Low Pressure Air, ABI = Aeration Basin Influent

(2) Process Fluid Abbreviations: INF= Raw Influent; GR=Grit; LPA=Low Pressure Air, ABI = Aeration Basin Influent

(3) See Section 400557 for Operator requirements.

(4) See pipe schedule for line test pressures and specifications for valve design pressure requirements. For valves at pump stations, confirm with pump manufacturer for flow and pressure requirements.

(5) This schedule is provided for Contractor's convenience and does not relieve them of requirements to install all valves shown on the Drawings.

Valve Type Summary	
Valve Type	Description
ARV1	Air Release Valves for Water Service
ARV2	Thermoplastic Air Release Valves
AVRV	Air/Vacuum relief Valves for Water Service
ASR	Air Release Valves for Wastewater Service
ASC	Combination Air Valves for Wastewater Service
BFV1	AWWA Butterfly Valves
BFV2	Cartridge Seat Process Duty Butterfly Valves
BFV3	High Performance Butterfly Valves
BFV4	Butterfly Valves for Low Pressure Air Service (Metal Body)
BFV5	Cartridge Seat Thermoplastic Butterfly Valves
BFV6	Boot Seat Thermoplastic Butterfly Valves
CAV1	Combination Air Valves for Water Service
CAV2	Combination Air Valves for Water Service with Anti Surge Mechanism
BPREG	Backpressure Regulating/Inline Pressure-relief Valves
DV2	Plastic Diaphragm Valves
SRV	Surge Relief Valve
VPBV	Vee Port Ball Control Valves
BV3	Two Piece Brass Body Ball Valves, 3-Inch and Smaller
BV8	Thermoplastic Ball Valves
VPBV	Vee-Port Ball Valve
RFCV	Rubber Flapper Check Valves 3-inch and Larger
RPZBP	Reduced Pressure Zone Backflow Preventers
DDCV1	Double Disk Check Valve -Blower Discharge Service
TDCV	Tilting Disk Check Valves
SCV1	Iron Body Swing Check Valves 4-inch and larger
SCV2	Alloy Body Swing Check Valves for Saline Service
GV1	Double Disc Gate Valves
GV2	Double Revolving Disc Gate Valves
GV3	Solid Wedge, Metal-Seated Gate Valves
GV4	Solid Wedge, Resilient-Seated Gate Valves
GV5	General-Duty Gate Valves-Smaller than 3 inches
GV6	Plastic Gate Valves
PRV1	Pressure Reducing Valves
PRV2	Thermoplastic Pressure Reducing Valves
PV1	Eccentric Plug Valves
PV3	Eccentric Plug Valves with Modulating Actuator for flow control
SV1	Solenoid Valves 2” and Larger
SV2	Solenoid Valves Smaller than 2”

END OF SECTION 400551A

SECTION 400553 - IDENTIFICATION FOR PROCESS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Stencils.
4. Pipe markers.
5. Ceiling tacks.
6. Labels.
7. Lockout devices.

B. Related Requirements:

1. Division 09 for requirements for painting by this Section.
2. Section 400551 “Common Requirements for Process Valves” for basic materials and methods for valves.

1.3 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's catalog literature for each specified product.

B. Shop Drawings:

1. Indicate list of wording, symbols, letter size, spacing of labels, and color-coding for mechanical identification and valve chart and schedule.
2. Indicate valve tag number, location, function, and valve manufacturer's name and model number.

C. Samples: Submit two tags proposed and the manufacturer’s standard color chart and letter styles for each size to be used on Project.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4 INFORMATIONAL SUBMITALLS

A. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

B. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.6 MAINTENANCE MATERIAL SUBMITTALS

1.7 QUALITY ASSURANCE

A. Piping Color Scheme and Lettering Size: Comply with ASME A13.1.

B. Color coding system and labeling, according to Texas Commission of Environmental Quality Water Hygiene Division: See Division 09 for painting requirements.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 TAGS

A. Metal Tags for All Valves:

1. Manufacturers:

a. Brady ID.
b. Craftmark Pipe Markers.
c. Kolbi Pipe Marker Co.
d. Marking Services, Inc.
e. Pipemarker.com (Brimar Industries, Inc.)
f. R&R Identification Co.
g. Seton Identification Products.

2. Description:

a. 19 gauge Brass or 0.025 inch Typ 304 Stainless-steel(for corrosive and wet areas) construction; stamped letters or engraved letters.
b. Minimum Tag Size and Configuration: 2 inches; diameter with finished edges.
c. Provide with brass hooks suitable for attaching the tag to the valve operator.
d. Stamp or etch tags with the valve number and information on the valve schedule coded in a system provided by the Owner.

2.2 PIPE MARKERS

A. Plastic Pipe Markers and Directional Arrows for all pipes 3/4 – inch and larger:

1. Manufacturers:

a. Brady ID.
b. Craftmark Pipe Markers.
c. Marking Services, Inc.
d. R&R Identification Co.
e. Seton Identification Products

2. Description:

a. Factory-fabricated, flexible, and semi-rigid plastic.
b. Preformed to fit around pipe or pipe covering.
c. Larger sizes may be of maximum sheet size, with spring fastener.
d. Letters shall bear the full pipe system name as scheduled.
e. Color shall be white or black depending on background color.
f. Letter sizes:

OUTSIDE DIAMETER OF PIPE (INCHES)	LENGTH OF COLOR FIELD (INCHES)	SIZE OF LETTERS (INCHES)
¾ to 1-1/4	8	½
1-1/2 to 2-3/8	8	¾

2-1/2 to 6	12	1-1/2
8 to 10	24	2-1/2
Over 10	32	3

B. Plastic Underground Pipe Markers Used for All Buried Pipes:

1. Manufacturers:

a. Brady ID
b. Craftmark Pipe Makers
c. Kolbi Pipe Marker Co.
d. Marking Services, Inc.
e. Pipemarker.com (Brimar Industries, Inc.)
f. Seton Identification Products.

2. Description:

a. Brightly colored, continuously printed plastic ribbon tape.
b. Minimum Size: 6 inches wide by 4 mils thick.
c. Manufactured for direct burial service.
d. Letter sizes per Paragraph 2.2A.

2.3 LOCKOUT DEVICES

A. Lockout Hasps:

1. Manufacturers:

a. Brady ID.
b. Master Lock Company, LLC.

2. Description:

a. Material: Anodized aluminum.
b. Furnish hasp with erasable label surface.
c. Minimum Size: 7-1/4 by 3 inches.

B. Valve Lockout Devices:

1. Manufacturers:

a. Brady ID.
b. Master Lock Company, LLC.

2. Description:

a. Material: Plastic.
b. Furnish device to restrict access to valve operator and to accept lock shackle.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. According to manufacturer instructions.

B. Apply stencil painting.

C. Install identifying devices after completion of coverings and painting.

D. Install nameplates with corrosion-resistant mechanical fasteners or adhesive.

E. Tags:

1. Identify all valves with tags.
2. Install tags using corrosion-resistant chain.
3. Install tags prior to testing and start-up of related equipment.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Piping:

1. Identify piping, concealed or exposed, with plastic pipe markers.
2. Use tags on piping 3/4-inch diameter and smaller.
3. Identify service, flow direction, and pressure.
4. Install in clear view and align with axis of piping.
5. Location: Place labels and directional arrows at a maximum of 15-foot on center at both sides of penetrated walls or floors, adjacent to valves, at connected equipment, at branch fitting and in congested pipe layouts. Contractor to review TCEQ requirements and may need to decrease spacing as required.
    a. Two labels minimum each room, crawl space or compartment, unless otherwise approved.
    b. Arrows indicated direction of flow shall point away from label. If flow may be in both directions, use double-headed arrows.

END OF SECTION 400553

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SECTION 400557 - ACTUATORS FOR PROCESS VALVES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Following types of actuators for linear, multi-turn, and quarter turn valves and gates:

1. Manual actuators.
2. Electric motor actuators.

B. Related Requirements:

3

1. Section 055000 “Metal Fabrications” for miscellaneous metalwork and fasteners as required.
2. Section 099679 “Atmospheric Protection and Plant Service Areas Coatings” for non-submerged actuators as required.
3. Section 400507 “Hangers and Supports for Process Piping” for hangers, anchors, sleeves, and sealing of piping to adjacent structures.
4. Section 400551 “Common Requirements for Process Valves” for common product requirements for valves for placement by this Section.

1.3 DEFINITION

A. Where the term “valve” alone is used in this Section, it applies to both valves and gates as the corresponding text context dictates.

1.4 COORDINATION

A. Section 400551 “Common Requirements for Process Valves” for valve schedule requirements.

B. Coordinate Work of this Section with installation of valves, gates, and accessories.

1.5 ACTION SUBMITTALS

A. Product Data: Manufacturer information for actuator with model number and size indicated.

B. Shop Drawings:

1. Parts list, materials, sizes, position indicators, limit switches, control system, actuator mounting, wiring diagrams, control system schematics with external interfaces on assembly drawings.
2. Actuator Shop Drawings with respective valve and gate submittal.

C. Manufacturer's Certificate: Products meet or exceed specified requirements.

1.6 INFORMATIONAL SUBMITTALS

A. Manufacturer Instructions: Special procedures and placement requirements.

B. Source Quality-Control Submittals: Results of factory tests and inspections and provide required certifications.

C. Field Quality-Control Submittals: Results of Contractor-furnished tests and inspections.

D. Qualifications Statements:

1. Qualifications for manufacturer and installer.
2. Manufacturer's approval of installer.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Documentation of actual locations and types of actuators.

1.8 QUALITY ASSURANCE

A. Valve Actuators in NEC Class I, Group C and D, Division 1 or 2 Hazardous Locations: Comply with NFPA 70.

B. Minimum NEMA Enclosure Classification:

1. Non-submergence Installations: NEMA 4X.
2. Submergence Installations: NEMA 6P/IP68.

C. Single Source Requirements:

1. Furnish electric motor actuators in the scope of the project by the same manufacturer. Coordinate this requirement with actuated valves and gates included in scope of vender furnished equipment.
2. Furnish actuators, floor stands, stem guides, stems, extensions, and accessories for slide gate assemblies by slide gate manufacturer.

D. Mate actuators to equipment at equipment manufacturers or integrators facility.

1. Test assembled product. Certify ready for installation prior to shipment to job site.
2. For extremely large assemblies requiring disassembly for installation, the actuator may be disassembled for shipment and remounted in the field.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Furnish temporary end caps and closures on piping and fittings and maintain in place until installation.
3. Provide additional protection according to manufacturer instructions.

1.11 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.12 WARRANTY

A. Manufacturer’s Special Warranty: Submit standard written warranty against manufacturing defects for manual pneumatic electric-motor actuators.

1. Warranty Period: 2-Years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. Refer to valve and gate schedule for actuator type, accessories, and sizing information.

B. Provide clockwise closed actuation unless otherwise noted on the valve and gate schedule.

C. Supply chain actuators for manual valves located 7 feet or higher above finished floor.

2.2 ACCESSORIES

A. Floor Stands:

1. Materials:

   a. Stand: Cast iron.
   b. Stem Bushing: Sintered bronze.
   c. Position Indicator: Bronze.

2. Height to input shaft or handwheel: 36 inch.
3. Base Mounting Requirements:

   a. Concrete Floor Mounting: Type 316 stainless steel anchor bolts.
   b. Face of Basin or Offset Mounting: Heavily reinforced, adjustable wall bracket with required anchor hardware using Type 316 stainless steel.

4. Actuator Mounting Requirements:

   a. Manual Actuator: Cast iron handwheel on top of floor stand with dual ball type thrust bearings, grease fitting on bearing bowl, hardened machined alloy bronze lift nut (for rising stem). Where manual effort is greater than 40 lb rim pull with 2 feet diameter wheel, provide geared actuator with a handwheel or crank.

      1) Handwheel casting to include the word “OPEN” and an arrow indicating the direction of operation.

   b. Gearbox or Direct Powered Actuator: Through bolt holes matched to actuator or gearbox bolting pattern.

5. Non-rising stem position indicator: Mechanical indicator connected to and driven by stem extension and cast position marks on floor stand with the word “OPEN” cast at the top of the travel, and a field mounted aluminum “CLOSED” tag supplied with drive rivets, installed based on number of valve turns.
6. Rising Stem Position Indicator: Permanent markings on transparent stem covers.

B. Stem Covers: Fracture-resistant clear polycarbonate stem covers for rising stems. Closed top with adhesive type position indicator markings.

C. Extension Stems and Stem Guides:

1. Extension stems and couplings to actuate recessed, buried, below slab valves and gates via operating nut or floor stand mounted actuator.
2. Stem Extensions and Stem Couplings: Alloy steel, hardware of Type 316 stainless steel unless specified otherwise in the respective slide gate specification.
3. Stem and Stem Couplings: Rated for five times the maximum input torque capacity of the actuator.
4. Adjustable, Cast Iron Wall Bracket Type Stem Guides: Include two-piece bushing.
5. Spacing: 10 feet spacing or at spacing calculated by manufacturer to prevent buckling with a safety factor of 2 based on design thrust, shaft material and shaft size.

D. Torque Tubes:

1. Supply where shown on the Drawings or Valve and Gate Schedule or as recommended by Manufacturer.
2. Supported by/mated to valve bonnet/yoke.
3. Sized by supplier for the required actuator torque.
4. Drilled specifically for valve and actuator bolt pattern.
5. Internal extension keyed or shaped specifically to mate to valve shaft and fabricated of Type 316 stainless steel.
6. Internal extension designed for axial adjustment for mating purposes.

E. Chain Wheels:

1. Supply for manual valves 3 inch diameter or larger mounted 7 feet and greater above operating floor level.
2. Type: Sprocket rim with chain and floating chain guide.
3. Chain Wheel and Guides Materials: Cast iron with hot-dip galvanized chain.
4. Chain Length: Extend to 5-1/2 feet above operating floor level.
5. Chain Storage: Include where chains may interfere with personnel egress; made with high-strength thermoplastic polymer in safety orange color.
    a. Basis-of-Design: Trumbull, Model ‘Chain Up’ as manufactured by Trumball Manufacturing, Inc., or equal.
6. Chain Wall Hooks: Include where feasible to prevent chain from impeding personnel egress.

2.3 MANUAL ACTUATORS

A. Operating Nuts:

1. 2 inch cast iron AWWA design.
    a. Painted Carbon Steel Tee Handle Operator: 2 inch AWWA nut socket end extension length for nut actuated valves where nuts are recessed in valve boxes.
    b. Tee Extension Length: Determine based on nut height as shown on Drawings with handle height approximately 3 feet above operating surface.
2. Operating Nuts Recessed on Concrete: Cast iron floor box with cover and tee handle operator with 2 inch AWWA nut socket end.
3. Nut Operated Non-Rising Stem Buried Valves: Cast iron bonnet skirts, extension pipes valve box and cover. Stem extensions with AWWA nut end to elevation shown on the Drawings or scheduled.
4. Two tee handles for every ten buried or encased non-rising stem application with 2 inch AWWA operating nut.

B. Gear-Assisted Manual Valve Actuators:

1. Provide:
    a. For manually actuated valves and gates larger than 8 inch nominal diameter and for ball and plug valves 6 inch and larger.
    b. With power actuators where torque requirements dictate.

2. Comply with AWWA C504.
3. Handwheel Diameter: 8 inch
4. Maximum Handwheel Pull: 40 lbs maximum.
5. Housings: Cast or ductile iron.
6. Worm or helical gear type.
7. Gears: Hardened steel, machine cut and mated.
8. Bearings: Permanently lubricated bronze.
9. Input and Output Shafts: Sealed with greased, waterproof machine shaft seals.
10. Filled with waterproof grease and designed for submerged service where scheduled.
11. Handwheel: Removable.
    a. Diameter: 8 inch up to 12 inch valve size.
    b. Diameter: 12 inch diameter up to 16 inch valve size.
    c. Diameter: 18 inch diameter for larger than 16 inch valve size.
    d. Maximum Diameter: 24 inch diameter.
12. Include mechanical top mounted valve position indication, opening direction, and adjustable stops.

C. Direct Manual Slide Gate Actuators:

1. Small Gates not Requiring Gear Reduction to Achieve Rim Pull Requirements: Yoke or floor stand mounted handwheel with dual ball type thrust bearings, grease fitting on bearing bowl, hardened machined alloy bronze lift nut.

D. Gear-Assisted Manual Slide Gate Actuators:

1. Provide manually actuated slide gates where direct mount actuators cannot meet rim pull requirements and design safety factors.
2. Include power actuators where torque requirements dictate.
3. Comply with AWWA C504.
4. Yoke mount for self-contained gates and floor stand mount for non-self-contained gates.
5. Accessories specified hereinabove where pertinent to the application.
6. Handwheel or crank style operator with maximum rim or crank pull of 40 lbs.
    a. Crank operators of cast iron construction with revolving brass grip.
    b. Handwheel casting to include the word “OPEN” and an arrow indicating the direction of operation.
7. Gear Boxes:
    a. Bevel or parallel shaft as required by installation geometry.
    b. Fully enclosed cast or ductile iron housings.
    c. Suitable for pedestal or yoke (bench) mounting.
    d. Mechanical seals on input shafting.
    e. Shafting fully supported with anti-friction ball or roller bearings throughout.
    f. Precision machined high strength bronze lift nuts.
    g. Precision cut steel gears.
    h. Input Shafts: Type 316 stainless steel.
    i. AWWA drive nut for removable crank, wheel or portable power operator to be 2 inches.
    j. Single or compound reduction as required to achieve rim pull requirements.
    k. No damage to gearbox components with 100 lbs rim pull.

l. Coordinate with gate stem design such that catastrophic failure occurs at stem nut prior to stem buckling.

8. Tandem gear drives where indicated on Gate Schedule. Tandem drives include parallel gear boxes, Type 316 stainless steel interconnecting shafting, and flexible couplings furnished by the manufacturer.

2.4 ELECTRIC MOTOR ACTUATORS

A. General:

1. Where specified on the Valve and Gate Schedule, or shown on Drawings.
2. Comply with AWWA C542.
3. Actuators for Valves 3 inches and Smaller: 120 Volt, 1 Phase, 60 Hertz power supply.
4. Actuators for Valves Larger than 3 inches and for slide gates and weir gates: 480 Volt, 3 Phase, 60 Hz power supply.

B. 120 Volt Power Actuators:

1. Actuators to have reversing motor, reduction gearing, local position indicator, position limit switches, provision for manual override, 100 to 1000 in-lbs torque range and motor thermal and electronic control protection.
2. Enclosure:

a. Cast aluminum or steel alloy.
b. Powder coated or fusion bonded epoxy finish.
c. NEMA 4X.

3. Power Train:

a. Self-locking planetary epicyclical gear design.
b. Hardened steel gears with bronze bearings.
c. Housing Penetrations: Seal with mechanical seals.
d. Housing: Equip with space heaters.
e. Mounting System: ISO 5211.

4. Actuator for Open/Close/Jog Reversing Service: Proportional/modulating service where required in the equipment specifications or Instrumentation Drawings.
5. Motors:

a. Design for valve actuation service.
b. Insulation: Class F.
c. Split phase capacitor protection.
d. Duty Cycle: 40 percent at 100 degrees F for open/close duty, and 100 percent for modulating duty.
e. 90-Degree Travel Time: 10 to 20 seconds depending on actuator size.
f. Actuator Switches: Have two SPDT 15 Amp rated switches for remote open/close valve position indication.

6. Products: Subject to compliance with requirements, provide one of the following or equal:

a. Series 92 as manufactured by Asahi/America.

b. P Series as manufactured by Promation Engineering, Inc.
c. Bettis TorqPlus as manufactured by Emerson Actuation Technologies.

C. 480 Volt Power Actuators:

1. General: 3 phase 60 hz supply rated, self-contained, totally enclosed with motor, integral reversing starters, local controls, reduction gearing, limit switch gearing, limit switches, control power transformer, torque switches, bored and keyed drive sleeve for non-rising stems, declutch lever, auxiliary handwheel, and local position indication.
2. Separately seal motor and control compartments with space heaters in limit switch, motor, and control compartments.
3. Suitable for indoor and outdoor use, fully functional in ambient temperature range from -20 to 140 degrees F at 100 percent relative humidity.
4. Size to guarantee full travel, seating and unseating torque or thrust as specified by the valve or gate manufacturer.
5. Size to provide torque required to operate valve or gate at 90 percent of nominal voltage.
6. Design Travel Rate:
   a. As indicated on valve and gate schedule, and if not so indicated:
      1) Gate Valves and Slide Gates: 12 inches per minute.
      2) Globe Valves: 4 inches per minute.
      3) Quarter Turn Valves: 30 seconds per 1 foot of throat diameter.
      4) Quarter Turn Valves – Modulating: Minimum 60 seconds per 1 foot of throat diameter.
7. Enclosure: Cast aluminum construction, 0-ring sealed, watertight to NEMA 4X/6 and submersible to IP 68-8, 20 feet for 72 hours..
   a. Where required on Valve and Gate Schedule, certified explosion proof for Class I, Division 1 and 2, Groups C and D.
   b. External Fasteners: Type 316 stainless steel.
   c. Include anti-condensation heater, suitable for continuous operation.
8. Motors:
   a. High-starting torque; low stall torque, low inertia, designed and built by actuator manufacturer.
   b. Embed thermistor in each motor winding for thermal protection.
   c. Insulation: Class F, with a duty rating of at least 15 minutes at 40 degrees F ambient temperature.
9. Motor Protection:
   a. De-energize without damage in the event of a stall condition when attempting to move a jammed valve.
   b. De-energize in the event of an over-torque condition.
   c. Imbed a minimum of two thermal devices in motor windings to de-energize the motor in case of overheating.
10. Gear Train:
    a. Grease filled, O-ring sealed in cast or ductile iron gear case.
    b. Suitable for operation in any orientation.
    c. Hardened, machine cut steel gears, and precision machined alloy bronze worm gear.

d. Reduction gearboxes as specified in Paragraph "Gear-Assisted Manual Valve Actuators."

11. Manual Operation:
    a. Handwheel which does not rotate during motor operation.
    b. Utilize actuator worm shaft/worm wheel to maintain self-locking gearing and to facilitate changeover from motor to manual operation when the actuator is under load. Do not use designs that bypass actuator worm gear or break valve load at worm gear.
    c. Automatic return from manual to motor operation upon starting motor.
    d. Manual operation capable with seized motor.

12. Position and Torque Calibration:
    a. Torque and travel adjustment parameters:
        1) Position Setting Range: 1 to 500 turns, with resolution of 2.81 degrees and accuracy to 5.0 degrees of actuator output.
        2) Torque Setting: 40 to 100 percent of rated torque.
    b. Torque switch bypass for the torque sensing system to inhibit torque switch trip during unseating or during starting in mid-travel against high inertia loads.

13. Wiring and Terminals:
    a. Tropical grade insulated stranded cable of appropriate size for the control and 3-phase power.
    b. Include actuators without plug and socket terminal connections having power and control disconnect switches for ease of maintenance and safety.

14. Controls:
    a. Microprocessor: Based with mechanically and electronically interlocked reversing contactors for Open/Close duty and solid-state contactors for modulating duty.
    b. Local/Off /Remote Selector Switch and Open/Stop/Close Pushbuttons: Mount on actuator face with red and green indication lights for open/close, and amber for power On, and red or over torque fault.
    c. Remote On/Off Service: Actuator to accept one remote signal to open and a second remote signal to close.
    d. Modulating Service: When in remote mode, actuator to accept a 4 to 20 mA DC position control signal and position valve 0 to 100 percent of travel in proportion to control signal.
    e. Monitoring Relays: Remotely indicate fault signal for indication of power failure or thermal switch tripped.
    f. Outputs to be provided for position of selector switch.
    g. Gear Actuated Position Transmitter: On modulating duty actuator that is a two-wire device, produce 4 to 20 mA DC signal proportional to 0 to 100 percent travel.
    h. Transmitter: Have easily accessible zero and span adjustment potentiometers.
    i. DC Power Supply: Integral with operator and powered from 110-volt AC internal transformer. Positioner board to provide repeatable accuracy to 0.25 percent of span and have separate trim pots for zero, span, and dead band adjustment.
15. Position Indication: Continuous mechanical dial indication of valve and gate position in step with the actuator at all times in both the hand wheel and motor operation. For

modulating applications, graduations on mechanical dial position indicator to be 0 to 100 percent scale.

16. Limit Switches:
    a. Adjustable type to trip at any point between fully opened and fully closed.
    b. Mid-travel Switches: Provide as noted.
    c. Do not allow set position to be lost if over travel occurs in either manual or electric modes of operation.
    d. Two independent and fully adjustable rotary type position limit switches each with 10 Amp DPDT contacts for remote open/close position indication.

17. Torque Switches: Actuator with adjustable torque switches and be responsive to load encountered in either direction of travel.
18. Terminal Compartment:
    a. Three threaded cable entries.
    b. Stud-type Terminals: Embed in a terminal block of high tracking-resistance compound.
    c. Three-phase Power Terminals: Shroud from control terminals by means of an insulating cover.

19. Remote Control Stations:
    a. Where indicated, remote control stations for actuators located below the operating floor or located more than 7 feet above the operating floor.
    b. Include a Local/Off/Remote selector switch, Open/Stop/Close pushbuttons and Open/Close indicating lights.
        1) Local/Off/Remote selector to include padlock mount for the Off position.
    c. Include auxiliary contacts for remote indication of switch position.

20. Manufacturers: Provide products by one of the following or equal.
    a. EIM M2CP as manufactured by Emerson (EIM)

2.5 SOURCE QUALITY CONTROL

A. Factory Testing:

1. Shop inspect and test completed assemblies.
2. Factory performance as specified below for actuators and supply individual test certificates. Submit test certificates prior to shipment of valve actuators. Test equipment to simulate a typical valve and gate load, and record the following parameters:
    a. No load current.
    b. Current at maximum torque setting.
    c. Stall current.
    d. Torque at maximum torque setting.
    e. Stall torque.
    f. Test voltage and frequency.
    g. Actuator output speed.
    h. Factory testing will include 20% of actuators and at least 1 Modulating, and 1 Open/Close unit.

B. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify field dimensions are as indicated on Shop Drawings.

3.2 INSTALLATION

A. Install products plumb, square, and true according to manufacturer’s published installation instructions.

B. Securely mount actuators using brackets or hardware specifically designed for attachment to valves/gates. Use 1 or 2 plate adapter mounting. No box brackets or adapters to be used.

C. Extend chain actuators to 5-1/2 feet above operating floor level.

D. Include a removable plug and socket head or termination of all external writing if actuator is located in a vault location or subject to flooding.

E. Contractor shall seal incoming conduit prior to entering into actuator enclosure.

3.3 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Perform adjustments during normal occupancy hours.

3.4 DEMONSTRATIONS

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain actuators.

1. Time Duration: Allow four hours during a single day.

END OF SECTION 400557

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SECTION 400559.23 - STAINLESS STEEL SLIDE GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Stainless steel slide gates.

B. Related Requirements:

1. Section 400551 “Common Requirements for Process Valves” for powered lifting devices.

1.3 DEFINITIONS

A. Operating Head: Distance from centerline of gate to maximum water level of channel.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's product information for system materials and component equipment.

B. Shop Drawings:

1. System materials and component equipment.
2. Description of materials cross-referenced to a sectional drawing listing material by trade name and ASTM reference number.
3. Certified shop and installation drawings showing details of construction, dimensions and anchor bolt locations.
4. Installation and anchoring requirements, fasteners, and other details.
5. Descriptive literature, bulletins and/or catalogs of the equipment.
6. The weight of each component.
7. Description of surface preparation and shop prime painting of gates and accessories.
8. Gate identification number, location, service, type, size, design pressure, operator details, stem details, and loads.
9. Listing of forces transmitted to floor stands if applicable.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Products meet or exceed specified requirements.

B. Manufacturer's Instructions: Detailed instructions on installation requirements, including storage and handling procedures.

C. Source Quality-Control Submittals: Results of factory tests and inspections.

D. Field Quality-Control Submittals: Results of Contractor-furnished tests and inspections.

E. Manufacturer Reports:

1. Certify that equipment has been installed according to manufacturer's instructions.
2. Document activities on Site, adverse findings, and recommendations.

F. Qualifications Statements:

1. Submit qualifications for manufacturer and licensed professional.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of installed slide gates and components.

B. Operation and Maintenance Data: Submit maintenance instructions for equipment and accessories.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts:

1. Furnish one set of manufacturer's recommended spare parts.

B. Tools: Furnish special tools and other devices required for Owner to maintain equipment. Provide special tools and spare parts required for normal operation and maintenance of the equipment.

C. O&M Manual: Provide copy of manufacturer's operation and maintenance manuals.

1. Include required cuts, drawings, equipment lists, descriptions, etc. to instruct operating and maintenance personnel unfamiliar with such equipment.
2. Include trouble shooting data and full preventive maintenance schedules.

D. Factory Representative: Provide two days to instruct representatives of the Owner on proper operation and maintenance of the equipment.

1.8 QUALITY ASSURANCE

A. Gate manufacturer to be ISO 9001:2015 certified or provide an alternate quality assurance plan for review and approval by the Engineer.

B. Maintain a copy of each standard affecting Work of this Section on Site.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Licensed Professional: Professional engineer experienced in design of specified Work.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer's instructions.

C. Protect materials from physical damage, moisture and dust by storing in clean, dry location remote from areas involved in construction operations.

1. Provide additional protection according to manufacturer's instructions.

1.11 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Document field measurements on Shop Drawings.

1.12 WARRANTY

A. Furnish 2-years manufacturer's warranty for slide gates from the date of Substantial Completion.

B. Furnish 2-years manufacturer's warranty that clear plastic stem covers will not crack, discolor, or become opaque from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Slide gates shall have the characteristics and dimensions as tabulated in the Gate Schedule included herein.

B. Minimum Vertical Loading: 50 percent of force on the gate from operating head acting on horizontal centerline of gate, multiplied by effective gate area, plus weight of slide and stem.

C. Gate Reinforcement: As required for deflection not greater than 1/360 of span. Slide deflection shall not exceed 1/720 x length or 1/16 inch whichever is less under maximum design head conditions.

D. Operating Head:

1. Safety Factor: Design gate to operate under specified operating head with safety factory of five.

E. Minimum Material Thickness: 1/4 inch.

2.2 STAINLESS STEEL SLIDE GATES

A. Manufacturers:

1. Whipps, Inc. of Athol, MA.
2. RW Gate Company of Troy, NY.

B. Description:

1. Comply with AWWA C561.
2. Self- contained stainless steel slide gate, with extended frame, yoke, lifting stem attached to yoke, lift and lift support, stem, stem guide, and stem block.
3. Non- self-contained stainless steel slide gate, with limited frame, lifting stem, lift and lift support, stem, stem guide, and stem block
4. Size: As indicated in Gate Schedule.
5. Operating Head: As indicated in Gate Schedule.
6. Closure: As indicated in Gate Schedule.
7. Opening: As indicated in Gate Schedule.

C. Gates: Type 316 stainless steel, self-contained or non-self contained, as indicated in Gate Schedule, type with disc arranged to lower or raise to open and with guides designed to mount on the face of or embedded in concrete, as indicated in Gate Schedule.

1. Disc or Sliding Member: Type 316 and the stainless steel plate reinforced stainless steel structural members welded to the plate not more than 16 inch apart.

a. Deflection: 1/720 of span of the gate or 1 /16 -inch, whichever is less, under the design head.
b. Reinforcing Ribs: Extend into guides so they overlap seating surface of the guide.
c. The portion of the disc that engages the guide shall have a minimum thickness of 1/4-inch.
d. A Specially Extruded Resilient Seal:

1) Mounted on the invert member with stainless-steel attachment bolts to provide flush bottom closure.
2) Seal Shape: Produce a seating surface with minimum width of 3/4 inch
3) Vertical Seal Face: In contact with seating surface of guide providing a proper seal at the corners.

e. Reinforcements, Retainer and Bolts: Same material as disc.

2. Configuration: Removable.

D. Guides: Type 316 stainless steel construction, designed for maximum rigidity, weighing a minimum of 13 lbs per foot for face mounted frames and 6.5 lbs per foot for embedded or in-channel mounted frames.

1. The structural members for the guide and guide extensions are to be formed into a one-piece shape for rigidity.
2. Holes for anchor bolts to be provided at a distance of every 18 inches for face mounted units or embedding keyways for embedded units or are to be spaced as required to handle the design pressure for the application, whichever is less.

    a. Bolts to be acceptable on both side of the gusset. Manufacturer to procure holes on either side for mounting constructability.

3. The portion of the face-mounted frame, where the anchor bolts penetrate, will have a minimum thickness of 1/4-inch.
4. Guides to extend beneath opening a sufficient amount to support the disc in fully down or open position for downward opening gates.
5. Guide extensions to be "C" shaped stainless-steel members, or similar, for rigidity, weighing a minimum of 6.5 lbs per foot.

E. Gate Seal:

1. Gate to be sealed with UV stabilized, self-adjusting UHMWPE material with a nitrile compression cord.
2. Seal to be placed in a stainless-steel channel, welded to the guides of the gate.
3. Seals to be provided on the invert and sides of gate, and along the top seal member on gates identified in the Gate Schedule to have top closure.
4. Deflection: Arrange seal to have a minimum deflection of 1/16 -inch.
5. Attachment hardware to be same material as the guides.

F. Yokes (for self-contained): Type 316 stainless steel construction with the yoke supporting the operating benchstand.

1. Formed by welding two "C" channels to the top of the guides to provide a single piece rigid frame.
2. Arrangement: Disc and stem to be removable without disconnecting the yoke.
3. Top of yoke height: Minimum – 42"

G. Lifting Nut: Brass

1. Grease fitting on manual operators.
2. Roller bearings or ball bearing above and below lifting nut.

H. Seats: Impacted into dovetail slots and held in position without use of screws or other fasteners.

1. Maximum Clearance between Seating Faces: 0.004 inch when gate is fully closed.

I. Frames: One-piece configuration.

1. Mounting: As indicated in Gate Schedule.
2. Material: Type 316 stainless steel.
3. Furnish continuous embed or mounting flange.
4. Thickness: 1/4 inch.
5. Seats: Ultra-high-molecular-weight polymer.
6. Bottom Flush Closure: Resilient seal securely attached to frame along invert.

J. Lifting Stem: Type 316 stainless steel for the entire length.

1. Tensile Strength: 60,000 psi.
2. Diameter: Of sufficient size at base of thread to lift the weight of the gate, offset the resistance of the gate to the maximum unbalanced head and fully allow for starting impact.
3. Minimum Diameter: 1-1/2 inch to withstand twice the rated output of the operator.
4. Slenderness Ratio (l/r): Less than 200.
5. Non-Rising Stems: Non- rising stems shall have a bronze nut. Equip stems with adjustable bronze stop collars above and below the lift nut preventing over opening or over closing the gate
6. Stem Guides: Type 316 stainless steel, UHMWPE bushed, mounted in a Type 316 stainless-steel bracket. Provide as recommended by manufacturer. Adjustable in two directions and spaced at sufficient intervals to adequately support the stem. Spacing not to exceed 10 feet.
7. For non-rising stems, stem may connect to the downstream side of the slide.
8. Configuration: Removable.
9. Thread: Full depth machine rolled, Acme type, double lead threads.
10. Finish: 16 microinch or better.
11. Stem Covers: Provide rising stem gates with clear fracture resistant polycarbonate covers.
    a. Will not discolor or become opaque for a minimum of 5 years after installation.
    b. Capped, vented, and of a length to allow full travel of gate.
    c. Bottom end mounted in a housing or adapter plate for easy field mounting.
    d. Indicator markings showing gate position.

2.3 FINISHES

A. Stainless Steel Surfaces: Mill finish.

B. Welds to be sandblasted to remove weld burn and scale.

2.4 ACCESSORIES

A. Hardware: Type 316 stainless steel. Conform to ASTM A276 or ASTM A193/A194 and F593/F594 unless otherwise specified.

B. Attaching Bolts and Anchor Bolts: Type 316 stainless steel. Furnished by slide gate manufacturer.

C. Nameplates: Each gate is to be provided with a nameplate that includes the manufacturer’s name, opening size and maximum head rating, as a minimum. Nameplate to be mounted on the gate yoke or pedestal.

2.5 SOURCE QUALITY CONTROL

A. Shop inspection and testing of completed assemblies.

B. Owner Inspection: Make completed clarifier equipment available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner seven days before inspection is allowed.

C. All welds shall be performed be welders with AWS D1.6 certification.

D. Certificate of Compliance: When fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify facilities are ready to receive slide gates.

3.2 PREPARATION

A. Clean surfaces according to manufacturer's instructions.

3.3 INSTALLATION

A. Install slide gates according to manufacturer's instructions.

B. Ensure products are installed plumb, true, and free of warp or twist.

C. Locate operators to avoid interference with handrails and other Work.

D. Gate Installation: Under the supervision of the gate manufacturer’s factory representative.

E. Manufacturer to provide service until operation is satisfactory.

F. Guides: Surface and Flange Mounted.

1. Install guides with adhesive anchors or expansion anchors. Utilize backing nuts.
2. Position guides at elevation as indicated on Drawings.
3. Grout space between the guides and the mounting surface according to manufacturer’s instructions.

G. Guides: Recessed.

1. Cut slot in concrete to receive guides.
2. Position guides at elevation as indicated on Drawings.
3. Grout guides in place according to manufacturer's instructions.

H. Sealant:

1. Apply 1/8 inch thick layer of elastomeric sealant to back of frame.
2. Tighten nuts snug until sealant begins to flow beyond frame.
3. Remove excess sealant.
4. Cure sealant for minimum seven days.
5. Tighten nuts to their final positions.

I. Lubricants: Oil and grease as required for initial operation.

3.4 FIELD QUALITY CONTROL

A. Inspection: Verify gate and components alignment, smooth operation, with no binding or scraping.

B. Testing per AWWA C561:

1. Maximum slide gate leakage under seating and unseating head: 0.05 gpm/ft. of seating perimeter.
2. After installation, field test slide gates ensuring items of equipment are in compliance with Specifications, including leakage requirements.
3. For units failing to meet specified requirements, make necessary change and retest units. If unit remains unable to meet test requirements to Engineer’s satisfaction, it will be replaced with a satisfactory unit at no additional cost to Owner.

C. Equipment Acceptance: Adjust, repair, modify, or replace components failing to perform as specified and re-inspect.

1. Make final adjustments to equipment under direction of manufacturer's representative.

D. Furnish physical checkout and installation certificate from equipment manufacturer's representative attesting equipment has been properly installed and is ready for startup and testing.

E. Submit the equipment manufacturer's Certificate of Field Testing.

F. Submit the equipment manufacturer's Certificate of Functional Testing.

3.5 ADJUSTING

A. Adjust slide gates to provide smooth operation.

3.6 MANUFACTURER’S SERVICES

A. Manufacturer shall advise, consult, and instruct the Contractor on:

1. Installation procedures and adjustments and inspect the equipment during installation as a condition of acceptance of the work.
2. Startup and testing of the finished installation.

B. Minimum maintenance training topics:

1. Step-by step, “hands-on” assembly and disassembly procedural instructions.
2. Replacement part identification and ordering procedures.
3. Lubrication procedures, including drain-down and refill procedures.
4. Recommended routine maintenance procedures.
5. Troubleshooting and diagnostic procedures.

C. Man-hour requirements listed below are exclusive of travel time and do not relieve the manufacturer of the obligation to provide sufficient service to place equipment in satisfactory operation. *1

1. Supervise Installation: Trips - 1 Hours/Trip - 8.
2. Inspect and Approve Installation *2: Trips per Facility - 1 Hours/Trip - 8.
3. Instruct Owner's personnel in proper startup and O&M *3: Trips - 2 Hours/Trip - 8.
4. Supervise and Assist in Testing *4: Trips per Facility - 1 Hours/Trip – 8.
5. Notes:

    a. *1 - Manufacturer's factory representative shall be present at frequent enough intervals to ensure proper installation, testing and initial operation of the equipment. Minimum time on site per trip based on 8-hour working days.
    b. *2 - Manufacturer's factory representative shall submit to the Engineer a written certification that the system has been installed in accordance with the manufacturer's recommendations.
    c. *3 - Instruction may be given upon completion of Item 2, provided that the O&M manuals have been submitted to and accepted by the Engineer.
    d. *4 - May be done upon completion of Item 3 if acceptable to the Engineer. The time required for performance testing is in addition to the above specified hours.

3.7 SCHEDULES

A. Slide Gate Schedule: Manufacturer will supply slide gates within the project as indicated in the gate schedule. In the absence of seating and unseating head data, the manufacturer will assume a flooded basin condition from top of concrete to base of gate and assume both a seating and unseating loading condition.

B. Attached.

END OF SECTION 400559.23

Gate Tag	Gate Type	Opening Size Width (IN)	Opening Size Height (IN)	Gate Location	Service	Self-Contained Frame (Y/N)	Operator Mounting	Operator Type	Opening Invert Elevation	Gate Invert Elevation (See Note 1)	Operating Floor Elevation	Slide Travel to Full Open Open Pposition (IN)	Seating Head, ft	Unseating head, ft	Guide Frame Mounting Type	Pedestal Mounting Type	Top Seal Required (Y/N)	Direction of Operation
SG-2000-1	Slide	30	30	Coarse Bar Screen	Raw Wastewater	N	Pedestal	Manual	670.75	670.25	680.75	30	11	11	Wall Mounted	Floor Mounted	y	Upward
SG-2000-2	Slide	30	30	Coarse Bar Screen	Raw Wastewater	N	Pedestal	Manual	670.75	670.25	680.75	30	11	11	Wall Mounted	Floor Mounted	Y	Upward
SG-2100-1	Slide	18	18	Grit Basin Channel	Screened Wastewater	N	Pedestal	Manual	692.58	692.08	700.77	18	20.3	20.3	Channel Mounted	Floor Mounted	Y	Upward
SG-2100-2 (See Note 2)	Slide	24	24	Grit Basin Channel to 24" INF	Screened Wastewater and/or degritted Wastewater	N	Pedestal	Manual	698	697.50	700.77	24	20.3	20.3	Channel Mounted	Floor Mounted	y	Upward
SG-2100-3	Slide	14	60	Grit Basin Effluent	Degritted Wastewater	N	Pedestal	Manual	687	686.50	700.77	30	16.8	16.8	Wall Mounted	Floor Mounted	y	Upward
SG-2100-4	Slide	24	42	Grit Basin into Headcell	Screened Wastewater	Y	Yoke	Manual	695.17	694.67	700.77	42	20.3	16.7	Wall Mounted	-	N	Upward
SG-2760-1	Slide	24	24	Inlet Distribution Box	Screened Wastewater	N	Pedestal	Manual	687	686.50	697.5	24	17	17	Wall Mounted	Floor Mounted	Y	Upward
SG-2760-2	Slide	24	24	Inlet Distribution Box	Screened Wastewater	N	Pedestal	Manual	687	686.50	697.5	24	17	17	Wall Mounted	Floor Mounted	Y	Upward
SG-2761-1	Weir	30	36	Inlet Distribution Box	Screened Wastewater	Y	Yoke	Manual	693.5	693.00	697.5	36	17	17	Wall Mounted	-	Y	Downward
SG-2761-2	Weir	30	36	Inlet Distribution Box	Screened Wastewater	Y	Yoke	Manual	693.5	693.00	697.5	36	17	17	Wall Mounted	-	Y	Downward
SG-2762-1	Weir	30	36	Contact Mix	Screened Wastewater	Y	Yoke	Manual	693.5	693.00	697.5	36	17	17	Wall Mounted	-	Y	Downward
SG-2762-2	Weir	30	36	Contact Mix	Screened Wastewater	Y	Yoke	Manual	693.5	693.00	697.5	36	17	17	Wall Mounted	-	Y	Downward
SG-2763-1	Slide	30	30	Chlorine Contact	Clarified Effluent	N	Pedestal	Manual	689.25	688.75	697.5	30	17	17	Wall Mounted	Face Mounted	Y	Upward
SG-2763-2	Slide	30	30	Chlorine Contact	Clarified Effluent	N	Pedestal	Manual	689.25	688.75	697.5	30	17	17	Wall Mounted	Face Mounted	Y	Upward

Notes:

1. Gate Invert Elevation assumed to be 6" below opening invert elevation to allow for sufficient mounting clearance.
2. Contractor to field verify the center elevation of 24" -INF - DI prior to procrument of slide gate

SECTION 400561 - GATE VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid wedge, resilient-seated gate valves.

B. Related Requirements:
1. Section 400551 “Common Requirements for Process Valves” for basic materials and methods related to valves commonly used for process systems.

1.3 DEFINITIONS

A. Outside screw and yoke (OS&Y) valve: A valve in which the operating screw is driven by a threaded nut that is built into the handle.

1.4 SUBMITTALS

A. As specified in Section 400551 “Common Requirements for Process Valves” for submittal requirements for compliance with this section.

1.5 QUALITY ASSURANCE

A. Test valves in accordance with AWWA C500, C509, C515.

B. Provide Installation Inspection and Operator Training per Section 400551 “Common Requirements for Process Valves”.

C. Provide testing and inspection certificates.

1.6 WARRANTY

A. Furnish manufacturer's warranty for valve and associated components for 2-years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOLID WEDGE, RESILIENT-SEATED GATE VALVES – TAG TYPE GV1

A. Manufacturers:
1. American Flow Control
2. Clow Valve
3. Mueller
4. EJ Flow Master

B. Description:

1. Above grade wastewater service.
2. As specified in Section 400551 “Common Requirements for Process Valves”.
3. Comply with AWWA C509 and C515 as applicable to the type of valve specified.
4. Except as otherwise specified, valves shall be rated for a working pressure of 150 psi:
   a. All valve bodies shall be hydrostatically tested to at least twice the rated working water pressure. In addition, valves shall be seat tested, bi directional at the rated working pressure, with seat leakage not to exceed one fluid ounce per inch of valve diameter per hour. Provide certificates of testing.
5. End Connections: ASME B16.1, ASME B16.5, and ASME B16.42, flanged.
6. Gear Actuators for Manual Valves: Comply with AWWA C509 and C515 as applicable to the type of valve specified.
7. Body: no recesses in valve body.

C. Operation:

1. As specified in Section 400551 “Common Requirements for Process Valves”.
2. Stem: Non-rising.
3. Operator: Manual handwheel.
4. Furnish gear operators for valves 8 inches and larger, and chainwheel operators for valves mounted over 6 feet above operating floor.

D. Materials:

1. Wedge: Resilient ASTM A126, cast or ductile iron, fully encapsulated with an approved synthetic rubber material, bonded and vulcanized in accordance with ASTM B429 Method B.
2. Body: ASTM A126, cast iron or ASTM A536, ductile iron
3. Disc: vulcanized rubber bonded and vulcanized in accordance with ASTM B429 Method B.
4. Stem, Stem Nuts, Glands, and Bushings: Type 316 stainless steel.
5. Connecting Hardware: Type 316 stainless steel.
6. Exposed valves shall be furnished with Class 125 flanged ends and provided with outside screw, yoke, and handwheel operator.

E. Finishes:

1. As specified in Section 400551 “Common Requirements for Process Valves”.
2. Body, internal and external, including bonnet: AWWA C550, Epoxy, 4-mil minimum thickness.

3. Gate: ASTM D2000 EPDM encapsulated, ASTM B429 Method B Bonded and vulcanized.

2.2 SOURCE QUALITY CONTROL

A. As specified in Section 400551 “Common Requirements for Process Valves”.
B. Testing: Test gate valves according to AWWA C509.
C. UL and FM approved.

PART 3 - EXECUTION

3.1 INSTALLATION

A. According to AWWA C500 and C509.
B. Dielectric Fitting: Provide between dissimilar metals.

END OF SECTION 400561

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SECTION 400562 - PLUG VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Eccentric plug valves.

B. Related Requirements:

1. Section 400551 “Common Requirements for Process Valves” for basic materials and methods related to valves commonly used for process systems.

1.3 ACTION SUBMITTALS

A. As specified in Section 400551 “Common Requirements for Process Valves” for submittal requirements for compliance with this Section.

B. Submit manufacturer certification confirming that plug valves are capable of passing "pigging" cleaning equipment (using a Girard or similar cleaning pig of full nominal pipeline diameter) in either direction without the use of special equipment.

1.4 INFORMATIONAL SUBMITTALS

A. Source Quality Control: Submit test reports and certification.

1.5 QUALITY ASSURANCE

A. Test valves in accordance with AWWA C517

B. Provide Installation Inspection and Operator Training per Section 400551 “Common Requirements for Process Valves and Piping”.

C. Provide testing and inspection certificates.

1.6 WARRANTY

A. Furnish manufacturer's warranty for valve and associated components for 2-years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ECCENTRIC PLUG VALVES – Tag Type PV1

A. Manufacturers: Provide products by following without substitution nor equal:

1. DeZurik
2. M&H Valve
3. Val-Matic.
4. Henry Pratt

3

B. Description:

1. As specified in Section 400551 “Common Requirements for Process Valves.”
2. Type:

a. Offset disc type.
b. Non-lubricated.
c. Serviceable (able to be repacked) under full line pressure.
d. Eccentric.
e. Capable of sealing in both directions at the rated pressure.
f. Unobstructed flow path when open.
g. Drop tight shut-off to the full valve rating with pressure on either side of the plug.

3. Body:

a. 30,000-psi tensile strength.
b. Top entry, bolted bonnet.
c. Body shall be cast with integral piping connections.

4. Plug:

a. To be removable without removing the valve from the line.
b. To have an integral upper and lower shaft:

1) Seals on upper and lower journals to prevent entrance of solids into journals.

c. One piece.

5. Bearings:

a. Permanently lubricated.

6. Minimum Design Pressure: At below rated minimum design pressures, certify by manufacturer as permitting zero leakage for a 5-minute duration with full pressure applied in either direction.

    a. Sizes 4-inch through 12-inch: 175 psig.
    b. Sizes 14-inch and Larger: 150 psig.

7. Maximum Process Fluid Temperature: Same as fluid temperature as the pipe they connect to, whichever is higher.

8. Ports:

    a. Configuration: Rectangular.
    b. Minimum Port Area: 100% of nominal pipe area.

9. Seats:

    a. Full 360-degree seating by contact of a resilient seating material on the plug mating with welded-in seating surface in the body.
    b. Screw in body seats not acceptable.
    c. Resilient and of the continuous interface type having consistent opening and closing torques.
    d. Non-jamming in the closed position.

10. Stem Bearings: Self-lubricating.
11. Stem Seals:

    a. Type: V-ring.
    b. Externally adjustable and repackable without removing the bonnet from the valve, or self-adjusting.

12. Packing and Gland: Accessible and externally adjustable.
13. End Connections:

    a. Mechanical Joint: Comply with ANSI/AWWA C111/A21.11.
    b. Flanged: Comply with ASME B16.1 and B16.42.
    c. Grooved: Comply with ANSI/AWWA C606.

C. Operation:

1. As specified in Section 400551 “Common Requirements for Process Valves”.
2. A suitably sized steel actuator mounting bracket shall be provided to provide an air gap between the actuator and the valve stem seal. Under no circumstance shall the gear box be mounted directly to the top body flange such that leakage could directly enter the gear box.
3. Provide adjustable limit stops for both opening and closing and a clearly marked position indicator.
4. Manually Operated:
    a. 4 Inches and Smaller: Securely attached lever.
    b. Greater Than 4 Inches: Worm gear manual operators with handwheel.

c. Furnish chain wheel operators for valves mounted over 7 feet above operating floor.

D. Materials:

1. Body:

a. Cast iron, AWWA C517 Ductile iron, ASTM A536.
b. Lining: Epoxy, and Glass Lining, as specified in Section 400519 “Ductile Iron Process Pipe”.
1) Glass Lining to be furnished on the grit suction and discharge lines.

2. Plug:

a. Ductile iron, ASTM A536, Grade 65-45-12
b. Lining: Resilient coating of Neoprene material or alternate as recommended by valve manufacturer for service conditions.

3. Seats: High Nickel.
4. Stem: Type 316 stainless steel.
5. Stem Bearings: Type 316 Stainless steel.
6. Seals: PTFE.
7. Connecting Hardware: Type 316 stainless steel.

E. Finishes: As specified in Section 400551 “Common Requirements for Process Valves.”

PART 3 - EXECUTION

3.1 GENERAL

A. As specified in Section 400551 “Common Requirements for Process Valves” for submittal requirements for compliance with this Section.

3.2 INSTALLATION

A. According to AWWA C517.

B. Horizontal Piping: Stem horizontal, Plug opening to crown of body.

C. Vertical Piping: Plug at top when closed.

D. Plugs: On top when open and on pressure side when closed.

END OF SECTION 400562

SECTION 400563 - BALL VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Two-piece brass body ball valves.
2. Thermoplastic ball valves.

B. Related Requirements:

1. Section 400551 “Common Requirements for Process Valves” for basic materials and methods related to valves commonly used for process systems.

1.3 SUBMITTALS

A. As specified in Section 400551 “Common Requirements for Process Valves” for submittal requirements for compliance with this Section.

1.4 QUALITY ASSURANCE

A. Test valves in accordance with AWWA C504, API 598, MSS SP61 as applicable for types listed herein.

1.5 WARRANTY

A. Furnish manufacturer's warranty for valve and associated components for 2-years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TWO-PIECE BRASS BODY BALL VALVES 3-INCH AND SMALLER- Tag Type BV3

A. Manufacturers:

1. Apollo Valve.
2. Milwaukee Valve.
3. NIBCO Inc.

B. Description:

1. Standard: MSS SP-110.
2. SWP Rating: 150 psi (1035 kPa).
3. CWP Ratings for Valves NPS 1/4 to NPS 2 (DN 8 to DN 50): 600 psi (4140 kPa).
4. CWP Ratings for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 400 psi (3447 kPa).
5. Body Design: Two-piece.
6. Body Material: Forged Brass.
7. Ends: Threaded or soldered joint.
8. Seats: PTFE.
9. Stem Material: Type 316 Stainless steel.
10. Stem Extension Sleeve Material: Aluminum to extend operating handle past pipe insulation.
11. Ball Material: Type 316 Stainless steel.
12. Port: Full.
13. Packing Material: PTFE.
14. Operator: Steel lever with zinc plating and vinyl grip.
15. Working Pressure: As indicated on the valve schedule or be of the same working pressure as the pipe they connect to, whichever is higher. Working pressure of the pipe is noted on the Pipe Schedule on Drawings.

C. Provide for general water service on metallic piping where not otherwise indicated.

2.2 THERMOPLASTIC BALL VALVES

A. Manufacturers:

1. George Fischer.
2. ASAHI.
3. Spears.

B. Description:

1. Valves shall be verified as completely compatible with intended and specified service; compatibility shall apply to material of valve and internal components, included seals, gaskets, O-rings, and washers; solvents and primers used in valve joint make-up shall be specifically in conformance with written instructions of valve supplier. Service chemicals and service conditions are shown in the Pipe Schedule on the Drawings and Division 40.

2. Working Pressure: As indicated on the valve schedule or be of the same working pressure as the pipe they connect to, whichever is higher. Working pressure of the pipe is noted on the Pipe Schedule on Drawings.
3. Ports: Full size.
4. End Connections:
    a. Union.
    b. Flanged: Comply with ASME B16.1

C. Operator: quarter-turn manual

D. Materials:

1. Body and Ball: PVC, ASTM D1784, made from unplasticized polymer, and generally suitable for service to 120 degrees F.
2. Seats: PTFE.

E. Valves from ½-inch to 2-inches shall have a snap-on fit handle attaching to valve stem to prevent handle from falling off.

2.3 SOURCE QUALITY CONTROL

A. As specified in Section 400551 “Common Requirements for Process Valves.”

B. Testing: Test ball valves according to AWWA C507.

PART 3 - EXECUTION

3.1 INSPECTION

A. As specified in Section 400551 “Common Requirements for Process Valves” for submittal requirements for compliance with this Section.

3.2 INSTALLATION

A. According to AWWA C507.

B. As specified in Section 400551 “Common Requirements for Process Valves.”

END OF SECTION 400563

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SECTION 400564 - BUTTERFLY VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. AWWA butterfly valves.
2. High performance butterfly valves.
3. Butterfly valves for low pressure air service (metal body)

B. Related Requirements:

1. Section 400551 “Common Requirements for Process Valves” for basic materials and methods related to valves commonly used for process systems.
2. Section 400523 “Stainless Steel Process Pipe and Tubing”.
3. Section 431118 “Vertically Split Multistage Centrifugal Blowers”.
4. Section 431133 “Rotary Lobe Blowers”.
5. Section 465121 “Coarse Bubble Diffusers”.
6. Section 465136 “Ceramic Disc Fine Bubble Diffusers”.

C. Van Stone flanges shall not be used with pinch valves, industrial butterfly valves; elastomer bellows style expansion joints or other piping system components having an elastomer liner (rubber seat) that is used as a gasket.

1.3 SUBMITTALS

A. As specified in Section 400551 “Common Requirements for Process Valves” for submittal requirements for compliance with this Section.

1.4 QUALITY ASSURANCE

A. Test valves in accordance with AWWA C504, API 598, MSS SP61 as applicable for types listed herein.

B. Provide Installation Inspection and Operator Training per Section 400551 “Common Requirements for Process Valves”.

C. Provide testing and inspection certificates.

1.5 WARRANTY

A. Furnish manufacturer's warranty for valve and associated components for 2-years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARTRIDGE SEAT PROCESS DUTY BUTTERFLY VALVES (Positive Displacement Air Service) - Tag Type BFV2

A. Manufacturers:

1. Keystone Series 60
2. or Engineer Approved Equal

B. Description:

1. Comply with MSS SP 67, API 609, ANSI B16.104, ISO 5211 shaft standard.
2. Minimum Working Pressure: Per drawing M-1.
3. Maximum Process Fluid Temperature: Per drawing M-1.
4. Body Style: Wafer
5. Disc: concentric, undercut for air service valves.
6. Shaft: two-piece design, square or double D input to Capable for mechanical separation from disc without damage to shaft or disc.
7. Bearings: Self-lubricating.
8. Shaft Seals/Packing:
    a. Multiple O-rings.
    b. Mechanically retained.
9. Seats:
    a. Cartridge type.
    b. Resilient and replaceable. Field adjustable and replaceable.

C. Actuator:

1. Per valve schedule.
2. Gear Actuators for Manual Valves: Comply with AWWA C504.

D. Materials:

1. Body: Cast iron ASTM A126, Class B.
2. Stem: Type 416 SS A351 CF8M
3. Disc: 316 SS A582
4. Disc Coating: None
5. Seats:
    a. Elastomer: Fluoroelastomer
6. Bearings: PTFE Gar-Fil reinforced.

E. Finishes:

1. As specified in Section 400551 "- Common Requirements for Process Valves".
2. Manufacturer's standard fusion bonded epoxy.
3. Manufacturer's polyester powder coat.

2.2 SOURCE QUALITY CONTROL

A. As specified in Section 400551 "Common Requirements for Process Valves".

B. Testing: Test butterfly valves according to AWWA C504.

C. Submit an affidavit of compliance stating that the valves have been manufactured and tested in accordance with AWWA C504 and specifically list all exceptions.

PART 3 - EXECUTION

3.1 Examination:

A. As specified in Section 400551 "Common Requirements for Process Valves" for submittal requirements for compliance with this Section.

3.2 INSTALLATION

A. As specified in Section 400551 "Common Requirements for Process Valves."

B. According to Manufacturer's Instructions.

C. Van Stone flanges shall not be used with industrial butterfly valves, or other piping system components having an elastomer liner that is used as a gasket.

END OF SECTION 400564

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SECTION 400565.23 - SWING CHECK VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Swing check valves 3 inches (75 mm) and larger.

B. Related Requirements:
   1. Section 099679 “Atmospheric Protection and Plant Service Areas Coatings
   2. Section 400551 “Common Requirements for Process Valves” for basic materials and methods related to valves commonly used for process systems.

1.3 COORDINATION

A. Section 400551 “Common Requirements for Process Valves” for valve schedule.

B. Coordinate Work of this Section with piping and equipment connections as specified in other Sections and as indicated on Drawings.

1.4 SUBMITTALS

A. Comply with Section 400551 “Common Requirements for Process Valves”.

B. Product Data: Submit manufacturer's catalog information, indicating materials of construction and compliance with indicated standards.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Source Quality-Control Submittals: Indicate results of factory tests and inspections and provide required certifications.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Qualifications Statement:

   1. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping, valves and other appurtenances, connections, and centerline elevations.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum of five years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 400551 “Common Requirements for Process Valves”.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Protect valves and appurtenances by storing off ground.
3. Protect valve ends from entry of foreign materials by providing temporary covers and plugs.
4. Provide additional protection according to manufacturer instructions.

1.8 WARRANTY

A. Furnish manufacturer's warranty for valve and associated components for 2-years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 IRON BODY SWING CHECK VALVES 4-INCH AND LARGER - Tag Type SCV1

A. Manufacturers:
1. GA Industries
2. DeZurik
3. Mueller
4. Val-Matic
5. Pratt

B. Description:

1. Comply with AWWA C508.

2. Size: 4 Inches and larger
3. Type: Swing, metal disc, with hinge shaft extended rom body, sealed with stuffing box, packing and gland.
4. Seat: Bronze
5. Working Pressure: 150 psig
    a. All valve bodies shall be hydrostatically tested to at least twice the rated working water pressure. In addition, valves shall be seat tested, bidirectional at the rated working pressure, with seat leakage not to exceed one fluid ounce per inch of valve diameter per hour. Provide certificates of testing.
6. Disc controller:
    a. Air cylinder cushion to control “slamming” of the valve.
7. Mounting: Horizontal or vertical.
8. End Connections: Flanged, ASMR B16.1

C. Materials:

1. Body and Cover: Cast iron, ASTM A126/ Ductile iron, ASTM A536.
    a. Lining: Epoxy and Glass Lining, as specified in Section 400519 “Ductile Iron Process Pipe”
        i. Glass Lining to be furnished on the grit pump discharge lines.
2. Disc: Bronze, ASTM B62/Ductile Iron ASTM A536
3. Seat: Field replaceable, bronze, ASTM B62
4. Packing and O-Ring: Buna N
5. Grease Fittings: Type 316 stainless steel
6. Rubber Components: Buna N
7. Connecting Hardware: Type 304 stainless steel.

D. Construct valves so that disc and body seat may be easily removed and replaced without removing the valve from the line.

1. Fit with an extended hinge arm with outside level and weight.
2. The position of the weight shall be adjustable.
3. Install level so as to be in the horizontal position when the valve is in the closed position, for both horizontal and vertical pipeline installations.

E. Finished: As specified in Section 400551 – Common Requirements for Process Valves.

2.2 SOURCE QUALITY CONTROL

A. Section 400551 “Common Requirements for Process Valves”.

B. Testing:

1. Hydrostatically test check valves at twice rated pressure according to AWWA C508.
2. Permitted Leakage at Indicated Working Pressure: None.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field dimensions are as indicated on Shop Drawings.

B. Inspect existing flanges for nonstandard bolt-hole configurations or design and verify that new valve and flange mate properly.

3.2 PREPARATION

A. Thoroughly clean valves before installation.

B. Surface Preparation:

1. Touch up shop-primed surfaces with primer.
2. Solvent-clean surfaces that are not shop primed.
3. Clean surfaces to remove loose rust, mill scale, and other foreign substances by commercial sand blasting; SSPC SP 6.
4. Prime surfaces.

3.3 INSTALLATION

A. According to AWWA C508 and manufacturer instructions.

B. Dielectric Fittings: Provide between dissimilar metals.

3.4 FIELD QUALITY CONTROL

A. Inspection:

1. Inspect for damage to valve lining or coating and for other defects that may be detrimental as determined by Engineer/Engineer.
2. Repair damaged valve or provide new, undamaged valve.
3. After installation, inspect for proper supports and interferences.

B. Pressure test valves with piping.

3.5 CLEANING

A. Keep valve interior clean as installation progresses.

B. After installation, clean valve interior of soil, grit, loose mortar, and other debris.

END OF SECTION 400565.23

SECTION 400565.29 - DOUBLE-DISK CHECK VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Double-disk swing check valves, 2 through 52 inches in size.

B. Related Requirements:

1. Division 09 for coating and touchup of shop-primed surfaces with primer.
2. Section 400551 “Common Requirements for Process Valves” for basic materials and methods related to valves commonly used for process systems.

1.3 COORDINATION

A. Coordinate Work of this Section with piping and equipment connections as specified in other Sections.

1.4 SUBMITTALS

A. Section 400551 “Common Requirements for Process Valves”.

B. Product Data: Submit catalog information, indicating materials of construction and compliance with indicated standards.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Source Quality-Control Submittals: Indicate results of factory tests and provide required certifications.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping, valves and other appurtenances, connections, and centerline elevations.

1.6 QUALITY ASSURANCE

A. Comply with AWWA C518.

B. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

C. Provide Installation Inspection and Operator Training Per Section 400551 “Common Requirements for Process Valves”.

D. Provide testing and inspection certificates.

E. Perform Work according to City of Georgetown standards.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Protect valves and appurtenances by storing off ground.
3. Cover flange faces with 3/4-inch plywood blinds.
4. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.10 WARRANTY

A. Furnish manufacturer's warranty for valve and associated components for 2-years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DOUBLE-DISK CHECK VALVES – Tag Type DDCV

A. Manufacturers:

1. Henry Pratt Company, Series 740.
2. DeZurik/APCO, 9000 Series.
3. Crispin.
4. US Valve, Technocheck.
5. Or approved equal.

B. Description:

1. Blower Discharge Service– Tag Type DDCV1

a. Type: Double-disk, spring-loaded, swing check valves.
b. Size: 2 through 52 inches.
c. Style: Wafer.
d. Body: CF8M Type 316 stainless steel.
e. Disk: Type 316 Stainless steel.
f. Seats: Resilient.
g. Seal: Viton B – blower service.
h. Hinge Pin: Type 316 stainless steel.
i. Spring Material: X-750.

2. Working Pressure: As indicated in valve schedule or be of the same working pressure as the pipe they connect to, whichever is higher. The working pressure of the pipe is noted on the Pipe Schedule on Drawings.
3. Maximum Process Fluid Temperature: same fluid temperature as the pipe they connect to.

C. Finishes: As specified in Section 400551 “Common Requirements for Process Valves.”

2.2 SOURCE QUALITY CONTROL

A. Testing:

1. Hydrostatically test check valves at twice rated pressure according to AWWA C518.
2. Permitted Leakage at Indicated Working Pressure: None.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field dimensions are as indicated on Shop Drawings.

B. Inspect existing flanges for nonstandard bolt-hole configurations or design and verify that new valve and flange mate properly.

3.2 PREPARATION

A. Thoroughly clean valves before installation.

B. Surface Preparation:

1. Touch up shop-primed surfaces with primer as specified in Division 09.
2. Solvent-clean surfaces that are not shop primed.
3. Clean surfaces to remove loose rust, mill scale, and other foreign substances by power wire brushing.
4. Prime surfaces as specified in Division 09.

3.3 INSTALLATION

A. According to AWWA C518 and manufacturer instructions.

B. Dielectric Fittings: Provide between dissimilar metals.

3.4 FIELD QUALITY CONTROL

A. Inspection:

1. Inspect for damage to valve lining or coating and for other defects that may be detrimental as determined by Engineer/Engineer.
2. Repair damaged valve or provide new, undamaged valve.
3. After installation, inspect for proper supports and interferences.

B. Pressure test valves with piping.

3.5 CLEANING

A. Keep valve interior clean as installation progresses.

B. After installation, clean valve interior of soil, grit, loose mortar, and other debris.

END OF SECTION 400565.29

SECTION 400578.23 - AIR/VACUUM VALVES FOR WASTEWATER SERVICE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Air release/vacuum breaker valves for wastewater treatment facilities.

B. Related Requirements:

1. Division 09: Preparing, priming, and painting surfaces, including field-applied and equipment finishing.
2. Section 400507 - Hangers and Supports for Process Piping: Anchors and supports.
3. Section 400551 - Common Requirements for Process Valves: Typical product and installation requirements for valves specified in this Section.
4. Section 404213 - Process Piping Insulation: Insulation applied to process piping systems.

1.3 COORDINATION

A. Section 013300 – Submittal Procedures: Requirements for submittals.

B. Coordinate Work of this Section with installation of process piping.

1.4 SUBMITTALS

A. Section 013300 – Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer catalog information.

C. Shop Drawings: Indicate materials, dimensions, weights, and end connections on assembly drawings.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Source Quality-Control Submittals: Indicate results of factory tests and inspections and provide required certifications.

F. Qualifications Statements:

1. Submit qualifications for manufacturer and installer.

1.5 CLOSEOUT SUBMITTALS

A. Section 017700 “Closeout Procedures”: Requirements for submittals.

B. Project Record Documents: Record actual locations of air release/vacuum breaker valves.

1.6 QUALITY ASSURANCE

A. Manufacturer Quality Management System: Certified to ISO 9001.

B. Perform Work according to AWWA C-512 standards.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 “Product Requirements” for requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Furnish temporary end caps and closures on piping and fittings and maintain in place until installation.
3. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.10 WARRANTY

A. Furnish manufacturer's warranty for valve and associated components for 2-years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 AIR/VACUUM VALVES FOR WASTEWATER SERVICE – Tag Type AVRV

A. Manufacturers:

1. Val-Matic Valve & Manufacturing Corp.
2. DeZURIK.
3. Vent-O-Mat
4. Or engineer-approved equal.

B. Description:

1. Type: Fully automatic, float operated.
2. Comply with AWWA C512.
3. Valves shall be designed to release large amounts of air during pipeline filling, release small amounts of air accumulated during pipeline operation, and allow large volume of air during pipeline drainage or pipe break. Valves shall have an intake orifice area equal to nominal size of valve.
4. Suitable for sewage service.
5. Size: As indicated on Valve Schedule and Drawings.
6. Valve Body Connections: Furnish 2-inch NPT cleanout and 1-inch NPT drain.
7. Pressure Rating: 250 psig.

C. Materials:

1. Body and Cover: Cast iron, ASTM A16/ Ductile iron, ASTM A536/ Type 316 stainless steel, ASTM A351/A351M.
2. Float: Type 316 stainless steel.
3. Seats: Buna-N/EPDM.
4. Seals: Acrylonitrile-butadiene / EPDM.
5. Trim: Type 316stainless steel
6. Hardware: Type 316 stainless steel

D. End Connections:

1. Size 3 Inches and Smaller:

    a. Threaded, NPT.

E. Valve Body Connections:

1. Threaded, NPT.
2. Cleanout: 2 inches.
3. Drain: 1 inch.

F. Accessories:

1. Backwash accessories, including inlet shutoff valve, blowoff valve, rubber supply hose, and quick-disconnect couplings.

2.2 INSULATION

A. As specified in Section 404213 - Process Piping Insulation.

2.3 FINISHES

A. Prepare piping appurtenances for field finishes as specified in Division 09.

2.4 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field dimensions are as indicated on Drawings.

3.2 PREPARATION

A. Thoroughly clean end connections before installation.

B. Close pipe and equipment openings with caps or plugs during installation.

C. Cleaning: Clean surfaces to remove foreign substances.

3.3 INSTALLATION

A. According to manufacturer instructions.

B. Provide access for operation, removal, and maintenance, and to avoid discharge to occupied areas or other equipment.

C. Vent the valve properly and pipe outlet to nearest drain or as directed by the Engineer.

3.4 FIELD QUALITY CONTROL

A. Inspect for interferences and proper supports.

B. Testing:

1. As specified in Section 400551 - Common Requirements for Process Valves.
2. Demonstrate operation without undue noise or vibration.

C. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than 1 day on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.

D. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.
3. Repair damaged coatings with material equal to original coating.

E. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.5 CLEANING

A. Keep interior of air release valves clean as installation progresses.

3.6 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 400578.23

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SECTION 400578.29 - COMBINATION AIR VALVES FOR WASTEWATER SERVICE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Combination air valves for wastewater treatment facilities.

B. Related Requirements:

1. Division 09 for preparing, priming, and painting surfaces, including field-applied and equipment finishing.
2. Section 400507 “Hangers and Supports for Process Piping” for anchors and supports.
3. Section 400551 “Common Requirements for Process Valves” for typical product and installation requirements for valves specified in this Section.
4. Section 404213 - Process Piping Insulation: Insulation applied to process piping systems.

1.3 COORDINATION

A. Section 013300 – Submittal Procedures: Requirements for submittals.

B. Coordinate Work of this Section with installation of process piping.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Indicate materials, dimensions, weights, and end connections on assembly drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Product Data: Submit manufacturer catalog information.

C. Manufacturer Instructions: Submit special procedures and setting dimensions.

D. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections and provide required certifications.

F. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.

G. Qualifications Statements:

1. Submit qualifications for manufacturer and installer.

1.6 CLOSEOUT SUBMITTALS

A. Section 017700 “Closeout Procedures”: Requirements for submittals.

B. Project Record Documents: Record actual locations of combination air valves.

1.7 QUALITY ASSURANCE

A. Manufacturer Quality Management System: Certified to ISO 9001.

B. Perform Work according to AWWA C-512 standards.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 “Product Requirements” for requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Furnish temporary end caps and closures on piping and fittings and maintain in place until installation.
3. Provide additional protection according to manufacturer instructions.

1.10 FIELD CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.

2. Indicate field measurements on Shop Drawings.

1.11 WARRANTY

A. Furnish manufacturer's warranty for valve and associated components for 2-years from the Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COMBINATION AIR VALVES FOR WASTEWATER SERVICE – Tag Type CAV

A. Manufacturers: Provide products from one of following or Engineer approved equal:

1. RF Valves, Inc. (Vent-O-Mat)
2. ARI Flow Control Accessories
3. GA Industries

B. Description:

1. Type:

a. Fully automatic, float operated.
b. Body: Single.

2. Comply with AWWA C512.
3. Size: As indicated on Valve Schedule and Drawings.
4. Suitable for sewage service.
5. Provide with flushing capabilities.
6. Pressure Rating: 150 psig
7. Combination Air Valves:

a. Perform functions of an air/vacuum valve (exhaust large quantities of air on start-up, admits air on shut-down) and air release valves (release air continuously during operation) to maintain system efficiency and prevent pipeline surges.

C. Materials:

1. Body and Cover: Stainless steel, ASTM A351/ Cast Iron, ASTM A126
2. Float: Stainless Steel/HDPE/Polypropylene
3. Seats: Buna-N/EPDM
4. Seals: Buna-N/EPDM
5. Hardware: Stainless Steel

D. End Connections - Single Body:

1. Size 3 Inches and Smaller:

a. Threaded, NPT.

E. Valve Body Connections:

1. Threaded, NPT.
2. Cleanout: 2 inches.
3. Drain: 1 inch.

F. Accessories:

1. Backwash accessories, including inlet shutoff valve, blowoff valve, rubber supply hose, and quick-disconnect couplings.

2.2 INSULATION

A. As specified on in Section 404213 – Process Piping Insulation.

2.3 FINISHES

A. Prepare piping appurtenances for field finishes as specified in Division 09.

2.4 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Certificate of Compliance:

1. If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field dimensions are as indicated on Shop Drawings.

3.2 PREPARATION

A. Thoroughly clean end connections before installation.

B. Close pipe and equipment openings with caps or plugs during installation.

C. Cleaning: Clean surfaces to remove foreign substances.

3.3 INSTALLATION

A. According to manufacturer instructions.

B. Provide access for operation, removal, and maintenance, and to avoid discharge to occupied areas or other equipment.

C. Vent the valve properly and pipe outlet to nearest drain or as directed by the Engineer.

3.4 FIELD QUALITY CONTROL

A. Inspect for interferences and proper supports.

B. Testing:

1. As specified in Section 400551 “Common Requirements for Process Valves.”
2. Demonstrate operation without undue noise or vibration.

C. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than 1 day on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.

D. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.
3. Repair damaged coatings with material equal to original coating.

E. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.5 CLEANING

A. Keep interior of air release valves clean as installation progresses.

3.6 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 400578.29

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SECTION 400582 - SOLENOID VALVES FOR PROCESS SERVICE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Solenoid valves for process applications.

B. Related Requirements:
   1. Section 400551 “Common Requirements for Process Valves” for basic materials and methods related to valves commonly used for process systems.

1.3 COORDINATION

A. Coordinate Work of this Section with process piping Work as specified in other Sections and as indicated on Drawings. Note that solenoid valves may be shown on Electrical and/or Mechanical Drawings, or may only be specified, but if so specified or shown, shall be provided. Solenoid valves located in hazardous classified areas shall be provided with electrical enclosures which satisfy the electrical classification as specified or shown on the electrical drawings.

1.4 ACTION SUBMITTALS

A. Product Data: Submit manufacturer information, indicating materials of construction, wiring diagrams, and compliance with indicated standards.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 SOLENOID VALVES – Tag Type SV

A. Manufacturers:

3
1. Type L by Magnatrol Valve Corp. Hawthorne, NJ 07507
2. Atkomatic 14500 Series by Circle Valve. Harleysville, PA 19438
3. Or Engineer approved equal as suitable for service required.

B. Description:

1. Working Pressure: 10 psig.
2. Minimum Working Pressure Differential: 0 psig.
3. Maximum Fluid Temperature: 330 degrees F.
4. Coil: Class H.

3
5. Operation: Fail close, energize to open except for water seal lines to pumps where valves will fail open, energize to close.
6. Enclosures: NEMA 4X rated.
7. Electrical Characteristics: 120VAC.
8. End Connections Less than 2-inches: Threaded or as needed for installation.
9. End Connections Greater than 2-inches: Flanged or as needed for installation.
10. Valves 2” in size or larger shall include a manual override actuated by a handle-levered plunger mounted to the bottom of the valve body. These valves must be mounted in a horizontal run of piping, with the solenoid up in the vertical position.

C. Materials:

3
1. Body: Brass.
2. Body: Bronze
3. Trim and Spring: Stainless steel with copper coil Class A encapsulated.
4. Seals: Viton or PTFE or as needed for chemical compatibility.

2.2 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.
3. Submit chemical compatibility tables for diaphragm valve materials and chemical process service. Solenoid valve materials shall exhibit excellent compatibility with respective chemicals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. As specified in Section 400551 “Common Requirements for Process Valves”.

B. Install protective strainers upstream of solenoid valves.

3.2 FIELD QUALITY CONTROL

A. As specified in Section 400551 “Common Requirements for Process Valves”.

END OF SECTION 400582

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SECTION 400593.23 – LOW-VOLTAGE MOTOR REQUIREMENTS FOR PROCESS EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single- and three-phase motors for application on process equipment provided under other Sections.

B. The manufacturer of the driven equipment shall provide the associated motor.

C. Related Requirements:

1. Section 260526 “Grounding and Bonding for Electrical Systems”.
2. Section 260553 “Identification for Electrical Systems”.

1.3 DEFINITIONS

A. NETA ATS: Acceptance Testing Specification.

B. VFC: Variable-frequency motor controller. See VFD.

C. VFD: Variable-frequency drive. Used interchangeably with the term VFC.

1.4 SUBMITTALS

A. Product Data: For each type and rating of motor indicated.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include nameplate data, compliance with specified standards, electrical ratings and characteristics, physical dimensions, frame size, weights, mechanical performance data, support points and the following:

a. Descriptive bulletins, including full description of insulation system.
b. Bearing design data.
c. Efficiency at 1/2, 3/4 and full load.
d. Power factor at 1/2, 3/4 and full load.
e. Conduit entry points and sizes.
f. Special features and accessories (i.e. space heaters, temperature detectors, etc.).

g. Power factor correction capacitor rating and type (when required).

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Qualifications Statements:

1. Submit qualifications for manufacturer and testing agency.

1.5 QUALITY ASSURANCE

A. Electric motors driving identical equipment shall be identical

B. Motors shall be listed under UL recognized component file as applicable.

C. Motor manufacturer to maintain a documented ISO 9001 quality assurance program implementing suitable procedures and controls to monitor all aspects of production and testing.

D. When electrically driven equipment differs from that indicated, adjust the motor size, wiring and conduit systems, disconnect devices, and circuit protection to accommodate the equipment actually installed.

E. Testing Agency Qualifications: Member company of NETA.

1.6 DELIVERY, STORAGE AND HANDLING

A. Ship motor fully assembled, capable of being lifted in one piece.

B. Inspection: Accept materials on site in manufacturer's original packaging and inspect for damage.

C. Storage:

1. Store materials according to manufacturer instructions.
2. Energize motors furnished with space heaters to prevent condensation throughout the storage and construction period. Perform periodic motor insulation resistance tests per manufacturer’s storage recommendations.
3. For extended outdoor storage, remove motors from equipment and store separately.
4. Maintain bearings during storage and construction period, and periodically rotate the motor shaft per manufacturer’s storage recommendations.
5. Lubricate per manufacturer’s recommendations and inspect purged grease for water, rust, or other contaminants.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of motors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three-year(s) from date of Substantial Completion for inverter duty motors.
2. Warranty Period: Five-year(s) from date of Substantial Completion for constant speed severe-duty motors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Nidec (US Motors).
2. ABB (Baldor-Reliance).
3. TECO-Westinghouse.
4. Toshiba.
5. WEG.
6. General Electric.
7. Or equal.

2.2 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.

B. Comply with the latest revision of the following as applicable:

1. NEMA MG 1, “Motors and Generators”.
2. IEEE 841 for TEFC motors where driven equipment specification indicates equipment requires motors to be severe-duty, chemical duty, or mill duty.

C. Unless otherwise noted, all motors 1/2 through 100 horsepower shall be rated 230/460 Volt, three-phase, 60 Hertz A.C.; motors 125 horsepower and above shall be rated 460 Volt, three-phase, 60 Hertz; and motors below 1/2 horsepower shall be rated 115/230 Volt, single phase, 60 Hertz A.C.

D. Duty: Continuous duty at ambient temperature of 40 degrees C and at altitude of 3300 feet above sea level.

E. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

F. Horsepower rating: Size for operation within the full load nameplate rating without applying the service factor, throughout the full range of mechanical or hydraulic operating condition.

G. Specific motor application data such as Hp, rpm, enclosure type, accessories, etc., are specified under the detailed driven mechanical equipment specification.

H. Nameplates: Engrave or emboss on Type 316 stainless steel fastened to the motor frame with stainless steel screws or drive pins with information per NEMA MG 1.

I. Space heater: Include 120-volt space heater for moisture control on all motors rated 50 horsepower and larger.

J. Service Factor: 1.15 service factor on sine wave power and 1.0 service factor on VFD power in a 40 degrees C ambient, unless otherwise noted.

K. Motors and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

L. Enclosures: Conform to one of the NEMA standard enclosure designs as specified under the detailed driven mechanical equipment specification. If no enclosure type is specified, provide TEFC (Totally Enclosed Fan Cooled) enclosures.

M. Motors connected to VFCs: Inverter duty rated and comply with NEMA MG 1, Part 31. First or second torsional critical speed shall be outside the operating speed range for all VFC controlled motors.

N. Three-phase motors:

1. Description: NEMA MG 1, Design B, medium induction motor.
2. Efficiency: Meet or exceed requirements for NEMA MG 1, Part 12 for Premium Efficient motors 1 HP and larger.
3. Service Factor: 1.15.
4. Multispeed Motors: Variable torque.

    a. For motors with 2:1 speed ratio, consequent pole, single winding.
    b. For motors with other than 2:1 speed ratio, separate winding for each speed.

5. Rotor: Random-wound, squirrel cage.
6. Code Letter Designation:

    a. Motors 15 HP and Larger: NEMA starting Code F or Code G.
    b. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

7. Accessories: Where specified herein, or under process mechanical specification.

O. Class 1 Division 2 locations: Motors in Class 1, Division 2 locations shall be marked with a temperature code label suitable for use in the hazardous area classification where installed. Motors shall also comply with IEEE 841 severe duty requirements, with the following additional requirements:

1. The Class, Group and Temperature Code: Provide one of the following:

    a. Class I Group D – T2B (260 degrees C).
    b. Class I Group D, Class II Groups F and G – T3B (165 degrees C).

c. Class I Groups C and D, Class II Groups F and G – T3C (160 degrees C).

2. Thermostats: Where winding thermostats are used to obtain surface temperature limitation, the thermostats shall be connected in series with the starter holding coil (stop button). Winding temperature detectors and switches shall be UL listed for use in Class 1 Division 2 locations.
3. The exposed surface of motor condensation heaters shall not exceed 80 percent of the nameplate temperature code value.
4. Ventilation fan shall be constructed of corrosion-resistant, non-sparking material such as bronze.

2.3 THREE PHASE MOTOR CONSTRUCTION

A. Enclosure and Frame:

1. NEMA enclosure type as specified in the process equipment specification.
2. NEMA frame for the associated horsepower.
3. Motor frames: Cast iron or welded heavy plate steel construction, stiff enough to withstand the rotating forces and torques generated and designed to limit or avoid any undesirable harmonic resonances.
4. Provide a threaded, forged steel, shouldered eyebolt blind tapped into the motor frame for lifting on all frames 254T and larger.
5. Condensate drain openings: Locate drain holes at the low points in the end brackets to allow removal of accumulated moisture from enclosures. Provide corrosion resistant, breather drain plugs for severe-duty motors.
6. Hardware: Hex head, SAE Grade 5 or better, plated for corrosion protection.
7. Nameplates: Engraved or embossed stainless steel plates fastened to the motor frame with stainless steel screws or drive pins. Clearly indicate all items of information listed in the applicable part of NEMA MG 1.
8. Main terminal box: Fabricated steel or cast iron, sized per the NEC for number and size of conduit connections and conductor bending and terminations as indicated on the Drawings. Split box top to bottom with capability to rotate entry point to any quadrant. Provide gaskets between the box and motor frame and between box and its cover. Include ground lug for equipment grounding conductor termination.
9. Bearing housings: Provide machined surfaces for attaching a magnet mounted accelerometer to monitor the motor vibration in the vertical, horizontal, and axial directions at each bearing housing.
10. Frame grounding: provide motor frame grounding pad or threaded stud where supplemental grounding to frame is indicated on the drawings.
11. Corrosion resistant mill and chemical duty paint.

B. Windings:

1. Copper.
2. Insulation rating: Class F.
3. Temperature rise: Class B at 1.0 SF, Class F at 1.15 SF.
4. Insulation: Non-hygroscopic, epoxy encapsulated windings for enclosure types WP I and WP II. Provide upgraded insulation by additional dips and bakes to increase moisture resistance for totally enclosed designs. Provide vacuum pressure impregnated (VPI) epoxy insulation for moisture resistance for outdoor motors.

5. Provide chemical and humidity resistance insulation system when IEEE 841 motors are specified.
6. Provide winding surge withstand capability per NEMA 1, Part 31 for VFC driven motors.
7. Provide specified temperature sensing devices for VFC driven equipment. If not specified, provide a winding temperature detector per the accessories paragraph.

C. Motor leads: Non-wicking type, minimum Class F temperature rating and permanently numbered for identification.

D. Stator: Built up core using high grade, low loss silicon steel laminations keyed or dovetailed to the stator frame and securely held in place at each end.

E. Rotor:

1. Forged or rolled steel shaft, machined, smooth finished, with sufficient strength for operation including 25 percent overspeed condition.
2. Shaft end coordinated with driven equipment coupling.
3. Entire assembly coated with protective coating.
4. Inpro seals on both ends of the shaft to prevent grease leakage and entrance of foreign materials, such as water and dirt, into the bearing area while running, coasting, or at rest. Severe duty motors to have improved sealing per IEEE 841.
5. Vertical Motor Shafts:

    a. Provide hollow shaft and P flange mounting to allow driven shaft to extend through provide for vertical pump applications.
    b. Coupling for connecting the motor shaft to the driven shaft is located in the top of the motor.
    c. Where solid shaft is provided couple the driven shaft below the P flange face.

6. Rotor Core:

    a. Solid, built-up stack of fully processed and coated, high-grade, low-loss silicon steel laminations.
    b. Die cast aluminum or fabricated copper bars or their respective alloys.
    c. Rotors on frames 213T and above to be keyed to shaft and rotating assembly dynamically balanced.

7. Rotor Assembly:

    a. Coated with corrosion resistant epoxy insulating varnish or other protective coating, thermally stable, statically and dynamically balanced.
    b. Balance weights securely attached to the rotor resistance ring by welding or similar permanent method.

F. Horizontal Bearings: roller type, grease lubricated.

1. Bearings: Anti-friction open or single-shield, vacuum-degassed steel ball or roller bearings, electric motor quality, designed for 45 degrees C maximum temperature rise. Metric size bearings are not acceptable.

2. Life: L 10 life of 100,000 hours for direct coupled applications and 26,000 hours for belted applications based. IEEE 841 motors, L 10 life increased to 150,000 and 50,000 hours respectively.
3. Shaft seals: Provide to prevent grease leakage and the entrance of foreign materials, such as water and dirt, into the bearing area while running, coasting, or at rest.
4. Shaft currents: Provide mitigation per process equipment specification.
5. Comply with ABMA and refer to process equipment specification for stricter or additional requirements.

G. Vertical Bearings: per manufacturer, thrust type.

1. Bearings: Manufacturer's standard design, constructed with thrust bearings on top to allow inspection and/or replacement without requiring complete disassembly of motor, of type and size to satisfy thrust loading requirements.
2. Life: Rated for an in-service L 10 life of 100,000 hours, designed to support the weight of the rotor plus, if required, the weight of the rotating driven equipment parts and the hydraulic thrust created by the driven equipment, with a 40 degrees C maximum temperature rise. Metric bearings are not acceptable.
3. Shaft seals: Provide to prevent grease leakage and the entrance of foreign materials, such as water and dirt, into the bearing area while running, coasting, or at rest.
4. Shaft currents: Provide mitigation per process equipment specification.
5. Comply with ABMA and refer to process equipment specification for stricter or additional requirements.

2.4 THREE PHASE MOTOR ACCESSORIES

A. Space heaters: Silicone rubber strip type, accessible for inspection, rated 120 Volt, single phase, designed to prevent condensation inside the enclosure when the motor is idle, with leads brought out to a separate terminal box. Emboss the heater wattage and voltage on the motor nameplate.

B. Winding temperature switch: Three embedded bi-metallic temperature thermostat switches with normally closed contacts and leads terminating in the main conduit box.

C. Winding temperature RTDs: Six 100 Ohm platinum (PT 100), three-wire resistance-type temperature detectors (RTDs) embedded in the stator windings, two per phase, symmetrically installed between stator coils where highest temperature will occur. RTD leads brought out to separate terminal box on the motor frame. One RTD set in each phase to be operational and one RTD set to be spare.

D. Bearing temperature sensing: Number, type, and location for motor and driven equipment per process equipment specification.

1. RTD: Replaceable 100 Ohm platinum (PT 100) three-wire RTD's, with spring loaded tip. Mount RTD as close as possible to outer surface of each bearing. RTD includes conduit connection head, terminal block, and cabling brought out to a common terminal box.
2. Dial type thermometer.
3. Temperature relay, furnished with indicating scale.
4. Iron or copper constantan thermocouple.

E. Motor shaft currents: insulate the ODE bearing and provide a shaft grounding strap. Insulate bearing probes to prevent shorting out bearing insulation.

F. Vibration Sensors: Number, type, and location for motor and driven equipment per process equipment specification. Provide machined surfaces at each bearing housing for attaching a magnetic mounted accelerometer in order to monitor motor vibration in vertical, horizontal and axial directions. Coordinate with the supplier of the machine monitoring equipment.

G. Anti-Backspin Device: Provide shaft mounted, mechanical non-reverse ratchet rated at 100 percent of motor full load torque for immediate protection against reversing due to phase reversals or from backspin at shutdown.

H. Encoder for vector drive motors: Provide encoder on opposite drive end to sense rotor speed and provide closed loop feedback (quadrature signal with line driver output) to a control device. Provide sufficient length of encoder cable to connect encoder to variable frequency controller.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Motors 1/20 HP and Smaller: Shaded-pole type.

D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

E. Insulation: Class F or better, with Class B temperature rise of 80 degrees C above ambient, 1.15 service factor. Locked rotor current to be no greater than specified in NEMA MG 1, Design "N".

F. Standard enclosure: Fully gasketed, totally-enclosed air over or fan cooled in conformance with NEMA MG 1.

G. Washdown duty enclosure: Where motor is installed in wet or corrosive areas routinely exposed to washdowns, high humidity or caustic chemicals, provide stainless steel, paint free washdown motors with Inpro bearing isolators, stainless steel T-type condensation drains, nitrile conduit box gasket, and corrosion resistant fans.

H. Bearings: Sealed ball bearings permanently lubricated for 10 years normal use, furnished with shaft slinger.

I. Class 1, Division 1 and 2 locations: Explosion proof, marked with a T3B temperature code label, and UL listed for use in Class 1, Division 1, Groups C & D, and Class II, Groups E, F, & G hazardous location. The temperature code marking to appear on the nameplate.

2.6 SOURCE QUALITY CONTROL

A. Factory Testing: Prior to shipment perform manufacturer's standard tests in accordance with NEMA MG 1 and IEEE 112.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Upon delivery of motor and prior to unloading, inspect equipment for damage.

B. Comply with DELIVERY, STORAGE, AND HANDLING article within this specification.

3.2 INSTALLATION

A. Prepare rigid foundation or mounting surface to minimize vibration and maintain alignment between motor and load shaft.

B. Install the motors per manufacturer's installation instructions.

C. Anchor motor base to load bearing surface with grade 5 steel bolts or better.

D. Align the motor shaft with driven equipment according to manufacturer's written instructions. Adjust axial position of motor frame with respect to load shaft.

E. Accurately adjust flexible couplings for direct drive according to machine manufacturer's guidelines. Check alignment to minimize vibrations. Coupling spacing shall be according to coupling manufacturer guidelines.

F. Install motor branch circuit conduits and conductors in accordance with NEC and local code requirements. Connect motors to rigid conduit system by a short section of liquid-tight flexible conduit to isolate the conduit system from motor vibration. Where motors are installed outdoors, bring conduit into bottom of motor terminal box to avoid standing water at connection point.

G. Terminate the motor leads as shown on the connection diagrams using products intended for vibration applications.

H. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

I. Tighten electrical connections and terminals according to manufacturers' published torque values.

J. Install conduit and wiring between motor auxiliary devices and associated indicators, controllers and protective devices in accordance to installation drawings.

K. Connect devices sensitive to electromagnetic interferes such as RTD's, thermistors, thermal protector switches, vibration sensors with shielded instrumentation wiring per installation drawings.

L. Comply with NECA 1.

M. Seismic Bracing: Comply with requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

3.3 IDENTIFICATION

A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems." Identify field-installed conductors, interconnecting wiring, and components.

3.4 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until motors are ready to be energized and placed into service.

B. Lubrication and Shaft Rotation: Lubricate parts and rotate shaft periodically according to manufacturer’s written instructions until motors are ready to be energized and placed into service.

3.5 FIELD QUALITY CONTROL

A. Perform inspections and tests Inspect and test according to the Inspection and Test Procedures for Rotating Machinery state in NETA Acceptance Testing Specification paragraph 7.15.1. Options tests are not required unless called for within the process equipment specification.

B. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Motors will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies the motor and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP AND ADJUSTMENT

A. Complete installation and startup checks according to manufacturer's written instructions. Confirm motor is structurally, mechanically, and electrically ready for start-up. Checks include support system, vibration isolation, alignment, lubrication system, and cleanliness.

B. Start-up motor in accordance with process equipment specification.

C. Verify correct phase rotation at motor with driven equipment uncoupled. Correction for phase rotation to be made in the motor terminal box.

D. Prepare inspection and test reports.

3.7 DEMONSTRATION / SYSTEM FUNCTION TESTS

A. Run motor for system testing as required in motor controller and driven equipment specifications.

B. Confirm correct operation of all protective and metering devices.

C. Measure voltage and motor running current and evaluate relative to load conditions and nameplate full load amperes. Corrective action is required for any current imbalance 10 percent or greater.

D. Prepare driven equipment system testing report. Include results of all tests and check made, meter readings and recordings, and summary adjustments made. Clearly identify any discrepancies and concerns.

END OF SECTION 400593.23

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SECTION 404113.13 - PROCESS PIPING ELECTRICAL RESISTANCE HEAT TRACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Self-regulating cables.
2. Heat-tracing controls.

B. Related Requirements:

1. Section 404213 “Process Piping Insulation” for insulation and jacketing of process piping.

1.3 DEFINITIONS

A. Self-Regulating Index (SRI): The rate of change of power output in Watts per degree F, as measured between the temperatures of 50 and 100 degrees F.

1.4 COORDINATION

A. Coordinate Work of this Section with installation of process piping and, installation of piping insulation.

1.5 ACTION SUBMITTALS

A. Product Data: Submit manufacturer information for system materials and component equipment, including thermal properties, electrical characteristics, and connection requirements.

B. Shop Drawings:

1. Indicate system materials and component equipment.
2. Submit wiring and control diagrams, installation and anchoring requirements, fasteners, and other details.

1.6 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

C. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

D. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping and appurtenances receiving heat tracing, and locations of source power and controls.

1.8 QUALITY ASSURANCE

A. Perform Work according to industry standards.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.11 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SELF-REGULATING CABLE

A. Manufacturers:

1. Raychem/Pentair Thermal/Chemelex.
2. Chromolox.
3. Thermon.

B. Description:

1. Bus Wires:

a. Quantity: Two.
b. Orientation: Parallel.
c. Material: Nickel-coated copper.
d. Minimum Size: 16 gage.

2. Heating Element: Self-regulating polymeric core.
3. Jacketing:

a. Description: Tinned copper braid with resistance less than cable bus wire resistance.
b. Comply with ASTM B193.
c. Insulating Jacket: Fluoropolymer.

4. Cable Temperature Identification Number (T-Rating):

a. T6, without use of thermostats.
b. Comply with NEC.

5. Output:

a. As indicated on Drawings.
b. Minimum 3 W/ft.

C. Performance and Design Criteria:

1. Power Output: Vary relative to temperature of surface of pipe or appurtenance.
2. Cable can be cut to length on Site.
3. Minimum SRI:

a. Cable Rating 3 W/ft.:0.038 W/degrees F.
b. Cable Rating 5 W/ft.: 0.060 W/degrees F.
c. Cable Rating 8 W/ft.: 0.074 W/degrees F.
d. Cable Rating 10 W/ft.:0.100 W/degrees F.

4. Heat losses shall be calculated using the manufacturer’s standard procedure in conjunction with the insulation requirements indicated on the drawings and

specifications. The design heat output of the electrical heat trace system shall include a 10 percent factor of safety.

D. Operation:

1. Electrical Characteristics:
   a. Voltage: 120 V, single phase, 60 Hz.

E. Accessories:

1. Splicing connectors.
2. End terminations.
3. T-connectors.
4. Power termination kits.
5. Aluminum heat transfer tape: 2 mil thickness, 2-1/2-in wide.

2.2 HEAT-TRACING CONTROLS

A. Single Thermostat:

1. Description: Stainless-steel remote bulb with 6-foot capillary encased in flexible stainless-steel armor.
2. Housing:
   a. FM approved.
   b. Rating: NEMA 250 Type 4X.
3. Set-Point Range: 35 to 235 degrees F.

B. Explosion-Proof Thermostat:

1. Description: 6-foot capillary bulb encased in armored sheathing.
2. Housing:
   a. Material: Cast aluminum.
   b. Comply with NEC hazardous location requirements based on Site conditions.
3. Set-Point Range: 35 to 235 degrees F.

2.3 SOURCE QUALITY CONTROL

A. Testing:

1. Retain at least 75 percent of rated power after 20 years of operation at maximum published continuous exposure temperature.
2. Retain at least 90 percent of rated power after 1,000 hours of operation at maximum published intermittent exposure temperature.
3. Cable Dielectric Test: Passing 2.5 kV dielectric test for one minute according to ASTM D2633 after undergoing a 0.5 kg-m impact.

4. Before shipment, demonstrate cable insulation resistance of 20 megohms minimum bus to braid using a 2,500-V dc megger, and demonstrate tolerance for one minute at voltage equal to twice rated plus 1,000 V applied bus to braid.
5. Thermal Runaway:

    a. Ensure that cable produces less than 0.5 W/ft. when energized and heated to 350 degrees F for 30 minutes.
    b. After testing and reenergizing, demonstrate that cable does not have an increasing power output leading to thermal runaway.

B. Owner Inspection:

1. Make completed heat-tracing assembly available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven days before inspection is allowed.

C. Owner Witnessing:

1. Allow witnessing of factory inspections and tests at manufacturer's test facility.
2. Notify Owner at least seven days before inspections and tests are scheduled.

D. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces of pipes, valves, and fittings are clean and dry.

B. Verify that piping has been inspected and is ready for insulation.

3.2 INSTALLATION

A. Install heat tracing before insulation is installed.

B. Install equipment according to manufacturer instructions.

C. If required, spiral heat-trace cable around piping to obtain proper heating per length of piping.

D. Do not overlay cable over cable.

E. Cover installed heating cable with thermal insulation and waterproof jacketing as soon as possible.

F. Affix following label to exterior of thermal insulation every 15 feet and readily visible from ground level: CAUTION: ELECTRIC HEAT TRACING.

3.3 FIELD QUALITY CONTROL

A. After installation, inspect for proper operation.

B. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than one days on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.

C. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

D. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.4 ADJUSTING

A. Check control functions and adjust as required.

3.5 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 404113.13

SECTION 404213 - PROCESS PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Process piping insulation.
2. Jacketing.
3. Accessories.

B. Related Requirements:
1. Section 404113.13 “Process Piping Electrical Resistance Heat Tracing”

1.3 ACTION SUBMITTALS

A. Product Data: Product description, thermal characteristics, list of materials, and thickness for each service and location.

B. Samples: Submit two samples of representative size, illustrating each insulation type.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Products meet or exceed specified requirements.

B. Manufacturer's Instructions: Manufacturer's published literature indicating recommended installation procedures.

C. Qualifications Statements:

1. Qualifications for manufacturer and applicator.
2. Manufacturer's approval of applicator.

1.5 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame-spread index of 25 and maximum smoke-developed index not exceeding 50, according to ASTM E84.

B. Comply with ASTM C585 for inner and outer diameters of pipe insulation.

C. Factory-fabricated fitting covers according to ASTM C450.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Applicator: Company specializing in performing Work of this Section with minimum three years' experience and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on-Site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Inspection: Accept insulation on-Site in manufacturer's packaging. Inspect for damage.

C. Store insulation according to manufacturer's instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.8 AMBIENT CONDITIONS

A. Install insulation only when ambient temperature and humidity conditions are within ranges as recommended by manufacturer.

B. Maintain recommended temperature and humidity before, during, and after installation for minimum of 24 hours.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.10 WARRANTY

A. Provide Manufacturer/Supplier warranty in accordance with CIP 16 “Warranty”.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Closed-Cell Elastomeric Insulation:

1. Manufacturers: Armacell LLC or Equal.
2. Furnish materials according to standards set by authorities having jurisdiction.

2.2 PIPE INSULATION

A. Type P-5: Flexible, closed-cell elastomeric and tubular.

1. Comply with ASTM C534, Type I.
2. Thermal Conductivity: 0.27 Btu-in./h.-ft.-deg. F at 75 degrees F.
3. Operating Temperature Range: Minus 70 to 180 degrees F.

2.3 PIPE INSULATION JACKETS

A. Aluminum Pipe Jacket:

1. Comply with ASTM B209.
2. Sheet Thickness: 0.020 inches
3. Finish: Smooth.
4. Joining: Longitudinal slip joints with 2-inch laps.
5. Fitting Covers: Description: Die-shaped, with factory-attached protective liner.
6. Metal Jacket Bands:

    a. Width: 1/2 inches.
    b. Thickness and Material: 0.016 inches aluminum.

2.4 PIPE INSULATION ACCESSORIES

A. Vapor-Retarder Lap Adhesive: Compatible with insulation.

B. Closed-Cell Elastomeric Insulation Pipe Hangers:

1. Polyurethane insert with aluminum single-piece construction and self-adhesive closure.
2. Thickness: Match pipe insulation.

C. Insulating Cement:

1. Comply with ASTM C195.
2. Hydraulic setting on mineral wool.

D. Adhesives: Compatible with insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping and equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

B. Fire-Rated Penetrations:

1. Continue insulation through penetrations of building assemblies or portions of assemblies having fire-resistance rating of one hour or less.
2. Provide intumescent firestopping when continuing insulation through assembly.
3. Finish at supports, protrusions, and interruptions.

C. Piping Systems Conveying Fluids Below Ambient Temperature:

1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
2. Jacketing:

a. Furnish factory-applied or field-applied vapor-retarder jackets.
b. Secure factory-applied jackets with pressure-sensitive adhesive with self-sealing longitudinal laps and butt strips.
c. Secure field-applied jackets with outward-clinch expanding staples, and seal stapled penetrations with vapor-retarder mastic.

3. Fittings, Joints, and Valves:

a. Insulate with molded insulation of like material and thickness as adjacent pipe.
b. Finish with glass cloth and vapor-retarder adhesive or PVC fitting covers.

D. Piping Systems Less than 140 degrees F.

1. Factory-applied or field-applied standard jackets, secured with outward-clinch expanding staples or pressure-sensitive adhesive system on standard factory-applied jacket and butt strips, or both.
2. Fittings, Joints, and Valves:

a. Insulate with like material and thickness as adjoining pipe.
b. Finish with glass cloth and adhesive or PVC fitting covers.

3. Do not insulate unions and flanges at equipment; bevel and seal ends of insulation at such locations.

E. Inserts and Shields:

1. Piping 1-1/2 inch Diameter and Smaller: Install shield between pipe hanger and insulation.
2. Piping 2 inch Diameter and Larger:

    a. Install insert between support shield and piping, and under finish jacket.
    b. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
    c. Insert Material: Compression-resistant insulating material suitable for planned temperature range and service.

3. Piping Supported by Roller-Type Pipe Hangers: Install shield between roller and inserts.

F. Closed-Cell Elastomeric Insulation:

1. Push insulation onto piping.
2. Miter joints at elbows.
3. Seal seams and butt joints with manufacturer's recommended adhesive.
4. If application requires multiple layers, apply with staggered joints.
5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

G. Piping Exposed in Equipment Rooms or Finished Spaces (Less than 10 feet above Finished Floor): Finish with aluminum jacket.

H. Piping Exterior to Building or not in a climate-controlled space:

1. Provide vapor-retarder jacket.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass-mesh-reinforced, vapor-retarder cement.
3. Cover with aluminum jacket with seams located at 3- or 9-o'clock position on side of horizontal piping, with overlap facing down to shed water, or on bottom side of horizontal piping.

I. Heat-Traced Piping Interior to Building:

1. Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe.
2. Size large enough to enclose pipe and heat tracing.

J. Heat-Traced Piping Exterior to Building:

1. Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe.
2. Size insulation large enough to enclose pipe and heat tracing.
3. Cover with aluminum jacket with seams located at 3- or 9-o'clock position on side of horizontal piping, with overlap facing down to shed water.

3.3 ATTACHMENTS

A. Process Piping Insulation Schedule: Insulate piping 4” and Smaller.

1. Chemical Piping:

a. Type: P-5.
b. Thickness:

1) Pipe Sizes 1-1/4 Inches and Smaller: 1/2 inch.
2) Pipe Sizes 1-1/2 Inches and Larger: 1 inch.

c. Pipes: All sodium bisulfite carrier lines including:

1) 2-inch fill piping
2) 2-inch discharge piping
3) 1/2-inch suction piping
4) Above grade 1/2-inch discharge piping

2. Non-Potable Water:

a. Type P-5.
b. Thickness:

1) Pipe Sizes 1-1/4 Inches and Smaller: 1/2 inch.
2) Pipe Sizes 1-1/2 Inches and Larger: 1 inch.

c. Pipe Sizes 4 Inches and smaller, included the following:

1) Exposed grit washer service water piping.
2) Exposed service water piping serving outdoor hose station / yard hydrants.

END OF SECTION 404213

SECTION 406100 - PROCESS CONTROL AND ENTERPRISE MANAGEMENT SYSTEMS GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes procurement of the services of a Process Control System Supplier (PCSS) to provide all materials, equipment, labor, and services required to achieve a fully integrated and operational system as specified herein, in "Related Requirements" under this Article, and in related drawings, except for those services and materials specifically noted.

B. Under this contract, the PCSS will also serve as the Applications Engineer System Supplier (AESS).

C. Work includes but is not limited to the following:

1. The PCSS shall perform all Applications Engineering System Supplier (AESS) related work as indicated in Sections 406863 "Configuration of HMI Software" and 406866 "Configuration of Controller Software", unless otherwise indicated in the scope of work section herein including but not limited to all SCADA HMI configuration and PLC programming required for a complete and functional information and control system.

    a. Application Engineering – SCADA HMI configuration, database, and screen additions and modification of the existing SCADA system.
    b. PLC programming shall be provided by the PCSS except for vendor-furnished package systems, which will be provided by the respective vendor.

2. Refer to other Division 40 specifications and the drawings for additional scope of work for the PCSS.
3. The following process equipment vendors are responsible for the controls and programming associated with their respective process equipment. These process equipment vendors shall supply as-built software documentation to the Owner as specified herein.

    a. Bar Screen.
    b. Grit Separator and Washer Classifier.
    c. Aeration Blowers

4. Each process equipment vendor shall coordinate with the Process Control Systems Supplier (PCSS) to provide a "memory map" of data registers that are to be exchanged between their respective PLC controller and the SCADA System.

5. Modifications to existing plant Human Machine Interface (HMI) graphics, creating of new HMI graphics using the Contract Documents, and programming of the new and existing PLCs are also part of the contract.
6. Modifications of existing PLC-IHSPS to run irrigation transfer pumps automatically based on the Clearwell level.

D. Include auxiliary and accessory devices necessary for system operation or performance, such as transducers, relays, signal amplifiers, intrinsic safety barriers, signal isolators, software, and drivers to interface with existing equipment or equipment provided by others under other Sections of these specifications, whether indicated on the Drawings or not.

E. All equipment and installations to satisfy applicable Federal, State and local codes. Refer to Electrical drawings for area classifications for Class and /Division ratings.

F. Use the equipment, instrument, and loop numbering scheme indicated on the Drawings and in the specifications in the development of the submittals. Do not deviate from or modify the numbering scheme.

G. Related Requirements:

1. Section 406121.20 “Process Control System Testing.”
2. Section 406126 “Process Control System Training.”
3. Section 406196 “Process Control Descriptions.”
4. Section 406263 “Operator Interface Terminals.”
5. Section 406343 “Programmable Logic Controllers.”
6. Section 406613 “Switches and Routers.”
7. Section 406717 “Industrial Enclosures.”
8. Section 406733 “Panel Wiring.”
9. Section 406866 “Configuration of Controller Software.”
10. Section 407000 “Instrumentation for Process Systems.”

1.3 DEFINITIONS

A. Process Control System Supplier (PCSS): Entity responsible for providing all materials, equipment, labor, and services required to achieve a fully integrated and operational control system.

B. Applications Engineering System Supplier (AESS): Entity who provides all programming, configuration, and related services for the control system equipment provided by the PCSS.

C. Maintenance of Plant Operations (MOPO): A construction plan which prevents or limits process disruptions during construction.

1.4 PREINSTALLATION MEETINGS

A. Conduct a project kickoff coordination meeting within two weeks after submitting the Project Plan. The purpose of the meeting is to discuss the PCSS's Project Plan, to summarize the PCSS's understanding of the project; discuss any proposed substitutions or alternatives; schedule testing and delivery deadline dates; provide a forum to coordinate hardware and

software related issues; and request any additional information required from the Owner. The meeting will last up to one business day.

B. Conduct 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. The meeting will last up to one business day.

C. Attendance at MOPO workshop.

D. Other on-site or conference call coordination meetings with Engineer, Contractor, Vendors, as required prior to any field start-up or activity testing begins.

E. Schedule the mandatory coordination meetings as described herein. Hold the meetings at the Owner's designated location and include attendance by the Owner, the Engineer, the Contractor, the PCSS's Project Engineer. Other Division 40 specifications may require additional meetings. Prepare and distribute an agenda for this meeting a minimum of one week before the scheduled meeting date. Schedule the meeting for a minimum of one week before the requested meeting date.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, mountings, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of control equipment, control panels, and instrumentation as specified herein.

4. Include diagrams for power, signal, and control wiring.

C. Qualifications Submittal:

1. For non-listed PCSS’, submit, within 30 calendar days after Notice to Proceed, detailed information on staff and organization to indicate compliance with the Quality Assurance requirements of this Section. Qualification’s submittal is required to be submitted and approved before any further submittals will be accepted. Failure to meet the minimum requirements is grounds for rejection as a PCSS. Qualifications Submittal to contain the following:

a. Copies of ISA CCST Level 1 certificates for all field technicians or resumes demonstrating field experience.
b. Notarized statement from the firm's financial institution demonstrating ability for the firm to meet the obligations necessary for the performance of the work.
c. Copy of UL-508 certificate for panel fabrication facilities.
d. Project references for water or wastewater projects as defined in the "Quality Assurance" paragraphs.
e. Documentation to demonstrate the ability to complete this project including resumes of key staff, financial capacities, details on engineering, design, fabrication, and field service capacity, and location of staff responsible for responding to the site within four hours to resolve startup issues.

D. Project Plan, Deviation List, and Schedule Submittal:

1. Submit, within 45 calendar days after Notice to Proceed, a Project plan. Submit for approval the Project Plan before further submittals are accepted. The Project Plan to contain the following:

a. Overview of the proposed control system describing the understanding of the project work, a preliminary system architecture drawing, interfaces to other systems, schedule, startup, and coordination. Include a general discussion of startup,, approach to testing and training, and other tasks as required by these specifications.
b. Preliminary list of, PLC software, and PLC hardware, including version numbers, solely to determine compliance with the requirements of the Contract Documents prior to beginning development of system programming. The review and approval of software and hardware systems as part of this Project Plan stage does not relieve the PCSS of meeting all the functional and performance requirements of the system as specified herein. Substitution of manufacturer or model of these systems after the submittal is approved is not allowed without Engineer's approval.
c. Project personnel and organization including the PCSS project manager, project engineer, and lead project technicians. Include resumes of each of these individuals and specify in writing their commitment to this project. These do not need to be submitted again if already submitted in the Qualification submittal.
d. Sample formats of the shop drawings to be submitted and in conformance with the requirements of the Specifications. At a minimum include samples of panel fabrication drawings, loop drawings, control system architecture and I/O wiring diagrams
e. Preliminary coordination meeting agendas as specified herein.
f. Preliminary testing plan.
g. Preliminary training plan.

2. Define Exceptions to the Specifications or Drawings in a Deviation List consisting of a paragraph-by-paragraph review of the Specifications indicating acceptance or any proposed deviations, the reason for exception, the exact nature of the exception and the proposed substitution so that an evaluation may be made by Engineer. Specifically state if no exceptions are taken to the specifications or drawings. If there is no statement by the PCSS, then it is acknowledged that no exceptions are taken.

3. PCSS is required to prepare a project schedule in Gantt chart format clearly showing task linkages for all tasks and identifying critical path elements. PCSS schedule is based on

the General Contractor schedule and meets all field installation, testing, and start-up milestones in that schedule. The project schedule illustrates I&C related major project milestones including the following:

4. The PCSS must coordinate their work with the General Contractor's overall schedule. PCSS schedule incorporates all PCSS milestones including but not limited to the following:

    a. Schedule for all subsequent project submittals. Include the time required for Contractor's submittal preparation, Engineer's review time, and a minimum of two complete review cycles.
    b. Proposed dates for all project coordination meetings.
    c. Hardware purchasing, fabrication, and assembly (following approval of related submittals).
    d. Software purchasing and configuration (following approval of related submittals).
    e. Shipment of instrument and control system equipment.
    f. Installation of instrument and control system equipment.
    g. Testing: Schedule for all testing.
    h. Schedule for system cutover, startup, and/or going on-line for each major system. At a minimum include the schedule for each process controller provided under this Contract.
    i. Schedule for all training including submittal and approval of O&M manuals, factory training, and site training.

    j. Listing of all major graphics and PLC programs intended to be created or modified for this project. Indicate if graphic or program is new or existing.

5. Component and Wiring Identification and Tagging Plan:

    a. All components provided by PCSS require a tag, label, or nameplate. Review specifications and provide a drawing indicating the tagging and labeling scheme used by the PCSS:

        1) Instruments.
        2) Network Rack Components.
        3) Panel Hardware.
        4) Standalone hardware or communication equipment.
        5) Wires and communication cables.

    b. Provide detailed information so Engineer can review the following characteristics for each type of tag, label, or nameplate for the different types of components provided above:

        1) Size or range of size of the tag, label or nameplate.
        2) Font style.
        3) Material.
        4) Color(s).

E. Input/Output (I/O) List Submittal:

1. Submit, within 60days after Notice to Proceed, a complete system Input/Output (I/O) address list for equipment connected to the control system under this Contract.
2. Base the I/O list on the P&ID's, the Drawings, the design I/O list (if included), and requirements in the Specifications.

3. Submit the I/O list in both a Microsoft Excel readable electronic file format and an 8-1/2 inch by 11-inch hard copy.
4. Reflect all active and spare I/O points on the I/O list. Add points to accommodate spare I/O's as required in the specifications.
5. Arrange the I/O list so that each control panel has a dedicated worksheet, which includes the following information:

    a. TAG NUMBER(S): As indicated on Drawings, the identifier assigned to a device that performs a function in the control system. As part of this information, break out the tag loop number to allow for sorting by loop.
    b. DESCRIPTION: A description of the function of the device (text that includes signal source, control function, etc.) Include the text "Spare Points" for all I/O module points that are not connected to equipment.
    c. PHYSICAL LOCATION: Control Panel designation of where the I/O point is wired to.
    d. PHYSICAL POINT ADDRESS: Rack, Slot, and Point (or Channel) assignment for each I/O point.
    e. I/O TYPE: use DO - Discrete Output, DI - Discrete Input, AO - Analog Output, AI - Analog Input, PI - Pulse Input, or PO - Pulse Output.

    f. RANGE/STATE: Range in engineering units corresponding to an analog 4-20 mA signal, or the state at which the value of the discrete points is "1."
    g. ENGINEERING UNITS: Engineering units associated with the Analog I/O.
    h. ALARM LIMITS: Include alarm limits based on the control descriptions and the Drawings.
    i. P&ID: P&ID or drawing where the I/O point appears on. Mark as "NA" (Not Applicable) if the I/O point is derived from a specification requirement and is not on the P&IDs.

    j. LOGICAL POINT ADDRESS: I/O address of each point.
6. Sort the I/O list in order by:

    a. Physical location.
    b. I/O Type.
    c. Loop Number.
    d. Device Tag.

7. Once I/O list is approved, PLC I/O addresses are not be modified without approval by Engineer.
8. For I/O layout requirements, refer to Section 406343 "Programmable Logic Controllers."

F. Field Instruments Submittal:

1. Refer to the Instruments section for submittal requirements.

G. Control System Architecture Hardware and Software Packages Submittal:

1. Refer to Sections below for equipment required as part of the Hardware and Software Packages submittal:

    a. Section 406263 "Operator Interface Terminals".

b. Section 406343 “Programmable Logic Controllers”.
c. Section 406613 “Switches and Routers”.
d. Section 406717 “Industrial Enclosures”.
e. Section 406763 “Control Panel Mounted UPS”.
f. Section 406863 “Configuration of HMI Software”.
g. Section 406866 “Configuration of Controller Software”.

2. For each hardware and software packages component specified in the sections above, submit a cover page that lists date, specification number, product name, manufacturer, model number, locations, and power required. Preferred format for the cover page is ISA-TR20.00.01-2001 (updated in 2004-2006), general data sheet; however, other formats will be acceptable provided they contain all required information.
3. Complete system architecture drawings showing in schematic form the interconnections between major hardware components including, control panels, computers, networking equipment, control panels with PLC systems and I/O modules, local operator interfaces, process equipment vendor panels with PLCs, and networked peripherals such as power monitors, security cameras, etc. The PCSS is required to provide unique network architecture drawings for each facility to the following networks:

    a. SCADA.

4. Develop the system architecture drawings in accordance with the following information and guidelines:

    a. Show power connections to each piece of equipment or grouping of equipment with voltage and power sources noted such as 120VAC UPS battery, 24VDC battery, or 120VAC from LP (lighting panel). Indicate specific UPS number or circuit number whenever possible.
    b. All communication cable types should be uniquely identified with a specific line type and cable characteristics clearly indicated in a key or legend located on drawings. For example, 50/125-micron multimode mode fiber, or CAT6 Ethernet copper cabling. Any multiconductor communication cables will be clearly labeled above each individual communication with a note added to drawing that states if no quantity exists above a linetype, there is only one communication cable between devices. If a multi-conductor cable has multiple colors, legend to clearly indicate which colors are used for which networks (i.e., a multi-pair fiber optic cable used for dedicated networks such as SCADA, Electrical, Security, HVAC, etc.)
    c. All communication cables need to be assigned a unique cable identification label and shown in either a table or above the communication line.
    d. Identify network protocols for each communication path or for system indicated in a key or legend as appropriate. Examples are Allen-Bradley EtherNet/IP, Modbus TCP/IP, or DNP3.
    e. Indicate which port or connection number the communication cable is terminating at any device that has multiple ports or connection points. For multiple devices, this could be shown once in a key or legend and noted on architecture as appropriate.
    f. For each PLC control panel or network communication enclosure provided by PCSS, the architecture drawing clearly references other drawings provided by the PCSS for detailed panel wiring diagrams with a note near that PLC panel or communication enclosure indicating referenced drawing numbers. A placeholder is acceptable at the time of submission if these drawings are to be submitted at a later date.

g. Use symbology and/or icons whenever possible to represent a device and differentiate between devices that are different form factors, i.e., tower computer vs. desktop computer vs. rack mounted. Vendor CAD libraries are preferred for symbols.
h. Develop a diagram that will allow a qualified technician to interconnect all equipment without having to refer to additional manuals or literature.
i. Use a minimum sheet size of 11-inch x 17-inch and use of more than one sheet is acceptable with a logical breakout between sheets (i.e., head end on one sheet and plant control system on another). Clearly identify line continuations between drawings.

5. Provide a cybersecurity plan discussing configuration protocols and settings for all computers, switches, firewalls, routers, etc. in accordance with the NIST cybersecurity framework. Provide sufficient information in this plan to ensure the system will follow this NIST cybersecurity framework.
6. Provide a software schedule or spreadsheet for project which clearly indicates which software packages and operating systems are loaded onto which computers and servers.

H. Panel Layout Drawings and Wiring Diagrams Submittal:

1. Panel Layout Drawings: Submit Drawings for all panels specified. Draw to scale panel assembly and elevation drawings and detail all equipment in or on the panel. Use 11 inch x17 inch sheet size for panel drawings and include the following:

a. Clearly indicate a legend sheet with all symbols used on drawings and with voltage, color, and size of each wire and in accordance with requirements of Section 406733 “Panel Wiring.”
b. Interior and exterior panel elevation drawings to scale.
c. Nameplate schedule.
d. Conduit access locations.
e. Panel construction details.
f. Cabinet assembly and layout drawings to scale. Include a bill of material on the assembly drawing with each panel component clearly defined. Cross-reference the bill of material to the assembly drawing so that a non-technical person can readily identify all components of the assembly by manufacturer and model number.
g. Fabrication and painting specifications including color (or color samples).
h. Construction details, NEMA ratings, intrinsically safe barrier information, gas sealing recommendations, purging system details, etc. for panels located in hazardous locations or interfacing to equipment located in hazardous areas.

i. For every control panel, heating and cooling calculations for each panel supplied indicating conformance with cooling requirements of the supplied equipment and environmental conditions. Include on calculations the recommended type of equipment required for both heating and cooling.
j. Submit evidence that all control panels are constructed in conformance with UL 508 and bear the UL seal confirming the construction. Specify if UL compliance and seal application accomplished at the fabrication location or by field inspection by UL inspectors. Costs associated with obtaining the UL seal and any inspections are be borne by Contractor.

2. Wiring Diagrams Submittal:

a. PCSS to provide complete wiring diagrams showing all wiring connections in the I/O system where direct hardwired interfaces exist between the PCSS control panels and vendor provided control panels furnished under other Divisions. This includes but is not limited to terminal block numbering, relay contact information, instruments, equipment, and control panel names. Include drawings in Final O&M submittal. Leaving this information blank on Final Documentation drawings is not acceptable.

b. Panel wiring diagrams depicting wiring within and on the panel as well as connections to external devices. If ISA Loop Wiring Diagrams are specified below, equipment external to the control panel and related external connections do not need to be shown on the Panel Wiring Diagrams. Panel wiring diagrams include power and signal connections, UPS and normal power sources, all panel ancillary equipment, protective devices, wiring and wire numbers, and terminal blocks and numbering. Field device wiring includes the device ISA-tag and a unique numeric identifier. Diagrams identify all device terminal points that the system connects to, including terminal points where I/O wiring lands on equipment not supplied by the PCSS. Wiring labeling used on the drawings match that shown on the Contract Documents or as developed by the PCSS and approved by the Engineer. I/O wiring numbered with rack number, slot number, and point number. Two-wire and four-wire equipment to be clearly identified, and power sources noted. Submit final wire numbering scheme. Provide panel drawings that are 11-inch x 17-inch in size.

c. ISA Loop Wiring Diagrams: Not required.

I. Controller Program Submittal:

1. Refer to Section 406866 “Configuration of Controller Software” for specific submittal requirements.

J. Testing Plan Submittals:

1. Refer to Section 406121.20 “Process Control System Testing” for specific testing submittal requirements.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For any named PCSS, submit a statement on company letterhead indicating that the requirements in the “Quality Assurance” paragraph below are met by the firm.

B. Product Test Reports: Refer to individual instrument, component, or hardware specifications for specific requirements.

C. Evaluation Reports: Refer to individual instrument, component, or hardware specifications for specific requirements.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For all PCSS supplied hardware to include in operation and maintenance (O&M) manuals.
   1. Include the following information on the operations and maintenance manuals:

      a. Table of Contents:

         1) Provide a Table of Contents for the entire manual with the specific contents of each volume clearly listed. Include the complete Table of Contents in each volume.

      b. Instrument and Equipment Lists:

         1) Develop the following lists in Microsoft Excel format:
            a) An instrument list or spreadsheet for all instruments supplied including tag number, description, specification section and paragraph number, manufacturer, model number, calibrated range, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.
            b) An equipment list or spreadsheet for all non-instrument devices supplied listing description, specification section and paragraph number, manufacturer, model number, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.

      c. Equipment Operations and Maintenance Information:

         1) Provide ISA-TR20.00.01-2001(updated in 2004-2006) data sheets for all field instruments. For non-field instrumentation devices, provide a cover page for each device, piece of equipment, and OEM software that lists date, specification number, product name, manufacturer, model number, Location(s), and power required. Preferred format for the cover page is ISA-TR20.00.01-2001(updated in 2004-2006), general data sheet; however, other formats will be acceptable provided they contain all required information.
         2) Provide either new documentation written specifically for this project or modified standard vendor documentation to the vendor O&M documentation for each device, piece of equipment, or OEM software. Indicate with arrows or circles all portions that apply to all standard vendor documentation furnished. Neatly line out or cross out all portions that do not apply. Remove groups of pages or sections that do not apply to the specific model supplied.

         3) Provide the record documentation of the completed test forms with signoffs as specified in Section 406121.20 “Process Control System Testing.”
         4) Include instrument/equipment calibration and configuration forms developed as specified in Section 406121.20 “Process Control System Testing.”

      d. As-Built Drawings:

1) Complete as-built drawings, including all drawings and diagrams specified in this section under the "Submittals" section. Include on the drawings all termination points on all equipment the system is connected to, including terminal points of equipment not supplied by the PCSS. Provide electronic files for all drawings produced. Provide drawings in AutoCAD ".dwg" format and in Adobe Acrobat format.
2) Include on as-built documentation information from submittals, as described in this Specification, updated to reflect the as-built system. Incorporate errors in or modifications to the system resulting from the Factory and/or Functional Acceptance Tests.

B. Operations and Maintenance Data - Software Maintenance Manual

1. Include these manuals as part of "Final System Documentation."
2. Software Listings and Databases: Submit hard copies of the same information required in the "Controller Program Submittal" except include files updated to reflect the as-built system. Include PDF versions of these files on the DVDs specified below.
3. PID Loop Tuning Parameters: Submit annotated chart recorder traces or computer system trend screen printouts showing tuned control loop response to plus and minus 40 percent of full span step changes of loop setpoint for each individual loop. For cascade loops, submit charts showing response of the secondary loop with secondary setpoint on manual and also response of the entire cascade control loop in automatic mode. Include a description of tuning methodology used.
4. Supply hardcopies of configuration information for the HMI systems, reporting systems, Historian Systems, and any other programs developed under this Contract.
5. Machine Readable Documentation: Provide two sets of as-built software documentation on DVDs or USB thumb drives in original electronic format for all PLC, HMI systems, reporting systems, Historian Systems, and any other programs developed under this Contract. Incorporate all changes made during or after testing, start-up, and commissioning.
6. Include final version of the system standards and conventions manual reflecting as-programmed conditions.

7. System Configuration Section:

a. Include a printout (or screen capture) of all configuration screens for every device requiring PCSS configuration. This includes, but is not limited to, the hardware firewall, PLC processors, PLC redundancy, EtherNet/IP, and any other communication modules.

C. Operations and Maintenance Data - Operators' Manual:

1. Provide Operator's Manuals prior to final acceptance of the system.
2. Separately bind and include in the manual all information necessary for the operator to monitor and control the plant from the control system. Write the manuals in non-technical terms and organize for quick access to each detailed description of the operator's procedure. Include the following information:

a. A comprehensive table of contents of the manual.
b. A simple overview of the entire system indicating the function and purpose of major control system components described by area or building.

c. A detailed description of the operation of the HMI and OIT including all appropriate displays. Including a screenshot of each HMI and OIT display screen and annotating each function in text is an acceptable format for presenting this information.
d. Step-by-step procedures for starting up or shutting down critical component of the control system such as server or a control panel.
e. Login / logout procedures for the operator interface system(s).
f. Complete, step-by-step procedures for printing reports and entering manual data.
g. 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 and/or frequency system performs an automatic back-up with a listing of all applications that are backed up or need to be backed up.
h. Operational description for operating HMI computer equipment and peripherals including printers, CD-ROMs, removable bulk storage devices, UPS, etc. Include in the description procedures for typical maintenance and troubleshooting tasks.
i. A complete glossary of terms and definition of acronyms.
j. 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.

D. Software and Firmware Operational Documentation:

1. Original Licensed Software:

a. Submit original software licenses and keys for all software provided under this Contract. Submit original paper based and electronic documentation for all software provided. Submit license agreement information including serial numbers, license agreements, User Registration Numbers, and related information. Provide licenses for all software under this Contract to Owner at the time of purchase. Provide media in software sleeves within O&M manual.

E. Electronic O&M Information:

1. In addition to the hard copy of O&M data, provide an electronic version of all equipment manuals and data sheets, along with any software back-up of configuration files, on DVD or USB thumb drive. Supply electronic documents in Adobe Acrobat format.
2. Provide electronic files for all custom-developed manuals including training manuals. Supply text in Microsoft Office and Adobe Acrobat formats.
3. Provide electronic files for all drawings produced. Supply drawings in AutoCAD ".dwg" and in Adobe Acrobat formats. Provide drawings using the AutoCAD eTransmit feature to bind external references, pen/line styles, fonts, and the drawing file into individual zip files.
4. If specified in the training section, provide digital copies of all training videos. Format videos so they are readable by standard DVD players and by standard PC DVD drives, a minimum of 800 by 600 pixels, and include sound.

F. Include information on the cover and edge of each volume.

1.8 MAINTENANCE MATERIAL SUBMITTAL

A. Furnish extra materials from the same product run**,** that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Refer to individual specification sections in Division 406343 through 407543 for spare equipment requirements and provide one comprehensive spare parts submittal for project.

B. Pack all spare parts and test equipment in individual cartons and label with indelible markings clearly indicating components inside. Supply with the required spare parts complete ordering information paperwork including manufacturer's contact information (address and phone number), part name, part number, equipment name and tag number(s) for which the part is to be used (if applicable). Deliver and store the spare parts in a location directed by the Owner or Engineer.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: PCSS to hold a valid UL-508 certification for their panel fabrication facility.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

C. Responsible for the technical supervision of the installation by providing on-site supervision to the installers of the various components.

D. Process Control System Supplier (PCSS): “systems integrator” regularly engaged in the design and the installation of instrumentation systems and their associated subsystems as they are applied to the municipal water and wastewater industry. For the purposes of this Specification Section, a “systems integrator” means an organization that complies with all of the following criteria:

1. Employs personnel on this project who have successfully completed ISA or manufacturer’s training courses on general process instrumentation and configuration and implementation of the specific programmable controllers, computers, and software proposed for this project. Key personnel to hold ISA CCST Level 1 certification or have a minimum of 10 years of verifiable plant startup experience. Key personnel include, as a minimum, the lead field technician.
2. Has successfully completed work of similar or greater complexity on at least three previous projects within the last five years. Successful completion is defined as a finished project completed on time, without any outstanding claims or litigation involving the PCSS. Potential references for projects where the PCSS's contract was of similar size to this project.
3. Has been actively engaged in the type of work specified in this Section for a minimum of five years.

E. Maintain a permanent, fully staffed, and equipped service facility within 200 miles of project site with full-time employees capable of designing, fabricating, installing, calibrating, and testing the systems specified herein. Respond to on-site problems within 12 hours of notice.

Provide an on-site response within four hours of notification starting at two months before scheduled startup to two months after startup completion.

F. Listed suppliers will not be required to submit a qualifications proposal (see "Informational Submittals"). Contractors interested in listing an equal to the above listed suppliers to submit PCSS' qualifications for review and approval as specified herein.

G. Select a PCSS from one of the following:

1. Prime Controls
2. 1725 Lakepointe Drive
3. Lewisville, TX 75057
4. Phone: (972) 221-4849
5. Fax: (972) 420-4842
6. Contact: Brian Poarch
7.
8. Control Panels USA Inc.
9. 2530 Shell Road
10. Georgetown, TX 78628
11. Phone: (512) 863-3224
12. Fax: (512) 868-5446
13. Contact: Brian Iguchi.
14.
15. 3. Tesco Controls
16. 8000 Jetstar Road Ste. 150
17. Irving, TX 75063
18. Phone: (279) 399-4750
19. Contact: Timothy Milberger
20.

H. Being listed in this specification does not relieve any potential PCSS from meeting the qualifications specified in this Section.

1.10 FIELD CONDITIONS

A. Environmental Requirements: Refer to Electrical Drawings for specific environmental and hazardous area classifications.

B. Elevation: Design equipment to operate at the project ground elevation.

C. Temperature:

1. Outdoor area equipment to operate between -4 to 122 degrees F ambient.
2. Equipment in indoor locations operate between 50 to 95 degrees F degrees ambient minimum.
3. Storage temperatures range from 32 to 122 degrees F degrees ambient minimum.
4. Furnish additional cooling or heating if required by the equipment specified herein.
5. Relative Humidity. Air-conditioned area equipment operate between 20 to 95 percent relative, non-condensing humidity. All other equipment operates between 5 to 100 percent relative, condensing humidity.

D. Do not ship control system equipment located in the control room until the control room areas comply with specified ambient temperature and humidity and free of dust and debris.

1.11 WARRANTY

A. Warranty Period: Two years from date of Substantial Completion unless noted otherwise in individual specification sections.

PART 2 - PRODUCTS

2.1 GENERAL

A. Electrical Requirements for Control System:

1. Operate equipment 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 to be provided between power supply and interconnected instrument loop. Supply constant voltage transformers where equipment requires voltage regulation.
2. With the exception for field device network connected devices, all electronic instrumentation utilizes linear transmission signals of isolated 4 to 20 mA DC (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, 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 have double-pole, double-throw (DPDT) contacts rated at a minimum of 600 VA, unless noted otherwise.
5. Switches and/or signals indicating an alarm, failure or upset condition wired in a fail-safe manner as shown on the P&IDs**,** and as indicated on the instrument list**.** A fail-safe condition is when an open circuit generates an alarm state, i.e., contact opens.
6. Materials and equipment UL approved whenever such approved equipment and materials are available.
7. All equipment furnished designed and constructed so that in the event of power interruption, the systems specified all go through an orderly shutdown with no loss of memory and resume normal operation without manual resetting when power is restored, unless otherwise noted.
8. Surge protection requirements for control system power, signal, and communication lines are specified in Section 407856 “Isolators, Intrinsically Safe Barriers, and Surge Suppressors.” Note that, per city of Georgetown, in addition to stated surge protection requirements, all 4-20mA signals to and from pumps/PLC are required to have analog surge protection provided.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and Insert other specific conditions and other conditions affecting performance of the Work.

B. Examine instruments and communication controller devices before installation. Reject instrument and communication controller devices that are wet, moisture damaged, or mold damaged.

C. Examine walls, floors, roofs, and process area for suitable conditions where control panels instrumentation or computers will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION

A. The shield on each process instrumentation cable to be continuous from source to destination and be grounded at only one ground point for each shield.

B. Provide sunshades for equipment mounted outdoors in direct sunlight. Include sunshades standoffs to allow air circulation around the cabinet. Orient equipment outdoors to face to the North to minimize the impact of glare and ultraviolet exposure on digital readouts.

3.3 IDENTIFICATION

A. Provide identification system for all PCSS provided hardware, instrumentation, and communication cabling.

3.4 FIELD QUALITY CONTROL

A. Refer to individual hardware and instrument specification Sections.

3.5 STARTUP SERVICE

A. Refer to Section 406121.20 “Process Control System Testing.”

B. Refer to Section 406126 “Process Control System Training.”

C. 100 percent checkout of all field components both new and existing.

D. Engage a factory-authorized service representative to perform startup service as specified in individual hardware and instrument specification Sections.

E. Weekly on-site coordination meetings with Engineer, Contractor, and AESS as required during active construction period.

3.6 SOFTWARE SERVICE AGREEMENT

A. Refer to individual hardware and software specifications for specific requirements.

END OF SECTION 406100

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SECTION 406121.20 - PROCESS CONTROL SYSTEM TESTING [CONTRACTOR PERFORMS PROGRAMMING]

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes process control system testing, where Applications Engineering services are performed by Contractor.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406196 “Process Control Descriptions”.
3. Section 406343 “Programmable Logic Controllers”.
4. Section 406613 “Switches and Routers”.
5. Section 406717 “Industrial Enclosures”.
6. Section 406733 “Panel Wiring”.
7. Section 406866 “Configuration of Controller Software”.
8. Section 407000 “Instrumentation for Process Systems”.
9. Section 407856 “Isolators, Intrinsically Safe Barriers, and Surge Suppressors”.

1.3 DEFINITIONS

A. Process Control System Supplier (PCSS): Entity responsible for providing all materials, equipment, labor, and services required to achieve a fully integrated and operational control system.

B. Applications Engineering System Supplier (AESS): Entity who provides all programming, configuration, and related services for the control system equipment provided by the PCSS.

C. Programmable Logic Controller (PLC): A ruggedized programmable computer used for industrial automation.

D. Input/Output (I/O): Analog or digital field instrument signals to be received and interpreted by a PLC.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Refer to Section 4061000 “Process Control and Enterprise Management Systems General Provisions.”

1.5 ACTION SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Testing Submittals - Submit, in one submittal, the following testing related documents:

1. Status Signoff Forms:

a. Develop and submit project specific I/O Status and Automatic Control Strategy signoff forms to be used during factory and field testing to organize and track each loop's inspection, adjustment, calibration, configuration, and testing status and sign off. Include sign-off forms for each testing phase showing all loops.

1) Example forms are shown in the Appendices.
2) Separate forms for factory and field testing can be used, or they can be combined, at the discretion of the PCSS.
3) Submit testing forms prior to start of testing.

1. Testing Procedures:

a. Submit detailed procedures proposed to be followed for each of the tests specified herein. The test procedures serve as the basis for the execution of the required tests to demonstrate that the system meets and functions as specified. At a minimum, provide the following test procedures:

1) Network and Communications Testing.
2) I/O Testing.
3) UPS.
4) Control panel power, indictors, and hardwired logic tests.

b. Structure documents in an orderly and easy to follow manner to facilitate an efficient and comprehensive test.
c. Indicate in test procedures all pre-testing setup requirements, all required test equipment, and simulation techniques to be used.
d. Structure test procedures in a cause and effect manner where the inputs are indicated, and the outputs are recorded.
e. Include in test procedures the demonstration and validation under normal operating conditions and under various failure scenarios as specified in Contract Documents.
f. Do not start testing until all Testing Submittals have been approved.

C. Test Documentation:

1. Upon completion of each required test, document the test by submitting a copy of the signed off Testing Status forms. Testing is not be considered complete until the signed-

off forms have been submitted and approved. Submittals of other test documentation, including "highlighted" wiring diagrams with field technician notes, are not acceptable substitutes for the formal test documentation.

1.6 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For Test Documentation of system:

1. Upon completion of each required test, document the test by submitting a copy of the signed-off Testing Status forms. Testing is not considered complete until the signed-off forms are submitted and approved. Submittal of other test documentation, including "highlighted" wiring diagrams with field technician notes, are not acceptable substitutes for the formal test documentation.

1.7 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.8 COST OF TRAVEL

A. Scheduled tests will only be attended once by Engineer /Owner. If test is not successful, all subsequent tests will be performed at Contractor's expense. Reimburse Owner for all costs, including labor and expenses, invoiced by Engineer, and incurred by Owner for subsequent retests.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TESTING - GENERAL

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

B. Track results of all testing on a project specific status sign-off form or similar document. The PCSS is responsible for maintaining the sheet. Appendix of this Section has an example template for this sheet.

C. Tests the PCSS is required to perform are as follows:

1. Factory Testing:

a. Unwitnessed Factory Test (UFT).
b. Witnessed Factory Test (WFT).

2. Field Testing:

    a. Operational Readiness Test (ORT).
    b. Functional Demonstration Test (FDT).
    c. Site Acceptance Test (SAT).

D. 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, provide all special testing materials and equipment required for a suitable means of simulation.

E. PCSS to coordinate all required testing with Contractor, affected subcontractors, Engineer, and Owner.

F. Do not ship equipment to jobsite until Engineer or Owner has received all Factory Testing results and approved the system as ready for shipment.

G. Engineer reserves the right to test or re-test any functions.

H. Correction of Deficiencies:

1. Correct deficiencies in workmanship and/or items not meeting specified testing requirements to meet specification requirements at no additional cost to Owner.
2. Repeat testing, as specified herein, after correction of deficiencies is made until specified requirements are met. Perform work at no additional cost to Owner.

3.2 FACTORY TESTING - UNWITNESSED FACTORY TEST (UFT)

A. Purpose of UFT is for PCSS 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 tests, but not be limited to the following. Address each of these tests 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 and OIT 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 and OIT nodes.
    b. Connect analog input signals to a signal generator at field terminal blocks in control panels to verify proper status in HMI and OIT 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 and OIT 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 and OIT 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, and other materials.
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.
i. Demonstrate failover capabilities of the redundant PLCs.

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.

3.3 FACTORY TESTING - WITNESSED FACTORY TEST (WFT)

A. Purpose of WFT is to allow Engineer or Owner representatives to witness functionality, performance, and stability of entire hardware and software system as a complete integrated system. WFT to be run by PCSS and conducted at PCSS's facility.

B. Required Documents for Test:

1. Clean set of approved panel drawings and wiring diagrams.
2. Set of Contract Documents - all drawings and specifications.
3. All design-change related documentation.
4. Master copy of the PCSS developed factory testing signoff forms.
5. Testing procedures.

C. Operate the system continuously throughout WFT without failure, except where initiated per established test procedures. Unanticipated failures may, at Owner or Engineer's option, result in overall WFT being deemed unsuccessful. Correct and re-test all deficiencies identified during these tests prior to completing WFT or shipment of panels to jobsite as determined by Owner/Engineer.

D. Perform these tests during the WFT, but not be limited to, the following:

1. A repeat of all tests specified in the UFT.

E. Daily schedule during these tests to be as follows:

1. Morning meeting to review the day's test schedule.
2. Scheduled tests and sign-offs.
3. End of day meeting to review day's test results and to review or revise next day's test schedule.
4. Unstructured testing period by witnesses.

F. Upon successful completion of WFT, PCSS to submit a record copy of test results as specified in PART 1.

3.4 FIELD TESTING - OPERATIONAL READINESS TEST (ORT)

A. Purpose of ORT is to check that process equipment, instrument installation, instrument calibration, instrument configuration, field wiring, control panels, and all other related system components are ready to monitor and control the processes. This test determines if equipment is ready for operation.

B. This test to take place prior to FDT and startup. Prior to starting this test, install relevant process equipment and mechanically test instruments installed, control panels installed, and field wiring complete.

C. Required Documents for Test:

1. Master copy of the PCSS developed field testing sign-off forms.
2. Testing procedures.
3. Calibration forms.

D. These inspections, calibrations, and tests do not require witnessing. However, Engineer may review and spot-check testing process periodically. All deficiencies found to be corrected by PCSS prior to commencement of Functional Demonstration Test.

E. PCSS to maintain Sign-off forms and Calibration forms at job site and make them available to Engineer/Owner at any time.

F. Perform the following tests as part of ORT:

1. Instrument calibration, configuration, and set-up.
2. Input/Output (I/O) Testing to HMI and OITs.
3. Testing of control strategies.

G. Instrument calibration, configuration, and set-up:

1. Calibrate, configure, and set-up all components and instruments to perform specified functions.
2. Calibration form:

    a. For any component or instrument requiring dip switch settings, calibration, or custom configuration, maintain a calibration form in field documenting this information. These forms provide a summary of the actual settings used in the field to allow an Instrument technician to replace the device entirely and configure it to function as it did before.
    b. Add this information to Instrument data sheet and to a copy of manufacturer's standard "Configuration Sheet", or create a separate form.

        1) If a separate form, list Project Name, Loop Number, ISA Tag Number, I/O Module Address, Manufacturer, Model Number/Serial Number, Output Range and Calibrated Value.

    c. Some examples of required information are:

        1) For Discrete Devices: Actual trip points and reset points.

2) For Instruments: Any configuration or calibration settings entered into instrument
3) For Controllers: Mode settings (PID).
4) For I/O Modules: Dip switch settings, module configuration (if not documented in native programming documentation).

d. Maintain a copy of these forms in field during testing and make them available for inspection at any time.
e. For any device that allows a software back-up of configuration files to a laptop, make configuration files available to Engineer/Owner for inspection. Submit as part of Final System Documentation as specified in Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

H. I/O Testing:

1. Purpose of I/O testing is to check that process equipment, instrument installation, calibration, configuration, field wiring, and control panels are set-up correctly to monitor and control the processes. This test is commonly referred to as a "loop test" or an I/O checkout.
2. PCSS in conjunction with Contractor to test signals under process conditions. Preferred test method will always be to execute test wherever possible to end elements. For example, preferred test will prove valve open/close limit switches by operating valve, not by installing a jumper on limit switch contacts. However, if equipment or process is not available to test a signal over its entire calibrated range, PCSS may test using a simulation method and make a note on sign-off form.
3. Perform the following I/O tests:

a. Discrete Input: At device or instrument, change signal condition from inactive to active state. Observe results on all indicators within loop such as HMI screens, OIT screens, pilot lights, horns, beacons, etc.
b. Analog Input: Test analog signal over entire engineering range at various intervals including 0, 50 percent, and 100 percent as well as on increasing and decreasing range. Observe results on all indicators within loop such as HMI screens, OIT screens, recorders, digital indicators, etc.
c. Test discrete output signals by switching equipment to manual control at the HMI and OIT nodes and turning output on or using other means to turn output on. Then verify equipment responds accordingly.
d. Test analog output signals by switching equipment to manual control at HMI and OIT nodes and turning output on or other means to turn output on. Then verify equipment responds accordingly.

I. Testing of Automatic Control Strategies:

1. Verify all automatic control strategies using actual process equipment and instruments, or other means, to verify logic performs as expected. Verify faults and logical failure scenarios for control strategies such as instrument failures, equipment failures, loss of communication between HMI Server and PLC, loss of peer-to-peer communication, out of range testing for analog inputs, loss of power, and all other strategies specified in control strategy document.

J. Repeat all systems tests specified under factory testing.

K. Test UPS to verify UPS switch power correctly while keeping all UPS powered loads online. Also, test sizing of UPS by switching off-line power to UPS and verify if they maintain specified run time.

L. For all panels with enclosures modified by this Contract, test internal control panel temperature under full running conditions to ensure proper cooling/ventilation is being provided.

M. Upon successful completion of ORT, PCSS to submit a record copy of test results as specified in PART 1 and request scheduling of FDT.

3.5 FIELD TESTING - FUNCTIONAL DEMONSTRATION TEST (FDT)

A. After facility is started-up and running treatment process in automatic control to extent possible, perform a Functional Demonstration Test. Purpose of FDT is to allow Engineer or Owner representatives to witness actual functionality, performance, and stability of system while connected to process equipment.

B. Required Documents for Test:

1. Set of panel drawings and wiring diagrams from ORT with corrections noted.
2. Set of Contract Documents - all drawings and specifications.
3. All design-change related documentation.
4. Signed-off master copy of the PCSS developed field testing signoff forms.
5. Testing procedures.
6. Copy of completed calibration forms.
7. One copy of all O & M Manuals for PCSS supplied equipment.

C. Perform a witnessed FDT on each process area. To extent possible, repeat testing performed during ORT.

D. Follow specified daily schedule during factory tests and FDT.

E. After coordinating with Operations, perform a "Black Start" of the plant to confirm plant operation recovers as specified in Contract Documents. Black start means shutting off power to the plant and turning it back on. Perform separate tests by recovering the plant while on generator (if a generator is specified) and while on utility power.

F. Document punch list items and resolutions noted during test on Punch list/Resolution form. In event of rejection of any part or function test procedure, PCSS to perform repairs, replacement, and/or retest within 10 days.

G. Upon successful completion of the FDT, PCSS to submit a record copy of test results as specified in PART 1.

3.6 FIELD TESTING - SITE ACCEPTANCE TEST (SAT)

A. After completion of FDT, and system is started-up and running treatment process in automatic control to extent possible, perform a test on the system.

B. While this test is proceeding, Engineer and Owner have full use of system. Only allow plant operating personnel to operate equipment associated with live plant processes. Plant operations remain the responsibility of Owner and decision of plant operators regarding plant operations are final.

C. During this test, PCSS personnel to be present as required to address any potential issues that would impact system operation. PCSS is expected to provide personnel for this test who have an intimate knowledge of hardware and software of system. When PCSS personnel are not on-site, PCSS to provide cell phone/pager numbers that Owner personnel can use to ensure that support staff is available by phone and/or on-site within four hours of a request by operations staff.

D. PCSS to analyze and correct any malfunctions during test. In event of rejection of any part or function, PCSS to perform repairs or replacement within 5 days.

E. Throughout duration of SAT, do not make software or hardware modifications to the system without prior approval from Owner or Engineer.

3.7 APPENDICES

A. APPENDIX 406121-A: EXAMPLE INPUT/OUTPUT (I/O) STATUS SIGN OFF FORM

1. An example template for I/O Status signoff form to be used for documenting testing results to Owner is attached. PCSS is required, prior to testing, to create a project specific I/O Status signoff form based on attached template or approved equal. PCSS may obtain an electronic copy of template from Engineer or develop it on their own.

B. APPENDIX 406121-B: EXAMPLE AUTOMATIC CONTROL STRATEGIES SIGN OFF FORM

1. An example template for Automatic Control Strategies signoff form to be used for documenting testing results to Owner is attached. PCSS is required, prior to testing, to create a project specific Automatic Control Strategies signoff form based on attached template or approved equal. PCSS may obtain an electronic copy of template from Engineer or develop it on their own.

C. Refer to Appendix A and Appendix B on following pages.

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[Project Name] Appendix A - Input/Output (I/O) Status Sign-Off Form

All Sections below are required to be filled out by PCSS as part of Field Testing.
Instrument Alarm Setpoint - Setpoint for any alarms set by PCSS
Wiring Complete - Signal wired from field device to PLC
I/O Tested - Signal tested from field device to SCADA HMI

PLC	Signal Tag	Description	Range or Active State when closed	P&ID	Signal	Rack	Slot	Channel	Instrument Alarm Setpoint	Calibrate, config., and Wiring complete	Date	PCSS I/O Testing	Date	I/O Testing to the HMI	Date	Notes
PLC-SC	LIT-4000-1	Secondary Clarifier No. 1 Sludge Level	0-10 ft	8	AI	2	1	0								
PLC-SC	LIT-4010-3	Secondary Clarifier No. 3 Sludge Level	0-10 ft	8	AI	2	1	1								
PLC-SC	SI-4100-1	RAS Pump No. 1 Speed Feedback	0-100%	14	AI	2	1	2								
PLC-SC	SI-4100-4	RAS Pump No. 4 Speed Feedback	0-100%	15	AI	2	1	3								
PLC-SC	FIT-4102-1	RAS Flow Pumps 1-3	0-1900 GPM	14	AI	2	1	4								
PLC-SC	SI-4110-1	WAS Pump No. 1 Speed Feedback	0-100%	14	AI	2	1	5								
PLC-SC	N/A	Spare Slot	N/A	N/A	Spare	2	5	N/A								
PLC-SC	SC-4100-1	RAS Pump No. 1 Speed Setpoint	0-100%	14	AO	2	7	0								
PLC-SC	SC-4100-2	RAS Pump No. 2 Speed Setpoint	0-100%	14	AO	2	7	1								
PLC-SC	SC-4100-3	RAS Pump No. 3 Speed Setpoint	0-100%	14	AO	2	7	2								
PLC-SC	SC-4110-1	WAS Pump No. 1 Speed Setpoint	0-100%	14	AO	2	7	3								
PLC-SC	Spare	Spare	N/A	N/A	AO	2	7	4								
PLC-SC	Spare	Spare	N/A	N/A	AO	2	7	5								
PLC-SC	TSH-4000-1	Secondary Clarifier No. 1 High Temp	Normal	8	DI	3	1	0								
PLC-SC	XA-4000-1	Secondary Clarifier No. 1 Motor Overload	Normal	8	DI	3	1	1								
PLC-SC	WAH-4000-1	Secondary Clarifier No. 1 High Torque	Normal	8	DI	3	1	2								
PLC-SC	WAHH-4000-1	Secondary Clarifier No. 1 High High Torque	Normal	8	DI	3	1	3								
PLC-SC	YRI-4000-1	Secondary Clarifier No. 1 On/Off	On	8	DI	3	1	4								
PLC-SC	YCI-4000-1	Secondary Clarifier No. 1 In Remote	In Remote	8	DI	3	1	5								
PLC-SC	YFI-4100-1	RAS Pump No. 1 VFD Fault	Normal	14	DI	3	1	6								
PLC-SC	FAL-4100-1	RAS Pump No. 1 Low Flow	Normal	14	DI	3	1	7	50 GPM	RJM	12/18/2011	JAS	12/22/2011	MIC	12/29/2011	Example completed line
PLC-SC	Spare	Spare	Normal	14	DI	3	1	8								
PLC-SC	YRI-4100-1	RAS Pump No. 1 Running	Running	14	DI	3	1	9								
PLC-SC	YCI-4100-1	RAS Pump No. 1 In Remote	In Remote	14	DI	3	1	10								
PLC-SC	YFI-4110-1	WAS Pump No. 1 VFD Fault	Normal	14	DI	3	1	11								
PLC-SC	FAL-4110-1	WAS Pump No. 1 Low Flow	Normal	14	DI	3	1	12								
PLC-SC	Spare	Spare	Normal	14	DI	3	1	13								
PLC-SC	YRI-4110-1	WAS Pump No. 1 Running	Running	14	DI	3	1	14								
PLC-SC	YCI-4110-1	WAS Pump No. 1 In Remote	In Remote	14	DI	3	1	15								
PLC-SC	HSS-4000-2	Secondary Clarifier No. 2 Start Command	Start	8	DO	4	6	0								
PLC-SC	Spare	Spare	N/A	N/A	DO	4	6	1								
PLC-SC	HSS-4100-2	RAS Pump No. 2 Start Command	Start	14	DO	4	6	2								
PLC-SC	HSS-7000-2	Sludge Holding tank Tank Blower No. 2 Start Command	Start	17	DO	4	6	3								
PLC-SC	HSS-4100-5	RAS Pump No. 5 Start Command	Start	15	DO	4	6	4								
PLC-SC	Spare	Spare	N/A	N/A	DO	4	6	5								
PLC-SC	HSS-4105-1	Secondary Scum Pump No. 2 Start/Stop	Start	15	DO	4	6	6								
PLC-SC	HSS-4110-2	WAS Pump No. 2 Start/Stop Command	Start	15	DO	4	6	7								
PLC-SC	7160-FQI-1	Sludge Loadout LCP Pumping Indicator	Pumping	17	DO	4	6	8								
PLC-SC	Spare	Spare	N/A	N/A	DO	4	6	9								
PLC-SC	HSS-7115-2	Sludge Holding Tank Mixer No. 2 Start	Start	17	DO	4	6	10								
PLC-SC	Spare	Spare	N/A	N/A	DO	4	6	11								
PLC-SC	HSO-7117-2	Sludge Holding Tank Discharge Valve No. 2 Open CMD	Open	17	DO	4	6	12								
PLC-SC	HSC-7117-2	Sludge Holding Tank Discharge Valve No. 2 Close CMD	Close	17	DO	4	6	13								
PLC-SC	HSS-7120-2	TS Transfer Pump No. 2 Start Command	Start	17	DO	4	6	14								
PLC-SC	Spare	Spare	N/A	N/A	DO	4	6	15								

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4-Jun-14 **[Project Name] Appendix B - Automatic Control Strategies Sign-Off Form**

All Sections below are required to be filled out by PCSS as part of Testing

Auto. Control Strategies. - Loop operational in Automatic as defined in Control Stategies

Control Strategies Loop #	Control Strategy Description	P&ID	Auto. Control Strategy	Date	Notes
LOOP 281 - 284	LOW FLOW PUMPS	8			
LOOP 290	LOW EQ CHANNEL FLOW NO.4	8			
LOOP 300	MICROFILTRATION AIR SUPPLY LOW PRESSURE	10			
LOOP 351, 352	SITE LIFT STATION PUMP NO.1 AND NO. 2	12			
LOOP 355	SITE LIFT STATION HIGH AND LOW LEVEL CONTROL	12			
LOOP 371, 372	SLUDGE HOLDING TANK NO.1 AND NO. 2 LEVEL	14			
LOOP 381, 382	SLUDGE TRANSFER PUMPS	14			
LOOP 385	SLUDGE TRANSFER PUMPS REMOTE START/STOP COMMAND	14			
LOOP 700	EFFLUENT PUMPING STATION LEVEL	14			
LOOP 701, 702, 703	EFFLUENT PUMP NO.1	14			
LOOP 840	POST AERATION CHANNEL AIR FLOW CONTROL	15			
LOOP 900	SLUDGE TRANSFER PUMPS DISCHARGE FLOW	8			
LOOP 971	CENTRIFUGE SLUDGE FEED PUMP NO.1	8			
LOOP 1001	CENTRIFUGE NO.1 SLUDGE FEED FLOW CONTROL	8			
LOOP 1411, 1412	SODIUM HYPOCHLORITE STORAGE TANKS LEVEL	8			
LOOP 1421, 1422	SODIUM HYPOCHLORITE PUMPS	8			
LOOP 1430	SODIUM HYPOCHLORITE STORAGE TANKS CONTAINMENT AREA HIGH LEVEL DETECTION	14			
LOOP 2051, 2052, 2053	DIESEL ENGINE GENERATOR STATUS	14			
LOOP 2055	TRANSFER SWITCH STATUS	14			
LOOP 2060	GENERATOR KILOWATTS MONITORING	14			
APPENDIX ONE	EQUIPMENT RESTART DURING A POWER LOSS WITH THE GENERATOR RUNNING	14			
APPENDIX TWO	EQUIPMENT RESTART WITH POWER RESTORED AFTER A POWER LOSS	14			
N/A	SELF-HEALING CAPABILITIES OF NETWORK	N/A			
N/A	REDUNDANT SCADA SERVER FAILOVER AND RECOVERY	N/A			

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END OF SECTION 406121.20

SECTION 406126 - PROCESS CONTROL SYSTEM TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes process control system training for provided devices and systems.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406263 “Operator Interface Terminal.”
3. Section 406343 “Programmable Logic Controllers.”
4. Section 406866 “Configuration of Controller Software.”
5. Section 407000 “Instrumentation for Process Systems.’

1.3 ACTION SUBMITTALS

A. Preliminary Training Plan Submittal:

1. Prior to preparation of Final Training Plans, submit outlines of each training course including course objectives and target audience, resumes of instructors, prerequisite requirements for each class, and samples of handouts for review.

B. Final Training Plan Submittal:

1. Upon receipt of Engineer's comments on preliminary training plan, submit specific proposed training plan with the following:

a. Definitions, objectives, and target audience of each course.
b. Schedule of training courses including proposed dates, duration, and locations of each class.
c. Complete copy of all proposed handouts and training materials bound and logically arranged with all materials reduced to a maximum size of 11 inch by 17 inch, then folded to 8.5 inch by 11 inch for inclusion into the binder.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. Directly relate the training and instruction to the system being supplied. Training program represents a comprehensive program covering all aspects of the operation and maintenance of the system.

B. Coordinate all training schedules with and at the convenience of Owner, including shift training required to correspond to Owner's working schedule.

C. All onsite instructors must be intimately familiar with the operation and control of Owner's facilities.

D. Provide detailed training manuals to supplement the training courses including specific details of equipment supplied and operations specific to the project. Provide the manuals in hardcopy for each student. Provide electronic copy of each training manual in PDF format for Owner's future use.

E. Make use of teaching aids, manuals, or slide/video presentations as required. After training services, deliver training materials to Owner.

F. Owner reserves the right to videotape all custom training sessions. Training tapes become sole property of Owner.

G. Cost of Travel for off-site training:

1. Cost of Travel for off-site training is paid directly by entity employing the staff doing the traveling.

3.2 TRAINING SUMMARY

A. Provide following training courses listed in the summary table below:

Description	Minimum Course Duration (hours)	Maximum Number of Trainees per Course	Number of Times Course to be Given	Intended Audience
Control System Overview Seminar	Covered in AESS scope of work			
Operator Control System Training	Covered in AESS scope of work			
Installed Control System	4	4	1	Maintenance, Administrator
PLC Hardware/Software	8	4	1	Maintenance
OIT Hardware/Software	8	4	1	Maintenance
Instrument manufacturer training – Chlorine and Turbidimeter Analyzers	8	4	1	Maintenance

Instruments	16	2	1	Maintenance
Instruments - Operator familiarity	2	8	1	Operations

B. Definitions of Audience Roles:

1. Administrator: Personnel responsible for maintaining the HMI / SCADA system.
2. Maintenance: Personnel responsible for maintaining the field controller hardware and instrumentation system.
3. Operations: Personnel responsible for daily plant operations.
4. Management: Non-daily operations personnel.
5. Include classroom and hands-on instruction such that a student with experience in process instrumentation can configure the HMI with no guidance or with only minimal supervision when attempting complex problems.

3.3 ONSITE TRAINING

A. Training personnel are required to be intimately familiar with the control system equipment, its manipulation, and configuration. Training personnel are required to command knowledge of system debugging, program modification, troubleshooting, maintenance procedure, system operation, and programming, and capable of transferring this knowledge in an orderly fashion to technically oriented personnel.

B. Installed Control System Training:

1. Provide training for Owner's personnel in the functionality, maintenance, and troubleshooting, of the installed Control System. Conduct training before Functional Demonstration Test (FDT), but not more than two months before.
2. Provide training and instruction specific to the system that is being supplied.
3. Provide training consisting of classroom instructions and hands-on instruction utilizing Owner's system.
4. Provide detailed training on the actual configuration and implementation for this Contract covering all aspects of the system that will allow Owner's personnel to maintain, modify, troubleshoot, and develop future additions/deletions to the system. Provide training covering the following subjects:

    a. System overview.
    b. System hardware components and specific equipment arrangements.
    c. Periodic maintenance.
    d. Troubleshooting and diagnosis.
    e. Network configuration, communications, and operation.
    f. TCP/IP addressing procedures for all Ethernet devices.

C. Programmable Logic Controller (PLC) Hardware and Software:

1. Provide training for Owner's personnel in operation, maintenance, troubleshooting, etc. with PLC hardware and software system. Conduct the training before FDT, but not more than two months before.
2. Provide training and instruction specific to the system that is being supplied.

3. Provide training consisting of classroom instructions and hands-on instruction utilizing Owner's system. Provide detailed training on the actual configuration and implementation for this Contract covering all aspects of PLC system that will allow Owner's personnel to maintain, modify, troubleshoot, and develop future additions/deletions to PLC system. Provide training covering the following subjects:

    a. PLC system overview.
    b. PLC system architecture.
    c. PLC system hardware components and specific equipment arrangements.
    d. PLC system startup, shut down, load, backup, and PLC failure recovery.
    e. Periodic maintenance.
    f. Troubleshooting and diagnosis down to the I/O card level.
    g. PLC configuration, communications, and operation.

D. Instrument Manufacturer Training:

1. Provide manufacturer instrument training for those instruments where specifically indicated in the Instruments section. This is on-site training provided by an authorized representative of the manufacturer. Manufacturer's representative is required to be fully knowledgeable in equipment operation and maintenance.

E. Instrument Training:

1. Provide instruction on the maintenance of the field and panel instrumentation for Owner's instrumentation technicians. Conduct this training before FDT, but no more than 1 month before and at a time suitable to Owner. This training takes place at Owner's facility. Training program is required to include the following elements:

    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. Testing, adjustment, and calibration procedures.
    d. Troubleshooting and diagnosis.
    e. Maintenance and frequency.

F. Instruments - Operator Familiarity:

1. Provide operator level instruction on use of field and panel instrumentation for Owner's operations staff.
2. Conduct training before 30-day site acceptance test, but no more than 1 month before and at a time suitable to Owner.
3. Training Location: Owner's facility.
4. Include hands on demonstration of information each transmitter indicates, and method used to retrieve any operator information from transmitter, including use of pushbuttons and interpretation of international graphic symbols used on the instruments.

END OF SECTION 406126

SECTION 406193 - PROCESS CONTROL SYSTEM INPUT/OUTPUT LIST

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes process control system Input-Output (I/O) lists.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for I/O list submittal requirements.
2. Section 406343 “Programmable Logic Controllers.”

1.3 DEFINITIONS

A. Input/Output (I/O): Analog or digital field instrument signals to be received and interpreted by a PLC.

B. Programmable Logic Controller (PLC): Ruggedized programmable computer used for industrial automation.

1.4 ACTION SUBMITTALS

A. Process Controller Input/Output (I/O) Schedule

1. Submit complete I/O schedule as specified in Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. An electronic copy of this I/O list can be requested from the Engineer for use in preparing the I/O list submittal.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 ATTACHMENTS

A. Process Controller I/O Schedule.

END OF SECTION 406193

APPENDIX A
PROCESS CONTROLLER I/O SCHEDULE

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Drawing No.	ISA Tag Name and Loop No.	Type	Description	Destination
SG-IA-1	LI-2005-1	AI	SG WWTP Wetwell No. 1 Level	SG-PLC
SG-IA-1	LAL-2010-1	DI	SG WWTP Wetwell No. 1 Low Level	SG-PLC
SG-IA-1	LAH-2010-1	DI	SG WWTP Wetwell No. 1 High Level	SG-PLC
SG-IA-1	LALL-2010-1	DI	SG WWTP Wetwell No. 1 Low Low Level	SG-PLC
SG-IA-1	LAHH-2010-1	DI	SG WWTP Wetwell No. 1 High High Level	SG-PLC
SG-IA-1	YCI-2010-1A	DI	SG WWTP Wetwell No. 1 Influent Pump No. 1 In Auto	SG-PLC
SG-IA-1	YRI-2010-1	DI	SG WWTP Wetwell No. 1 Influent Pump No. 1 Running	SG-PLC
SG-IA-1	XA-2010-1	DI	SG WWTP Wetwell No. 1 Influent Pump No. 1 Fault	SG-PLC
SG-IA-1	TAH-2010-1	DI	SG WWTP Wetwell No. 1 Influent Pump No. 1 High Temperature	SG-PLC
SG-IA-1	MAH-2010-1	DI	SG WWTP Wetwell No. 1 Influent Pump No. 1 Leak	SG-PLC
SG-IA-1	YCI-2010-1B	DI	SG WWTP Wetwell No. 1 Influent Pump No. 1 LCS In Remote	SG-PLC
SG-IA-1	HSS-2010-1	DO	SG WWTP Wetwell No. 1 Influent Pump No. 1 Start/Stop	SG-PLC
SG-IA-1	YCI-2010-2A	DI	SG WWTP Wetwell No. 1 Influent Pump No. 2 In Auto	SG-PLC
SG-IA-1	YRI-2010-2	DI	SG WWTP Wetwell No. 1 Influent Pump No. 2 Running	SG-PLC
SG-IA-1	XA-2010-2	DI	SG WWTP Wetwell No. 1 Influent Pump No. 2 Fault	SG-PLC
SG-IA-1	TAH-2010-2	DI	SG WWTP Wetwell No. 1 Influent Pump No. 2 High Temperature	SG-PLC
SG-IA-1	MAH-2010-2	DI	SG WWTP Wetwell No. 1 Influent Pump No. 2 Leak	SG-PLC
SG-IA-1	YCI-2010-2B	DI	SG WWTP Wetwell No. 1 Influent Pump No. 2 LCS In Remote	SG-PLC
SG-IA-1	HSS-2010-2	DO	SG WWTP Wetwell No. 1 Influent Pump No. 2 Start/Stop	SG-PLC
SG-IA-1	YCI-2010-3A	DI	SG WWTP Wetwell No. 1 Influent Pump No. 3 In Remote	SG-PLC
SG-IA-1	YRI-2010-3	DI	SG WWTP Wetwell No. 1 Influent Pump No. 3 Running	SG-PLC
SG-IA-1	XA-2010-3	DI	SG WWTP Wetwell No. 1 Influent Pump No. 3 Fault	SG-PLC
SG-IA-1	TAH-2010-3	DI	SG WWTP Wetwell No. 1 Influent Pump No. 3 High Temperature	SG-PLC
SG-IA-1	MAH-2010-3	DI	SG WWTP Wetwell No. 1 Influent Pump No. 3 Leak	SG-PLC
SG-IA-1	YCI-2010-3B	DI	SG WWTP Wetwell No. 1 Influent Pump No. 3 LCS In Remote	SG-PLC
SG-IA-1	HSS-2010-3	DO	SG WWTP Wetwell No. 1 Influent Pump No. 3 Start/Stop	SG-PLC
SG-IA-1	ZS-2000-1	DI	SG WWTP Influent Lift Station Cabinet Intrusion Alarm	SG-PLC
SG-IA-1	JS-2000-1	DI	SG WWTP Influent Lift Station DC Power Fail	SG-PLC
SG-IC-1	FI-2740-1	AI	SG WWTP Clarifier No.1 RAS Flow	SG-PLC
SG-IC-1	FI-2740-2	AI	SG WWTP Clarifier No.2 RAS Flow	SG-PLC
SG-IC-1	AI-2720-1	AI	SG WWTP Aeration basin No.1 Dissolved Oxygen	SG-PLC
SG-IC-1	AI-2720-2	AI	SG WWTP Aeration basin No.2 Dissolved Oxygen	SG-PLC
SG-ID-1	PI-2311-1	AI	SG WWTP Aeration Blowers Outlet Pressure	SG-PLC
SG-IE-1	YCI-2401-1A	DI	SG WWTP Aeration Sludge Holding Tank Blower No. 1 In Auto	SG-PLC
SG-IE-1	YRI-2401-1	DI	SG WWTP Aeration Sludge Holding Tank Blower No. 1 Running	SG-PLC
SG-IE-1	XA-2401-1	DI	SG WWTP Aeration Sludge Holding Tank Blower No. 1 Fault	SG-PLC
SG-IE-1	YCI-2401-1B	DI	SG WWTP Aeration Sludge Holding Tank Blower No. 1 LCS In Remote	SG-PLC
SG-IE-1	HSS-2401-1	DO	SG WWTP Aeration Sludge Holding Tank Blower No. 1 Start/Stop	SG-PLC
SG-IE-1	PAH-2401-1	DI	SG WWTP Aeration Sludge Holding Tank Blower No. 1 Discharge High Pressure	SG-PLC

Drawing No.	ISA Tag Name and Loop No.	Type	Description	Destination
SG-IE-1	TAH-2401-1	DI	SG WWTP Aeration Sludge Holding Tank Blower No. 1 Discharge High Temperature	SG-PLC
SG-IE-1	YCI-2401-2A	DI	SG WWTP Aeration Sludge Holding Tank Blower No. 2 In Auto	SG-PLC
SG-IE-1	YRI-2401-2	DI	SG WWTP Aeration Sludge Holding Tank Blower No. 2 Running	SG-PLC
SG-IE-1	XA-2401-2	DI	SG WWTP Aeration Sludge Holding Tank Blower No. 2 Fault	SG-PLC
SG-IE-1	YCI-2401-2B	DI	SG WWTP Aeration Sludge Holding Tank Blower No. 2 LCS In Remote	SG-PLC
SG-IE-1	HSS-2401-2	DO	SG WWTP Aeration Sludge Holding Tank Blower No. 2 Start/Stop	SG-PLC
SG-IE-1	PAH-2401-2	DI	SG WWTP Aeration Sludge Holding Tank Blower No. 2 Discharge High Pressure	SG-PLC
SG-IE-1	TAH-2401-2	DI	SG WWTP Aeration Sludge Holding Tank Blower No. 2 Discharge High Temperature	SG-PLC
SG-IE-1	TAH-2000-1	DI	SG WWTP Aeration Sludge Holding Electrical Room High Temperature	SG-PLC
SG-IE-1	TAH-2000-2	DI	SG WWTP Aeration Sludge Holding Electrical Room High Temperature	SG-PLC
SG-IE-1	TAH-2000-3	DI	SG WWTP Aeration Sludge Holding Electrical Room High Temperature	SG-PLC
SG-IE-1	YCI-2001-1	DI	SG WWTP Generator Ready	SG-PLC
SG-IE-1	YRI-2001-1	DI	SG WWTP Generator Running	SG-PLC
SG-IE-1	XA-2001-1	DI	SG WWTP Generator Fault	SG-PLC
SG-IE-1	LAH-2001-1	DI	SG WWTP Generator Fuel Level Low	SG-PLC
SG-IF-1	FAH-2590-1	DI	SG WWTP Chemical System Area Eyewash Activated	SG-PLC
SG-IF-2	YCI-2550-1	DI	SG WWTP Sodium Bisulfite Feed Pump No. 1 In Remote	SG-PLC
SG-IF-2	YRI-2550-1	DI	SG WWTP Sodium Bisulfite Feed Pump No. 1 Running	SG-PLC
SG-IF-2	XA-2550-1	DI	SG WWTP Sodium Bisulfite Feed Pump No. 1 Fault	SG-PLC
SG-IF-2	HSS-2550-1	DO	SG WWTP Sodium Bisulfite Feed Pump No. 1 Start/Stop	SG-PLC
SG-IF-2	SI-2550-1	AI	SG WWTP Sodium Bisulfite Feed Pump No. 1 Speed Feedback	SG-PLC
SG-IF-2	SC-2550-1	AO	SG WWTP Sodium Bisulfite Feed Pump No. 1 Speed Setpoint	SG-PLC
SG-IF-2	PAH-2550-1	DI	SG WWTP Sodium Bisulfite Feed Pump No. 1 Discharge High Pressure	SG-PLC
SG-IF-2	YCI-2550-2	DI	SG WWTP Sodium Bisulfite Feed Pump No. 2 In Remote	SG-PLC
SG-IF-2	YRI-2550-2	DI	SG WWTP Sodium Bisulfite Feed Pump No. 2 Running	SG-PLC
SG-IF-2	XA-2550-2	DI	SG WWTP Sodium Bisulfite Feed Pump No. 2 Fault	SG-PLC
SG-IF-2	HSS-2550-2	DO	SG WWTP Sodium Bisulfite Feed Pump No. 2 Start/Stop	SG-PLC
SG-IF-2	SI-2550-2	AI	SG WWTP Sodium Bisulfite Feed Pump No. 2 Speed Feedback	SG-PLC
SG-IF-2	SC-2550-2	AO	SG WWTP Sodium Bisulfite Feed Pump No. 2 Speed Setpoint	SG-PLC
SG-IF-2	PAH-2550-2	DI	SG WWTP Sodium Bisulfite Feed Pump No. 2 Discharge High Pressure	SG-PLC
SG-IG-1	YCI-2600-1A	DI	SG WWTP Wet Weather Storage Tank Blower No. 1 In Auto	SG-PLC
SG-IG-1	YRI-2600-1	DI	SG WWTP Wet Weather Storage Tank Blower No. 1 Running	SG-PLC
SG-IG-1	XA-2600-1	DI	SG WWTP Wet Weather Storage Tank Blower No. 1 Fault	SG-PLC
SG-IG-1	YCI-2600-1B	DI	SG WWTP Wet Weather Storage Tank Blower No. 1 LCS In Remote	SG-PLC
SG-IG-1	HSS-2600-1	DO	SG WWTP Wet Weather Storage Tank Blower No. 1 Start/Stop	SG-PLC
SG-IG-1	PAH-2600-1	DI	SG WWTP Wet Weather Storage Tank Blower No. 1 Discharge High Pressure	SG-PLC
SG-IG-1	TAH-2600-1	DI	SG WWTP Wet Weather Storage Tank Blower No. 1 Discharge High Temperature	SG-PLC
SG-IG-1	YCI-2700-1A	DI	SG WWTP PECAN Branch Transfer Pump No. 1 In Auto	SG-PLC
SG-IG-1	YRI-2700-1	DI	SG WWTP PECAN Branch Transfer Pump No. 1 Running	SG-PLC

Drawing No.	ISA Tag Name and Loop No.	Type	Description	Destination
SG-IG-1	XA-2700-1	DI	SG WWTP PECAN Branch Transfer Pump No. 1 Fault	SG-PLC
SG-IG-1	HSS-2700-1	DO	SG WWTP PECAN Branch Transfer Pump No. 1 Start/Stop	SG-PLC
SG-IG-1	SI-2700-1	AI	SG WWTP PECAN Branch Transfer Pump No. 1 Speed	SG-PLC
SG-IG-1	SC-2700-1	AO	SG WWTP PECAN Branch Transfer Pump No. 1 Speed Setpoint	SG-PLC
SG-IG-1	YCI-2700-2A	DI	SG WWTP PECAN Branch Transfer Pump No. 2 In Auto	SG-PLC
SG-IG-1	YRI-2700-2	DI	SG WWTP PECAN Branch Transfer Pump No. 2 Running	SG-PLC
SG-IG-1	XA-2700-2	DI	SG WWTP PECAN Branch Transfer Pump No. 2 Fault	SG-PLC
SG-IG-1	HSS-2700-2	DO	SG WWTP PECAN Branch Transfer Pump No. 2 Start/Stop	SG-PLC
SG-IG-1	SI-2700-2	AI	SG WWTP PECAN Branch Transfer Pump No. 2 Speed	SG-PLC
SG-IG-1	SC-2700-2	AO	SG WWTP PECAN Branch Transfer Pump No. 2 Speed Setpoint	SG-PLC

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SECTION 406196 - PROCESS CONTROL DESCRIPTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions”.

1.2 SUMMARY

A. Applications Engineer System Supplier (AESS) Programming Scope

1. Develop the control system applications to implement the process control descriptions for all new and existing systems. This Section is provided to define control strategies to be used for PLC programming of the system.
2. The Contract Documents are a single integrated document, and as such, all Drawings, Specifications Divisions and Specifications Sections apply. It is the responsibility of the Contractor and Subcontractors to review all Sections to ensure a complete and coordinated project.
3. The PCSS is cautioned to read this Section and all related Sections and their entirety prior to starting any programming. Many general control strategies and requirements are defined once in the body of this Section with the specific requirement called out in the individual control strategy. Implement these general strategies throughout this Contract unless specifically directed otherwise in the individual loop process control descriptions.
4. Follow loop and device tagging criteria shown on the Drawings without exception.
5. Establish programming approach and database/variable identification standards prior to performing any programming work. Review the proposed standards and conventions with the Owner during the coordination workshop required by Section 406863 “Configuration of HMI Software.”

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121.20 “Process Control System Testing”.
3. Section 406126 “Process Control System Training”.
4. Section 406263 “Operator Interface Terminal”.
5. Section 406343 “Programmable Logic Controller”.
6. Section 406866 “Configuration of Controller Software”.
7. Section 407000 “Instrumentation for Process Systems”.

C. This specification section is a performance-based document, and it defines the minimum requirements. The PCSS shall furnish a fully integrated and operational system. Auxiliary and accessory programming structures necessary for proper system operation, performance, and failure contingency, for all new I/O, shall be included whether or not they are shown or described in the Contract Documents.

1.3 DEFINITIONS

A. Applications Engineering System Supplier (AESS): The entity who provides all programming, configuration, and related services for the control system equipment provided by the PCSS.

B. Human Machine Interface (HMI): A software-based user interface with supervisory level control of machine level equipment.

C. Input/Output (I/O): Analog or digital field instrument signals to be received and interpreted by a PLC.

D. Operator Interface Terminal (OIT): A hardware component of the SCADA system used for device level control and monitoring.

E. Operator Workstation (OWS): A hardware component of the SCADA system used for supervisory level control and monitoring.

F. Process Control System Supplier (PCSS): The entity responsible for providing all materials, equipment, labor, and services required to achieve a fully integrated and operational control system.

G. Programmable Logic Controller (PLC): A ruggedized programmable computer used for industrial automation.

H. Supervisor Control and Data Acquisition (SCADA): Hardware and software components used for high-level supervisory monitoring of industrial processes. Typical devices that are part of the SCADA network include computers (OWS), PLCs, Ethernet switches, OITs, and HMIs.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. Control System Hierarchy:

1. The control descriptions are broken into a hierarchical layer concept. There may be one layer or multiple layers per loop, depending upon that loop. An example of multiple layered loop is shown in Figure 1.

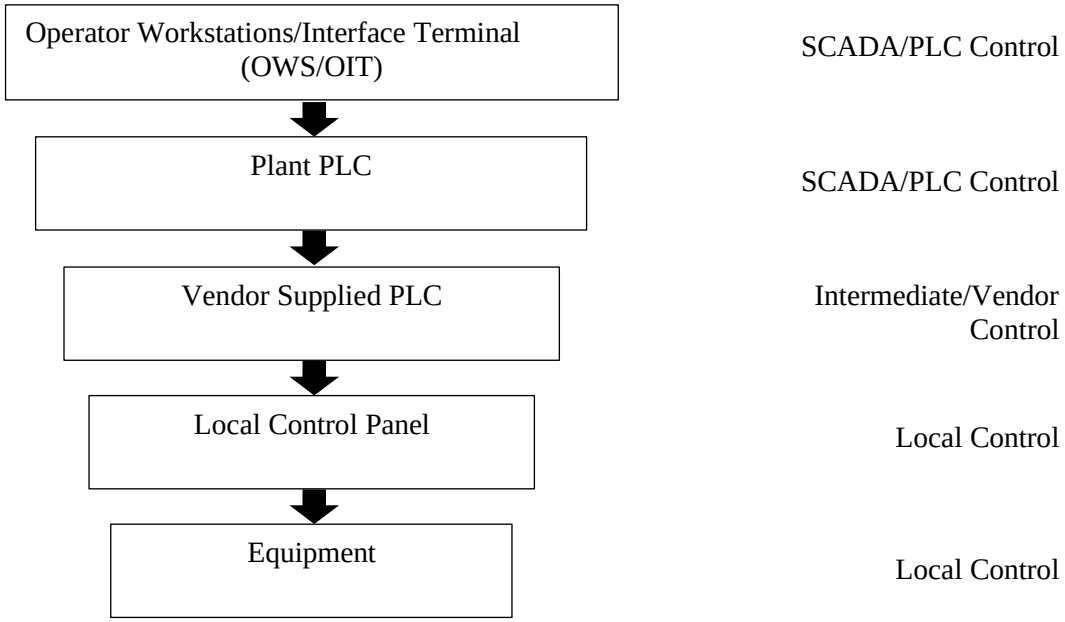

Figure 1. Control System Hierarchy

As shown in Figure 1, the lowest layer of control, local control, is at that piece of equipment or that piece of equipment's panel or drive. The second layer of control is at an intermediate control panel between the equipment and the SCADA I/O or vendor's PLC I/O. The third layer would be at the vendor's PLC or microprocessor touchscreen station. The highest layer of control is by the SCADA PLC System with its associated operator workstations (OWS) in the main control room, remote office locations, and satellite locations operator interface terminals (OITs). The SCADA PLC/ OWS refers to both the SCADA PLC, which does the actual monitoring and control logic for the process equipment and the SCADA operator workstation (OWS), which are computers that have graphical software that interface to the PLC software for monitoring and implementing all operator-required tasks to control that process equipment. Any functions done in the operator workstations also take place at all the SCADA OITs.

B. Loop Numbering:

1. The following is a list of areas and the loop numbers associated with each area for San Gabriel WWTP:

Coarse Bar Screen and Influent Lift Station (SG-IA-1)	2000-2099
Grit Basin (SG-IB-1 and SG-IB-2)	2100-2199
Treatment Unit and Return Activated Sludge (SG-IC-1)	2700-2799
Aeration Blower System (SG-ID-1)	2300-2399
Aeration Sludge Holding Tank Blower (SG-IE-1)	2400-2499
Sodium Bisulfite Storage and Feed (SG-IF-1 and SG-IF-2)	2500-2599
Wet Weather Storage Blower (SG-IG-1)	2600-2699
Pecan Branch Transfer Pumps (SG-IG-1)	2700-2749
Irrigation Transfer Pumps (SG-IH-1)	400-500

3.2 GENERAL CONTROLS AND MONITORING

A. Overview:

1. The hardware and/or software functions noted by this paragraph reference are to be implemented in the PLC control system.
2. Setpoints, as defined by this section, refer to numerical values adjustable from the HMI.
3. The PLC is responsible for resetting command bits sent from the HMI to the PLC. If the commanded state cannot be achieved for any reason, the PLC resets the bit to allow the operator to set the command bit again. For example, when pressing the AUTO button on the HMI, the PLC resets the AUTO command from the HMI after the device is in the AUTO Mode. If the AUTO Mode is not available for any reason, the PLC resets the bit, so the AUTO button can be selected at the HMI once AUTO control is available.

B. Interlocks:

1. Hardwired interlocks will interlock the controls locally, at the vendor PLC, and at the plant PLC. If the interlock occurs, the shutdown will cause the equipment to be inoperable at all levels of control.
2. Software interlocks are represented in a particular layer of the operation description and interlock the controls in that layer and the layers above it. However, the interlock does not interlock the commands in the layer before it. For example, a software interlock implemented at the SCADA/PLC level will not stop equipment from being controlled locally.
3. Interlocks that shutdown (stop a piece of equipment and prevent it from being restarted or moved) are displayed on the faceplate pop-up graphic for that piece of equipment.

C. Motors:

1. Provide monitoring and control of the signals shown on the P&IDs.
2. Hardwired and software interlocks are defined in individual loop descriptions.
3. Motors can be started manually by the operator at the HMI, or automatically by the control strategy.
4. Automatic control strategies are defined in individual loop descriptions.
5. The SCADA system stops a motor or drive, if it does not receive the AUTO or REMOTE status or one of its software interlocks trips. If the drive or motor is in HAND or LOCAL, it will continue to run but the SCADA start/stop output will be open.
6. If a motor stops for any reason, it cannot be restarted automatically once the problem with the motor has been resolved. A manual reset from the OWS or OIT is required to resume operation.
7. Motors that have a HAND-OFF-AUTO (HOA) selector, indicate to the operator that the pump is being run in the HAND position. A motor is being run in HAND when the AUTO position is not true and the run confirm status is true. If not in AUTO, the SCADA PLC output contact will open and stop (shutdown) the pump.

D. Valves:

1. Provide monitoring and control of the signals shown on the P&IDs.
2. Hardwired and software interlocks are defined in individual loop descriptions.
3. Valves with only full travel capability can be opened or closed manually by the operator at the HMI, or automatically by the control strategy.
4. Modulating valves with position feedback can be positioned between 0% and 100% open manually by the operator at the HMI, or automatically by the control strategy.

5. Automatic control strategies are defined in individual loop descriptions with their corresponding process variable used for control.

E. Analog Instruments:

1. Analog instruments refer to indicating devices capable of providing a continuous output relative to time.
2. Provide monitoring of the analog signals shown on the P&IDs.
3. Analog signals may be a continuous voltage (-10V to 10V, 0V to 5V, 0V to 10V) or current (0 mA to 20mA, 4mA to 20mA) as determined by the output of the field instrument. The output range corresponds to the minimum and maximum full-scale measurement.
4. The PLC will linearly scale the output range (voltage or current) to the equivalent values in engineering units.
5. Provide cutoff deadbands for when the analog signal is approaching the minimum or maximum full-scale measurement.

    a. An analog signal measuring less than or equal to 2 percent of full-scale will be forced to zero after an adjustable time delay.
    b. An analog signal measuring greater than 100 percent of full-scale will be clamped at 100 percent.

6. Provide a CALIBRATION mode with an adjustable time setpoint (in hours).

    a. When entering CALIBRATION mode, the last good value is held prior to CALIBRATION mode being activated. The value is held until the calibration time setpoint expires.
    b. The Operator may enter a calibration value, which will be the value held until the calibration time setpoint expires.
    c. When active, clearly indicate the instrument is in CALIBRATION mode on any local OITs and in the HMI system.

F. Discrete Instruments:

1. Discrete instruments refer to indicating devices with any number of non-continuous defined states (e.g., ON/OFF, 0 or 1)
2. Provide monitoring of the discrete signals shown on the P&IDs.

    a. When a contact or status from the instrument is true, the PLC will receive power to its input channel. The PLC registers this as a binary bit of 1.
    b. When a contact or status from the instrument is false, the PLC will receive no power (open circuit) to its input channel. The PLC registers this as a binary bit of 0.

G. PLC Hardware:

1. Monitor status and communication faults at the HMI.

    a. Implement watchdog timers to monitor CPU and I/O module health, and execution time for PLC routines.
    b. Generate an alarm at the HMI if any watchdog timer expires.

2. Program the system time for all PLCs to synchronize with a Network Time Protocol (NTP) server once every 24 hours.

H. Input Validation:

1. Provide input validation for setpoints used in process control (e.g., chemical dosage setpoints, pump flow setpoints).
2. The PLC will verify that the HMI setpoint is within an acceptable predefined range.
3. Out of range values will be rejected by the PLC and the current value will be retained.

3.3 HISTORICAL DATA COLLECTION

A. Provide historical data collection for all analog inputs, process control setpoints, flow totals, equipment runtimes, and discrete equipment statuses (ON/OFF), unless otherwise stated in the individual loop descriptions. Historical data collection is as follows:

Collection Options	
Collection Type:	Polled
Collection Interval:	1 minute
Collection Offset:	0 seconds
Time Resolution:	Milliseconds
Compression:	Enabled
Collector Deadband:	0.5 Percent Range
Collector Compression Timeout:	15 minutes

3.4 ACCUMULATORS AND TOTALIZERS

A. Accumulators:

1. Display accumulated run time for all equipment with a RUNNING status. Each run time accumulation is resettable from the HMI with a reset push button.
2. The PLC will update the flow totals at 12:00 a.m. local time.

Runtime	Display Format
Current Day:	XX.XX Hrs.
Yesterday:	XX.XX Hrs.
Current Month:	XXX.X Hrs.
Previous Month:	XXX.X Hrs.
Accumulated Total:	XXXXXX Hrs.

B. Flow Totalizers:

1. Totalize all flow indications.

   a. If the flowmeter provided has a configurable pulse output for totalized flow, perform flow totalization using the pulse output. The PLC calculates totalized flow by multiplying the number of pulses by the volume per pulse.
   b. If the flowmeter provided does not have a configurable pulse output for totalized flow, perform flow totalization using the analog 4-20mA signal.

      1) Do not totalize if the analog signal is outside the 4-20 mA range.
      2) Do not totalize if the value of the flow input is less than 2% of the full range of the input.

3) Do not totalize if a discrete status exists that can be used to determine if flow is present (for example, no flow can be present unless a pump is running).

2. Each flow totalization is resettable from the HMI/OIT with a reset push button.
3. Display totalized flow in million gallons (MG), thousands of gallons (kGal), or Gallons (Gal) in accordance with the following:

Totalizer	MG Format	kGal Format	Gal Format
Current Day:	X.XXX	XXX.XX	XXXX.X
Yesterday:	X.XXX	XXX.XX	XXXX.X
Current Month:	XXX.X	XXX.X	XXXX
Previous Month:	XXX.X	XXX.X	XXXX
Accumulated Total:	XXXX	XXXX	XXXX

4. Use appropriate flow totalizer units for the total volume anticipated for the time period. Unless requested by the Owner, water process flows are totalized in million gallons (MG) and chemical flows are totalized in gallons (Gal). Auxiliary flow (e.g., backwash) units are determined based on the total flow for the day.
5. Chemical systems which do not have flowmeters will calculate usage based on the chemical tank volume. The PLC will calculate tank volume based on the measured level and the vessel geometry or the measured weight and the specific weight of the chemical.
6. The PLC will update the flow totals at 12:00 a.m. local time.

3.5 ALARMING AND EQUIPMENT FAILURES

A. Analog Alarms:

1. Provide analog alarming capability for all analog signals monitored by the PLC.
2. Supervisor level users can set a common time setpoint (initially set to 5 seconds) that is used to generate alarms. The following alarms (setpoints to be Supervisor adjustable) are generated based on the analog feedback value. Each alarm includes the ability for individual enabling and disabling.

    a. High-High.
    b. High.
    c. Low.
    d. Low-Low.
    e. Loss of Signal.

3. LOSS OF SIGNAL alarm is generated when an analog signal goes outside the 4-20 mA range due to a failure at the instrument or PLC card. The following SCADA programming occurs:

    a. If the analog signal is used in a control loop or ratio control loop, that loop is placed into MANUAL.
    b. If the analog signal is used in a calculation, that calculation uses the last good analog signal. If the calculation is used in a control loop, that loop is placed into MANUAL.

4. SETPOINT REJECTED alarm is generated at the HMI when an analog setpoint is out of range and rejected by the PLC.

B. Discrete Alarms:

1. Program all discrete alarm signals wired to the PLC (float switches, pressure switches, overload alarms) to alarm after an HMI adjustable time delay expires.
2. The maximum alarm delay for Safety related alarms (e.g., E-stop) is 500ms. Set each alarm timer during startup.

C. Motor Failure Alarms:

1. Supervisor level users can set a common elapsed time setpoint for each scenario below:

a. Motors being remotely controlled generate a FAIL-TO-START alarm when the PLC sends the START command to the motor and it does not receive a RUNNING status from the motor after a supervisor adjustable time setpoint. When a FAIL-TO-START alarm is generated, the START output command from the PLC is deenergized and the motor is prevented from starting until a reset is issued from the HMI.
b. Motors being remotely controlled generate a FAIL-TO-STOP alarm when the PLC sends the STOP command to the motor and it continues to run after a supervisor adjustable time setpoint.
c. Motors with adjustable speed control generate a SPEED DEVIATION alarm when the motor is running and the PLC sends a speed setpoint to the motor and it does not reach the correct speed (within a deadband, initially set to 10%) within a supervisor adjustable time setpoint. The motor remains running if the SPEED DEVIATION alarm is activated.

D. Valve Failures:

1. Supervisor level users can set a common time setpoint that is used to generate the following alarms. When a valve position alarm is active, the PLC output is maintained unless explicitly stated in the individual loop descriptions (e.g., a fail to open alarm does not trigger the PLC to close the valve).

a. All discrete valves (OPEN-CLOSE) being remotely controlled generate a FAIL-TO-OPEN alarm when the PLC sends the OPEN command to the valve and it does not reach the OPENED limit within a supervisor adjustable time setpoint.
b. All discrete valves (OPEN-CLOSE) being remotely controlled generate a FAIL-TO-CLOSE alarm when the PLC sends the CLOSE command to the valve and it does not reach the CLOSED limit within a supervisor adjustable time setpoint.
c. All modulating valves (POSITIONING) being remotely controlled generate a FAIL-TO-POSITION alarm when the valve feedback does not match the PLC commanded position within a supervisor adjustable time setpoint.

3.6 AUTOMATIC CONTROLS

A. Lead/Lag and Duty/Standby Strategy:

1. Pump Priority:

a. When pumps are called to operate by the automatic sequence, the order of their priority is determined by the following mode selection.
1) Operator Mode: The operator manually selects the priority of each pump (LEAD/LAG/STANDBY/OFFLINE) using radio buttons on a popup display. The order can be changed at any time, but no two pumps can be

selected to have the same priority. The pump cannot run in automatic mode or be used in any of the following automatic sequences if placed OFFLINE.

2) Alternation Mode: Used for pumps operating in a DUTY/STANDBY configuration. The pump priorities are rotated each time the DUTY pump is stopped by the control strategy.
3) Sequential Mode: Used for groups of three or more pumps (e.g., LEAD/LAG/STANDBY). The pumps are inserted into the sequence in ascending numerical order and the PLC rotates the pumps using a revolving queue. After an adjustable time setpoint expires, the LEAD pump becomes the STANDBY and the previous LAG pump becoming the new LEAD.

2. Automatic Operation:

a. If the individual loop description requires that the pumps operate in the LEAD/LAG/STANDBY mode, the LAG is called to start when the following conditions are met after a time delay. If more than one LAG pump is included in the strategy (LEAD/LAG1/LAG2/STANDBY), the sequence repeats.

1) The LEAD pump is running at maximum speed for an adjustable length of time.
2) The process variable being controlled is more than 5% from the target value. For example, in flow control, the flow must be 5% below the target.

b. If multiple pumps are called to run by the automatic logic, the pumps will run at the same speed.
c. If the automatic strategy determines that a pump is needed and the pump for the required sequence position is unavailable, the pump with the next highest position immediately starts.
d. If the individual loop description requires the pumps to operate in the DUTY/STANDBY mode, the STANDBY pump only starts if the DUTY pump is not available to run when called to start by the automatic strategy.

B. PID Control:

1. When individual control loops require PID control, use the PLC manufacturer's standard PID control functions. Provide a PID faceplate with the following parameters:

a. Setpoint (SP): Reference to the setpoint. This is the setpoint entered (either manually from the HMI or via program logic, as required by the individual loop description) and is maintained by the PID controller.
b. Process Variable (PV): Reference to the process variable. The process variable is the feedback from a field device or instrument for comparison to the SP by the PID controller.
c. Output (CV): Reference to the controlled variable. This is the signal varied by the PID controller in order to maintain the PV at the desired SP.

2. PID controller accepts inputs for proportional (P), integral (I), and derivative (D) setpoints used to tune the controller response. PID tuning parameters can be entered manually by the Operator at the HMI or calculated automatically if the PID controller supports autotuning functionality.
3. Operator can place the PID controller in MANUAL or AUTOMATIC mode.

a. In MANUAL, the Operator will enter the desired output (CV). The PID controller will use setpoint tracking to write the process variable (PV) to the controller setpoint (SP) to ensure bumpless transfer when the controller is switched from MANUAL to AUTO.
b. In AUTO, the PID controller adjusts the output (CV) to hold the process variable (PV) at the setpoint (SP).

4. Configure PID controller to prevent reset windup when operating in MANUAL mode or when the output (CV) has reached maximum limit.

C. Chemical Flow Pacing:

1. Provide the following control for individual loops referencing automatic flow pacing.
2. The individual loop description defines the process flow meter used for flow pacing.
3. Control the speed of the chemical feed pump proportionally to the flow rate. An adjustable DOSAGE SETPOINT (mg/L) and CHEMICAL WEIGHT (lb/gal) are entered from the HMI. The feed rate calculation is based on the following equation (**Eq.1**):

$FR = Chemical\ Feed\ Rate\ \left(\frac{Gal}{hr}\right)$[Calculated in **Eq. 1**]
$Dose = Dosage\ Setpoint\ \left(\frac{mg}{L}\right)$ [Operator Adjustable Setpoint from HMI]
$Flow = Process\ Flow\ Rate(MGD)$ [Feedback from flow meter defined in individual loop description]
$Weight = Chemical\ Weight\ \left(\frac{lb}{gal}\right)$ [Operator Adjustable Setpoint from HMI]

Eq. 1

$$FR = Dose * Flow * \frac{8.34}{24 * Weight}$$

An HMI adjustable setpoint allows the operator to enter the PUMP CAPACITY (gal/hr). The PUMP SPEED OUTPUT is calculated as follows (**Eq. 2**):

$OP = Pump\ Speed\ Output$ (%) [Calculated in **Eq. 2**]
$FR = Chemical\ Feed\ Rate\ \left(\frac{Gal}{hr}\right)$ [Calculated in **Eq. 1**]
$PC = Pump\ Capacity\ \left(\frac{gal}{hr}\right)$ [Operator Adjustable Setpoint from HMI]
$PS = Pump\ Stroke$ (%) [Operator Adjustable Setpoint from HMI, initially set at 100%]

Eq. 2

$$OP = \frac{FR}{PC * \left(\frac{PS}{100}\right)} * 100\%$$

3.7 INDIVIDUAL CONTROL DESCRIPTIONS AND CONTROL SEQUENCES

LOOP 2000-1 SAN GABRIEL – MULTIPLE RAKE BAR SCREEN (Packaged System)
PLC: SG-PLC
P&ID: SG-IA-1

A. General:

1. One multi-rake type mechanical bar screen (SCR-2000-1) is located upstream of the influent lift station. Under normal operating conditions, the mechanical bar screen is used for screening all incoming raw wastewater. Slide gates allow flow to bypass the screen, if needed, during peak storm events or screen maintenance.

2. The mechanical bar screen system is a vendor-supplied package that meets the requirements of specification Section 462113.

3. Wastewater enters the screening channels from the influent sewer. The bar screen removes large objects and debris from the wastewater flow before it is gravity flown into the influent lift station. Debris collected by the screen is deposited into a garbage can for disposal.

4. Ultrasonic level instruments are located upstream and downstream of the mechanical bar screen to provide a differential level measurement which may be used to signal the bar screen to run. The screen may also be run on a timed basis or manually, as necessary.

B. Control:

Hardwired Interlocks:

Refer to Section 462113 for additional details on hardwired interlocks.

Local Control Panel:

Software Interlock:
Refer to Section 462113 for software interlock.

On/Off Features:

Refer to Section 462113 for controls.

SCADA PLC/OWS: Monitoring only.

Alarms / Monitoring:

Local:

Refer 462113 Multi-Rake Bar Screen Specification for additional alarms.

SCADA PLC/OWS:

At minimum, the following signals are to be provided to SCADA for monitoring via Ethernet connection.
a. Bar Screen in Auto (YCI-2000-1)
b. Bar Screen Speed (SI-2000-1)
c. Bar Screen Running in Reverse (YRR-2000-1)
d. Bar Screen Running in Forward (YRF-2000-1)
e. Bar Screen Common Fault (XA-2000-1A)
f. Bar Screen Overload (XA-2000-1B)
g. Bar Screen E-Stop (XA-2000-1C)
h. Screen Channel Upstream High Level (LAH-2000-1)
i. Screen Channel Downstream High Level (LAH-2000-2)
j. Screen Channel Differential Level (LI-2000-1)

Coordinate with packaged system supplier for a full listing of alarms and monitoring parameters.

LOOP 2005-1 SAN GABRIEL – INFLUENT LIFT STATION LEVEL

PLC: SG-PLC
P&ID: SG-IA-1.

A. General:

1. The influent wet well shall be fitted with a Guided Wave Radar level transmitter (LE/LIT-2005-1) to provide continuous level measurement to SCADA. This level shall be utilized for influent pumps operation.

2. Upon failure of the PLC, the float switches shall take over the control locally at the MCC via relay logic.

3. Method of control via the SCADA HMI is that the pumps start and stop based on the wet well level (as indicated by the transmitter in the wet well).

B. Control:

1. Local:

None.

2. SCADA PLC/OWS:

The influent pumps shall be controlled based on the influent level value. The operator shall enter a level setpoint at the SCADA PLC/OWS.

C. Alarms/Monitoring:

1. Local:

Level indication (LIT-2005-1)

2. SCADA PLC/OWS:

Level Indication (LI-2005-1)
Calculated Level High Alarm (LAH-2005-1)
Calculated Level High-High Alarm (LAHH-2005-1)
Calculated Level Low Alarm (LAL-2005-1)
Calculated Level Low-Low Alarm (LALL-2005-1)

LOOP 2010-1 SAN GABRIEL – INFLUENT LIFT STATION LEVEL SWITCHES

PLC: SG-PLC
P&ID: SG-IA-1.

A. General:

1. Lift station shall be fitted with four float switches intended to provide a backup means of pump control if LIT or PLC fails and installed at the following elevations:
   a. LSHH (LSHH-2010-1) installed at 672.42
   b. LSH (LSH-2010-1) installed at 671.42
   c. LSL (LSL-2010-1) installed at 670.42
   d. LSLL (LSLL-2010-1) installed at 668.50

B. Control:

1. Local:

None.

2. SCADA PLC/OWS:

a. In case of Level transmitter failure, the float switches (LSL & LSH) shall be utilized as a backup for influent pump operations from SG-PLC. These floats shall be only for alarming purpose at SCADA if the level transmitter healthy.

b. Low Low-level switch interlocks to the motor starter to trip the influent pumps regardless of operation mode.

c. Low level and High-Level switches also interlock to the motor starter. In case of PLC failure, these floats shall be utilized to operate the influent pumps at the MCC.

C. Alarms/Monitoring:

1. Local:

None.

2. SCADA PLC/OWS:

Level Low-Low Alarm (LALL-2010-1)
Level Low Alarm (LAL-2010-1)
Level High Alarm (LAH-2010-1)
Level High-High Alarm (LAHH-2010-1)

LOOP 2010-X SAN GABRIEL – INFLUENT PUMPS
PLC: SG-PLC
P&ID: SG-IA-1

A. General:

1. There are three influent pumps (PMP-2010-X). These pumps deliver raw influent from the lift station to the headworks. The influent pumps operate as Lead/Lag/Standby configuration and operate based on lift station level Transmitter (LIT-2005-1) along with float switches(LSH/LSL-2010-1) as a backup. The operator can select which pump is lead and which pump is lag at SCADA PLC/OWS or automatically alternated based on a Pumps Alternate Timer (Operator adjustable, 0-XX hours). X denotes the pump number 1/2/3.

B. Control:

Hardwired Interlocks:

- The high motor winding temperature (TSH-2010-X), leak detection (MSH-2010-X), E-STOP shall be wired to the motor starter. If any one of the switches is tripped, then the motor shall stop.

- A pressure switch (PSH-2010-X) will be installed to monitor the discharge pressure of each pump. The motor shall be prohibited from operation and an alarm sent to SCADA upon activation of the switch.

- A Low-Low cutoff level float (LSLL) will be set at elevation defined above and the mechanical drawings. The low-low alarm shall stop all

operating pumps upon activation on falling level regardless of Hand or Auto operation.

- Low level (LSL) and High-Level (LSH) floats are also set at elevation defined above and the mechanical drawings. These floats interlock to the motor starter for pump operations at MCC. In case of PLC failure, these floats shall be utilized to operate the influent pumps at the MCC in Hand mode.

Local Control Station:

Local: When the Local/Off/Remote selector switch (HS) is in the "Local" position, the pump can be started or stopped through the pushbuttons.

Off: When the Local/Off/Remote selector switch (HS) is in the "Off" position, the pump cannot be operated from locally or remotely.

Remote: When the Local/Off/Remote selector switch (HS) is in the "Remote" position, pump control is transferred to the Motor starter at MCC.

MCC:

Hand: When the Hand/Off/Auto selector switch (HS) is in the "Hand" position, the pump can be started or stopped through the pushbuttons of the motor starter at MCC.

Off: When the Hand/Off/Auto selector switch (HS) is in the "Off" position, the pump cannot be operated from the locally or remotely.

Auto: When the Hand/Off/Auto selector switch (HS) is in the "Auto" position, pump control is transferred to the SCADA PLC/OWS.

SCADA PLC/OWS:

The operator shall enter Lift station LEAD SETPOINT, LAG SETPOINT and STOP LEVEL SETPOINT based upon the Lift station level. These setpoints shall be common for all Influent Lift Station Pumps.

Software Interlock:

If the high motor winding temperature (TAH) or Leak (MAH) are detected at the SCADA PLC/OWS system, the pump shall stop.

If the Lift station high-high level (LAHH) is detected at the SCADA PLC/OWS system, the running pump shall stop irrespective any operational modes.

On/Off Features:

Manual: The pump can be manually started or stopped (HSS) by the operator at the SCADA PLC/OWS.

Auto: Pump Control is primarily based on the wet well level transmitter (LIT) and secondarily on level floats (LSL/LSH). The float switches are only intended as backup to the Level transmitter(LIT) and all floats expect LSLL will not override the LIT.

The pumps shall operate in a Lead/Lag/Standby sequence. The operator shall enter the level setpoints for the Lead and Lag pumps to start and stop.

The operator shall select which pump is lead or lag or standby when all pumps are placed in Auto or automatically alternated based on a Pumps Alternate Timer (Operator adjustable, 0-XX hours). Provide alteration sequence based on articles of section 3.6 "Automatic Controls," "lead/lag and Duty/Standby Strategy".

Lead: When the level in lift station rises above the 'Start Lead Pump' setpoint for an adjustable amount of time, the Lead pump will be called to start.

Lag: As the level in the lift station continues to increase and rises above the 'Start Lag' setpoint plus an adjustable offset value, the Lag pump will be called to start.

The two pumps will run together until the level in the wet well drops below the stop setpoint, at which all pumps will stop.

Standby: The standby pump shall automatically start when a lead or lag pump fails and is not stopped by the operator.

Failover: When the pump is chosen as the lag pump, it shall automatically assume the lead role when original lead pump fails or is stopped by an interlock but is not stopped by the operator.

C. Alarms/Monitoring:

Local Control Station:

Influent Pump No. 1 Run Light (YRL-2010-1A)
Influent Pump No. 1 Fault Light (XL-2010-1A)
Influent Pump No. 2 Run Light (YRL-2010-2A)
Influent Pump No. 2 Fault Light (XL-2010-2A)
Influent Pump No. 3 Run Light (YRL-2010-3A)
Influent Pump No. 3 Fault Light (XL-2010-3A)

MS Control Panel:

Influent Pump No. 1 Run Light (YRL-2010-1B)

Influent Pump No. 1 Fault Light (XL-2010-1B)
Influent Pump No. 1 LCS Remote Light (YCL-2010-1)
Influent Pump No. 2 Run Light (YRL-2010-2B)
Influent Pump No. 2 Fault Light (XL-2010-2B)
Influent Pump No. 2 LCS Remote Light (YCL-2010-2)
Influent Pump No. 3 Run Light (YRL-2010-3B)
Influent Pump No. 3 Fault Light (XL-2010-3B)
Influent Pump No. 3 LCS Remote Light (YCL-2010-3)

SCADA PLC/OWS:

Influent Pump No. 1 In Auto Indication (YCI-2010-1A)
Influent Pump No. 1 Running Indication (YRI-2010-1)
Influent Pump No. 1 Fault Alarm (YFI-2010-1)
Influent Pump No. 1 Motor High Temperature Alarm (TAH-2010-1)
Influent Pump No. 1 Leak Alarm (MAH-2010-1)
Influent Pump No. 1 LCS In Remote Indication (YCI-2010-1B)
Influent Pump No. 1 High Discharge Pressure Switch Alarm (PAH-2010-1)
Influent Pump No. 1 Start/Stop Command (HSS-2010-1)
Influent Pump No. 2 In Auto Indication (YCI-2010-2A)
Influent Pump No. 2 Running Indication (YRI-2010-2)
Influent Pump No. 2 Fault Alarm (YFI-2010-2)
Influent Pump No. 2 Motor High Temperature Alarm (TAH-2010-2)
Influent Pump No. 2 Leak Alarm (MAH-2010-2)
Influent Pump No. 2 LCS In Remote Indication (YCI-2010-2B)
Influent Pump No. 2 High Discharge Pressure Switch Alarm (PAH-2010-2)
Influent Pump No. 2 Start/Stop Command (HSS-2010-2)
Influent Pump No. 3 In Auto Indication (YCI-2010-3A)
Influent Pump No. 3 Running Indication (YRI-2010-3)
Influent Pump No. 3 Fault Alarm (YFI-2010-3)
Influent Pump No. 3 Motor High Temperature Alarm (TAH-2010-3)
Influent Pump No. 3 Leak Alarm (MAH-2010-3)
Influent Pump No. 3 LCS In Remote Indication (YCI-2010-3B)
Influent Pump No. 3 High Discharge Pressure Switch Alarm (PAH-2010-3)
Influent Pump No. 3 Start/Stop Command (HSS-2010-3)

LOOP 2100 SAN GABRIEL – GRIT REMOVAL SYSTEM (Packaged System)
PLC: GRIT PLC (vendor provided)
P&ID: SG-IB-1 & SG-IB-2

A. General:

1. Screened wastewater flows from the headworks to the grit removal system. The grit removal system consists of one stacked tray vortex grit concentrator, two Grit Pumps, and One Grit Classifier. The bottom of the stacked tray vortex grit concentrator is equipped with a fluidizing water line. The fluidizing water pipe contains a motorized ball valve which shall be controlled locally and through the vendor MCP. The fluidizing water valve shall remain open when the stacked tray vortex concentrator is online.

2. The Grit pumps and washer classifier components are controlled by the Grit Removal System Master Control Panel (MCP-2110-1), which includes a PLC and serves as the logic control for the Grit Removal System.

B. Control:

Hardwired Interlocks:

Refer to Sections 462323 and 462363 for any hardwired interlocks.

Local Control Panel:

Software Interlock:

Refer to Sections 462323 and 462363 for any software interlock.

On/Off Features:

When the Local/Off/Remote switch at the MCP is in Remote, the washer classifier and grit screw shall be controlled from the Master Control Panel.

The operator shall be able to start stirrer and grit screw running and stop screen running from the OIT.

Refer to Sections 462323 and 462363 for detailed controls.

SCADA PLC/OWS: Monitoring only.

C. Alarms/Monitoring:

Local:

Refer to Sections 462323, 462363 for alarms at MCP.

SCADA PLC/OWS:

Display all modes of operation
Display all sequence steps and states
Display all physical states of each mechanical device
Display all readouts and status of each instrument

Coordinate with packaged system supplier for a full listing of alarms and monitoring parameters.

LOOP 2720-X SAN GABRIEL – TREATMENT UNITS DISSOLVED OXYGEN
PLC: SG-PLC
P&ID: SG-IC-1

A. General:

1. Continuous dissolved oxygen measurement of the treatment units are done through dissolved oxygen analyzer(AIT-2720-X) in each unit. X denotes the treatment units 1/2.

B. Control:

1. Local:

a. None.

2. SCADA PLC/OWS:

a. None.

C. Alarms/Monitoring:

1. Local:

a. Dissolved Oxygen Indication (AIT-2720-X)

2. SCADA PLC/OWS:

Dissolved Oxygen Indication (AI-2720-X)
Calculated Dissolved Oxygen High Alarm (AAH-2720-X)
Calculated Dissolved Oxygen High-High Alarm (AAHH-2720-X)
Calculated Dissolved Oxygen Low Alarm (AAL-2720-X)
Calculated Dissolved Oxygen Low-Low Alarm (AALL-2720-X)

LOOP 2740 SAN GABRIEL – RAS FLOWMETER VAULT FLOW
PLC: SG-PLC
P&ID: SG-IC-1

A. General:

1. Continuous flow measurement of each RAS line is done through a strap-on doppler flow meter. X denotes the treatment units 1/2.

B. Control:

1. Local:

a. None.

2. SCADA PLC/OWS:

a. None.

C. Alarms/Monitoring:

1. Local:

a. None.

2. SCADA PLC/OWS:

Flow Indication (FI-2740-X)
Calculated Flow High Alarm (FAH-2740-X)
Calculated Flow High-High Alarm (FAHH-2740-X)
Calculated Flow Low Alarm (FAL-2740-X)
Calculated Flow Low-Low Alarm (FALL-2740-X)

LOOP 2310-X SAN GABRIEL – AERATION BLOWERS
PLC: SG-PLC
P&ID: SG-ID-1

A. General:

1. There are four aeration blowers (BLR-2310-X). These blowers supply low-pressure air to the treatment units. X denotes the blower number 1/2/3/4.

B. Control:

Hardwired Interlocks:

The high motor winding temperature (TE) shall be wired to the motor starter and when the temperature high alarm shall trip the motor. The motor inlet bearing and outlet bearing vibration transmitters (VIT) shall be wired to the vendor provided local control panel and if the vibration reaches the trip setpoint the motor shall stop. When the E-stop push button is pressed, the blower shall stop.

MS Control Panel:

Hand: When the Hand/Off/Auto selector switch (HS) is in the "Hand" position, the blower can be started or stopped through the pushbuttons.

Off: When the Hand/Off/Auto selector switch (HS) is in the "Off" position, the blower cannot be operated from the MS panel or remotely.

Auto: When the Hand/Off/Auto selector switch (HS) is in the "Auto" position, blower control is transferred to the SCADA PLC/OWS.

Local Control Panel:

Refer to Sections 431118 for detailed operation at LCP.

SCADA PLC/OWS:

SCADA PLC shall be used to monitor the blower. Refer to Sections 431118 for any additional controls.

C. Alarms/Monitoring:

Local Control Station:

Aeration Blower No. 1 Run Light (YRL-2310-1)
Aeration Blower No. 1 Fault Light (XL-2310-1)
Aeration Blower No. 2 Run Light (YRL-2310-2)
Aeration Blower No. 2 Fault Light (XL-2310-2)
Aeration Blower No. 3 Run Light (YRL-2310-3)
Aeration Blower No. 3 Fault Light (XL-2310-3)
Aeration Blower No. 4 Run Light (YRL-2310-4)
Aeration Blower No. 4 Fault Light (XL-2310-4)

MS Control Panel:

Aeration Blower No. 1 Run Light (YRL-2310-1D)
Aeration Blower No. 1 Fault Light (XL-2310-1E)
Aeration Blower No. 1 LCS Remote Light (YCL-2310-1A)
Aeration Blower No. 1 In Auto Light (YCL-2310-1B)
Aeration Blower No. 2 Run Light (YRL-2310-2D)
Aeration Blower No. 2 Fault Light (XL-2310-2E)
Aeration Blower No. 2 LCS Remote Light (YCL-2310-2A)
Aeration Blower No. 2 In Auto Light (YCL-2310-2B)
Aeration Blower No. 3 Run Light (YRL-2310-3D)
Aeration Blower No. 3 Fault Light (XL-2310-3E)
Aeration Blower No. 3 LCS Remote Light (YCL-2310-3A)
Aeration Blower No. 3 In Auto Light (YCL-2310-3B)
Aeration Blower No. 4 Run Light (YRL-2310-4D)
Aeration Blower No. 4 Fault Light (XL-2310-4E)
Aeration Blower No. 4 LCS Remote Light (YCL-2310-4A)
Aeration Blower No. 4 In Auto Light (YCL-2310-4B)

SCADA PLC/OWS:

Aeration Blower No. 1 In Auto Indication (YCI-2310-1)
Aeration Blower No. 1 Running Indication (YRI-2310-1)
Aeration Blower No. 1 Fault Alarm (YFI-2310-1)
Aeration Blower No. 1 Motor High Temperature Alarm (TAH-2310-1)
Aeration Blower No. 1 Amps Indication (II-2310-1)
Aeration Blower No. 1 Inlet Bearing Vibration Indication (VI-2310-1A)
Aeration Blower No. 1 Outlet Bearing Vibration Indication (VI-2310-1B)
Aeration Blower No. 1 KWH Indication (JI-2310-1)
Aeration Blower No. 2 In Auto Indication (YCI-2310-2)
Aeration Blower No. 2 Running Indication (YRI-2310-2)
Aeration Blower No. 2 Fault Alarm (YFI-2310-2)
Aeration Blower No. 2 Motor High Temperature Alarm (TAH-2310-2)
Aeration Blower No. 2 Amps Indication (II-2310-2)
Aeration Blower No. 2 Inlet Bearing Vibration Indication (VI-2310-2A)
Aeration Blower No. 2 Outlet Bearing Vibration Indication (VI-2310-2B)
Aeration Blower No. 2 KWH Indication (JI-2310-2)
Aeration Blower No. 3 In Auto Indication (YCI-2310-3)
Aeration Blower No. 3 Running Indication (YRI-2310-3)
Aeration Blower No. 3 Fault Alarm (YFI-2310-3)
Aeration Blower No. 3 Motor High Temperature Alarm (TAH-2310-3)
Aeration Blower No. 3 Amps Indication (II-2310-3)
Aeration Blower No. 3 Inlet Bearing Vibration Indication (VI-2310-3A)
Aeration Blower No. 3 Outlet Bearing Vibration Indication (VI-2310-3B)
Aeration Blower No. 3 KWH Indication (JI-2310-2)
Aeration Blower No. 4 In Auto Indication (YCI-2310-4)
Aeration Blower No. 4 Running Indication (YRI-2310-4)
Aeration Blower No. 4 Fault Alarm (YFI-2310-4)
Aeration Blower No. 4 Motor High Temperature Alarm (TAH-2310-4)
Aeration Blower No. 4 Amps Indication (II-2310-4)
Aeration Blower No. 4 Inlet Bearing Vibration Indication (VI-2310-4A)
Aeration Blower No. 4 Outlet Bearing Vibration Indication (VI-2310-4B)

Aeration Blower No. 4 KWH Indication (JI-2310-4)

LOOP 2401-X SAN GABRIEL – AERATED SLUDGE HOLDING TANK BLOWERS
PLC: SG-PLC
P&ID: SG-IE-1

A. General:

1. There are two ASHT blowers (BLR-2401-X). The ASHT blowers deliver air to the sludge holding tank. The ASHT blowers operate in Duty/Standby configuration. The operator can select which blower is duty and which blower is standby at the blower local control station (LCS-2401-X) that offers local control to blowers 1 and 2.

B. Control:

Hardwired Interlocks:

- A temperature switch (TSH-2401-X) and pressure switch (PSH-2401-X) will be installed to monitor the discharge temperature and discharge pressure of each blower. The motor shall be prohibited from operation and an alarm sent to SCADA upon activation of these switches.

Local Control Station:

Local: When the Local/Off/Remote selector switch (HS) is in the "Local" position, the blower can be started or stopped through the pushbuttons.

Off: When the Local/Off/Remote selector switch (HS) is in the "Off" position, the blower cannot be operated from Local Control Station.

Remote: When the Local/Off/Remote selector switch (HS) is in the "Remote" position, blower control is transferred to the MS Control Panel.

MS Control Panel:

Hand: When the Hand/Off/Auto selector switch (HS) is in the "Hand" position, the blower can be started or stopped through the pushbuttons.

Off: When the Hand/Off/Auto selector switch (HS) is in the "Off" position, the blower cannot be operated from the MS panel or remotely.

Auto: When the Hand/Off/Auto selector switch (HS) is in the "Auto" position, blower control is transferred to the MS Control Panel.

SCADA PLC/OWS:

Software Interlock:

None.

On/Off Features:

Manual: The blower can be manually started or stopped (HSS) by the operator at the Local Control Station and at Motor Control Center.

Auto: None.

The operator shall select whether the blower is Duty or Standby and alternation between duty and standby shall be manual.

C. Alarms/Monitoring

Local Control Station:

ASHT Blower No. 1 Run Light (YRL-2401-1A)
ASHT Blower No. 1 Fault Light (XL-2401-1B)
ASHT Blower No. 2 Run Light (YRL-2401-2A)
ASHT Blower No. 2 Fault Light (XL-2401-2B)

MS Control Panel:

ASHT Blower No. 1 Run Light (YRL-2401-1D)
ASHT Blower No. 1 Fault Light (XL-2401-1E)
ASHT Blower No. 1 LCS Remote Light (YCL-2401-1A)
ASHT Blower No. 1 In Auto Light (YCL-2401-1B)
ASHT Blower No. 2 Run Light (YRL-2401-2D)
ASHT Blower No. 2 Fault Light (XL-2401-2E)
ASHT Blower No. 2 LCS Remote Light (YCL-2401-2A)
ASHT Blower No. 2 In Auto Light (YCL-2401-2B)

SCADA PLC/OWS:

ASHT Blower No. 1 In Auto Indication (YCI-2401-1A)
ASHT Blower No. 1 Running Indication (YRI-2401-1)
ASHT Blower No. 1 Fault Alarm (YFI-2401-1)
ASHT Blower No. 1 Start/Stop Command (HSS-2401-1)
ASHT Blower No. 1 LCS In Remote Indication (YCI-2401-1B)
ASHT Blower No. 1 High Pressure Alarm (PAH-2401-1)
ASHT Blower No. 1 High Temperature Alarm (TAH-2401-1)
ASHT Blower No. 2 In Auto Indication (YCI-2401-2A)
ASHT Blower No. 2 Running Indication (YRI-2401-2)
ASHT Blower No. 2 Fault Alarm (YFI-2401-2)
ASHT Blower No. 2 Start/Stop Command (HSS-2401-2)
ASHT Blower No. 2 LCS In Remote Indication (YCI-2401-2B)
ASHT Blower No. 2 High Pressure Alarm (PAH-2401-2)
ASHT Blower No. 2 High Temperature Alarm (TAH-2401-2)

LOOP 2550-X SAN GABRIEL – SODIUM BISULFITE FEED SYSTEM
PLC: SG-PLC

P&ID: SG-IF-2

A. General:

There are two sodium bisulfite metering pumps (PMP-2550-X). These pumps pump sodium bisulfite chemical to the chlorine contact mix chamber. The pumps operate as Duty/Standby. The operator can select which pump is the duty and which pump is the standby pump at SCADA PLC/OWS. The sodium bisulfite metering pumps have automated control from the SCADA PLC/OWS with adjustable dosage setpoints. X denotes the pump number 1/2.

B. Control:

Hardwired Interlocks:

None.

Local Integral Pump Control:

Local: When the pump is in Local control mode, the pump can be started or stopped, and the speed of the pump can be varied through the pump control interface on the pump.

Off: When the pump is in the "Off" state, the pump cannot be operated locally or remotely.

Remote: When the pump is in Remote control mode, the pump control is transferred to the SCADA PLC/OWS.

SCADA PLC/OWS:

Software Interlock:

If the high discharge pressure switch (PSH) is tripped, the metering pump shall stop.

On/Off Features:

Manual: The pump can be manually started or stopped (HSS) by the operator at the SCADA PLC/OWS.

Auto: The operator shall select which pump is duty or standby when both pumps are placed in Auto.

Duty: The pump shall start once placed on duty and the operator initiates the start command.

Standby: When the pump is chosen as the standby pump, it shall automatically start when the duty pump, fails, and is not stopped by the operator.

The operator shall also select whether the alternation between duty and standby shall be manual or by a timer mode. If the operator selects the timer mode, the operator shall enter the length of time between alternations.

When the duty pump is running and the SCADA PLC/OWS timer mode selects the standby pump as duty, the SCADA PLC/OWS shall start the new duty pump and then stop the new standby pump (old duty) once the new duty pump is running.

Speed Adjustment Features:

Manual: When the speed control loop is placed in Manual, the operator will be able to manually adjust the speed (SC) of the pump controller at the SCADA PLC/OWS.

Auto: The percent speed of the pump, through the PLC analog output signal, controlling percent pump speed to maintain the operator-entered chemical dosage set-point.

C. Alarms / Monitoring:

Local:

None.

SCADA PLC/OWS:

Sodium Bisulfite Feed Pump No. 1 In Remote Indication (YCI-2550-1)
Sodium Bisulfite Feed Pump No. 1 Motor Run Indication (YRI-2550-1)
Sodium Bisulfite Feed Pump No. 1 Fault Alarm (XA-2550-1)
Sodium Bisulfite Feed Pump No. 1 Speed Indication (SI-2550-1)
Sodium Bisulfite Feed Pump No. 1 High Discharge Pressure (PAH-2550-1)
Sodium Bisulfite Feed Pump No. 1 Start/Stop Command (HSS-2550-1)
Sodium Bisulfite Feed Pump No. 1 Speed Command (SC-2550-1)
Sodium Bisulfite Feed Pump No. 2 In Remote Indication (YCI-2550-2)
Sodium Bisulfite Feed Pump No. 2 Motor Run Indication (YRI-2550-2)
Sodium Bisulfite Feed Pump No. 2 Fault Alarm (XA-2550-2)
Sodium Bisulfite Feed Pump No. 2 Speed Indication (SI-2550-2)
Sodium Bisulfite Feed Pump No. 2 High Discharge Pressure (PAH-2550-2)
Sodium Bisulfite Feed Pump No. 2 Start/Stop Command (HSS-2550-2)
Sodium Bisulfite Feed Pump No. 2 Speed Command (SC-2550-2)

LOOP 2590-1 CHEMICAL SYSTEM AREA EMERGENCY EYEWASH AND SHOWER

General: The emergency eyewash and shower unit flow switch status is monitored by SCADA PLC/OWS.

Control:

Local:

None.

SCADA PLC/OWS:

None.

Alarms / Monitoring:

Local:

None.

SCADA PLC/OWS:

Flow Switch Activated (FAH-2590-1)

LOOP 2600-1 SAN GABRIEL – WET WEATHER STORAGE TANK BLOWER
PLC: SG-PLC
P&ID: SG-IG-1

A. General:

1. There is a wet weather blower (BLR-2600-1). The wet weather blower delivers air to the wet weather storage tank.

B. Control:

Hardwired Interlocks:

- A temperature switch (TSH) and pressure switch (PSH) will be installed to monitor the discharge temperature and discharge pressure of each blower. The motor shall be prohibited from operation and an alarm sent to SCADA upon activation of these switches.

Local Control Station:

Local: When the Local/Off/Remote selector switch (HS) is in the "Local" position, the blower can be started or stopped through the pushbuttons.

Off: When the Local/Off/Remote selector switch (HS) is in the "Off" position, the blower cannot be operated from Local Control Station.

Remote: When the Local/Off/Remote selector switch (HS) is in the "Remote" position, blower control is transferred to the MS Control Panel.

MS Control Panel:

Hand: When the Hand/Off/Auto selector switch (HS) is in the "Hand" position, the blower can be started or stopped through the pushbuttons.

Off: When the Hand/Off/Auto selector switch (HS) is in the "Off" position, the blower cannot be operated from the MS panel or remotely.

Auto: When the Hand/Off/Auto selector switch (HS) is in the "Auto" position, blower control is transferred to the MS Control Panel.

SCADA PLC/OWS:

Software Interlock:

None.

On/Off Features

Manual: The blower can be manually started or stopped (HSS) by the operator at the SCADA PLC/OWS, Local Control Station and at Motor Control Center.

Auto: None.

C. Alarms/Monitoring:

Local Control Station:

Wet Weather Blower No. 1 Run Light (YRL-2600-1A)
Wet Weather Blower No. 1 Fault Light (XL-2600-1B)

MS Control Panel:
Wet Weather Blower No. 1 Run Light (YRL-2600-1D)
Wet Weather Blower No. 1 Fault Light (XL-2600-1E)
Wet Weather Blower No. 1 LCS Remote Light (YCL-2600-1A)
Wet Weather Blower No. 1 In Auto Light (YCL-2600-1B)

SCADA PLC/OWS:

Wet Weather Blower No. 1 In Auto Indication (YCI-2600-1A)
Wet Weather Blower No. 1 Running Indication (YRI-2600-1)
Wet Weather Blower No. 1 Fault Alarm (YFI-2600-1)
Wet Weather Blower No. 1 Start/Stop Command (HSS-2600-1)
Wet Weather Blower No. 1 LCS In Remote Indication (YCI-2600-1B)
Wet Weather Blower No. 1 High Pressure Alarm (PSH-2600-1)
Wet Weather Blower No. 1 High Temperature Alarm (TSH-2600-1)

LOOP 2700-X SAN GABRIEL – PECAN BRANCH TRANSFER PUMPS
PLC: SG-PLC
P&ID: SG-IG-1.

A. General:

1. There are two pecan branch transfer pumps (PMP-2700-X). These pumps deliver water from wet weather storage basin to the pecan branch wastewater treatment plant. The pumps operate in Duty/Standby configuration and operate based on wet weather storage/equalization basin level. The operator can select which pump is duty and which pump is standby at SCADA PLC/OWS. X denotes the pump number 1/2.

B. Control:

Hardwired Interlocks:

None.

VFD Control Panel:

Hand: When the Hand/Off/Auto selector switch (HS) is in the "Hand" position, the pump can be started or stopped through the pushbuttons. The speed of the pump can be varied through SC.

Off: When the Hand/Off/Auto selector switch (HS) is in the "Off" position, the pump cannot be operated from the VFD panel or remotely.

Auto: When the Hand/Off/Auto selector switch (HS) is in the "Auto" position, pumps control is transferred to the SCADA PLC/OWS.

SCADA PLC/OWS:

Software Interlock:

If Wet weather equalization basin low level (LAL-204) is detected at the existing RTU-SGWWTP, then SCADA PLC/OWS system, shall stop all running pumps.

On/Off Features

Manual: The pump can be manually started or stopped (HS) by the operator at the SCADA PLC/OWS.

Auto: None.

.

Speed Adjustment Features

Manual: The operator will be able to manually adjust the speed (SC) of the pump controller at the SCADA PLC/OWS.

Auto: None.

C. Alarms/Monitoring:

VFD Control Panel:

Pecan Branch Transfer Pump No. 1 Motor Run Light (YRL-2700-1)
Pecan Branch Transfer Pump No. 1 Motor Fault Light (XL-2700-1)
Pecan Branch Transfer Pump No. 1 Motor Remote Light (YCL-2700-1A)
Pecan Branch Transfer Pump No. 2 Motor Run Light (YRL-2700-2)
Pecan Branch Transfer Pump No. 2 Motor Fault Light (XL-2700-2)
Pecan Branch Transfer Pump No. 2 Motor Remote Light (YCL-2700-2A)

SCADA PLC/OWS:

Pecan Branch Transfer Pump No. 1 VFD Speed Indication (SI-2700-1A)
Pecan Branch Transfer Pump No. 1 In Auto Indication (YCI-2700-1)
Pecan Branch Transfer Pump No. 1 Running Status (YRI-2700-1A)
Pecan Branch Transfer Pump No. 1 Fault Alarm (XA-2700-1A)
Pecan Branch Transfer Pump No. 1 Speed Command (SC-2700-1)
Pecan Branch Transfer Pump No. 1 Start/Stop Command (HSS-2700-1)
Pecan Branch Transfer Pump No. 2 VFD Speed Indication (SI-2700-2A)
Pecan Branch Transfer Pump No. 2 In Auto Indication (YCI-2700-2)
Pecan Branch Transfer Pump No. 2 Running Status (YRI-2700-2A)
Pecan Branch Transfer Pump No. 2 Fault Alarm (XA-2700-2A)
Pecan Branch Transfer Pump No. 2 Speed Command (SC-2700-2)
Pecan Branch Transfer Pump No. 2 Start/Stop Command (HSS-2700-2)

LOOP 2750-X SAN GABRIEL – IRRIGATION TRANSFER PUMPS
PLC: PLC-IHSPS (Existing)
P&ID: SG-IH-1.

A. General:

1. There are two existing irrigation transfer pumps (ITP-X). These pumps deliver clarified, disinfected water from chlorine contact basin to the irrigation Clearwell. The transfer pumps operate as Lead/Lag configuration and operate based on irrigation Clearwell level. The operator can select which pump is lead and which pump is lag at SCADA PLC/OWS or automatically alternate based on a Pumps Alternate Timer (Operator adjustable, 0-XX hours). X denotes the pump number 1/2.

B. Control:

Hardwired Interlocks:

- The high discharge pressure (PSH-2750-X) shall be wired to the motor starter. If the switches are tripped, then the motor shall stop.

Control Panel (Existing):

Hand: When the Hand/Off/Auto selector switch (HS) is in the "Hand" position, the pump can be started or stopped through the selector switch (HS) of the motor starter at Control Panel.

Off: When the Hand/Off/Auto selector switch (HS) is in the “Off” position, the pump cannot be operated from the locally or remotely.

Auto: When the Hand/Off/Auto selector switch (HS) is in the “Auto” position, pump control is transferred to the SCADA PLC/OWS.

SCADA PLC/OWS:

The operator shall enter Clearwell LEAD SETPOINT and LAG SETPOINT based upon the Clearwell level (LIT-700) connected to the existing IHSPS PLC. These setpoints shall be common for both Transfer Pumps.

Software Interlock:

If chlorine contact basin low-level alarm (LAL-404) is detected at the SCADA PLC/OWS system, the pump (ITP-1) shall stop.

If chlorine contact basin low-level alarm (LAL-402) is detected at the SCADA PLC/OWS system, the pump (ITP-2) shall stop.

If Irrigation water Clearwell high-level alarm (LAH-705) is detected, then all running pumps shall stop.

If a pump is running and the associated pump control valve at its discharge is NOT opened for XX seconds, a pump control valve alarm is triggered, and the respective pump shall stop.

On/Off Features

Manual: The pump can be manually started or stopped (HSS) by the operator at the SCADA PLC/OWS.

Auto: Pump Control is based on the Clearwell level transmitter (LIT-700).

The pumps shall operate in a Lead/Lag sequence. The operator shall enter the level setpoints for the Lead, Lag, pumps to start and stop.

The operator shall select which pump is lead or lag when all pumps are placed in Auto or automatically alternate based on a Pumps Alternate Timer (Operator adjustable, 0-XX hours). Provide alteration sequence based on articles of section 3.6 “Automatic Controls”, “lead/lag and Duty/Standby Strategy”.

Lead: When the level in Clearwell rises above the ‘Start Lead Pump’ setpoint for an adjustable amount of time, the Lead pump will be called to start.

Lag: As the level in the Clearwell continues to increase and rises above the ‘Start Lag’ setpoint plus an adjustable offset value, the Lag pump will be called to start.

The two pumps will run together until the level in the wet well drops below the stop setpoint, at which all pumps will stop.

Failover: When the pump is chosen as the lag pump, it shall automatically assume the lead role when original lead

pump fails or is stopped by an interlock but is not stopped by the operator.

C. Alarms/Monitoring:

SCADA PLC/OWS:

Irrigation Transfer Pump No. 1 In Auto Indication
Irrigation Transfer Pump No. 1 Running Indication
Irrigation Transfer Pump No. 1 Fault Alarm
Irrigation Transfer Pump No. 1 High Discharge Pressure Alarm
Irrigation Transfer Pump No. 1 Start/Stop Command
Irrigation Transfer Pump No. 1 Valve Open Indication
Irrigation Transfer Pump No. 1 Valve Close Indication
Irrigation Transfer Pump No. 2 In Auto Indication
Irrigation Transfer Pump No. 2 Running Indication
Irrigation Transfer Pump No. 2 Fault Alarm
Irrigation Transfer Pump No. 2 High Discharge Pressure Alarm
Irrigation Transfer Pump No. 2 Start/Stop Command
Irrigation Transfer Pump No. 2 Valve Open Indication
Irrigation Transfer Pump No. 2 Valve Close Indication

LOOP 2000-1 SAN GABRIEL – CONTROL ROOM SG-PLC CABINET INTRUSION
PLC: SG-PLC
P&ID: SG-IA-1.

A. General:

Control Room SG-PLC control panel intrusion is monitored through a position switch.

B. Control:

Local:

None

SCADA PLC/OWS:

None

C. Alarms / Monitoring:

Local:

None

SCADA PLC/OWS:

Cabinet Intrusion Alarm (ZA-2000-1)

LOOP 2000-1 SAN GABRIEL – CONTROL ROOM SG-PLC CABINET DC POWER FAIL
PLC: SG-PLC
P&ID: SG-IA-1.

A. General:

Control Room PLC cabinet DC power fail is monitored at SCADA PLC/OWS.

B. Control:

Local:

None

SCADA PLC/OWS:

None

C. Alarms / Monitoring:

Local:

None

SCADA PLC/OWS:

DC Power Fail Alarm (JA-2000-1)

LOOP 2000-1 SAN GABRIEL – CONTROL ROOM SG-PLC CABINET UPS
PLC: SG-PLC
P&ID: SG-IA-1.

A. General:

Control Room SG-PLC cabinet UPS status is monitored at SCADA PLC/OWS.

B. Control:

Local:

None

SCADA PLC/OWS:

None

C. Alarms / Monitoring:

Local:

None

SCADA PLC/OWS:

Loss of Incoming Power Alarm (XA-2000-1A)
On Bypass Status (YCI-2000-1)
Low Battery Alarm (XA-2000-1B)

LOOP 2000-2 SAN GABRIEL – CONTROL ROOM UPS
PLC: SG-PLC
P&ID: SG-IE-1.

D. General:

Control Room UPS status is monitored at SCADA PLC/OWS.

E. Control:

Local:

None

SCADA PLC/OWS:

None

F. Alarms / Monitoring:

Local:

None

SCADA PLC/OWS:

Loss of Incoming Power Alarm (XA-2000-2A)
On Bypass Status (YCI-2000-2)
Low Battery Alarm (XA-2000-2B)

LOOP 2000-1 SAN GABRIEL – ELECTRICAL HOUSE I HIGH TEMPERATURE
PLC: SG-PLC
P&ID: SG-IE-1.

A. General:

Electrical House I high temperature is monitored through temperature switch.

B. Control:

Local:

None

SCADA PLC/OWS:

None

C. Alarms / Monitoring:

Local:

None

SCADA PLC/OWS:

High Temperature Alarm (TAH-2000-1)

LOOP 2000-2 SAN GABRIEL – ELECTRICAL HOUSE II HIGH TEMPERATURE
PLC: SG-PLC
P&ID: SG-IE-1.

A. General:

Electrical House II high temperature is monitored through temperature switch.

B. Control:

Local:

None

SCADA PLC/OWS:

None

C. Alarms / Monitoring:

Local:

None

SCADA PLC/OWS:

High Temperature Alarm (TAH-2000-2)

LOOP 2000-3 SAN GABRIEL – ELECTRICAL HOUSE III HIGH TEMPERATURE
PLC: SG-PLC
P&ID: SG-IE-1.

A. General:

Electrical House 1 high temperature is monitored through temperature switch.

B. Control:

Local:

None

SCADA PLC/OWS:

None

C. Alarms / Monitoring:

Local:

None

SCADA PLC/OWS:

High Temperature Alarm (TAH-2000-3)

APPENDIX ONE: GENERATOR STARTUP SEQUENCE

A. General

1. The estimated maximum running standby load is 900 kW. The standby generator is rated for 1000 kW.

2. A power monitor will continuously monitor the power load while the generator is in operation. If the combined load reaches 95% of the rated capacity, no further equipment will be started.

3. The Automatic Transfer Switch (ATS) will indicate if utility power is lost. On power loss, process equipment will be interlocked, and the generator will be called to START. When the generator is confirmed RUNNING, process equipment previously running in AUTO will be sequentially called to restart. Time delays between each step of the sequence will prevent generator overload.

B. Control

1. Each step of the sequence has an HMI adjustable step time setpoint (initially set to 20 seconds). The PLC will not proceed to the next step until the current steps' timer expires.

2. The automatic start-up sequence is as follows:

a. Energize Operations Building and E-house Buildings (to ensure all PLCs and controls are functional before process equipment)

b. Lift station and coarse screen

c. Process blowers

d. De-chlorination feed equipment

e. Irrigation transfer and high service pumps and disk filters

f. Grit removal and fine screen

g. Clarifier drives

h. Chlorination feed equipment

i. PD blower for digester

j. Belt press and polymer system

C. Alarms/Monitoring

1. The HMI will display START-UP FAULT alarm if any of the steps in the automatic start-up sequence are not confirmed complete before the step timer expires.

D. Data Collection:

1. None

END OF SECTION 406196

SECTION 406216 - OPERATOR WORKSTATION COMPUTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes Operator Workstation Computers.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements.

1.3 DEFINITIONS

A. Process Control System Supplier (PCSS): The entity responsible for providing all materials, equipment, labor, and services required to achieve a fully integrated and operational control system.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Shop Drawings:

1. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.5 INFORMATIONAL SUBMITTALS

1. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.6 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

1.8 TECHNOLOGY OBSOLESCENCE MITIGATION

A. Due to rapidly evolving technology of the equipment specified herein, the requirements specified are to establish a baseline for the type of equipment required. Provide the current version of hardware and software of similar specification at the time of purchase equivalent in cost to that which is specified. The procedure for submitting and releasing the equipment is as follows:

1. PCSS to submit for approval the required data for the equipment as part of the Hardware and Software Packages Submittal.
2. Order equipment as late as possible dependent on the construction schedule to ensure the latest equipment available is provided. Just prior to ordering, resubmit for approval the required data of the latest available hardware and software equivalent in cost to that which is specified. Do not order equipment more than 6 months prior to when it is needed to be continuously used on the project.
3. Specific hardware and software in this Section that will adhere to this requirement are as follows:

    a. Operator Workstation Computer.

1.9 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of computers that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Provide next day on-site service covering parts and labor for five years from date of purchase. The on-site service is to be performed by an authorized representative of the manufacturer.

PART 2 - PRODUCTS

2.1 WORKSTATION

A. Manufacturers:
1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following without substitution nor equal:

a. Dell T5810.
b. HP Z620.

B. General:

1. Tower chassis workstation configured to run software shown on Drawings and in Specifications.

C. Processor:

1. One Intel Quad-Core processor, 3.0 GHz or greater, minimum of 10 MB L3 cache on chip die, 2133 MHz front side bus minimum.

D. RAM:

1. 16 GB of RAM, 2133MHz speed minimum, 2 DIMMS maximum.

E. Media Drives:

1. DVD ± Dual-layer Drive with both Read and Write Capability.

F. Expansion slots:

1. Two Full Height PCI slots.
2. One Full Height PCI Express slot.

G. Internal Disk:

1. 2 TB of usable storage minimum, SATA, hard drives configured in a RAID 1 array.

H. Video Graphics:

1. Capable of 1920 x 1200 pixels, 70 Hz refresh rate and 32-bit true color minimum. VGA, DVI, and HDMI or Display Port outputs. 512MB of dedicated video RAM minimum. Card must be dual monitor capable.

I. I/O Ports & Devices:

1. Minimum of four USB 2.0 ports.

J. Interface Devices:

1. Generic USB 104 key (Windows) keyboard, no hot keys onboard.

2. Two button USB optical mouse with scroll wheel.
3. Monitor:

    a. LCD 20-inch nominal size minimum.
    b. Native Resolution: 1920 x 1080 resolution at 70 Hz minimum.
    c. 16 ms response time maximum.
    d. 250 nits (cd/m²) brightness minimum.
    e. 400 to 1 contrast ratio minimum.
    f. Vertical viewing angle of 85 degrees minimum.
    g. Horizontal viewing angle of 85 degrees minimum.
    h. Analog RGB, Digital DVI-D, and HDMI or Display Port video input connector types.
    i. Adjustable height stand.
    j. Soundbar.

K. Networking:

1. Two network cards in addition to any on-board network interface.
2. Required features for network interfaces:

    a. Support for latest Microsoft operating system.
    b. Gigabit Ethernet port, copper connection accepting standard CAT6 cables for Ethernet communications.
    c. IEEE 802.3ab support for gigabit networking standard.
    d. IEEE 802.Q VLAN support.
    e. Auto sensing 10/100/1000 Mbps.
    f. SNMP manageable.

L. Power supplies to operate from the voltage specified in Section 406100.

M. Operating System:

1. Latest release of 64-bit Windows Pro.

N. Backup Software:

1. Backup software is required above the default Microsoft Windows Backup utility included with the operating system. Refer to Section 406895 “System Support Software” for backup software requirements.

O. Other Software:

1. Microsoft Office Professional latest edition including the following programs at a minimum:

    a. Microsoft Excel.
    b. Microsoft Word.
    c. Microsoft Access.
    d. Microsoft PowerPoint.

2. Virus scan and protection software in accordance with Section 406895 “System Support Software.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and rooms for suitable conditions where computers will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 CONNECTIONS

A. Refer to Section 260526 “Grounding and Bonding for Electrical Systems.”

3.4 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121.20 “Process Control System Testing.”

C. Operator workstation computers will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121. 20 “Process Control System Testing.”

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, include software support for two years in service agreement.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software includes operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

END OF SECTION 406216

SECTION 406263 - OPERATOR INTERFACE TERMINALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes operator interface terminals.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements.
2. Section 406717 “Industrial Enclosures.”
3. Section 406343 “Programmable Logic Controllers.”
4. Section 406813 “Process Control (HMI) Software.”
5. Section 406863 “Configuration of HMI Software.”

1.3 DEFINITIONS

A. Operator Interface Terminal (OIT): A hardware component of the HMI used for device level control and monitoring.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Shop Drawings:

1. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.5 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.6 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Provide components compatible with functions required to form complete working system.

1.8 TECHNOLOGY OBSOLESCENCE MITIGATION

A. Due to rapidly evolving technology of specified equipment, the requirements specified are to establish a baseline for the type of equipment required. Provide current version of hardware and software of similar specification at the time of purchase equivalent in cost to that which is specified. Procedure for submitting and releasing the equipment is as follows:

1. PCSS to submit for approval the required data for the equipment as part of the Hardware Package Submittal.
2. Order equipment as late as possible dependent on the construction schedule to ensure the latest equipment available is provided. Just prior to ordering, resubmit for approval the required data of the latest available hardware and software equivalent in cost to that which is specified. Do not order equipment more than 6 months prior to when it is needed to be continuously used on the project.
3. Specific hardware in this Section that is that will adhere to this requirement are as follows:

    a. Operator Interface Terminal (OIT).

1.9 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.10 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.11 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of computers that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Provide next day on-site service covering parts and labor for one years from date of purchase. The on-site service is to be performed by an authorized representative of the manufacturer.

PART 2 - PRODUCTS

2.1 OPERATOR INTERFACE TERMINAL (OIT)

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following without substitution nor equal:

a. Rockwell Automation Allen-Bradley – PanelView Plus 7 Performance series.

B. General:

1. OITs are standalone devices with an integrated hardware/software platform to monitor and control a process through an interactive display.

C. Features:

1. Software:

a. OITs pre-packaged with all configuration and programming software necessary to perform functions as shown on drawings and within the specifications.
b. Integrated OIT software has the following features:

1) Trending.
2) Data logging.
3) Alarms.
4) Graphic symbols.
5) Animations.

2. Hardware:

a. Minimum one Secure Digital (SD) card slot.

D. Communications:

1. Ports:

a. Minimum two 10/100MB Ethernet.
b. Minimum one USB.
c. Minimum one serial RS-232.

2. Protocols:

a. EtherNet/IP.
b. Modbus TCP/IP.

E. Display:

1. Minimum of 15 inches viewable as measured diagonally across screen.
2. Minimum display resolution:

a. 320 x 240 for 4 inch to 6 inch displays.
b. 800 x 600 for 8 inch to 10 inch displays.
c. 1024 x 768 for 12 inch to 15 inch displays.
d. 1280 x 1024 for displays larger than 15 inches.

3. Color Active Matrix TFT.
4. Display supports touch screen input.

F. Environmental:

1. Rating: OIT rated to maintain rating of control panel it will be mounted on and meet area classification.
2. Operating Temperature: 32 to 122 degrees F.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and rooms for suitable conditions where operator interface terminals will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 CONNECTIONS

A. Refer to Section 260526 “Grounding and Bonding for Electrical Systems.”

3.4 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Operator interface terminals will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following Sections:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121. 20 “Process Control System Testing.”

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, include software support for two years in service agreement.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software includes operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days in advance to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 406263

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SECTION 406343 - PROGRAMMABLE LOGIC CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Programmable logic controllers for SG-PLC.
2. New PLC enclosures house PLC racks with required I/O modules, power supplies, processor module, communication modules, and ethernet switch as shown on Drawings.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406717 “Industrial Enclosures.”
3. Section 406733 “Panel Wiring.”
4. Section 407856 “Isolators, Intrinsically Safe Barriers, and Surge Suppressors.”

1.3 DEFINITIONS

A. Analog Input (AI): An electrical signal (1-5 Volts DC or 4-20 milliamps, for example) to be interpreted by a PLC.

B. Analog Output (AO): An electrical signal (1-5 Volts DC or 4-20 milliamps, for example) sent from a PLC to a field device.

C. Digital/Discrete Input (DI): A binary signal (0 or 1) to be interpreted by a PLC.

D. Digital/Discrete Output (DO): A binary signal (0 or 1) sent from a PLC to a field device.

E. Input/Output (I/O): Analog or digital field instrument signals to be received and interpreted by a PLC.

F. Programmable Logic Controller (PLC): A ruggedized programmable computer used for industrial automation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

B. Shop Drawings:

1. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.5 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.6 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Processor: Provide a spare processor unit for processor installed.
2. I/O Cards: Provide spares for each unique I/O module type installed. Provide two cards or 10 percent of installed quantity, whichever is greater.
3. PLC Power Supplies: Provide spare power supplies for power supply installed.
4. Miscellaneous Components: Provide spares for each unique component installed, including cables.

1.8 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

1.9 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.10 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of computers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Provide next day on-site service covering parts and labor for two years from date of purchase. The on-site service is to be performed by an authorized representative of the manufacturer.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Configuration: Networked programmable controller incorporated into main PLC system control panels for controlling Dove Springs and San Gabriel Wastewater Treatment Plant system.

2.2 SPARE I/O, SLOTS, AND FUTURE EXPANSION

A. Spare PLC I/O:

1. Provide 20 percent minimum of four points per type AI AO**,** DI, and DO for future use, regardless of whether any of those point types are used in that panel or not.
2. Provide spare I/O points of same type of I/O modules supplied.

B. Future PLC Expansion (Non-Chassis-Based PLC Systems):

1. Provide adequate space to the right of the last I/O card per row of I/O cards for 2 future I/O cards.
2. Card width based on the widest I/O card provided in panel.

C. Provide external relays for spare output points that require their use.

D. Wire all unused points on all I/O to terminal blocks in the order that they occur on the I/O modules.

2.3 COMPACT PLC SYSTEM

A. Manufacturers:

1. Provide all PLCs from a single manufacturer. If PLC manufacturer has authorized third party vendors to provide modules that are compatible with their platforms, then products manufactured by these authorized third-party vendors will be acceptable.
2. Manufacturers and their products are subject to compliance with requirements. Provide one of the following without substitution nor equal:

    a. Rockwell Automation Allen-Bradley – 1769-L24ER-QBFC1B.

B. General:

1. Provide processor, power supply, I/O modules, communication modules, and remote interface modules as required to meet system requirements.
2. PLC is modular based, rather than chassis-based.

3. Listed and classified by UL, CSA, or FM approval as suitable for purpose specified and indicated.
4. Contains the required memory and functional capacity to perform the specified sequence of operation with the scheduled inputs and output points.
5. Designed for continuous industrial service.
6. Provide products of a single manufacturer.
7. Provide equipment models that are currently in production.
8. In the event of power interruption, the system undergoes an orderly shutdown with no loss of memory and resumes normal operation without manual intervention when power is restored.
9. Provide PLCs that communicate between workstations, servers, instruments, switches, controllers, process actuators, etc. as shown on the Drawings.
10. PLC capable of stand-alone operation in the event of failure of the communication link to the HMI subsystem.

C. Physical:

1. Vibration: 3.5mm Peak-to-Peak, 5-9 Hz: 1.0G, 9-150 Hz. Vibration tested in accordance with IEC 68-2-6 and JIS C 0911. The system is to be operational during and after testing. Vibration Rating of 2.0G maximum peak acceleration for 10 to 500 Hz. In accordance with one of the following:

    a. DIN rail mounted PLC, 10 – 57 Hz., amplitude 0.075 mm, acceleration 25-100 Hz.
    b. Panel or plate mounted PLC: 2-25 Hz., amplitude 1.6mm, acceleration 25-200 Hz.
    c. In compliance with IEC 60068 and IEC 61131.

2. Shock: 15G, 11msec. Shock tested in accordance with IEC 68-2-27 and JIS C 0912. The system is to be operational during and after testing.
3. Operating Temperature: 32 to 140 degrees F.
4. Storage Temperature: -13 to 158 degrees F.
5. Relative Humidity: 10 to 95 percent, non-condensing.
6. Noise Immunity: Tested to operate in the high electrical noise environment of an industrial plant as governed by the following regulations: IEEE 472, IEC 801, MILSTD 461B, IEC 255-4, NEMA ICS 2-230.40, and ANSI/IEEE C-37.90A-1978.
7. Altitude (Operating): 0 to 6,500 feet.
8. Altitude (Storage): 0 to 9,800 feet.
9. Degree of protection: NEMA 1 (IP20).
10. All products have corrosion protection.

D. Identification:

1. Identify all major assemblies and sub-assemblies, circuit boards, and devices using permanent labels or markings indicating:

    a. Module product type such as analog or digital.
    b. Module catalog number.
    c. Module major revision number.
    d. Module minor revision number.
    e. Module manufacturer vendor.
    f. Module serial number.

E. PLC Central Processing Unit (CPU):

1. General:

a. Minimum 16-bit microprocessor with system timing and is responsible with scheduling I/O updates with no user programming required to ensure discrete or analog update.
b. Executes user relay ladder logic programs, communicates with intelligent I/O modules, and performs on-line diagnostics.
c. Consists of a single module which solves application logic, stores the application program, stores numeric values related to the application processes and logic, and interfaces to the I/O.
d. Samples all discrete and analog inputs and outputs including internal coils and registers, and service special function modules every scan. The CPU processes the I/O with user programs(s) stored in memory and controls outputs based on the results of the logic operation.
e. Supply the CPU with a battery-backed time of day clock and calendar.
f. CPU family allows for user program transportability from one CPU model to another.

2. Diagnostics:

a. Perform on-line diagnostics that monitor the internal operation of the PLC. If a failure is detected, initiate orderly system shutdown and fail-over. Monitor the following, at a minimum:

1) Memory failure.
2) Memory battery low.
3) General fault.
4) Communications port failure.
5) Scan time over run.
6) I/O failure.
7) Analog or special function I/O module failure.

b. Make diagnostic information accessible to the host communications interfaces and to the PLC program.
c. PLC indicators and on-board status area for the following conditions:

1) CPU run.
2) CPU error or fault.
3) I/O failure or configuration fault.
4) Status of Battery or back-up power module.
5) Communications indicator.

3. Memory:

a. Provide non-volatile battery backed memory of type CMOS RAM program memory or equivalent.
b. Memory Backup System: Provide lithium battery backup or equivalent capable of retaining all memory for a minimum of three months and a Flash memory system capable of reloading program in the event of memory loss.

1) Backup Storage: Provide backup battery or capable of being replaced without disrupting memory integrity. Provide a visual indication of low battery voltage or module error and an alarm bit in the PLC program.
2) Flash SD Memory Card: Provide memory card storage with capacity greater than processor memory capacity. Install memory cards in processors for factory testing.

c. Operating system contained in non-volatile firmware.
d. The memory containing the operating system is field updateable via a separate update tool.

4. Programming Environment:

a. Programming port: Use PLC Ethernet port for programming.
b. On-Line programming: Application programs may be modified or stored while the CPU is running, with minimal impact on the scan time.
c. Online programming including runtime editing.
d. IEC 61131-3 programming languages supported: Ladder logic, function block, sequential function chart, and structured text.
e. Supply all hardware and software necessary to program the CPU in these languages.

5. Communication Ports:

a. Provide expandable CPU supplied with additional modules to support the required communication interfaces.

6. Remote I/O Communications:

a. Provide CPU capable of communicating with up to 12 remote base locations. Automatically sample and update all local and remote I/O modules each scan cycle of the CPU.
b. Provide communication link between the CPU and any RIO chassis as recommended by the PLC manufacturer.
c. Provide diagnostic and equipment status information from each RIO.
d. Provide remote I/O system with a remote input/output arrangement capable of operation at locations physically separated from the PLC CPU as detailed on the drawings.
e. Communicate with the remote I/O arrangement through cable as recommended by the PLC manufacturer and provided by the PLC system supplier under this specification Section.

F. Power Supplies:

1. Power Input: 85 to 265VAC, 47 - 63Hz.
2. Provide DC power supplies capable of handling ripple up to 2.4V peak to peak.
3. Power supply provide power for the processor and applicable modules.
4. Provide clearly visible LED to indicate that the incoming power is acceptable, and the output voltage is present.
5. Provide over-current and over-voltage protection designed to operate in most industrial environments without the need for isolation transformers.

6. Size power supplies to accommodate the nominal load plus 30 percent.
7. Provide power supplies capable of sustaining brown out conditions of at least 1/2 of a cycle, a harmonic rate of 10 percent, and continuous operation through momentary interruptions of AC line voltage of 10ms or less.
8. Automatically shut down the PLC system whenever its output power is detected as exceeding 125 percent of its rated power.
9. Provide surge protection, isolation, and outage carry-over up to 2 cycles of the AC line.

G. Discrete Input & Output Modules:

1. General:

   a. Digital input and output modules provide ON/OFF detection and actuation capability.
   b. Provide cards of I/O type and count as required to implement the functions specified plus an allowance for active spares, as specified herein.
   c. Provide modules capable of being installed or removed while chassis power is applied.
   d. Provide the following status indicators.

      1) On/Off state of the field device.
      2) Module's communication status.
      3) Module health.

2. Module Specifications - 120VAC Input Module:

   a. Nominal Input Voltage: 120VAC.
   b. On-State Current: 15mA at 132VAC, 47 - 63Hz maximum.
   c. Maximum Off-State Voltage: 20V.
   d. Maximum Off-State Current: 2.5mA.
   e. Number of Points per Card: 16.

3. Module Specification - 120 VAC Solid State Output Module:

   a. For each triac type discrete output, provide an associated interposing relay located in the same control panel. Provide 120 VAC power for relay outputs from the associated motor starter control circuit (when used with motor starters) or other 120 VAC source (when I/O is not associated with a particular motor starter).
   b. Output Voltage Range: 74 - 265 VAC, 47 - 63 Hz.
   c. Output Current Rating:

      1) Per Point: 0.5A maximum at 86 degrees F; 0.25A maximum at 140 degrees F; Linear Derating.
      2) Per Module: 4A maximum at 86 degrees F; 2A maximum at 140 degrees F; Linear Derating.

   d. Surge Current per Point: 5A for 43ms each, repeatable every 2s at 140 degrees F.
   e. Minimum Load Current: 10mA per point.
   f. Maximum On-State Voltage Drop: 1.5V peak at 2.0A and 6V peak at load less than 50mA.
   g. Maximum Off-State Leakage: 2.5mA per point.

h. Number of Points per Card: 16.

4. Module Specifications - Individually Isolated Relay Output Module:

a. Output Voltage Range: 10 - 265VAC, 47 - 63 Hz, 5 - 125VDC.
b. Output Current Rating:

1) Per Point: 2.5A maximum.
2) Per Module: 16A maximum.

c. Power Rating (Steady State): 250VA maximum for 125VAC inductive output.
d. Maximum Off-State Leakage: 0 mA per point.
e. Configurable States:

1) Fault per Point: Hold Last State, ON or OFF.
2) Program Mode per Point: Hold Last State, ON or OFF.

f. Number of Points per Card: 16.

H. Analog Input & Output Modules:

1. General:

a. Analog input modules convert an analog signal (1 to 5 Volts DC, 4 to 20 milliamps, for example) that is connected to the module's screw terminals into a digital value.
b. Furnish analog output modules to convert a digital value that is delivered to the module into an analog signal on the module's screw terminals.
c. Provide modules designed to be installed or removed while power is applied.
d. Provide the following status indicators:

1) Module's communication status.
2) Module health.
3) Input/output devices.

e. Hardware and software indication provided when a module fault has occurred. Each module provided with an LED fault indicator and the programming software displays the fault information.
f. Provide analog modules that are software configurable through the I/O configuration portion of the programming software.
g. Following status can be examined in ladder logic:

1) Module Fault Word: Provides fault summary reporting.
2) Channel Fault Word: Provides under-range, over-range, and communications fault reporting.
3) Channel Status Words: Provides individual channel under-range and over-range fault reporting for process alarm, rate alarms and calibration faults.

h. Provide 24 VDC power for analog instrument loops as a part of the system. Derive 24 VDC power supply from the 120 VAC input power circuit to the PLC. Group the field side of the 24 VDC power sources as individual or grouped (of logically

associated circuits) fusing and provide with a readily visible, labeled blown fuse indicator.

2. Differential Analog Input Module:

a. Input Range: 0-20 mA.
b. Resolution: approximately 16 bits across range.
c. Input Impedance: Greater than 249 Ohms.
d. Overvoltage Protection: 8V ac/dc with on-board current resistor.
e. Normal Mode Rejection: 60 dB at 60 Hz.
f. Common Mode Noise Rejection: 120 dB at 60 Hz, 100 dB at 50 Hz.
g. Isolation Voltage:

1) Channel to Ground/Chassis - 100 percent tested at 1000 VDC minimum for 1s based on 250 VAC.

h. Provide individual isolators, in addition to the surge suppression devices specified, in the control panels listed in Section 406717 “Industrial Enclosures” for all signals that enter the panel from outside the building. Substitution of isolated analog input cards to meet this requirement is acceptable.
i. Number of Points per Card: 8.

3. Isolated Analog Output Current Module:

a. Output Current Range: 4 to 20 mA.
b. Current Resolution: 12 bits across 20 mA.
c. Open Circuit Detection: None.
d. Output Overvoltage Protection: 24V DC/AC maximum.
e. Output Short Circuit Protection: 20 mA or less (electronically limited).
f. Calibration Accuracy: Better than 0.1 percent of range from 4 mA to 20 mA.
g. Number of Points per Card: 8.

I. Communication Interfaces:

1. Supported Protocols:

a. EtherNet/IP.

2. Ports:

a. Two 100MB/1G Ethernet.
b. USB.
c. RS-232 Serial.

J. Required Accessories:

1. Include all necessary cables as specified by the manufacturer. Assemble and install cables per manufacturer recommendations.

2.4 SOURCE QUALITY CONTROL

A. Testing: Test programmable controller according to NEMA IA 2.2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and rooms for suitable conditions where Programmable Logic Controllers will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 CONNECTIONS

A. Refer to Section 260526 “Grounding and Bonding for Electrical Systems.”

3.4 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections in accordance with the following sections:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121.20 “Process Control System Testing.”

B. Programmable Logic Controllers will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121. 20 “Process Control System Testing.”

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
3. Refer to division 1 specification requirements.

3.7 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement includes software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software includes operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 406343

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SECTION 406613 - SWITCHES AND ROUTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Switches and routers.
2. PCSS is responsible for performing configuration services for equipment provided under this Section.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements.
2. Section 406717 “Industrial Enclosures.”
3. Section 406343 “Programmable Logic Controllers.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions”.

B. Shop Drawings:

1. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions”.

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Ethernet Switch: Provide one spare switch per each type installed.
2. Manufacturer’s cables: Provide one spare of each type installed.
3. Shielded Cat-6: Provide five 10-foot CAT-6 cables with connectors installed.

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.9 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of computers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Provide next day on-site service covering parts and labor for two years from date of purchase. The on-site service is to be performed by an authorized representative of the manufacturer.

PART 2 - PRODUCTS

2.1 RACK-MOUNTABLE MANAGED ETHERNET SWITCH

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide by the following without substitution nor equal:

a. Cisco Catalyst 9300 Series.

B. General:

1. Provide a modular, rack-mountable, managed Ethernet switch for connection to the network as shown on Drawings and specifications.
2. Provide ethernet switches by the same manufacturer for the project, regardless of type.

C. Physical Features:

1. Modular 19-inch rack-mountable enclosure.
2. Construction such that additional copper and fiber ports can be added and removed.
3. Power-over-Ethernet (PoE) copper ports: 10/100/1000BaseT(X) ports.
4. Copper ports: 10/100/1000BaseT(X) ports.
5. Operating temperature: 0 to 130 degrees F
6. Power: 120VAC redundant power supplies.
7. Enclosure: Metal case.
8. Rating: UL Class 1, Division 2 Groups A, B, C, and D.

D. Network Features:

1. Layer 3 routing.
2. Spanning Tree Protocol (STP).
3. Rapid Spanning Tree Protocol (RSTP) (IEEE 802.1w).
4. Full duplex on all port.
5. Auto negotiation and manual configurable speed and duplex.
6. Wire speed switching fabric.
7. IGMP snooping.
8. IGMP filtering.
9. Configuration password protected.
10. Configuration backup capability required.
11. SNMP V3.
12. Lock port function for blocking unauthorized access based on MAC address.

E. Additional Features:

1. Provide a dry contact rated for 120 VAC 5A to be used for common trouble alarm and programmable alarm. If the contact cannot use 120 VAC 5A, provide the necessary 24 VDC power from the PLC panel and provide interposing relays in the PLC panel.

F. Accessories:

1. SFP modules / transceivers:

a. 2 single-mode 10G modules.
b. 2 multi-mode 10G modules.
c. 2 RJ-45 10G modules.

2.2 INDUSTRIAL MANAGED ETHERNET SWITCH

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following without substitution nor equal:

a. Ruggedcom RS900.
b. Ruggedcom RSG2100P.

B. General:

1. Provide a DIN rail mountable industrial managed Ethernet switch for connection to the network as shown in the Drawings and specified herein.
2. Provide ethernet switches by the same manufacturer for the project, regardless of type.

C. Physical Features:

1. SFP Slots: 1G/10G SFP ports.
2. Power-over-Ethernet Plus (PoE+) Copper Ports: 10/100/1000BaseT(X) ports.
3. Copper Ports: 10/100/1000BaseT(X) ports.
4. Operating Temperature: 0 to 130 degrees F.
5. Power: redundant 24VDC power input.
6. Enclosure: Metal case.
7. Rating: UL Class 1, Division 2 Groups A, B, C, and D.

D. Network Features:

1. Layer 2 switching.
2. Spanning Tree Protocol (STP).
3. Rapid Spanning Tree Protocol (RSTP) (IEEE 802.1w).
4. Full duplex on all port.
5. Auto negotiation and manual configurable speed and duplex.
6. Wire speed switching fabric.
7. IGMP snooping.
8. IGMP filtering.
9. Configuration password protected.
10. Configuration backup capability required.
11. SNMP V3.
12. Lock port function for blocking unauthorized access based on MAC address.

E. Additional Features:

1. Provide dry contact rated for 120 VAC 5A to be used for common trouble alarm and programmable alarm. If the contact cannot use 120 VAC 5A, provide the necessary 24 VDC power from the PLC panel and provide interposing relays in the PLC panel.

2.3 CATEGORY 6 TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250MHz.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden CDT Networking Division/NORDX.
2. CommScope, Inc.
3. General Cable; General Cable Corporation.
4. Mohawk; a division of Belden Networking, Inc.

C. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.

D. Conductors: 100-ohm, 23 AWG solid copper.

E. Shielding/Screening: Shielded twisted pairs (FTP).

F. Cable Rating: Plenum.

G. Jacket: Blue thermoplastic.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and rooms for suitable conditions where computers will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 CONNECTIONS

A. Refer to Section 260526 “Grounding and Bonding for Electrical Systems.”

3.4 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections in accordance with the following Sections:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121 “Process Control System Testing.”

B. Switchers and routers will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121. 20 Process Control System Testing.

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. For Managed Ethernet Switches:

   a. Enable the lock port function to block unauthorized access based on MAC address for each switch and router. Assign static IP addresses to devices connecting to switch.
   b. Lock down all spare switch and router ports.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

3.8 SWITCHES AND ROUTERS SCHEDULE

A. Provide the devices in the following schedules:

Table 1. Ethernet Switch Schedule

Switch Designation	Type	Mount	Fiber Uplinks (1G/10G SFP)	Copper Ports (10/100/1000 BaseT(X), RJ45)	PoE Copper Ports (10/100/1000 BaseT(X), RJ45)
MES-SG	Managed Ethernet Switch	DIN Rail	0	8	0

END OF SECTION 406613

SECTION 406717 – INDUSTRIAL ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes industrial enclosures.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements.
2. Section 406733 “Panel Wiring.”
3. Section 406343 “Programmable Logic Controllers.”
4. Section 407856 “Isolators, Intrinsically Safe Barriers, and Surge Suppressors.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

B. Shop Drawings:

1. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

C. Calculation

1. Heat and colling calculations to demonstrate compliance to industrial panel temperature control requirements.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Touch-up Paint: Provide touch-up paint of each type and color used for all cabinets, panels, and consoles supplied.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with UL 508.

B. Provide components compatible with functions required to form complete working system.

C. Provide UL 508 label on complete assembly.

D. Maintain copies of panel drawings on site.

1.6 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.7 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of enclosures that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Provide next day on-site service covering parts and labor for two years from date of purchase.

PART 2 - PRODUCTS

2.1 INDUSTRIAL ENCLOSURES

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. Hoffman.
b. Rittal.

B. Structure and Enclosure:

1. Panels in indoor, dry, non-corrosive environments:

a. NEMA 12, painted steel or aluminum construction, as required by the schedule in PART 3.

2. Panels in outdoor, wet, or chemically corrosive environments:

a. NEMA 4X, stainless steel or FRP construction, as required by the schedule in PART 3.

3. Panels located in hazardous locations:

   a. Rated for the type of hazard (e.g., NEMA 7 for Class 1, Division 1).

4. Construction:

   a. Freestanding and floor-mounted vertical panels:

      1) Panels of 12-gauge sheet steel.
      2) Front panels or panels containing instruments: provide 10-gauge stretcher-leveled sheet steel, reinforced to prevent warping or distortion.

   b. Wall and Unistrut mounted panels:

      1) Panels no less than 14-gauge steel.

   c. Consoles:

      1) Panels of 12-gauge sheet steel.
      2) Front panels: provide 10-gauge stretcher-leveled sheet steel, reinforced to prevent warping or distortion.

5. Provide angle stiffeners on the back of the panel face to prevent panel deflection under instrument loading or operation, as follows:

   a. Structural framework internal to the panel allows for instrument support and panel bracing.
   b. Interior structure framework to permit panel lifting without racking or distortion.
   c. Removable lifting rings designed to facilitate simple, safe rigging, and lifting of the control panels during installation.

6. Full height and fully gasketed access door with full-length, continuous, piano type stainless steel hinges with stainless steel pins.

   a. Provide doors with three-point stainless steel latch and heavy-duty stainless-steel locking handle.
   b. Provide front access doors of sufficient width to permit instrument or control device mounting without interference from flush mounted instruments.
   c. Clamp-type door latches are not permitted.

7. Avoid kinks and sharp bends in wiring.

   a. Route wiring for easy access to other components for maintenance and inspection purposes.

8. Panel suitable for top and bottom conduit entry as required by the Electrical Drawings

a. For top mounted conduit entry, provide panel top with nominal one-foot square removable access plates, which may be drilled to accommodate conduit and cable penetrations.
b. Provide all conduit and cable penetrations with ground bushings, hubs, gasketed locknuts, and other accessories as required to maintain the NEMA rating of the panel and electrical rating of the conduit system.

C. General Requirements:

1. UL labeled control panels and cabinets.

a. UL listing includes enclosure, specific equipment supplied with enclosure, and equipment installation and wiring within and on the enclosure. If required for UL labeling, provide ground fault protective devices, isolation transformers, fuses, and other equipment necessary to achieve compliance with UL 508A requirement. The Drawings do not detail all UL 508A requirements.

2. Panel door handles with lock, or a hasp and staple for padlocking: key the locks for all control panels provided under this Contract alike.
3. Arrange devices for rear of panel mounting within the panel according to respective panel drawings and in a manner to allow for ease of maintenance and adjustment.

a. Locate heat generating devices, such as power supplies, at or near the top of the panel.

4. Mount all components in a manner that permits servicing, adjustment, testing, and removal without disconnecting, moving, or removing any other component.

a. Mount interior panel components on removable plates (sub-panels) and not directly on the enclosure.
b. Unless shock mounting is required by the manufacturer to protect equipment from vibration, provide rigid and stable mounting.
c. Mount and orient components in accordance with manufacturer’s recommendations.
d. Identify internal components with suitable plastic or metal engraved nametags mounted adjacent to (not on) each component identifying the component in accordance with the drawings and specifications.

5. Mount all panel components on a single rear-of-panel sub-panel unless the density of devices exceeds the panel mounting space permitted by the minimum panel dimensions specified. Side panel mounted components are not permitted without review and approval by Engineer.

6. Type 316 stainless steel hardware and fasteners:

a. Provide drilled and tapped mounting screws; self-tapping screws are not permitted.

7. Install suitable gaskets and faceplates, required to maintain NEMA rating of the panel.

D. Mounting Elevations:

1. Refer to ISA Recommended Practice RP60.3 for guidance on layout and arrangement of panels and panel mount components. Account for housekeeping pad dimensions.
2. Locate centerline of indicators and controllers no lower than 48 inches or higher than 66 inches above the floor on a panel face.
3. Locate centerline of lights, selector switches, and pushbuttons no lower than 32 inches or higher than 70 inches above the floor on a panel face.
4. Locate tops of annunciators no higher than 86 inches above the floor on a panel face.
5. Install panel components in accordance with manufacturer's guidelines.

2.2 TEMPERATURE CONTROL

A. Provide force air ventilation or air conditioning units as required to prevent temperature buildup inside of panel.

B. Heat Load Calculations:

1. Submit heat load calculations for all control panels located in areas where either venting is not possible due to NEMA rating of panel or control panel is located in an area or building without air conditioning.
2. Utilize manufacturer available thermal calculators to determine heating/cooling requirements (i.e. Saginaw SCE thermal calculator, Vent Hoffman cooling selection tool, or equivalent).
3. Ensure the internal temperature of the panel is regulated between 45 to 104 degrees F under all conditions.
4. Account for the following conditions in the heat load calculations:

    a. Loading and dissipation effects on all surfaces of the enclosure. Account for surfaces not available for heat transfer (e.g., against a wall).
    b. Internal heat load of components (load and duty cycle).
    c. For outside temperature limits, refer to Section 406100 "Process Control and Enterprise Management Systems General Provisions."

C. Sun Shields:

1. Provide custom fabricated sun shields for all outdoor panels in accordance with the following requirements:

    a. Fabricate sun shields from a material suited for the area classification rating of its environment.
    b. Design, fabricate, install, and support the unit to fully cover and shade the top, sides, and back of the enclosure, and to partially shade the front panel of the enclosure from direct exposure to sunlight from sunrise to sunset.
    c. Depending on overall size, sun shields may be fabricated in single or multiple segments for attachment to the enclosure support framing or to separate free standing framing around the enclosure, to preserve rigidity.
    d. Design and mount sun shields with a minimum 3-inch air gap around the enclosure for air circulation and heat dissipation.
    e. Drilling holes or welding studs directly to the enclosure for sun shield mounting is not permitted.

f. Slope the top section of the sun shield a minimum angle of 5 degrees from horizontal.

1) Wall mounted enclosures: slope the top section downward away from the wall and towards the front of the enclosure.
2) Free standing, floor mounted, and frame mounted enclosures: slope the top section downward towards the back side of the enclosure.

g. Incorporate a narrow and more steeply sloped drip shield segment on the front edge of the top section to shed water away from the front of the enclosure and prevent dripping or running directly onto the front panel of the enclosure.
h. Fabricate sun shields with continuous seam welds that are ground smooth.
i. Smooth round or chamfer exposed corners, edges, and projections to prevent injury.

D. Louvers:

1. If louvers are used, provide louver plate and filter kit.
2. Provide louver plates of stamped sheet metal construction.
3. Provide washable and replaceable filters.
4. Install louvers on the rear, top, or bottom of the panel, as required by the panel installation location.
5. For wall mounted enclosures with their backs directly adjacent to a wall, install louvers on the sides.

E. Forced Air Ventilation:

1. Provide forced air ventilation fans to create positive internal pressure within the panel.
2. Provide washable and replaceable filters.
3. Fan motors operate on 120-volt, 60-Hz power.

F. Air Conditioning:

1. For panels with internal heat that cannot be adequately dissipated with natural convention and heat sinks, or forced air ventilation, provide an air conditioner sized to deliver sufficient cooling.
2. NEMA rating equivalent to the NEMA rating of the panel. Maintain NEMA rating of panel when installed.
3. Provide air conditioner with conformal coating on exposed surfaces.
4. Mount air conditioners on panel side. If provided, cut sun shields to accommodate air conditioner.

G. Heating:

1. Provide an integral heater, fan, and adjustable thermostat for outdoor enclosures and enclosures located in unheated areas indoors or in areas subject to humidity and moisture, to reduce condensation and maintain the minimum internal panel temperature.

a. Mount unit near enclosure bottom with discharge away from heat-sensitive equipment.
b. Provide Hoffman DAH series, or equal.

2.3 ACCESSORIES

A. Nameplates:

1. Identify the panel and individual devices as required, unless otherwise indicated:

    a. Include up to three lines:

        1) First line containing the device tag number as shown on Drawings.
        2) Second line containing a functional description (e.g., Recirculation Pump No. 1).
        3) Third line containing a functional control description (e.g., Start).

2. Unless escutcheon plates are specified or unless otherwise noted on the Drawings:

    a. Furnish nameplates as 3/32-inch thick, black against white background unless otherwise noted, Lamicoid with engraved inscriptions. Bevel and smooth edges of nameplate.
    b. Nameplates with chipped or rough edges are not acceptable.

3. Mount or fasten cabinet mounted nameplates with epoxy adhesive or stainless-steel screws.
4. Provide a panel nameplate with a minimum of 1-inch high letters for every panel.
5. Provide legend plates or 1-inch by 3-inch engraved nameplates with 1/4-inch lettering for identification of door mounted control devices, pilot lights, and meters.
6. Use single Lamicoid nameplates with multiple legends for grouping of devices such as selector switches and pilot lights that relate to one function.

B. Print Storage Pockets:

1. Provide print storage pockets of steel construction, welded onto the door of the enclosure.
2. Size storage pockets to accommodate all prints required to service the equipment, and to accommodate 8.5-inch by 11-inch documents without folding.

C. Corrosion Control:

1. Protect panels from internal corrosion by use of corrosion-inhibiting vapor capsules. Size and quantity as necessary per manufacturer recommendations.
2. Manufacturer: Provide one of the following or equal:

    a. Zerust VC.
    b. Hoffman Model AHCI.

2.4 GENERAL FINISH REQUIREMENTS

A. Descale, degrease, fill, grind, and finish sections.

B. Finish steel-fabricated enclosures with two rust resistant phosphate prime coats and two coats of enamel, polyurethane, or lacquer finish which are applied by either hot air spray or conventional cold spray methods.

1. Brushed anodized aluminum, stainless steel, and FRP panels do not require a paint finish.

C. Grind smooth, sandblast, and then clean with solvent. Fill surface voids and grind smooth.

D. Immediately after cleaning, apply one coat of a rust-inhibiting primer inside and outside, followed by an exterior intermediate and topcoat of a two-component type epoxy enamel.

1. Apply final sanding to the intermediate exterior coat before top coating.

E. Apply a minimum of two coats of manufacturer’s standard, flat light-colored lacquer, on the panel interior after priming.

F. Unless otherwise noted, finish exterior colors as ANSI 61 gray with textured finish.

G. Finish products after assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and rooms for suitable conditions where industrial enclosures will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for cable trays.
3. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly and lubricate as recommended by manufacturer.

3.4 INDUSTRIAL ENCLOSURE SCHEDULE

A. Provide the following industrial enclosures:

Table 1. Industrial Enclosure Schedule

Panel Designation	Minimum Size	Enclosure Rating	Construction	General Requirements
SG-PLC	72-inch high by 72-inch wide by 24-inch deep	NEMA Type 12	Painted Steel	Free-standing, two-door, front-access only. Provide fold-down tray inside the cabinet
LRP-2010-1	24-inch high by 24-inch wide by 8-inch deep	NEMA Type 12	Painted Steel	Wall-mounted, single door, front-access only.

END OF SECTION 406717

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SECTION 406733 - PANEL WIRING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for internal wiring of control panels and consoles.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements.
2. Section 406717 “Industrial Enclosures.”
3. Section 407856 “Isolators, Intrinsic Safety Barriers, and Surge Suppressors.”

1.3 ACTION SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

PART 2 - PRODUCTS

2.1 CONTROL PANEL - INTERNAL CONSTRUCTION

A. Internal Electrical Wiring:

1. Provide stranded, type MTW interconnecting wiring:

a. Use 600-volt insulation rated for not less than 90 degrees Celsius.
b. Segregate wiring for systems operating at voltages in excess of 120 VAC from other panel wiring.

1) Locate either in a separate section of a multi-section panel or behind a removable Plexiglas or similar dielectric barrier.

c. Develop panel layout such that technicians have complete access to 120 VAC and lower voltage wiring systems without direct exposure to higher voltages.

2. For power distribution wiring on the line side of fuses or breakers:

a. Use 12 AWG minimum.
b. For control wiring on the secondary side of fuses:

1) Use 16 AWG minimum.
2) Utilize 18 AWG shielded, twisted pair cable insulated for not less than 600 volts for electronic analog circuits.

3. Cover power distribution blocks with protective guards to meet "finger-safe" requirements of IP20.
4. Route power and low voltage DC wiring systems in separate wireways.

a. Cross different system wires at right angles.
b. Separate different system wires routed parallel to each other by at least 6-inches.
c. Terminate different wiring systems on separate terminal blocks.
d. Do not fill wiring troughs to more than 60 percent visible fill.

5. Terminations:

a. Terminate wiring onto single tier terminal blocks:

1) Uniquely and sequentially number each terminal block.
2) Direct wiring between field equipment and panel components is not acceptable.
3) Multi-level terminal blocks or strips are not acceptable.

b. Arrange terminal blocks in vertical rows and separated into groups (power, AC control, DC signal).

1) Provide each group of terminal blocks with a minimum of 25 percent spares.

c. Use compression type, fused, unfused, or switched terminal blocks.

1) Use two terminals per point for discrete inputs and outputs (DI and DO) with adjacent terminal assignments.
2) Wire all active and spare PLC and controller points to terminal blocks.

d. Use three terminals per point for analog inputs and outputs (AI and AO) per shielded pair connection with adjacent terminal assignments for each point.

1) The third terminal is for shielded ground connection for cable pairs.

a) Ground the shielded signal cable at the PLC cabinet.
b) Wire all active and spare PLC and controller points to terminal blocks.

e. Use sleeve-type wire and tube markers with heat impressed letters and numbers.
f. Use only one side of a terminal block row for internal wiring.

1) Field wiring side of the terminal not to be within 6-inches of the side panel or adjacent terminal or within 8-inches of the bottom of free-standing

panels, or within 3-inches of stanchion mounted panels, or 3-inches of adjacent wireway.

g. Isolate circuit power from the SCADA cabinet to field devices (switches, dry contacts etc.) that are used as discrete inputs to the PLC input cards with an isolating switch terminal block with flip cover that is supplied with a dummy fuse.

1) Use Allen Bradley Model 1492-H7 or equal.
2) One isolating switch terminal block per loop numbered piece of equipment and one per spare I/O point is acceptable.

h. Isolate all PLC discrete outputs to the field with an isolating fuse switch terminal block with a flip cover and a neon blown fuse indicator.

1) Use Allen Bradley 1492-H4 or equal.

6. Clearly identify wiring to hand switches and other devices, which are live circuits independent of the panel's normal circuit breaker protection as such.
7. Clearly tag and color code wiring.

a. Tag numbers and color coding to correspond to panel wiring diagrams and loop drawings prepared by the PCSS.
b. Power wiring, control wiring, grounding, and DC wiring to utilize different color insulation for each wiring system used.
c. Color coding scheme to be in accordance with UL 508a.

8. Provide surge protectors on all incoming power supply lines at each panel per requirements of Section 407856 “Isolators, Intrinsic Safety Barriers, and Surge Suppressors.”
9. Each field instrument furnished under Division 40 and shown on Drawings as deriving input power from the control panel(s) to have a separate power distribution circuit with a circuit breaker or fuse and blown fuse indication.

a. Power instruments requiring 120VAC power as shown on Drawings.

10. Wiring trough for supporting internal wiring:

a. Plastic type with snap-on covers.
b. Side walls to be open top type to permit wire changing without disconnecting.
c. Trough to be supported to the subpanel by stainless steel screws.
d. Do not bond trough to the panel with glue or adhesives.

11. Provide each panel with a single tube, LED light fixture, 20 Watt in size (minimum).

a. Mounted internally to the ceiling of the panel.
b. Light fixture to be switched and be complete with the lamp.

12. Each panel to have a specification grade duplex convenience receptacle with ground fault interrupter:

a. Mount internally within a stamped steel device box with appropriate cover.

b. Convenience receptacle is not to be powered from a UPS.
c. Protect by a dedicated fuse or circuit breaker.

13. Each panel to be provided with an isolated copper grounding bus for all signal and shield ground connections. Shield grounding to be in accordance with the instrumentation manufacturer's recommendations.
14. Provide each panel with a separate copper power grounding bus (safety) in accordance with the requirements of the National Electrical Code.
15. Each panel to have control, signal, and communication line surge suppression in accordance with Section 407856 “Isolators, Intrinsic Safety Barriers, and Surge Suppressors.”
16. Microprocessor-based electronic devices in the panel that are powered by 120VAC to be powered by the UPS.
17. Provide each panel with a circuit breaker to interrupt incoming power.
18. Additional electrical components including transformers, motor starters, switches, circuit breakers, etc. to follow the requirements of Division 26.

B. Relays not provided under Division 26 and required for properly completing the control function specified in Division 40, Division 26 or shown on Drawings to be provided under this Section.

C. Orientation of devices including PLC and I/O when installed to be per the manufacturer's recommendations.

1. No vertical orientation of PLC racks are allowed unless specifically indicated by the manufacturer as an acceptable mounting alternative and also approved by Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

END OF SECTION 406733

SECTION 406763 - CONTROL PANEL MOUNTED UPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes control panel mounted uninterruptible power supplies (UPS).

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements.
2. Section 406717 “Industrial Enclosures.”

1.3 DEFINITIONS

A. Uninterruptible Power Supply (UPS): A device capable of providing emergency battery power when the main power source fails.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions”.

B. Shop Drawings:

1. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions”.

1.5 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.6 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. None Required

1.8 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. The UPS manufacturer to demonstrate at a minimum ten years of continuous field operating experience with equipment of similar size and design.

1. UPS Manufacturer:ISO 9001 certification.

C. Equipment: UL or ETL labeled.

1.9 TECHNOLOGY OBSOLESCENCE MITIGATION

A. Not applicable to this Section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 016000 “Product Requirements” for delivery, storage, and handling requirements.

1.11 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.12 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of computers that fail(s) in materials or workmanship within specified warranty period.

Warranty Period: Provide next day on-site service covering parts and labor for two year(s) from date of purchase. The on-site service is to be performed by an authorized representative of the manufacturer.

PART 2 - PRODUCTS

2.1 SINGLE PHASE UPS - INTERNAL TO CONTROL PANELS

A. Manufacturers

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

a. Allen Bradley 1609-D UPS.
b. Sola Hevi Duty SDU UPS..
c. Substitutions: Or equal

B. System Description:

1. Provide an industrially rated continuous-duty, on-line, solid state, line interactive, single-phase uninterruptible power system.
2. UPS to provide power conditioning and power backup for PLC, communications hardware, and other critical electronic loads as indicated on Drawings.
3. UPS system consists of the following major components:

a. Rectifier and battery charger.
b. Inverter.
c. Batteries.
d. Other features as described in this Section and as indicated on Drawings.

C. General Requirements:

1. Provide battery protection via an internal circuit breaker disconnect.
2. Current limiting circuitry to protect inverter output under any load condition.
3. AC output neutral be electrically isolated from UPS chassis.

a. UPS chassis to have an equipment ground terminal.
b. Provide provisions for installation of a bonding connector.

4. Suitable for installation in a UL508A listed panel.
5. DIN rail mountable.
6. UL recognized components for industrial applications in accordance with UL508 without derating.

D. Performance Requirements:

1. Ratings:

a. Output power: As shown in the schedule in PART 3.
b. Battery runtime: 14 minutes at full-load, 34 minutes at half-load.

2. Environment:

a. Ambient temperature: 0 to 40 degrees C.
b. Elevation: Up to 500-ft above mean sea level.
c. Relative humidity: 1 to 95 percent non-condensing.

3. System Input - Primary source:

a. Nominal Input Voltage: As shown in the schedule in PART 3.
b. Frequency: 45 to 65 Hz.
c. Input Power Factor: 0.95 lag minimum, 50 to 100 percent load.
d. Input Surge Withstandability: Per IEEE 587/ANSI C62.41. Category A and B, (6 kV).

4. System Output:

a. Nominal Output Voltage: As shown in the schedule in PART 3.
b. Frequency: 60 Hertz plus or minus 3 Hertz.
c. 100 percent load with 3:1 Crest Ratio
d. Frequency Slew Rate: 1 Hz/second. (Adjustable at startup)

5. AC to AC Efficiency (100 percent load @ rated PF): 88 percent online, 86 percent on battery.
6. Acoustical Noise:

a. Noise generated by UPS under normal operation not exceed 65 dBA (60 dBA typical) at one meter from any surface, measured at 25 degrees C (77 degrees F) and full load.

7. EMI Suppression:

a. UPS to meet FCC Rules and Regulation 47, Part 15, Subpart J, for Class A devices.

E. Modes of Operation:

1. UPS to operate as a line interactive on-line, fully automatic system in the following modes:

a. Normal:

1) Critical load continuously supplied with filtered and regulated AC power by inverter. Rectifier/battery chargers derive power from preferred AC source and supply DC power to inverter while simultaneously floats charge the batteries.

b. Emergency:

1) Upon failure of preferred AC power source, critical load continues to be supplied by inverter. Inverter power supplied without switching from storage battery. No interruption to critical load upon failure or restoration of preferred ac sources. If AC source cannot be restored before battery discharges to its low voltage dropout value, UPS automatically shuts itself down in an orderly manner.

c. Recharge:

1) Upon restoration of AC source, rectifier/battery charger to power inverter and simultaneously recharge batteries. This to be an automatic function causing no interruption to critical load.

F. Rectifier/Charger:

1. Solid-state equipment and controls necessary to convert incoming AC power to regulated DC power for input to inverter and for battery charging.
2. Solid-state SCR/IGBT power transistor type with constant voltage/current limiting control circuitry.

G. Inverter:

1. Include all solid-state equipment and controls to convert DC power from rectifier/charger or battery to a regulated AC power for powering critical load.

    a. Use Insulated Gate Bipolar Transistors (IGBTs) in a phase-controlled, pulse width modulated (PWM) design capable of providing the specified AC output.

2. Capable of supplying current and voltage for overloads exceeding 100 percent.

    a. Provide 150 percent of full load for 30 seconds and 125 percent of full load for 2 minutes.
    b. Status indicator and audible alarm indicate overload operation.

3. Maintain output voltage to within plus or minus 5 percent.
4. Output voltage total harmonic distortion (THD) not greater than 5 percent at full load.

H. Batteries:

1. High Temperature sealed, maintenance-free, high-rate discharge, lead-acid cells suitable for use indoors with no off gassing, or water addition requirements.

    a. Require no special ventilation.
    b. One or more battery banks with number of cells required to meet requirements of rest of these specifications.

2. Battery Design Life: 2 to 4 years

I. Controls and Monitoring:

1. Microprocessor-controlled circuitry:

    a. Provide fully automatic operation of UPS through use of a microprocessor-based controller.
    b. Operating and protection parameters firmware-controlled.
    c. Logic includes system test capability to facilitate maintenance and troubleshooting.
    d. Startup, battery charging, and transfers to be automatic.

2. Front Indicators: As a minimum, the following indicators to be provided on UPS control panel:

a. On-line (UPS is using utility power to power the load).

1) In bypass mode.
2) On battery.
3) Overload.
4) Replace battery / battery disconnected.
5) Fault.
6) Bar graph for utility voltage.
7) Bar graph for battery.

b. Front Panel UPS Controls:

1) Power On/Off.
2) Self-test.
3) Alarm silence.
4) Cold start.
5) Load off.

c. Remote alarm and status indication: Isolated SPDT dry contacts provided to indicate UPS status for remote monitoring. Contacts rated for 250VAC @ 5A or 30VDC @ 5A

1) Individual contacts provide for separate annunciation of the following alarm and status conditions:

2.2 SINGLE-PHASE UPS - EXTERNAL TO CONTROL PANEL

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

a. Ametek Solid State Controls.
b. Eaton Powerware.
c. Emerson Liebert GXT3 Series.
d. Schneider Electric APC Smart-UPS.
e. Tripp Lite.
f. Substitutions: Or equal

B. System Description:

1. Provide a continuous-duty, on-line, solid state, dual conversion, single-phase input (using input voltage as shown on the Drawings), single-phase 120VAC true sinewave output uninterruptible power system.
2. UPS to provide power conditioning and power backup for computer, communication, and other critical electronic loads as indicated on Drawings.
3. UPS system consists of the following major components:

a. Rectifier and battery charger.
b. Inverter.

c. Batteries and battery disconnect switch.
d. Automatic static bypass switch.
e. External maintenance bypass switch.
f. Integral control and monitoring panel.
g. Other features as described in this Section and as indicated on Drawings.

C. General Requirements:

1. External Battery Enclosure:

a. Provide a separate enclosure for housing additional batteries, if required to provide minimum run time as specified herein.

1) Battery enclosure to match main UPS enclosure in style and color.

2. Cabling required to interconnect all components provided by UPS manufacturer.
3. Provide battery protection via an internal circuit breaker disconnect.

a. Protect battery cabinets via an internal circuit breaker.

4. Current limiting circuitry to protect inverter output under any load condition.

a. High speed semiconductor fusing to protect static bypass in event of an output short circuit.

5. Electrically isolate AC Output neutral from UPS chassis.

a. UPS chassis to have an equipment ground terminal.

1) Provide provisions for installation of a bonding connector.

6. UPS to be suitable for installation at the location shown on Drawings.

D. Performance Requirements - Ratings:

1. Battery runtime:

a. Sized to support 125% of calculated load for 20 minutes. Submit UPS runtime calculations that indicate anticipated runtime at 125% load.
b. Provide additional batteries in separate enclosure as required to meet runtime requirement.

2. Output power:

a. UPS power to supply control panels and ancillary equipment shown on the Control System Architecture and P&IDs. Refer to the schedule in PART 3 for minimum UPS sizing.

E. Performance Requirements - Environment:

1. Ambient temperature: 0 to 40 degrees C.
2. Elevation: Project site elevation.

3. Relative humidity: 0 to 95 percent non-condensing.

F. Electrical Requirements:

1. System Input - Primary source:

a. Nominal input voltage: As shown in the schedule in PART 3.
b. Frequency: 60 Hertz plus or minus five percent.
c. Input Power Factor: 0.96 lag minimum, 50 to 100 percent load.
d. Input Current Total Harmonic Distortion (THD): < 33 percent.
e. Input Surge Withstandability: Per IEEE 587/ANSI C62.41. Category A and B, (6 kV).
f. Input Connection: Coordinate with electrical contractor.

2. System Output:

a. Nominal output voltage: As shown in the schedule in PART 3.
b. Frequency: 60 Hertz plus or minus 3 Hertz.
c. 100 percent load with 3:1 Crest Ratio.
d. Frequency Slew Rate: 1 Hz/second. (Adjustable at startup).
e. Output Connections: (six) NEMA 5-15R receptacles.

3. AC to AC Efficiency:

a. (100 percent load @ rated PF): 91 percent.

4. Acoustical Noise:

a. Noise generated by UPS under normal operation not to exceed 65 dBA (60 dBA typical) at one meter from any surface, measured at 25 degrees C (77 degrees F) and full load.

5. EMI Suppression:

a. UPS to meet FCC Rules and Regulation 47, Part 15, Subpart B, for Class A devices.

G. Modes of Operation:

1. Normal Mode:

a. UPS to be a continuous online unit.

1) Power to critical loads to be continuously generated by inverter during normal AC line power.
2) In event of AC line power failure, power to inverter is supplied by batteries.
3) Under normal operation, batteries to be charged in a manner that optimizes battery life.
4) Simple "trickle charge" of batteries not be acceptable.

2. Bypass Mode:

a. Automatic bypass transfers critical load to commercial AC source, bypassing UPS' inverter/rectifier, in case of an overload, load fault, or internal failure.

3. Maintenance Mode:

a. If a Maintenance Bypass switch is provided, external manual bypass switch to be operated to transfer load to alternate source when UPS is taken out of service for maintenance or repair.
b. This transfer occurs without power interruption.

H. Controls:

1. Microprocessor-controlled circuitry:

a. Provide fully automatic operation of UPS through use of a microprocessor-based controller.
b. All operating and protection parameters to be firmware-controlled.
c. Logic includes system test capability to facilitate maintenance and troubleshooting.
d. Automatic functions:

1) Startup
2) Battery charging
3) Transfers

2. Graphical Display:

a. Utilize an LED graphical display for:

1) UPS control
2) Monitoring
3) Alarming
4) Configuration
5) Diagnostic functions.

3. Provide the following operational controls and indicators per following KVA ranges:

a. Up to 3 KVA Controls:

1) UPS On/Alarm Silence/Manual Battery Test control.
2) Standby/Manual Bypass control.

b. Up to 3 KVA Indicators:

1) LED Battery Meter.
2) Battery in operation status.
3) Load on Inverter status.
4) Load on By-Pass status.
5) AC input status.
6) UPS malfunction alarm.

c. 3 to 6 KVA Controls:

1) UPS On/Alarm Silence/Manual Battery Test control.
2) Off/ Bypass control.

d. 3 to 6 KVA Indicators:

1) Battery in operation status.
2) Load on Inverter status.
3) Load on By-Pass status.
4) AC input status.
5) UPS malfunction alarm.
6) LED AC Input Meter.
7) LED Battery Meter.
8) AC input voltage (line to line).
9) AC input current (each phase).
10) AC input power (kW, KVA and power factor).
11) DC battery voltage.
12) Battery current (charge and discharge).
13) AC output voltage (line to line and line to neutral).
14) AC output current (each phase).
15) AC output frequency.
16) AC output power (kW, KVA and power factor).
17) Diagnostic Alarms:

I. Remote alarm and status indication:

1. Isolated SPDT Form C dry contacts provided to indicate UPS status for remote monitoring.

a. Contacts rated for 250VAC @ 5A or 30VDC @ 5A.
b. Individual contacts provided for separate annunciation of the following alarm and status conditions:

2. UPS Normal (UPS is using utility power to power the load and detects no faults).
3. UPS in Static bypass mode.
4. UPS using battery to power the load.
5. UPS on battery and battery low.
6. If a maintenance bypass switch is provided, provide a contact from that switch to indicate UPS in Maintenance Bypass mode.

J. Rectifier/Charger:

1. Term rectifier/charger denotes solid-state equipment and controls necessary to convert incoming AC power to regulated DC power for input to inverter and for battery charging.

a. Solid-state SCR/IGBT power transistor type with constant voltage/current limiting control circuitry.

K. Inverter:

1. Include all solid-state equipment and controls to convert DC power from rectifier/charger or battery to a regulated AC power for powering the critical load.

2. Use Insulated Gate Bipolar Transistors (IGBTs) in a phase-controlled, pulse width modulated (PWM) design capable of providing specified AC output.
3. Capable of supplying current and voltage for overloads exceeding 100 percent.

    a. Provide 150 percent of full load for 30 seconds and 125 percent of full load for 2 minutes.
    b. A status indicator and audible alarm indicate overload operation.
    c. UPS to transfer the load to bypass when overload capacity is exceeded.

4. Maintain output voltage to within plus or minus 4 percent.
5. Output voltage total harmonic distortion (THD) not greater than 5 percent for all loads.

    a. For 100 percent rated load of 3:1 crest factor nonlinear loads, output voltage total harmonic distortion no greater than 4 percent.
    b. Output rating is not to be derated in kVA or kW due to the 100 percent nonlinear load with 3:1 crest factor.

6. Use software control to adjust output voltage from plus or minus 5 percent of nominal value.

L. Batteries:

1. VRLA (valve-regulated lead-acid), sealed, maintenance-free, high-rate discharge, lead-acid cells suitable for use indoors with no off-gassing or water addition requirements.

    a. No special ventilation required.
    b. Consist of one or more battery banks with number of cells required to meet requirements of the rest of these specifications.

2. Design Life: five years.
3. Run time operation of UPS to be accomplished using batteries mounted within UPS enclosure and supplemented as required with an external battery enclosure to provide battery runtime specified.

M. External Maintenance Bypass:

1. Provide each UPS with a "two-position" external bypass switch system to permit UPS to be removed for repair or maintenance without causing power disruption to connected power loads.

    a. External bypass switch: snap-action type with switching speed approximately 10ms or less independent of operator action.
    b. Label the two positions UPS and UTILITY.

2. For UPS units up to and including 3KVA:

    a. Furnish an Electroswitch series 103 snap action switch or equivalent,
    b. Furnish custom plugs, receptacles, and appropriate wiring to achieve the specified functionality.

3. For UPS units above 3 KVA:

a. Furnish standard manufacturer's maintenance bypass switch unless a dry contact for remote monitoring is specified herein to monitor the switch and it is not offered by the manufacturer.
b. Otherwise, provide an Electroswitch series 103 switch or equivalent, along with:

1) Custom plugs, receptacles, and appropriate wiring to achieve the specified functionality.

4. Provide a dry contact to indicate when bypass switch is in "Maintenance" position.

a. Contact rated for 250VAC @ 5A or 30VDC @ 5A.

N. Enclosures:

1. UPS equipment housed in a free standing NEMA 1 enclosure(s).

Line up and match enclosures in style and appearance.

PART 3 - EXECUTION

3.1 UNINTERRUPTIBLE POWER SUPPLY SCHEDULE

A. Provide the following uninterruptible power supplies. Exact sizing of the UPS is the responsibility of the PCSS.

Table 1. Uninterruptible Power Supply Schedule

UPS Designation	Minimum VA	Input Voltage	Output Voltage	Location, Type, and Notes
UPS-SGB	1500 VA	120 VAC	120 VAC	PLC-SGB Enclosure. DIN rail mounted .
UPS-CONTROLROOM	1500 VA	120 VAC	120 VAC	STANDALONE

3.2 EXAMINATION

A. Examine walls, floors, roofs, and rooms for suitable conditions where UPS will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method:

1. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures:

1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.4 CONNECTIONS

A. Refer to Section 260526 “Grounding and Bonding for Electrical Systems.”

3.5 IDENTIFICATION

A. Refer to drawings for tagging designations

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Prepare test and inspection reports in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

2. Section 406121 Process Control System Testing.

3.7 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 SOFTWARE SERVICE AGREEMENT

A. Not Required

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 406763

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SECTION 406863 - CONFIGURATION OF HMI SOFTWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Provide all programming, configuration, and related services required to achieve a fully integrated and operational system. Control of all equipment to be in conformity with the Contract Drawings, process control descriptions, specifications, engineering data, instructions, and recommendations of the equipment manufacturer. Coordinate the control system for proper operation with related equipment and materials furnished by other suppliers under other Sections of these specifications and with related existing equipment. Include the following information:
    a. Configuration of the HMI System Software, Operator Interface Terminals, and drivers provided for all equipment shown on the drawings, including equipment provided by vendor package systems.
    b. Configuration of any alarm dialer provided.
    c. Configuration of the SCADA Historian Software.
    d. Configuration of system reports using the Reporting Software provided.
    e. Communications and functionality data 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.
2. Coordinate all work with plant operating personnel to minimize impacts on daily operation. Note delays caused for any reason and formally submit to Engineer and Owner in the form of a letter.
3. If referred to anywhere else in the project manual, AE or AESS services include, but are not limited to, those services specified in this Section.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements.
2. Section 406126 “Process Control System Training.”
3. Section 406196 “Process Control Descriptions.”
4. Section 406213 “Server Computers.”
5. Section 406216 “Operator Workstation Computers.”
6. Section 406263 “Operator Interface Terminals”
7. Section 406343 “Programmable Logic Controllers.”

8. Section 406863 “Configuration of HMI Software.”
9. Section 406866 “Configuration of Controller Software.”

1.3 DEFINITIONS

A. Applications Engineering System Supplier (AESS): Entity who provides all programming, configuration, and related services for the control system equipment provided by the PCSS.

B. Application Engineering (AE): Application Engineering.

1.4 PREINSTALLATION MEETINGS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.” The meetings below are in addition to the meetings specified in that section.

B. Schedule and conduct a standards and conventions workshop. The purpose of this workshop is to review the standards, conventions, and methodologies that will be used to program and develop the programs (i.e., HMI and PLC databases, HMI graphics, and PLC programming, etc.) and will solicit Engineer and Owner's input. Submit an agenda with examples for items to be discussed at client workshop.

C. Schedule and conduct a draft graphics review meeting. The purpose of this meeting is to present draft graphics for the Owner's and Engineer's review and feedback prior to creating the full set of graphics for review. For repetitive graphics such as graphics for multiple process trains, include an example of the first graphic only for discussion. Include discussion of process and overview displays, examples of pop-ups, trends, and system navigation tools. Expect major comments and incorporate any changes resulting from those comments.

D. Schedule and conduct a second graphics review meeting. The purpose of this meeting is to finalize the process of building the required HMI system. This meeting will be held after return of the draft graphics submittal and incorporation of comments. At this meeting, present the actual software displays, databases, security system, reports, and the like. The Owner will make comments on the system for incorporation prior to factory test. Bring a working system to allow for live demonstration of graphics.

E. Schedule and conduct a historical data management and reports workshop. The purpose of this workshop is to discuss and solicit Engineer/Owner input for storage and management of historical data; format of daily, monthly, and yearly reports; development of data entry templates; report formats and layouts; and user interface displays for accessing and generating reports. Bring examples of these documents for review and discussion.

F. Schedule and conduct a factory-testing coordination meeting, two weeks prior to factory testing. The purpose of this meeting is to discuss the specifics of proposed tests and provide a forum for coordinating required factory testing.

G. Schedule and conduct a field-testing coordination meeting, two weeks prior to field testing. The purpose of this meeting is to discuss specifics of proposed tests and provide a forum for coordinating required field-testing.

1.5 ACTION SUBMITTALS

A. Provide the submittals listed below:

1. System Standards and Conventions.
2. Operator Interface.
3. Controller Program.
4. Reports.
5. Historical Data Management.

B. System Standards and Conventions Submittal:

1. Following the standards and conventions workshop, submit standards and conventions to be used on this project. Define the submittal, 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, use the submitted standards and conventions as basis for programming and configuration of the system. Do not begin the system programming and configuration prior to the System Standards and Conventions Submittal.

C. Operator Interface:

1. 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 graphics for the first equipment only.
2. Following the draft graphics review meeting and prior to the factory test, submit a ready-for testing version of all graphic displays. These graphics should be completely finished other than the incorporation of comments and changes resulting from testing.
3. Submitted graphic displays and trends are to be no less than 8.5 inches by 11 inches and in full color.
4. Modify the existing graphics for Irrigation transfer pump station and Pecan Branch Transfer Pumps to accommodate the changes required to fulfill control requirements as per 406196 Control descriptions.

D. Historical Data Management:

1. Following the Historical Workshop, submit all aspects of the historical data management system and include as a minimum the following:

a. A complete listing of all signals to be collected and stored, including data sampling rate and duration for which the data will be immediately accessible.
b. Data reduction methods, rates, and the duration data will be immediately accessible.
c. Storage space requirements and supporting calculations.
d. Historical database design description, including data flow diagram, table definitions, procedures and queries used; and description of method of accumulating and displaying run times and flow totals. Define the method of interfacing to the reporting system, methods of handling Data Quality Flags, and methods of storing and displaying trending information.
e. Description of methodology for restoring data collected locally during times when 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.)

E. Reports:

1. Following the Historical Workshop, submit all aspects of the reports generation system and include as a minimum the following:

a. A complete list of all reports to be developed.
b. Complete listing of all signals to be reported, including calculated values.
c. Description of reporting data storage design, including method data is polled and stored.
d. Description of methodology for entering manual data and interfaced used.
e. Procedures for recall, generation and printing of reports
f. Printout of each report to be provided with details of each cell, where data comes from, and calculation of raw data.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. System specified performs the following generalized functions:

1. Allows operator to control equipment such as pumps and valves as shown on Drawings and as defined in Section 406196 “Process Control Descriptions.”
2. Perform real-time process control, including proportional integral derivative control action, sequencing, and process calculations.
3. Collect, calculate, and store accurate, reliable operating information for present and future uses.
4. Assist remote site operating personnel by noting and communicating of normal operating conditions and equipment failures.
5. Accumulate and store equipment running times for use in preventative maintenance.

6. Provide color graphic displays and reports for use by the system operating and supervisory personnel.
7. Provide trending for analog values.
8. Provide control system diagnostics.
9. Perform process control functions including PID, calculations, sequencing, timing, in the process controller. The HMI software performs the real-time database, report generation, graphic screens, program development, set point modification, data archiving, etc.
10. Allow the operator to manually control (by keyboard entry and mouse type pointing device) the status of pumps, valves, e.g., on/off, open/close, setpoint value,) when viewing the appropriate graphic screen on the HMI.

3.2 GRAPHIC DISPLAYS - GENERAL

A. Ensure displays contain and continuously update the displayed process variables, date, and time of day, with process values showing in engineering units. Incorporate on displays:

1. References to both instrumentation tag numbers and plant equipment numbers.
2. Process variables on their associated display(s) with correct engineering units.
3. Process variables with their associated data quality flags.

B. Operator commands related to controlling field devices or system attributes require multiple keystrokes or mouse actions to protect against inadvertent operations. Confirmation to the operator for the selected point to be controlled is provided, at which time a cancellation of the control can be affected.

C. Process graphic displays are depicted from the P&ID's, site plan drawings, mechanical drawings and electrical drawings included in these Contract Documents. The graphic displays include process flow streams, process structures, and all major items of process equipment and control devices in a schematic format.

D. Include on main graphical screens a title bar, main graphic area, navigational buttons, and alarm summary bar.

1. Title bar displayed on the top of each screen and include display name, description and time/date.
2. Main graphical area contains primary screen data in graphical format.
3. Navigational buttons include a minimum of main menu, trends, main alarm summary, and security log in.
4. Alarm summary bar displays the last three valid alarms on the bottom of each screen.

E. Provide animation to mimic level changes in tanks or vessels, and to mimic rotation of rotating equipment when running. Valve colors to change when opened and closed.

F. Adjust from the operator interface timers, setpoints, alarm actuation levels, unless specifically noted.

G. Ensure the system show field conditions with text that can alternate (i.e., OPEN/CLOSE, START/STOP, HIGH/LOW) and change color correspondingly. Field devices that are tri-state must be represented in three conditions.

H. Ensure conditions in the field designated as alarm conditions report to the operator workstation, actuate an audible alarm, and provide a visual blinking image on the associated graphic page. Display alarms and events on the screen and archived.

I. Identify interlocks that affect equipment operation both by alarm and by HMI indication.

J. Check analog inputs for out of range (via high and low limit checks) and alarmed.

K. Label process flow streams and color-code using the project color schedule in Division 09. Identify structures and equipment by name and appropriate equipment and loop tags.

L. Color coding for equipment status and alarms is as follows:

1. Red for on or open.
2. Green for off or closed.
3. Flashing red for alarm.
4. Yellow for acknowledged alarm.

M. Automatically record alarm and events should any of the following sequences or events occur:

1. Date/Time entry.
2. Limit changes.
3. Commanded or un-commanded change of any point.
4. Alarm conditions.
5. PLC activation or deactivation.
6. Operator login or logout activity.

N. There may be additional general programming requirements listed in PART 1 of the Section 406196 “Process Control Descriptions” that impact the HMI configuration.

3.3 SPECIFIC GRAPHIC SCREENS

A. At a minimum, provide the following types of graphic screen indicated below.

1. Plant Overview screen including a site plan representation, indicating the geographic location of each process and building.
2. Process graphic displays shall be based on the P&ID’s, site plan drawings, mechanical drawings and electrical drawings included in these contract documents. The graphic displays shall depict process flow streams, process structures, and all major items of process equipment and control devices in a schematic format.
3. Main menu screen linking all screens and process areas; complete and logical listing names and number of all screens.
4. Overall plant process block flow diagram screen showing major processes in block form with flow arrows. Each block includes a text description of key individual treatment processes. Navigational buttons to the individual treatment processes can be performed by pressing on the text description.
5. Individual treatment process screens graphically screening key process variables and equipment. Features:

    a. No operator entries are available from these screens.

b. Individual process flow screens for each process include all process components, including tanks, pumps, blowers, mixers, drives, flow meters, valves, mechanical devices, as well as manual shutoff and isolation valves.
c. These diagrams are generally depicted from the P&ID's with at least 1 screen per P&ID on average.

6. Individual unit process screens depicted from the P&ID's are used for control and screen of each major item of process equipment, process variables, and control devices, including pumps, blowers, valves, gates, mixers, and drives. Navigational buttons consist of the P&ID's flow arrows to other individual unit processes. The unit process screens provide the ability for the operator to go to individual equipment popup screens. These diagrams are generally depicted from the P&ID's with at least 2 screens per P&ID on average.
7. Provide popup screens for each piece of equipment to start/stop equipment, open / close valves, implement automatic control, adjust set points, establish and adjust tuning parameters, set alarm limits, and initiate a sequence.
8. PLC system diagnostic screens, showing the operational status, and fault conditions of all PLC components, including processors, I/O modules, OIT's, power supplies and UPS units.
9. Communications diagnostic screens, showing the details of network status, communications status of all major components including Operator Work Stations, peripheral devices and network components.
10. Maintenance screens display the raw value for each analog and digital I/O point in the system. They allow the operators/maintenance personnel to enter an override value for an analog point that is then used by the system instead of the value read from the input card / communications link.
11. Trend screens with the capability to screen up to eight, operator assigned, analog and/or digital process variables. Each analog value will be shown on a trend screen.
12. Main alarm summary screen includes the following information for each alarm: Time, tag name, description, alarm type, current value, and status. An acknowledge alarm button acknowledges all new unacknowledged alarms. Display alarms in the alarm summary screen and in the alarm banner as follows:

    a. Unacknowledged and active alarm: Displayed on screen, blinking
    b. Acknowledged and active alarm: Displayed on screen, not blinking.
    c. Unacknowledged and inactive alarm: Displayed on screen, blinking. Text/background of the alarm displayed in a different color than active alarms.
    d. Acknowledged and inactive alarm: Not displayed in banner.

13. Analog variable screens showing a tabular summary of all plant process variables, in operator assigned groupings.

3.4 SECURITY

A. Configure and implement the system with security to prevent unauthorized access. The system allows authorized changes to system operation through defined user accounts and password verification.

B. Coordinate with Owner user account information, including login name and password for each account.

C. Assign security levels of "display only," "operator mode," "supervisor mode," and "engineer mode" through assignable passwords. On system startup, automatically enter the "display only" security level. In the "display only" mode, information is available to be displayed on the screen, but no changes may be made. In the "operator mode," changes may be made to process set points, times, etc.; however, the overall control concepts may not be modified. In the "supervisor mode," all operator functions can be modified, and any special reports or critical process set points (data can be modified; however, the overall control concepts may not be modified). In the "engineer mode" level, all user modifiable parameters of the system are available for modification.

3.5 ALARM/EQUIPMENT STATUS REPORTING

A. Display on the alarm log all alarms as they occur. Include on the alarm message the time of occurrence, tag name, tag number, and whether it is a low, high, or failure alarm. When the point in alarm returns to normal, the time, point identification number, and return to normal are displayed. Include on all reports the plant equipment number of the associated device.

B. Log the equipment status whenever a change in status occurs (i.e., start, stop). Include on the equipment status log the time, equipment name, tag number, and the particular change in status.

3.6 HISTORICAL DATA MANAGEMENT

A. Provide the following features for processing and storage of system historical data:

1. Each system point (analog or digital, real or pseudo) has the capability of being historically logged. A point can be deleted from historical log at any time. Points can be added or deleted from the system using minimal keystrokes.
2. Sample and store all process analogs and all flow totals and run time indications of all primary process equipment motors in the historical data management system.
3. Data Processing: Store the real time instantaneous values in a historical log file on the hard disk at defined sampling rates.
4. Data Correction: Manually modify historical data by personnel with appropriate security levels. Differentiate such data from actual monitored values on reports, in the database and in trends.
5. Data Quality: Propagate data Quality flags to the next higher level of the history based on user selectable percentage determining tolerance levels for averages and totals. If the percentage of suspect data exceeds the tolerance level, the suspect data flag propagates to the next higher level. Maximums and minimums are taken from good data.
6. Manual Input Data Handling: This data consists of additional values not obtainable by the system such as laboratory analysis for use in reports. Enter and store all manually entered data in the appropriate engineering units. Display all data entered for confirmation on the display prior to incorporation to the database.

3.7 REPORTS

A. Determine quantity and format of reports at the historical data management and reports workshop and as a minimum include shift, daily, monthly and yearly reports. Provide a minimum of one of each type, shift, daily, monthly, and yearly reports.

B. The system generates reports from on-line historical data files or prompt the user for the appropriate archived data files.

C. Initiate reports automatically based upon time of day or manually upon operator's request.

D. Develop user-interface displays for report generation with easy recall of reports by entering time:day:year target values.

E. User interface displays allows the operator to define the destination of the report (e.g., display, printer, computer file, etc.) and when to print (e.g., immediately, on demand, or automatically at a specified time).

F. Print quality tags alongside the value.

G. Identify values for which there are no data with a special character. Thus, print only values which are actually zero.

H. Operational Report Types. Provide the following operational report types with the system:

1. Shift Operation Summary Report:

    a. Summarize plant operation from the start and finish time of operation on an operator-adjustable time interval shift operation report.
    b. Consist of the following: correct date, plant name, report name, page number, group headings, subheadings, point identification, and engineering units.

2. Daily Operation Summary Report:

    a. Summarize plant operation for the previous day on the daily operation report. Printed information is stored values (not averages) including scanned, lab, and manually entered data.
    b. The report format consists of the following: correct date, plant name, report name, page number, group headings, subheadings, point identifications, and engineering units.
    c. Also calculate the daily minimum, average, maximum, and total where applicable and print and store for each point.

3. Monthly Operation Summary Report:

    a. Summarize plant operation for the previous calendar month on the monthly operation summary report.
    b. Arrange the report format so that the first several pages conform to the requirements of the state regulatory agencies and separate from the rest of the monthly operation report for transmittal to the regulatory agency.
    c. Report format similar to the daily operation summary report, consisting of the following: month and year, plant name, report name, page number, group headings, sub-headings, point identifications, and engineering units.
    d. Print monthly minimum, average, maximum, and totals, where applicable, for each column of points printed.

4. Annual Operation Summary Report:

a. Summarize plant operation for the previous calendar year on the annual operation summary report. Report consists of scanned data, lab data, and manually entered data.
b. Format of the report is identical with the monthly operation summary report except for replacing month with year in the heading and replacing date with calendar month.

3.8 TESTING

A. Refer to Section 406121.20 “Process Control System Testing”.

B. Supplement to Field Testing requirements:

1. Prior to leaving the site, use the Owner's programming computer to monitor all PLC processors online, make on-line changes, upload, and download the processor to ensure programming software version compatibility.
2. Loop Tuning: Tune all PID control loops (single or cascade) following device installation but prior to commencement of the Functional Demonstration Test.

a. Achieve optimal loop tuning either by auto-tuning software or manually by trial and error, Ziegler-Nichols step-response method, or other documented process tuning method.
b. Determine and configure optimal tuning parameters to assure stable, steady state operation of final control elements running under the control PID. Adjust each control loop that includes anti-reset windup features to provide optimum response following startup from an integral action saturation condition.
c. Tune all PID control loops to eliminate excessive oscillating final control elements. Adjust loop parameters to achieve a decay ratio of 1/4 or better. In addition, achieve loop steady state at least as fast as the loop response time associated with critical damping.
d. Verify loop performance and stability by step changes to setpoint in the field.
e. Submit loop tuning documentation as specified in PART 1 of this Section.

3.9 TRAINING

A. Refer to Section 406126 “Process Control System Training” for general training requirements

B. Furnish training as shown in the table below.

Description	Minimum Course Duration (hours)	Maximum Number of Trainees per Course	Number of Times Course to be Given	Intended Audience
Onsite Training				
Control System Overview Seminar	2	12	1	Management
Operator Training (Pre start-up)	8	12	1	Operations
Operator Training (Post start-up)	8	12	1	Operations
Software Maintenance	2	2	1	Maintenance
System Reports and Historian	2	2	1	Maintenance

C. Control System Overview Seminar:

1. Provide Control System Overview seminar for Owner's personnel at Owner's facility. Objective of this seminar is to provide personnel with an overview understanding of Control System. Target seminar material to Owner's management, engineering, and other non-operations personnel. Seminar includes, but not limited to, the following:

    a. An overview of the Control system explaining how the hardware and software supplied under this Contract is used for the operation and control of the facilities.
    b. A block diagram presentation of the Control system showing how and what information flow within the system and what each functional unit does.
    c. An explanation of the operator interfaces including a demonstration of how to use an operator's workstation to monitor, control, navigate, display trends, and all other operational features of the system. Address outside of this course a discussion of process control of individual processes.
    d. A walkthrough of the installed system explaining each of the items covered in the functional units' discussion. Discuss the features and functions of operator controls and interfaces.

D. Operator Control System Training (pre- or post start-up):

1. Cover during operator training plant operation with the control system and use of the HMI display screens, including at a minimum all the following items:

    a. Basics of HMI control and navigation.
    b. Alarming and Interlocks.
    c. Auto functionality of automated processes and HMI control.
    d. Failure modes of equipment and operator responses.

2. Hold a minimum of two operator-training sessions (Pre-Startup) for operators one week before system startup. Use the Simulator specified in this project for the pre-startup training. Hold additional one or two operator-training sessions (Post-Startup) for operators one week after system startup.
3. Hold operator training at the convenience of Owner. Hold this training during the day, late at night, or very early in the morning to accommodate Owner's shift schedule.
4. Operator training is introductory in nature during pre-startup training and more in-depth and detailed during post-startup training.
5. At a minimum, provide the following teaching aids for distribution during Operator training sessions:

    a. Preliminary O&M Manuals (pre-startup); Final O&M Manuals (post-startup).
    b. P&IDs.
    c. Daily syllabus.

6. Fifty percent of the Operator training is "hands on" utilizing the installed Control System to the fullest extent possible. Confirm the operability of the Control System before commencing training. Training performed using a non-functioning Control System is not permitted.

E. Software Maintenance:

1. Provide training of how to back-up PLCs, HMIs, OITs, and any other software in this system.
2. Provide training on all aspects covered in the O&M Software Maintenance Manuals.
3. Provide training on PLC program structure, HMI configuration structure, tips in how to edit programming code, and other items which will supplement the maintenance staff's ability to edit and maintain the programs.

F. Historian and System Reports:

1. Provide training of how to run the reports, how to manually enter data, and how to print and reprint the reports.
2. Provide training on how to execute data queries that are outside of those defined in the reports.
3. Provide training on Historian configuration, report configuration, database maintenance and backup, and repair of failed reports.

END OF SECTION 406863

SECTION 406866 - CONFIGURATION OF CONTROLLER SOFTWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Provide all programming, configuration, and related services required to achieve a fully integrated and operational system. Control all equipment in full conformity with the Contract Drawings, process control descriptions, specifications, engineering data, instructions, and recommendations of the equipment manufacturer. Coordinate the control system for proper operation with related equipment and materials furnished by other suppliers under other Sections of these specifications and with related existing equipment.

    a. Provide configuration of the PLC provided for all equipment shown on the drawings, except for controls equipment shown being provided as part of a vendor package system.
    b. The following process equipment vendors shall provide all programming, configuration and related services required to achieve fully operational vendor-supplied systems. Control all equipment in full conformity with the Contract Drawings and Specifications related to these systems:
        1) Bar Screen
        2) Grit Separator and Washer Classifier.
        3) Aeration Blowers

2. Coordinate all work with plant operating personnel to minimize impacts on daily operation. Note delays caused for any reason and formally submitted to Engineer and Owner in the form of a letter.
3. If referred to anywhere else in the project manual, AE or AESS services include, but are not limited to, those services specified in this Section.
4. The PLC-based control functions at each process equipment vendor’s control panel shall include control and operator interface capability plus connectivity to the plant control system for monitoring and/or control as shown in the Contract Drawings. Vendor-supplied PLC programming shall be performed by the associated vendor. The process equipment vendors shall be responsible for coordinating with the Process Control System Supplier (PCSS) to ensure that all functions are properly incorporated into the respective supervisory control panel and plant control system (PCS).
5. Process equipment vendors shall coordinate with the PCSS and provide complete I/O lists and memory map of PLC registers including set points, controls, calculated alarms and

variables, etc., to be included on the PCS HMI screens for their respective process equipment PLCs.

6. Process equipment vendors shall coordinate with the PCSS to incorporate any required peer-to-peer messaging for controls and interlocks between their respective process equipment PLCs and other plant PLCs.
7. PCSS is to modify the existing PLC programming of PLC-IHSPS to automate the Irrigation Pump station based on Clearwell level as per control description 406196.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements.
2. Section 406196 “Process Control Descriptions.”
3. Section 406263 “Operator Interface Terminals”
4. Section 406343 “Programmable Logic Controllers.”
5. Section 406863 “Configuration of HMI Software.”

1.3 DEFINITIONS

A. Applications Engineering System Supplier (AESS): Entity who provides all programming, configuration, and related services for the control system equipment provided by the PCSS.

1.4 PREINSTALLATION MEETINGS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.” The meetings below are in addition to the meetings specified in that section.

1.5 ACTION SUBMITTALS

A. Controller Program Submittal:

1. For each controller, submit the following using the controller manufacturer's built-in printing functions. Electronic submission of Adobe Portable Document Format ("pdf") files in lieu of paper submittals is acceptable. Review will be for general program organization, level of documentation, and overall programming standards (basic pump and valve control, for example). The review will not attempt to confirm the logic works correctly for every loop.

    a. PLC programs showing ladder logic, function block, high level language or another controller language used. Include individual rung, network, and/or command descriptions with abundant comments to clearly identify function and intent of each code segment. Clearly present each logic segment, describe the function of each timer, label and define the purpose of each subroutine call, etc. Ensure that program documentation is sufficiently clear to allow determination of compliance with the process control requirements included in the control descriptions and with Drawings. The submittal demonstrates that all logic provided under this project follows the same structure and format and reflects a common programming approach.

b. Submit a memory usage report for the controller. Indicate total memory capacity and unused memory capacity.

c. Submit cross reference index of I/O allocation and controller memory address. Include every physical I/O point as well calculated or virtual I/O required for the implementation of the process scheme.

2. Submit details of control system communication. Submit a "memory map" or other means showing which signals are exchanged between PLCs. Also submit an HMI tag database showing all signals exchanged between the PLCs and HMI. Define any specific communication block memory addresses.

B. Submit all electronic files associated with the controller such that Owner and Engineer can open a complete copy of the controller program using the controllers native programming package.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONTROLLER PROGRAMS

A. Develop all application programs in a structured manner and follow an intuitive arrangement so that an instrumentation technician with basic programming knowledge will be able to understand. Utilize standard program templates or subroutines for repetitive logic such as equipment control, flow total calculations, equipment runtime calculations.

B. Make changes to the application programs and software configuration, based on comments during the submittals, the factory tests, the field tests, and during the commissioning process to meet the design intent, at no additional cost to Owner.

END OF SECTION 406866

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SECTION 407000 - INSTRUMENTATION FOR PROCESS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the general requirements to furnishing, installing, and servicing PCSS provided instruments.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements.
2. Section 407113 “Magnetic Flow Meters.”
3. Section 407133 “Propeller Flow Meters.”
4. Section 407143 “Variable Area Flow Meters.”
5. Section 407179 “Flow Switches.”
6. Section 407213 “Ultrasonic Level Meters.”
7. Section 407243 “Pressure and Differential Type Level Meters.”
8. Section 407276 “Level Switches.”
9. Section 407313 “Pressure and Differential Pressure Gauges.”
10. Section 407326 “Gauge-Pressure Transmitters.”
11. Section 407329 “Differential Pressure Transmitters.”
12. Section 407336 “Pressure and Differential Pressure Switches.”
13. Section 407363 “Diaphragm Seals.”
14. Section 407443 “Bimetallic Thermometers.”

1.3 DEFINITIONS

A. Process Control System Supplier (PCSS): Entity responsible for providing all materials, equipment, labor, and services required to achieve a fully integrated and operational control system.

1.4 ACTION SUBMITTALS

A. Submit complete documentation for all field instruments in one comprehensive submittal. Use ISA-TR20.00.01-2007 data sheet format as a cover sheet for each instrument prior to data sheets. Submit a complete Bill of Materials (BOM) or Index that lists all instrumentation equipment, sorted by Loop Number.

B. Submit separate data sheets for each instrument type:

1. Plant Equipment Number and ISA tag number per Drawings.
2. Product (item) name used herein and on Drawings.
3. Manufacturer's complete model number.
4. Location of the device.
5. Input - output characteristics.
6. Range, size, and graduations in engineering units.

C. Submit the following information for each instrument type:

1. Include construction details, material descriptions, dimensions of individual components and profiles.
2. Sizing calculations where applicable.
3. Indicate which instruments will be provided with certified calibration data (i.e., all flow metering devices) as part of O&M manual.
4. Include rated capacities, operating characteristics, electrical characteristics and furnished specialties and accessories.
5. Two-wire or four-wire device type as applicable.
6. Indicate which instruments will be provided with manufacturer’s maintenance services if specified.

D. Instrument Vendor Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of instrument.
4. Include diagrams for power, signal, and control wiring.

E. Submit catalog cuts for all instruments. Submit descriptive literature for each hardware component, which fully describes the units being provided.

F. Submit index and data sheets in electronic format as well as hard copies on 8-1/2 inch x 11 inch formats. Submit electronic copies in Microsoft Excel or Word format on USB thumb drive.

1.5 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.6 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Refer to individual instrument specifications for spare parts requirements.

B. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for PCSS requirements regarding submission of maintenance materials.

1.8 QUALITY ASSURANCE

A. Refer to individual instrument specifications for quality assurance requirements as well as which specific instruments require manufacturer’s start-up and training services.

B. Provide components compatible with functions required to form complete working system.

C. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for overall quality assurance requirements for PCSS scope of work.

PART 2 - PRODUCTS

2.1 INSTRUMENT TAGS

A. Permanent stainless steel or other non-corrosive material tag firmly attached and indelibly marked with the instrument tag number, as indicated in the Drawings. Tag equipment before shipping to the site.

B. Provide 1/8-inch by 3/8-inch, Type 316 stainless-steel button head machine screws.

C. All supplied instrument transmitters and instrument transmitter elements require a stainless-steel identification tag. Attach tag via stainless steel chain or stainless-steel wire, 24-gauge min, to a non-removable part of the device. Stamp the ISA alphanumeric instrument number as indicated on the P&ID, loop, or detail drawings into the tag. Minimum tag size is 1 inch H x 3 inch W with 3/16 inch high alphanumeric characters.

PART 3 - EXECUTION

3.1 GENERAL

A. See execution requirements in Section 406100 “Process Control and Enterprise Management Systems General Provisions”.

B. Unless specifically indicated, do not mount direct reading or electrical transmitting instrumentation on process piping. Mount instrumentation on instrument racks or stands. Provide all instrumentation connections with shutoff and drain valves. For differential pressure transmitters, 5-valve manifolds for calibration, testing and blow down service will be provided. For chemical or corrosive fluids, diaphragm seals with flushing connections will be provided.

3.2 INSTALLATION

A. See installation requirements in individual specification Sections.

3.3 ATTACHMENTS

A. APPENDIX A - Field Instrument Schedule.

END OF SECTION 407000

DRAWING NO.	ISA TAG NAME AND LOOP NO.	LOOP SUFFIX	TYPE	RANGE	SET POINT	UNITS	LOCATION & DESCRIPTION	PROVIDED BY	SPECIFICATION	INSTALLATION DETAIL (I DRAWING UNLESS OTHERWISE STATED)
SG-IA-1	LDIT-2000	1	Ultrasonic Level Meter	0-10	N/A	FT	Coarse Bar Screen Channel Level	46	407213	VENDOR PROVIDED
SG-IA-1	LE-2000	1	Ultrasonic Level Meter	0-10	N/A	FT	Coarse Bar Screen Channel Level	46	407213	VENDOR PROVIDED
SG-IA-1	LE-2000	2	Ultrasonic Level Meter	0-10	N/A	FT	Coarse Bar Screen Channel Level	46	407213	VENDOR PROVIDED
SG-IA-1	LE/LIT-2005	1	Guided Wave Radar Level Meter	0-15.5	N/A	FT	Influent Lift Station Level	40	407223	H
SG-IA-1	LI-2005	1	Level Indicator	N/A	N/A	FT	Influent Lift Station Level	40	407813	H
SG-IA-1	LSHH-2010	1	Float Level Switch	N/A	672.42	FT	Influent Lift Station Level High High	40	407276	E
SG-IA-1	LSH-2010	1	Float Level Switch	N/A	671.92	FT	Influent Lift Station Level High	40	407276	E
SG-IA-1	LSL-2010	1	Float Level Switch	N/A	670.42	FT	Influent Lift Station Level Low	40	407276	E
SG-IA-1	LSLL-2010	1	Float Level Switch	N/A	668.5	FT	Influent Lift Station Level Low Low	40	407276	E
SG-IA-1	PI-2010	1	Pressure Gauge	0-60	N/A	PSI	Influent Pump No. 1 Discharge Pressure	40	407313	C
SG-IA-1	PSH-2010	1	Pressure Switch	N/A	35	PSI	Influent Pump No. 1 Discharge Pressure High	40	407336	C
SG-IA-1	PI-2010	2	Pressure Gauge	0-60	N/A	PSI	Influent Pump No. 2 Discharge Pressure	40	407313	C
SG-IA-1	PSH-2010	2	Pressure Switch	N/A	35	PSI	Influent Pump No. 2 Discharge Pressure High	40	407336	C
SG-IA-1	PI-2010	3	Pressure Gauge	0-60	N/A	PSI	Influent Pump No. 3 Discharge Pressure	40	407313	C
SG-IA-1	PSH-2010	3	Pressure Switch	N/A	35	PSI	Influent Pump No. 3 Discharge Pressure High	40	407336	C
SG-IB-1	FE-2129	1	Rotameter	0-50	N/A	GPM	Stacked Vortex Tray Grit Unit Flow	46	407143	VENDOR PROVIDED
SG-IB-1	PI-2130	1	Pressure Gauge	0-15	N/A	PSI	Grit Pump No. 1 Discharge Pressure	43	407313	PROVIDED BY DIVISION 43
SG-IB-1	PSH-2130	1	Pressure Switch	N/A	10	PSI	Grit Pump No. 1 Discharge Pressure High	43	407336	PROVIDED BY DIVISION 43
SG-IB-1	PI-2130	2	Pressure Gauge	0-15	N/A	PSI	Grit Pump No. 2 Discharge Pressure	43	407313	PROVIDED BY DIVISION 43
SG-IB-1	PSH-2130	2	Pressure Switch	N/A	10	PSI	Grit Pump No. 2 Discharge Pressure High	43	407336	PROVIDED BY DIVISION 43

DRAWING NO.	ISA TAG NAME AND LOOP NO.	LOOP SUFFIX	TYPE	RANGE	SET POINT	UNITS	LOCATION & DESCRIPTION	PROVIDED BY	SPECIFICATION	INSTALLATION DETAIL (I DRAWING UNLESS OTHERWISE STATED)
SG-IB-2	PI-2100	1	Pressure Gauge	0-100	N/A	PSI	Grit Washer Classifier Pressure	40	407313	C
SG-IB-2	FE/FI-2110	1	Propeller Flow Meters	0-30	N/A	GPM	Grit Washer Classifier Flow	46	407133	VENDOR PROVIDED
SG-IB-2	PIT-2111	1	Pressure Transmitter	0-15	N/A	PSI	Grit Washer Classifier Pressure	46	407326	VENDOR PROVIDED
SG-IC-1	FIT-2740	1	Doppler Flow Meter	0-2,000	N/A	GPM	RAS Flowmeter Vault No. 1 Flow	40	407163	J
SG-IC-1	FE-2740	1A	Doppler Flow Meter	0-2,000	N/A	GPM	RAS Flowmeter Vault No. 1 Flow	40	407163	J
SG-IC-1	FE-2740	1B	Doppler Flow Meter	0-2,000	N/A	GPM	RAS Flowmeter Vault No. 1 Flow	40	407163	J
SG-IC-1	FIT-2740	2	Doppler Flow Meter	0-2,000	N/A	GPM	RAS Flowmeter Vault No. 2 Flow	40	407163	J
SG-IC-1	FE-2740	2A	Doppler Flow Meter	0-2,000	N/A	GPM	RAS Flowmeter Vault No. 2 Flow	40	407163	J
SG-IC-1	FE-2740	2B	Doppler Flow Meter	0-2,000	N/A	GPM	RAS Flowmeter Vault No. 2 Flow	40	407163	J
SG-IC-1	AE/AIT-2720	1	Dissolved Oxygen Analyzer	0-20	N/A	mg/L	Treatment Unit Tank No. 1 Dissolved Oxygen	40	407543 / 407506	I
SG-IC-1	AE/AIT-2720	2	Dissolved Oxygen Analyzer	0-20	N/A	mg/L	Treatment Unit Tank No. 2 Dissolved Oxygen	40	407543 / 407506	I
SG-ID-1	PI-2310	1B	Pressure Gauge	0-30	N/A	PSI	Aeration Blower No. 1 Discharge Pressure	43	407313	C
SG-ID-1	PI-2310	2B	Pressure Gauge	0-30	N/A	PSI	Aeration Blower No. 2 Discharge Pressure	43	407313	C
SG-ID-1	PI-2310	3B	Pressure Gauge	0-30	N/A	PSI	Aeration Blower No. 3 Discharge Pressure	43	407313	C
SG-ID-1	PI-2310	4B	Pressure Gauge	0-30	N/A	PSI	Aeration Blower No. 4 Discharge Pressure	43	407313	C
SG-ID-1	PIT-2311	1	Pressure Transmitter	0-XX	N/A	PSI	Aeration Blowers Discharge Pressure	40	407326	K
SG-IE-1	PDI-2401	1	Differential Pressure Gauge	0-XX	N/A	PSI	Inlet Air Silencer No. 1 Differential Pressure	43	407313	C
SG-IE-1	PI-2402	1	Pressure Gauge	0-XX	N/A	PSI	Aerated Sludge Holding Tank Blower No. 1 Suction Pressure	43	407313	C
SG-IE-1	PI-2401	1	Pressure Gauge	0-XX	N/A	PSI	Aerated Sludge Holding Tank Blower No. 1 Discharge Pressure	43	407313	C
SG-IE-1	PSH-2401	1	Pressure Switch	N/A	0-XX	PSI	Aerated Sludge Holding Tank Blower No. 1 Discharge Pressure High	43	407336	VENDOR PROVIDED

DRAWING NO.	ISA TAG NAME AND LOOP NO.	LOOP SUFFIX	TYPE	RANGE	SET POINT	UNITS	LOCATION & DESCRIPTION	PROVIDED BY	SPECIFICATION	INSTALLATION DETAIL (I DRAWING UNLESS OTHERWISE STATED)
SG-IE-1	TI-2401	1	Bimetallic Thermometer	0-XX	N/A	Deg F	Aerated Sludge Holding Tank Blower No. 1 Discharge Temperature	43	407443	VENDOR PROVIDED
SG-IE-1	TSH-2401	1	Temperature switch	N/A	0-XX	Deg F	Aerated Sludge Holding Tank Blower No. 1 Discharge Temperature High	43	407466	VENDOR PROVIDED
SG-IE-1	PDI-2401	2	Differential Pressure Gauge	0-XX	N/A	PSI	Inlet Air Silencer No. 2 Differential Pressure	43	407313	C
SG-IE-1	PI-2402	2	Pressure Gauge	0-XX	N/A	PSI	Aerated Sludge Holding Tank Blower No. 2 Suction Pressure	43	407313	C
SG-IE-1	PI-2401	2	Pressure Gauge	0-XX	N/A	PSI	Aerated Sludge Holding Tank Blower No. 2 Discharge Pressure	43	407313	C
SG-IE-1	PSH-2401	2	Pressure Switch	N/A	0-XX	PSI	Aerated Sludge Holding Tank Blower No. 2 Discharge Pressure High	43	407336	VENDOR PROVIDED
SG-IE-1	TI-2401	2	Bimetallic Thermometer	0-XX	N/A	Deg F	Aerated Sludge Holding Tank Blower No. 2 Discharge Temperature	43	407443	VENDOR PROVIDED
SG-IE-1	TSH-2401	2	Temperature switch	N/A	0-XX	Deg F	Aerated Sludge Holding Tank Blower No. 2 Discharge Temperature High	43	407466	VENDOR PROVIDED
SG-IE-1	TSH-2001	1	Temperature switch	N/A	N/A	Deg F	San Gabriel Electrical House Temperature - 1	23	407466	VENDOR PROVIDED
SG-IE-1	TSH-2001	2	Temperature switch	N/A	N/A	Deg F	San Gabriel Electrical House Temperature - 2	23	407466	VENDOR PROVIDED
SG-IE-1	TSH-2001	3	Temperature switch	N/A	N/A	Deg F	San Gabriel Electrical House Temperature - 3	23	407466	VENDOR PROVIDED
SG-IF-2	PI-2550	1	Pressure Gauge	0-125	N/A	PSI	Sodium Bisulfite Feed Pump No. 1 Discharge Pressure	46	407313	C
SG-IF-2	PSH-2550	1	Pressure Switch	N/A	50	PSI	Sodium Bisulfite Feed Pump No. 1 Discharge Pressure High	46	407336	VENDOR PROVIDED
SG-IF-2	PI-2550	2	Pressure Gauge	0-125	N/A	PSI	Sodium Bisulfite Feed Pump No. 2 Discharge Pressure	46	407313	C
SG-IF-2	PSH-2550	2	Pressure Switch	N/A	50	PSI	Sodium Bisulfite Feed Pump No. 2 Discharge Pressure High	46	407336	VENDOR PROVIDED
SG-IG-1	PDI-2600	1	Differential Pressure Gauge	0-XX	N/A	PSI	Inlet Air Silencer No. 1 Differential Pressure	43	407313	C
SG-IG-1	PI-2600	1	Pressure Gauge	0-XX	N/A	PSI	Wet Weather Storage Tank Blower No. 1 Discharge Pressure	43	407313	C
SG-IG-1	PSH-2600	1	Pressure Switch	N/A	0-XX	PSI	Wet Weather Storage Tank Blower No. 1 Discharge Pressure High	43	407336	VENDOR PROVIDED
SG-IG-1	TI-2600	1	Bimetallic Thermometer	0-XX	N/A	Deg F	Wet Weather Storage Tank Blower No. 1 Discharge Temperature	43	407443	VENDOR PROVIDED
SG-IG-1	TSH-2600	1	Temperature switch	N/A	0-XX	Deg F	Wet Weather Storage Tank Blower No. 1 Discharge Temperature High	43	407466	VENDOR PROVIDED

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SECTION 407133 - PROPELLER FLOW METERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes propeller flow meters.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions”.
2. Section 407000 “Instrumentation for Process Systems”.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

B. Product Test Reports: For each Propeller Flow Meter, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Propeller Flow Meters: One per each type of Propeller Flow Meter installed.

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.9 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of Propeller Flow Meter that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PROPELLER/TURBINE FLOW METER

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. Sparling Mainline - Propeller Flow meter.
b. Sponsler Inc., - Precision Turbine Flow meter.

B. Flow Element:

1. Type:

a. Magnetically coupled propeller/turbine flowmeter.

2. Function/Performance:

    a. Accuracy: Plus or minus 2 percent of rate.
    b. Operating Temperature: -20 to 180 degrees F.
    c. Repeatability: Plus or minus 0.25 degree of range.

3. Physical:

    a. Propeller or rotor: compatible with process fluid in which it is measuring.
    b. Material: Hastelloy C.
    c. Propeller secured on shaft with a key.
    d. Propeller shafts drive the vertical shaft through a magnetic coupling.
    e. Propeller magnetically coupled to horizontal drive shaft. Gearing on Horizontal and Vertical Shafts: Hardened Type 316 stainless steel.
    f. Vertical Shaft: Carbide tip resting on opposing carbide disc.
    g. Wetted Parts: Coated with a protective coating.
    h. Flange mounted with ANSI 150 lb. flanged ends compatible and similar to process pipe.
    i. Environmental Rating: NEMA 4X (IP65). Where hazardous areas are indicated on Drawings, rate equipment for that area.
    j. Finish on External Surfaces: Have a chemical and corrosion resistant finish.

4. Power Requirements:

    a. Meter to receive its power from its transmitter.

2.2 TRANSMITTER

A. Type:

1. Micro-processor based, intelligent transmitter compatible with meter provided.
2. Mounted remote from the meter.

B. Functional/Performance:

1. Accuracy (including flow tube): Plus or minus 0.5 percent of flow rate.
2. Operating Temperature: 14 to 122 degrees F.
3. Output: 4-20 mA output proportional to flow and a scaled pulsed output for remote totalization. Current output adjustable over the full range of the instrument.
4. Self-diagnostics with on screen display of faults.
5. Display: Digital indicator displaying flow in engineering units indicated in the Instrument Device Schedule.
6. Totalizer: A fully configurable totalizer integral to the transmitter. Totalized flow displayed.

C. Physical:

1. Remote mount: suitable for surface or pipe stand mounting as shown on Drawings or as required by physical location.

2. Enclosure: NEMA 4X (IP65). Where hazardous areas are indicated on Drawings, rate equipment for that area.

D. Power Requirements:

1. 24 VDC loop powered.

E. Accessories/ Required:

1. Provide signal cable for installation between the flow sensor and the transmitter. Length as required by installation indicated on the Drawings.
2. Keypad or remote device: where required for transmitter configuration depending upon area classification.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where propeller flow meter will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

B. Propeller flow meters will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

3.5 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Start-up services include calibration, oversight of installations of the sensor, and start-up of the sensor/transmitter in order to provide reliable measurement at the instrument.

    a. Work with the PCSS and AESS to verify the transmitter sends correct information to the control system (i.e., that the scaling and units are the same at the instrument and on the control system’s operator interface/PLC).
    b. Submit an instrument calibration report in order to document the calibration procedure of the instruments.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

B. While starting up the instruments, manufacturer to provide training to Owner's instrumentation technicians as follows:

1. How to calibrate, install, troubleshoot, read the diagnostics, and maintain the sensor and transmitter.
2. Provide one time and last up to two hours in the field.

END OF SECTION 407133

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SECTION 407143 - VARIABLE AREA FLOW METERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes variable area flow meters.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements.
2. Section 407000 “Instrumentation for Process Systems”.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

B. Product Test Reports: For each Variable Area Flowmeter, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Variable Area Flow Meters: One per each type of Flow Meter installed.

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.9 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace Variable Area Flow Meter that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ROTAMETERS – TUBE TYPE

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. ABB FAM540.
b. Brooks MT3809.

B. Performance and Design Criteria:

1. Design: According to AWWA M33.
2. Flow Rate Range: refer to instrument list.
3. Scale: Zero to 10 markings.

4. Accuracy: Plus or minus 5 percent of full scale.
5. Maximum Operating Temperature: 150 degrees F.
6. Maximum Operating Pressure: 100 PSIG.

C. Materials:

1. Tube Shield: Type 316L stainless steel.
2. Flow Tubes: Type 316L stainless steel.
3. Floats: Type 316L stainless steel.
4. Wetted Parts: Type 316L stainless steel.
5. End Fittings: Type 316L stainless steel.

2.2 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where variable area flow meters will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

3.3 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections in accordance with the following Sections:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions”.
2. Section 406121 “Process Control System Testing”.

B. Variable area flow meters will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following Sections:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions”.
2. Section 406121.20 “Process Control System Testing”.

3.5 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

B. While starting up the instruments, manufacturer to provide training to Owner's instrumentation technicians as follows:

1. How to calibrate, install, troubleshoot, read the diagnostics, and maintain the sensor.
2. Provide one time and last up to two hours in the field.

END OF SECTION 407143

SECTION 407163 - DOPPLER FLOW METERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes Doppler flow meters.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions”.
2. Section 407000 “Instrumentation for Process Systems”.

1.3 DEFINITIONS

A. Not used.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.5 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

1.6 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Doppler Flow Meters: Full-size units equal to 20 percent of quantity installed for each size indicated, but no fewer than two units.

1.8 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.9 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.10 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

PART 2 - PRODUCTS

2.1 DOPPLER FLOWMETER

A. Manufacturers:
1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

a. Greyline Instruments DFM 6.1
b. Thermo Scientific Polysonics SX40.
c. Substitutions: Not Permitted.

B. Type:

1. Encapsulated submersible ultrasonic Doppler flow element.

2. Suitable for installation on any pipe material.

C. Function/Performance:

1. Flow Range: 0.05 to 32 ft/sec (0.02 to 10 meters/sec)

2. Operating Temperature: -40 to 250 degrees F (-40 to 115 degrees C).

D. Power Requirements:

1. Transducer to receive power from the remote transmitter.

E. Required Accessories:

1. Factory calibrate each flow meter assembly (sensor and transmitter). Calibration report to be included in the final O & M manual.

2. Manufacturer's cable for connection of transducer to transmitter.

a. Length as required by installation indicated on Drawings.
b. Type 304 stainless steel strap on hardware for installation on pipe sizes as indicated on the Drawings.

3. All mounting hardware and coupling compounds required for a complete installation.

a. All metal hardware to be stainless steel.

2.2 TRANSMITTER

A. Type:

1. Microprocessor based, compatible with sensor provided.

B. Function/Performance

1. Accuracy (including sensor): Plus or minus 2 percent over a 10 to 1 range.

2. Operating Temperature: -5 to 140 degrees F (-20 to 60 degrees C).

3. Output: One 4-20 mA output adjustable over the flow range and scaled in engineering units. One alarm contact configurable over the output range.

4. Self-diagnostics and calibrated parameters.

5. Digital indicator displaying flow in engineering units.

6. Totalizer: A fully configurable totalizer integral to the transmitter. Totalized flow to be displayed.

C. Physical:

a. Suitable for surface, pipe stand, or wall mounting.
b. Enclosure: NEMA 4X (IP65).

D. Power Requirements:

a. 120VAC

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where Doppler flow meter will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 CONNECTIONS

A. Refer to Section 260526 “Grounding and Bonding for Electrical Systems.”

3.4 IDENTIFICATION

A. Refer to drawings for tagging designations

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Doppler flow meters will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 MAINTENANCE SERVICE

A. PCSS Maintenance Service required for this instrument: Refer to Section 406100 – Process Control and Enterprise Management Systems General Provisions.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

B. While starting up the instruments, manufacturer to provide training to the Owner's instrumentation technicians as follows:

1. How to calibrate, install, troubleshoot, read the diagnostics, and maintain the sensor and transmitter.
2. Provided one time and last up to four hours in the field.

END OF SECTION 407163

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SECTION 407213 - ULTRASONIC LEVEL METERS (CONTINUOUS AND POINT TYPE)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes ultrasonic level meters.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

1.3 DEFINITIONS

A. Double Pole Double Throw (DPDT): A switch with 2 inputs and 4 outputs. Each input has 2 corresponding outputs to control.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.5 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

B. Product Test Reports: For each Ultrasonic Level Meter, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Ultrasonic Level Meters One per each type of Ultrasonic Level Meter installed.

1.8 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.9 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.10 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of Ultrasonic Level Meters that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ULTRASONIC LEVEL/DIFFERENTIAL LEVEL METER

A. Transducer:

1. Manufacturers:

a. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

1) Endress & Hauser.
2) Pulsar Process Measurements, Inc.
3) Siemens Automation Technology; Siemens AG Industry Sector.

2. Type:

a. Non-contact, ultrasonic level transducer.
b. Remote mounted from transmitter.

3. Function/Performance:

a. Measuring Range: Suitable for the installation indicated on the Drawings, up to 50 feet.
b. Temperature Range: -4 to 140 degrees F.
c. Relative Humidity: Zero to 100 percent.
d. Beam Angle: 6 degrees or less.
e. Temperature Compensation: Integral temperature sensors for temperature compensation at above temperature ranges.

4. Physical:

a. Potted/encapsulated in a Kynar or other chemical and corrosion-resistant housing. Where indicated on Drawings, transducers approved for installation in Class I, Division 1, Groups C and D (Zone 0) environments.
b. Teflon-coated where mounted on chemical tanks and exposed to vapors in the tanks that are not compatible with the transducer material.
c. Capable of being completely submerged without damage.
d. Suitable for surface, pipe, NPT fitting or flange mounting as indicated on Drawings or Instrument Device Schedule. Provide appropriate mounting hardware. Flanges: 6 inch and resistant to attack by the medium being metered or, where required, protected by corrosion- resistant coatings and facings. All tank or well mounted transducers flanges to match flange provided by tank manufacturer or general contractor.

5. Options/Accessories Required:

a. Provide transducers with special heaters or other type of transducer protection designed to prevent sensor icing where transducers are located in areas where freezing condensation may occur.
b. Provide signal cable as recommended by the manufacturer, for installation between the transducer and the transmitter. Length, up to 1,000 feet, as required by installation indicated on Drawings.

B. Transmitter/Converter:

1. Manufacturers:

a. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

1) Endress & Hauser.
2) Pulsar Process Measurements, Inc.

3) Siemens Automation Technology; Siemens AG Industry Sector - Model HydroRanger 200.

2. Type:

a. Microprocessor based compatible with the transducers provided.
b. Transmitter: Remotely mounted from transducer.

3. Functional/Performance:

a. Resolution (including transducer): Plus or minus 0.1 percent of range or 0.08 inches, whichever is greater.
b. Accuracy (including transducer): Plus or minus 0.25 percent of range or 0.24 inches.
c. Range: As required by the installation indicated on Drawings and Instrument Device Schedule.
d. Temperature Range: -4 to 122 degrees F.
e. Output: Minimum two isolated 4-20 mA outputs and minimum four alarm contacts (number of contacts above 4 required of each device to be determined by signals required as shown on the drawings adjustable to trip at any point in the instrument range. Output contacts rated 5 A at 230 VAC.
f. Temperature Compensation: Compensation over temperature range of sensor.
g. Display: Digital indicator displaying level/differential level or volume in engineering units or percent as indicated on the Drawings or in the Instrument Device Schedule.
h. Diagnostics: On-screen instructions and display of self- diagnostics.
i. Loss of Signal to Transmitter: Ignore momentary loss-of-echo signals and indicate loss of echo on the transmitter unit.
j. Configuration Protection: Protected programmable parameters using E2PROM. Battery backup protection is not acceptable.

4. Physical:

a. Transmitter: Suitable for surface or pipe stand mounting.
b. Enclosure: NEMA 4X (IP65).
c. A/C Power: 120vac.

5. Accessories Required:

a. Hand-held programmer where required for configuration and calibration of the instrument.

2.2 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where ultrasonic level meters are installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radius.

3.3 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

B. Ultrasonic level meters is considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

3.5 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Start-up services include calibration, oversight of installations of the sensor, and start-up of the sensor/transmitter in order to provide reliable measurement at the instrument.

    a. Coordinate with the PCSS and AESS to test and verify the transmitter sends correct information to the control system (i.e., that the scaling and units are the same at the instrument and on the control system's operator interface/PLC).
    b. Submit an instrument calibration report in order to document the calibration procedure of the instruments.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 407213

SECTION 407223 - RADAR LEVEL METERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes radar level meters.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

1.3 DEFINITIONS

A. Not used.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.5 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

B. Product Test Reports: For each radar level meter, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Radar level meters: One of each type of radar level meter installed.

1.8 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.9 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.10 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of each radar level meter that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 NON- CONTACT RADAR-LEVEL MEASUREMENT DEVICE

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

a. Rosemount.
b. Siemens Automation Technology; Siemens AG Industry Sector.

c. VEGA Americas, Inc.
d. Substitutions: Or equal.

B. Type:

1. Non-contact, microwave type level meter.
2. High 24-26 GHZ radar frequency for continuous level measurement of slurry, corrosive liquids, low dielectric liquids and bulk solids in storage vessels. Also for measurement in tall or narrow tanks and for processes that have high pressure and temperature.
3. Antenna: Rod, Horn, Parabolic, or Encapsulated.

C. Function/Performance:

1. Measuring Range: As shown in the instrument schedule in Section 407000 “Instrumentation for Process Systems”.
2. Accuracy: Plus or minus 0.32 inches.
3. Operating Temperature: -40 to 149 degrees F.
4. Output: Isolated 4-20 mA output.
5. Display: Digital indicator displaying level or volume in engineering units or percent, as indicated on the Drawings or in the Instrument Device Schedule.
6. Diagnostics: On-screen instructions and display of self-diagnostics.

D. Physical:

1. Antenna: PVDF, Type 316 stainless steel, Hastelloy C or other material depending upon its compatibility to the process in which it is measuring.
2. Provide integral antenna with transmitter
3. Provide with a minimum Class 150 pound (DN 80, PN16) mounting flange to match vessel flange size, material and class when mounted on vessel.
4. NEMA 4X (IP66) housing. Where the instrument is installed in a hazardous area, provide explosion-proof housing, approved for Class I, Division 1, Groups C and D installation and certified for installation of the antenna in a Class I, Division 1, Groups C and D (Zone 0) environment.
5. Power Requirements**:** 24 VDC loop powered
6. Remote Display: Digital indicator displaying level or volume in engineering units or percent, as indicated on the Drawings or in the instrument schedule. Display unit used to remotely program the transmitter.

E. Required Accessories:

1. Hand-held programmer where required for configuration and calibration of the instrument.

F. Manufacturer Start-up and Training services:

1. Provide manufacturer's start-up and training services as specified in the start-up and training services paragraph.

2.2 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where radar level meters will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 CONNECTIONS

A. Comply with NEC.

3.4 IDENTIFICATION

A. Refer to drawings for tagging designations

3.5 FIELD QUALITY CONTROL

A. Perform the tests and inspection reports in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121 “Process Control System Testing”.

B. Radar level meters will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121 “Process Control System Testing”.

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. The start-up services include calibration, oversight of installations of the sensor, and start-up of the sensor/transmitter in order to provide reliable measurement at the instrument. Work with the PCSS and AESS to verify the transmitter sends correct information to the control system (i.e., that the scaling and units are the same at the instrument and on the control system’s operator interface/PLC). Submit an instrument calibration report in order to document the calibration procedure of the instruments.

3.7 MAINTENANCE SERVICE

A. Not Required.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

B. While starting up the instruments, the manufacturer to provide training to the Owner's instrumentation technicians as follows:

1. How to calibrate, install, troubleshoot, read the diagnostics, and maintain the sensor and transmitter.
2. Training to be provided 1 time and last up to 2 hours in the field.

END OF SECTION 407223

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SECTION 407243 - PRESSURE AND DIFFERENTIAL PRESSURE TYPE LEVEL METERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes pressure and differential pressure type level meters.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

B. Product Test Reports: For each Pressure and Differential Pressure Level Meter, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Pressure and Differential Pressure Level Meters: One per each type of Pressure and Differential Pressure Level Meter installed.

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.9 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of Pressure and Differential Pressure Type Level Meter that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FLANGED MOUNTED DIFFERENTIAL PRESSURE (LEVEL) TRANSMITTERS (OPEN TO ATMOSPHERE TANK)

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. ABB.
b. Foxboro
c. Model 3051L by Rosemount.

B. Type:

1. Flanged mounted, microprocessor based, intelligent type.

C. Function/Performance:

1. Range: Standard range of the manufacturer closest to the pressure range to be metered.
2. Accuracy: 0.075 percent of span.
3. Operating Temperature: -4 to 176 degrees F.
4. Temperature Effect: Combined temperature effects less than 0.2 percent of maximum span per -2 degrees F temperature change.
5. Output: 4-20 mA DC linear with pressure or level with HART protocol. Zero adjustable over the range of the instrument provided calibrated span is greater than the minimum calibrated span.
6. Stability: 0.05 percent of upper range limit for 1 year.
7. Display: Digital indicator displaying level in engineering units indicated in the Instrument Device Schedule.
8. Self-diagnostics with transmitter failure driving output to above or below out of range limits.
9. Simulation capability for inputs and loop outputs.
10. Test terminals available to ease connection for test equipment without opening the loop.
11. Registers that record minimum and maximum pressure and temperatures transmitter has been exposed to.
12. Run-time clock available to determine usage for warranty purposes.

    a. Warranty Period: Five years on this clock reading is included.

13. Over-range protection to 150 percent of the maximum pressure of the system being monitored by the instrument.

D. Physical:

1. Enclosure: NEMA 4X (IP66), explosion proof, approved for Class I, Division 1, Groups C and D (Exx d IIC T5).
2. Process Wetted Parts: Type 316L stainless steel, unless otherwise indicated in the instrument schedule.
3. Teflon gaskets and O-rings.
4. Flange: ANSI 3-inch, 150 lb. (DN 80, PN 25 or 40) carbon steel lower flange. High side left open to atmosphere.
5. Power supply: 24VDC loop power.
6. Sensor Fill Fluid: Silicone.

E. Required Accessories:

1. Provide span and zero adjustment at each transmitter and through the handheld programming unit.
2. Provide capillary seals and capillary filled cable for the low side flange connection suitable to the process liquid being metered if transmitter is mounted above or below flanged connection. Seal filled with silicone.

2.2 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where pressure and differential pressure level meters will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 CONNECTIONS

A. Refer to Section 260526 “Grounding and Bonding for Electrical Systems.”

3.4 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections in accordance with the following sections:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Section 407000 “Instrumentation for Process Systems.” Pressure and differential pressure type level meters will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following sections:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

B. While starting up the instruments, manufacturer to provide training to Owner's instrumentation technicians as follows:

1. How to calibrate, install, troubleshoot, read the diagnostics, and maintain the sensor and transmitter.
2. Provide one time and last up to two hours in the field.

END OF SECTION 407243

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SECTION 407276 - LEVEL SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes level switches.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Level Switches: One per each type of Float Switch installed.

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.9 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace float switches that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FLOAT SWITCHES

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. Contegra FS 90.
b. Evoqua Water Technologies Model 9G-EF.

B. Type:

1. Mercury free ball float switch.

C. Function/Performance:

a. Differential: Less than 8-inch.
b. Type of Switch: SPDT snap switch.
c. Switch Rating: 1A at 120 VAC or 100 VA @ 120 VAC.

D. Physical:

1. Type 316 stainless steel, Teflon, or non-stick coating, minimum 5 in diameter.
2. Totally encapsulated switch.
3. Heavy-duty cable, PVC, or equivalent jacketed integral to float.

E. Required Accessories:

1. Provide stainless steel hardware.
2. Lead wire to be waterproof cable of sufficient length so that no splice or junction box is required in the vault.
3. Provide cast-aluminum weatherproof junction box outside the sump pit with terminals for all floats and tapped as required for conduit connections.
4. Provide mounting equipment as shown on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where level switch will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radius.

3.3 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the following :

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

B. Level switches will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 407276

SECTION 407313 - PRESSURE AND DIFFERENTIAL PRESSURE GAUGES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes pressure and differential pressure gauges.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”
3. Section 407363 “Diaphragm Seals.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

B. Product Test Reports: For each Pressure and Differential Pressure Gauge, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Pressure and Differential Pressure Gauges: One per each type of Gauge installed.

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. Ametek US Gauge.
b. Ashcroft.
c. Weksler.

B. Type:

1. Bourdon tube actuated dial face pressure and differential pressure gauge.

C. Function/Performance:

1. Accuracy: Plus or minus 1.0 percent of full-scale range.
2. Provide for zero-reading adjustment.
3. Adjusting Screws: Accessible from rear of case without need for disassembly.
4. Comply with ASME B40.100.

D. Physical:

1. Dial:

a. Nominal Diameter: 4-1/2 inches.
b. Face: White, laminated plastic dials with black graduations.
c. Scale: Extend over arc not less than 200 and not more than 270 degrees.
d. Ranges and Graduation Units: As indicated on instrument schedule.

2. Cases:

a. Liquid filled.
b. Material: Phenolic or Type 316 stainless steel.
c. Provide removable rear plate.
d. For gauge pressure, vented case for temperature/atmospheric compensation
e. Windows:

1) Material: Clear acrylic or shatterproof glass.
2) Thickness: 1/8 inch.
3) Provide gasket.

3. Bourdon Tubes:

a. Material: Stainless steel, to brass socket.
b. Provide welded, stress-relieved joints.

4. Connection:

a. Location: Bottom.
b. Socket:

1) 1/2-inch NPT male thread.
2) Material: Brass forging.
3) Extend minimum 1-1/4 inches below gage cases.
4) Provide wrench flats.

c. Mounting: Stem or surface

E. Required Accessories:

1. Pressure Snubber:

a. Material: Type 316 stainless steel.
b. Provide isolation valve.

2. Shutoff Cocks: Furnished by gauge manufacturer.
3. Provide diaphragm seals as shown on Drawings.
4. Special scales: Engineer reserves the right to require special scales and/or calibration if the manufacturer's standard is not suitable for the application.
5. Liquid fill gauges at the factory.
6. For each differential pressure switch, provide a three-valve manifold. Manifold to be Type 316 stainless steel. Manifolds to be D/A Manufacturing or Anderson Greenwood.

2.2 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pipelines and process area for suitable conditions where pressure gauges will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA.

3.3 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121.20 “Process Control System Testing.”

B. Pressure and differential pressure gauges will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Start-up services include calibration. Submit an instrument calibration report in order to document the calibration procedure of the instruments.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 407313

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SECTION 407326 - GAUGE-PRESSURE TRANSMITTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes gauge-pressure transmitters.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”
3. Section 407363 “Diaphragm Seals.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

B. Product Test Reports: For each Gauge Pressure Transmitter, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Gauge Pressure Transmitters: One per each type of Gauge Pressure Transmitter installed.

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace Gauge Pressure Transmitters that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GAUGE PRESSURE TRANSMITTERS

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. ABB 266HRH.
b. Foxboro IGP20.
c. Rosemount 3051CG.
d. Siemens Sitrans P DS III.
e. Smar LD301M.

A. Type:

1. Microprocessor based, intelligent type.

B. Function/Performance:

1. Measuring Range: As shown in the instrument schedule in Section 407000.
2. Accuracy: 0.075 percent of span.
3. Operating Temperature: -4 to 176 degrees F.
4. Temperature Effect: Combined temperature effects less than 0.2 percent of maximum span per 82 degrees F temperature change.
5. Output Signal: 4 to 20 mA DC linear with pressure, with HART protocol.
6. Output: Zero adjustable over the range of the instrument calibrated span is greater than the minimum calibrated span.
7. Stability: 0.05 percent of upper range limit for 1 year.
8. Response Time: Less than 1 ms.
9. Display: Digital indicator displaying pressure in the engineering units indicated on the Drawings or in the instrument device schedule.
10. Diagnostics:

    a. Self-diagnostics with transmitter failure driving output to above or below out of range limits.
    b. Simulation capability for inputs and loop outputs.
    c. Test terminals available to ease connection for test equipment without opening the loop.
    d. Registers to record minimum and maximum pressure and temperatures transmitter has been exposed to be available.

11. Over Range Protection: Provide positive over range protection to 150 percent of the maximum pressure of the system being monitored.

C. Physical:

1. Power Supply: 24 VDC loop power
2. Enclosure:

    a. NEMA 4X (IP66), explosion proof.
    b. Approved for Class I, Division 1, Groups C and D.
    c. Instruments for hazardous locations have Factory Mutual (FM), Canadian Standards Association (CSA), and CENELEC approvals and certifications as specified herein and as indicated on Drawings or in instrument device schedule.

3. Process Wetted Parts (except for ozone/oxygen service):

    a. Isolating diaphragm and other wetted metal parts: Type 316L stainless steel.
    b. Gaskets and O-rings: Teflon.

4. Sensor Fill Fluid (except for ozone/oxygen service): Silicone.

D. Required Accessories:

1. Shutoff Cocks: Furnished by gauge manufacturer.
2. Provide diaphragm seals as shown on Drawings.

2.2 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where gauge pressure transmitter will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 CONNECTIONS

A. Refer to Section 260526 “Grounding and Bonding for Electrical Systems.”

3.4 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections in accordance with the following Sections:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”
3. Section 407363 “Diaphragm Seals.”

B. Gauge-pressure transmitters will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following Sections:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”
3. Section 407363 “Diaphragm Seals.”

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

B. While starting up the instruments, manufacturer to provide training to Owner's instrumentation technicians as follows:

1. How to calibrate, install, troubleshoot, read the diagnostics, and maintain sensor and transmitter.
2. Provide one time and last up to two hours in the field.

END OF SECTION 407326

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SECTION 407329 - DIFFERENTIAL PRESSURE TRANSMITTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes differential pressure transmitters.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

B. Product Test Reports: For each Differential Pressure Transmitter, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Differential Pressure Transmitters: One per each type of Transmitter installed

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.9 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace Differential Pressure Transmitters that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIFFERENTIAL PRESSURE TRANSMITTERS

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide the following without substitution nor equal:

a. Foxboro IDP25-T22B21F-M1L1.

A. Type:

1. Microprocessor based, intelligent type.

B. Function/Performance:

1. Measuring Range: As shown in the instrument schedule in Section 407000.
2. Accuracy: 0.075 percent of span.
3. Operating Temperature: -4 to 176 degrees F.
4. Temperature Effect: Combined temperature effects less than 0.2 percent of maximum span per 82 degrees F temperature change.
5. Output Signal: 4 to 20 mA DC linear with pressure, with HART protocol.
6. Output: Zero adjustable over the range of the instrument calibrated span is greater than the minimum calibrated span.
7. Stability: 0.05 percent of upper range limit for 1 year.
8. Response Time: Less than 1 ms.
9. Display: Digital indicator displaying pressure in the engineering units indicated on the Drawings or in the instrument device schedule.
10. Diagnostics:

    a. Self-diagnostics with transmitter failure driving output to above or below out of range limits.
    b. Simulation capability for inputs and loop outputs.
    c. Test terminals available to ease connection for test equipment without opening the loop.
    d. Registers to record minimum and maximum pressure and temperatures transmitter has been exposed to be available.

11. Over Range Protection: Provide positive over range protection to 150 percent of the maximum pressure of the system being monitored.

C. Physical:

1. Power Supply: 24 VDC loop power.
2. Enclosure:

    a. NEMA 4X (IP66), explosion proof.
    b. Approved for Class I, Division 1, Groups C and D.
    c. Instruments for hazardous locations have Factory Mutual (FM), Canadian Standards Association (CSA), and CENELEC approvals and certifications as specified and as indicated on Drawings or in the instrument device schedule.

3. Process Wetted Parts (except for ozone/oxygen service):

    a. Isolating diaphragm and other wetted metal parts: Type 316L stainless steel.
    b. Gaskets and O-rings: Teflon.

4. Sensor Fill Fluid (except for ozone/oxygen service): Silicone.

D. Required Accessories:

1. Provide span and zero adjustment at each transmitter and through the handheld programming unit.
2. Configuration of transmitter may be accomplished using the local display and pushbuttons without the use of an external programming device.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, and process area for suitable conditions where differential pressure transmitter will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121.20 “Process Control System Testing.”

B. Differential pressure transmitters will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121.20 “Process Control System Testing.”

3.5 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Start-up services include calibration, oversight of installations of the sensor, and start-up of the sensor/transmitter in order to provide reliable measurement at the instrument.

    a. Work with the PCSS and AESS to verify the transmitter sends correct information to the control system (i.e., that the scaling and units are the same at the instrument and on the control system's operator interface/PLC).
    b. Submit an instrument calibration report in order to document the calibration procedure of the instruments.

3.6 MAINTENANCE SERVICE

A. PCSS Maintenance Service required for this instrument: Refer to Section 406100 "Process Control and Enterprise Management Systems General Provisions."

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 407329

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SECTION 407336 - PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes pressure and differential pressure switches.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”
3. Section 407363 “Diaphragm Seals.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Pressure and Differential Pressure Switches: One per each type of switch installed.

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.9 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of pressure switches that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. Ashcroft.
b. Mercoid.
c. Static-O-Ring (SOR)

B. Type:

1. Pressure: Diaphragm actuated.
2. Differential Pressure: Adjustable diaphragm.

C. Function/Performance:

1. Accuracy:

a. Pressure: Plus or minus 5 percent of operating range.
Differential Pressure: Plus or minus 2.0 percent of full-scale range.

2. Range:

a. Pressure: Refer to instrument schedule in Section 407000 “Instrumentation for Process Systems”.
Differential Pressure: Refer to instrument schedule in Section 407000 “Instrumentation for Process Systems”.

3. Type of Switch: SPDT snap action.
4. Switch Rating: 10A at 230VAC.
5. Repeatability: Better than 1 percent of full scale.
6. Dead Band: Fixed dead band.
7. Set Points: Adjustable between 20 and 80 percent of adjustable range.
8. Automatic reset type.
9. Over Range Protection: Provide positive over range protection to 150 percent of the maximum pressure of the system being monitored.

D. Physical:

1. Hermetically sealed switches.
2. Enclosures shall meet area classification of location where the device is being installed.
3. Materials:

a. Diaphragm: Stainless steel.
b. Wetted parts: Type 316L stainless steel.
c. Seals: Viton.
d. Connection Port: Type 316 stainless steel.

4. Connection:

a. Location: Bottom.
b. Size: 1/4 inch.
c. Furnish taps for sensing lines.

E. Required Accessories:

1. Pressure: Type 316 stainless steel shutoff valve.

a. Provide manifold by D/A Manufacturing, Anderson Greenwood, or equal.

2. Differential Pressure: Type 316 stainless steel five-valve manifold. Mount manifold directly to the instrument or separately mounted, as shown on Drawings.

a. Provide manifold by D/A Manufacturing, Anderson Greenwood, or equal.

3. Provide diaphragm seals as shown on Drawings.
4. Where indicated on Drawings, provide Type 316 stainless steel pressure snubber for pulsation dampening.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pipelines and process area for suitable conditions where pressure and differential pressure switches will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 IDENTIFICATION

A. Refer to drawings for tagging designations

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121.20 “Process Control System Training”.

B. Pressure and differential pressure switches will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Start-up services include calibration, oversight of installations of the sensor, and start-up of the sensor/transmitter in order to provide reliable measurement at the instrument.

a. Work with the PCSS and AESS to verify the transmitter sends correct information to the control system (i.e., that the scaling and units are the same at the instrument and on the control system’s operator interface/PLC).
b. Submit an instrument calibration report in order to document the calibration procedure of the instruments.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

B. While starting up the instruments, the manufacturer to provide training to the Owner's instrumentation technicians as follows:

1. How to calibrate, install, troubleshoot, read the diagnostics, and maintain the pressure switches.
2. Provided 1 time and last up to 2 hours in the field.

END OF SECTION 407336

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SECTION 407363 - DIAPHRAGM SEALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes diaphragm seals.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”
2. Refer to Section 407313 “Pressure and Differential Pressure Gauges.”
3. Refer to Section 407336 “Pressure and Differential Pressure Switches.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Diaphragm Seals: One per each type of Diaphragm Seal installed.

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.9 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

PART 2 - PRODUCTS

2.1 DIAPHRAGM SEALS – THREADED

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. Rosemount.
b. Ashcroft.
c. Ronnigen-Petter Company.
d. Siemens

B. Type:

1. Threaded, mounted directly to pressure gauge socket.

C. Physical:

1. Wetted Parts and Bolt Materials: Corrosion resistant to process fluid.
2. Provide fill/bleed screw for filling of diaphragm seal.

3. Instrument Connection: NPT, 1/4 inch.
4. Process Connection: NPT, 1/2 inch.
5. Flushing Connection: NPT, 1/4 inch.
6. Working Pressure Rating: 150 psi.
7. Calibration: Provide cleanout ring to be removed for recalibration or cleaning, without loss of filling liquid or change in calibration.

2.2 DIAPHRAGM SEALS – ANNULAR FLANGE MOUNTED

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

   a. Red Valve.
   b. Wika.
   c. Siemens.

B. Type:

1. Line mounted, between two flanges.

C. Function/Performance:

1. Pressure Limit: Correspond to flange ratings.
2. Inside diameter conforms to the dimensions of the pipe where the seal is installed.
3. ANSI or DIN Flange Class: Equivalent to the flange class of the piping where the seal is installed. Bolting dimensions conform to ANSI or DIN drilling specifications as required by the installation.

D. Physical:

1. Body material and Flange: Type 316 stainless steel and compatible with process connection.
2. Process connection: 1/4-inch NPT.
3. Wetted Parts and Bolt Materials: Corrosion resistant to process fluid.
4. Sensing Liquid: Silicone Oil.

E. Diaphragm Seals:

1. Factory-assemble, fill, and calibrate entire assembly, including gauge switch and transmitter, prior to shipment.
2. Field filling is not acceptable.

F. Provide shop inspection and testing of completed assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine for suitable conditions where diaphragm seal will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121.20 “Process Control System Testing.”

B. Diaphragm seals will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121.20 “Process Control System Testing.”

3.4 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Start-up services include calibration, oversight of installations of the sensor, and start-up of the sensor/transmitter in order to provide reliable measurement at the instrument. Submit an instrument calibration report in order to document the calibration procedure of the instruments.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 407363

SECTION 407443 - BIMETALLIC THERMOMETERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes bimetallic thermometers.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

B. Product Test Reports: For each Thermometer, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Bimetallic Thermometers: One per each type of Thermometer.

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.9 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of Thermometers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BIMETALLIC THERMOMETERS

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. Ametek/US Gauge.
b. Ashcroft.
c. Marshalltown Manufacturing Co.
d. Moeller Instrument Co.
e. O. Trerice Co.
f. Palmer Wahl Instruments, Inc.
g. Weksler.

B. Type:

1. Bimetal type
2. Manufactured to ANSI B 40.3 or equivalent standards.

C. Function/Performance:

1. Range: Range as indicated on the instrument device schedule.
2. Accuracy: Plus or minus 1 percent of span.
3. Stem Length: Sized to penetrate the pipe where it is installed by approximately 1/3 to 1/2 of the pipe diameter.

D. Physical:

1. Dial: Nominal 5 inches white painted steel with black markings.
2. Case: All welded stainless steel construction.
3. Window: Polycarbonate.
4. Element: Type 316 stainless steel.

E. Required Accessories:

1. Swivel Head: Provide adjustable gauge position for viewing from any angle.
2. Provide extensions that clear the pipe insulation for thermometers being installed in insulated pipe.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where bimetallic thermometers will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

3.3 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

2. Section 406121.20 “Process Control System Testing”.

B. Bimetallic thermometers will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121.20 “Process Control System Testing.”

3.5 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Start-up services include calibration, oversight of installations of the sensor, and start-up of the thermometers, in order to provide reliable measurement at the instrument. Submit an instrument calibration report in order to document the calibration procedure of the instruments.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 407443

SECTION 407466 - TEMPERATURE SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes temperature switches.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

1.3 DEFINITIONS

A. Single Pole Double Throw (SPDT): A switch with a single input and single output.

B. Double Pole Double Throw (DPDT): A switch with two inputs and two outputs.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.5 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

B. Product Test Reports: For each Temperature Switch, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Temperature Switches: One per each type of Temperature Switch installed.

1.8 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.9 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of Temperature Switches that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INDUSTRIAL THERMOSTAT

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. Dayton 6EDY5
b. Johnson Controls A19PRC.
c. PECO Controls TH109.

B. Type:

1. Line voltage mechanical thermostat.
2. Fluid filled coil sensor.

C. Function/Performance:

1. Range: 40 to 100 degrees F.
2. Sensitivity: Plus or minus 3 degrees F.
3. Set Point: Field adjustable and set between 20 and 80 percent of the adjustable range.
4. Deadband: Fixed deadband.
5. Reset: Automatic reset type.
6. Switch Rating: 25 amps at 240VAC.

D. Physical:

1. Input Voltage: 24 to 277VAC.
2. Mounting: Wall-mounted, flat surface.
3. NEMA 4X (IP66) for non-hazardous locations. Where indicated on Drawings to be mounted in hazardous locations, provide explosion proof switch housing, approved for Class I, Division 1, Groups C and D.
4. Switching Arrangement: Single pole double throw (SPDT) unless double pole double throw (DPDT) switches are indicated on the instrument device schedule.

E. Required Accessories:

1. Provide all mounting hardware required for manufacturer recommended installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where temperature switches will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 CONNECTIONS

A. Refer to Section 260526 “Grounding and Bonding for Electrical System.”

3.4 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

B. Temperature switches will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

3.6 Insert "Cleaning" Article for specific requirements for cleaning the completed Work so it functions and performs properly.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

B. While starting up the instruments, manufacturer to provide training to Owner's instrumentation technicians as follows:

1. How to calibrate, install, troubleshoot, read the diagnostics, and maintain the sensor and transmitter.
2. Provide one time and last up to two hours in the field.

END OF SECTION 407466

SECTION 407506 - SINGLE PARAMETER ANALYZER TRANSMITTER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes single parameter analyzer transmitters.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements.
2. Section 407000 “Instrumentation for Process Systems.”
3. Section 4075XX “Sections for liquid analytical measurement.”

1.3 DEFINITIONS

A. Section 4075XX “Sections for liquid analytical measurement”: The XX in the number indicates all spec sections starting with the first 4 numbers (indicating a category described in the accompanying text) are included in the reference.

B. Single Pole Double Throw (SPDT): A switch with one input and two outputs.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.5 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

B. Product Test Reports: For each analyzer, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Single-Parameter Analyzer Transmitters: One per each type of Analyzer Transmitter.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.9 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of analyzer transmitters that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SINGLE-PARAMETER ANALYZER TRANSMITTER

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide the following:

a. Hach – SC4500.
b. Substitutions: Not Permitted.

B. Type:

1. Microprocessor-based, intelligent transmitter compatible with a minimum of sensor (digital or analog) inputs.

C. Function/Performance:

1. Accuracy: ± 0.1 percent of span.

2. Repeatability: ± 0.05 percent of span.
3. Response Time: 60 seconds to 90 percent of value on a step change.
4. Temperature Compensation: Compensation over entire temperature range of the instrument.
5. Environmental Conditions: 14 to 131 degrees F and 5 to 95 percent relative humidity.
6. Hardwired Outputs:

    a. Minimum: Two (2) 4-20mA outputs.
    b. Minimum: Four (4) SPDT configurable relays, rated 5A at 120VAC.

7. Network Communications:

    a. Modbus/RS485.
    b. Modbus/TCP.
    c. EtherNet/IP.

8. Diagnostics: On screen instructions and display of self-diagnostics.

D. Physical:

1. Transmitter: Suitable for surface or pipe stand mounting.
2. Enclosure: NEMA 4X (IP65).
3. Power Requirements: 120VAC powered

E. Accessories:

1. For rapid attachment and exchange of sensor, provide sensor connection cable and plug between the transmitter and the analyzer sensor.
2. Provide connection box for analyzers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where single parameter analyzer transmitter will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 CONNECTIONS

A. Refer to Section 260526 “Grounding and Bonding for Electrical Systems.”

3.4 IDENTIFICATION

A. Refer to drawings for tagging designations.

3.5 FIELD QUALITY CONTROL

A. Perform the tests and inspections in accordance to the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions”.
2. Section 406121.20 “Process Control System Testing”.

B. Single parameter analyzer transmitter will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions”.
2. Section 406121.20 “Process Control System Testing”.

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. The start-up services include calibration, oversight of installations of the sensor, and start-up of the sensor/transmitter in order to provide reliable measurement at the instrument. Work with the PCSS and AESS to verify the transmitter sends correct information to the control system (i.e., that the scaling and units are the same at the instrument and on the control system’s operator interface/PLC). Submit an instrument calibration report in order to document the calibration procedure of the instruments.

3.7 MAINTENANCE SERVICE

A. Not Required.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

B. While starting up the instruments, the manufacturer to provide training to the Owner's instrumentation technicians as follows:

1. How to calibrate, install, troubleshoot, read the diagnostics, and maintain the sensor and transmitter.
2. Provided 1 time and last up to 2 hours in the field.

END OF SECTION 407506

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SECTION 407543 - DISSOLVED OXYGEN ANALYZERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes dissolved oxygen analyzers.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements.
2. Section 407000 “Instrumentation for Process Systems.”
3. Section 407506 “Single Parameter Analyzer Transmitter.”

1.3 DEFINITIONS

A. Not used.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.5 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

B. Product Test Reports: For each dissolved oxygen analyzers, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Dissolved Oxygen Analyzers: One per each type of Analyzer installed.
2. Calibration / Maintenance Kits: Provide calibration and maintenance kits as recommended by the manufacturer.
3. Calibration Solution: Provide 2 year of recurring delivery of calibration solutions for 3-point calibration as recommended by the manufacturer to maintain the total number of analyzers installed.
4. Desiccant Cartridge: Provide 2 year of recurring deliver of replacement cartridges as recommended by the manufacturer to maintain the total number of turbidimeters installed.

1.8 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.9 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.10 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of dissolved oxygen analyzer that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period: 2 year) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DISSOLVED OXYGEN ANALYZER (OPTICAL TYPE SENSOR)

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

    a. YSI/Xylem IQ SensorNet FDO700 sensor.
    b. InsiteIG M10 Sensor.
    c. s::can – oxi::lyser II.
    d. HF Scientific AdvantEDGE Series.
    e. Electro-Chemical Devices Triton DO8 c.
    f. Substitutions: Or equal

B. Type:

1. Continuous monitoring of dissolved oxygen by an optical sensor using either luminescence excited with blue light pulses technology or fluorescence quenching principle.

C. Function/Performance:

1. Accuracy: Plus or minus 0.1 mg/l for DO < 1 mg/l, Plus or minus 0.2 mg/l for DO > 1 mg/l.
2. Repeatability: Plus or minus 0.01 mg/l.
3. Measuring Range: 0 to 20 mg/l .
4. Response Time: T90 in 30 seconds or less.
5. Sensitivity: Plus or minus 0.05 percent of span.
6. Temperature Range: 32 to 122 degrees F.
7. Materials on Construction: Noryl, polybutyl methacrolate, epoxy, polyurethane or PVC depending upon manufacturer.
8. Warranties: Probe, 3 years; Sensor, 1 year.
9. Rating: NEMA 6 for submergence and electrical classification requirements for that location as specified in the Approvals/Certifications paragraph.

D. Required Accessories:

1. Manufacturer's cable for connection of sensor to transmitter. Length as required by installation indicated on Drawings.
2. One mounting bracket per sensor for fixing the sensor assembly to hand railing or other fixed support.
3. One spare sensor cap for each set of ten or less sensor assemblies provided.

E. Manufacturer Start-up and Training services:

1. Provide manufacturer's start-up and training services as specified in the start-up and training services paragraph.

2.2 TRANSMITTER

A. Manufacturer:

1. Same manufacturer as dissolved oxygen analyzers, and in accordance with Section 407506 “Single Parameter Analyzer Transmitter,” as required by the instrument device schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where dissolved oxygen analyzer will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 CONNECTIONS

A. Refer to Section 260526 “Grounding and Bonding for Electrical Systems.”

3.4 IDENTIFICATION

A. Refer to drawings for tagging designations

3.5 FIELD QUALITY CONTROL

A. Perform the tests and inspection reports in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121.20 “Process Control System Testing”.

B. Dissolved Oxygen analyzers will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121.20 “Process Control System Testing”.

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. The start-up services include calibration, oversight of installations of the sensor, and start-up of the sensor/transmitter in order to provide reliable measurement at the instrument. Work with the PCSS and AESS to verify the transmitter sends correct information to the control system (i.e., that the scaling and units are the same at the instrument and on the control system’s operator interface/PLC). Submit an instrument calibration report in order to document the calibration procedure of the instruments.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

B. While starting up the instruments, the manufacturer to provide training to the Owner's instrumentation technicians as follows:

1. How to calibrate, install, troubleshoot, read the diagnostics, and maintain the sensor and transmitter.
2. Provided 1 time and last up to 2 hours in the field.

END OF SECTION 407543

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SECTION 407813 - INDICATORS AND METERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes indicators and meters.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements.
2. Section 406717 “Industrial Enclosures.”
3. Section 407000 “Instrumentation for Process Systems.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

B. Product Test Reports: For each Indicator and meter, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Indicators and Meters: One per each type of indicator and meter installed.

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of indicators and meters that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL-MOUNTED DIGITAL INDICATORS

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. Precision Digital ProVu Series
b. Red Lion Controls PAXDP Series.

B. Type:

1. Digital indicator.

C. Function/Performance:

1. Accuracy: Plus or minus 0.25 percent of calibrated range.
2. Operating Temperature: -4 to 158 degrees F.
3. Input: One 4 to 20 mA.
4. Output: One 4 to 20 mA.
5. Digital Outputs: Two Form C programmable contacts rated for 5A at 120/240 VAC.
6. Display: 0.56-inch-high efficiency, 5-digit LED display.

7. Indicator Failure: Failure of the indicator will not cause failure of the 4-20 mA loop.

D. Physical:

1. Suitable for panel mounting.
2. Case size nominal 2.5-inch-high by 5-inch-wide by 6 inch deep.
3. NEMA 4X and explosion-proof approved for Class I, Division 1, Groups C and D areas.
4. Programmable via integrated keypad.
5. Power Requirements: 120 VAC/60 Hz.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where indicators and meters will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 CONNECTIONS

A. Refer to Section 260526 “Grounding and Bonding for Electrical Systems.”

3.4 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections in accordance with the following Sections:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

C. Indicators and meters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports in accordance with the following Sections:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

2. Section 406121.20 “Process Control System Testing.”

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Start-up services include calibration, oversight of installations of the sensor, and start-up of the sensor/transmitter in order to provide reliable measurement at the instrument.

    a. Work with the PCSS and AESS to verify the transmitter sends correct information to the control system (i.e., that the scaling and units are the same at the instrument and on the control system’s operator interface/PLC).
    b. Submit an instrument calibration report in order to document the calibration procedure of the instruments.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

B. While starting up the instruments, manufacturer to provide training to Owner's instrumentation technicians as follows:

1. How to calibrate, install, troubleshoot, read the diagnostics, and maintain the indicators and meters.
2. Provide one time and last up to two hours in the field.

END OF SECTION 407813

SECTION 407816 - INDICATING LIGHTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes indicating lights.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements
2. Section 406717 “Industrial Enclosures.”
3. Section 407000 “Instrumentation for Process Systems.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

B. Product Test Reports: For each indicating light, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Indicating Lights: One per each type of indicating light installed.

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

C. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of Indicating Lights that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PILOT TYPE INDICATING LIGHTS

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal**:**

a. Cutler-Hammer.
b. Allen Bradley.
c. General Electric.
d. Square D.
e. Crouse Hinds (NEMA 7).

B. Type:

1. Energy efficient, Solid-State LED Lamps.

C. Function/Performance:

1. Low voltage LED lamps suitable for the voltage supplied.
2. Integral reduced voltage transformers for 120VAC powered lights.
3. Replaceable lamps from the front of the unit.

D. Physical:

1. NEMA 4X.
2. Lens caps: 1.18-inch diameter.
3. Lens color:

a. Running, on, open - Red.
b. Stopped, off, closed - Green.
c. Alarm - Amber.
d. White - Power on.
e. Blue - All other status indications not covered by the above.

4. Provide legend faceplates engraved to indicate the required function of each device.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where indicating lights will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 CONNECTIONS

A. Refer to Section 260526 “Grounding and Bonding for Electrical Systems.”

3.4 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections in accordance with the following Sections:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

C. Indicating lights will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports in accordance with the following Sections:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
   Section 406121.20 “Process Control System Testing.”

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Start-up services include calibration, oversight of installations of the sensor, and start-up of the sensor/transmitter in order to provide reliable measurement at the instrument.
   a. Work with the PCSS and AESS to verify the transmitter sends correct information to the control system (i.e., that the scaling and units are the same at the instrument and on the control system’s operator interface/PLC).
   b. Submit an instrument calibration report in order to document the calibration procedure of the instruments.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

B. While starting up the instruments, manufacturer to provide training to Owner's instrumentation technicians as follows:

1. How to calibrate, install, troubleshoot, read the diagnostics, and maintain the indicating lights.
2. Provide one time and last up to two hours in the field.

END OF SECTION 407816

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SECTION 407819 - SWITCHES AND PUSH BUTTONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes switches and push buttons.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements.
2. Section 406717 “Industrial Enclosures.”
3. Section 407000 “Instrumentation for Process Systems.”

1.3 DEFINITIONS

A. Not used.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.5 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

1.6 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.9 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
   1. Warranty Period: 2 year(s) from date of Substantial Completion.]

PART 2 - PRODUCTS

2.1 SELECTOR SWITCHES AND PUSHBUTTONS

A. Manufacturers:

   1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:

      a. Allen Bradley.
      b. Crouse Hinds (NEMA 7).
      c. Cutler-Hammer.
      d. General Electric.
      e. Square D.
      f. Substitutions: Or equal

B. Type:

   1. Heavy-duty oil tight type with stackable contact blocks.

C. Function/Performance:

   1. Contact arrangement and switching action as required for the control system specified.
   2. For 120VAC service, provide contacts rated 10A at 120VAC. For 24VDC service, provide silver sliding contacts rated 5A at 125VDC. For electronic (millivolt/milliamp) switching, provide contacts rated 1A at 28VDC.

D. Physical:

   1. NEMA 4X.
   2. Size: 1.18-inch (30 mm) diameter.
   3. Pushbuttons: Flush type operators.
   4. Selector switches: Knob or wing lever operators.

5. Provide legend plates denoting switch/pushbutton position and/or function.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where switches and push buttons will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 CONNECTIONS

A. Refer to Section 260526 “Grounding and Bonding for Electrical Systems.”

3.4 IDENTIFICATION

A. Refer to drawings for tagging designations

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Switches and push buttons will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 407819

SECTION 407853 - RELAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes relays.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements
2. Section 406717 “Industrial Enclosures.”
3. Section 407000 “Instrumentation for Process Systems.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

B. Product Test Reports: For each relays, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Relays: One of each type of relays installed.

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace relays that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL PURPOSE RELAYS AND TIME DELAYS

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. Allen Bradley.
b. IDEC.
c. Omron.
d. Schneider Electric.

B. Type:

1. General purpose plug-in type.

C. Function/Performance:

1. Provide all relays with number of poles required to meet the design intent.
2. Mechanical life expectancy to be in excess of 10 million.
3. Provide solid state time delays with polarity protection (DC units) and transient protection.

4. Time delay units in ranges from 0.1 second to 4.5 hours.

D. Physical:

1. Mounting: DIN rail.
2. Integral indicating light to indicate if relay is energized.
3. For 120 VAC service, provide contacts rated 10A at 120VAC. For 24 VDC service, provide contacts rated 5A at 28VDC. For electronic (milliamp/millivolt) switching applicator, provide gold plated contacts rated for electronic service.
4. Dust and moisture resistant covers.

E. Required Accessories:

1. Provide DIN rail mounted relay socket for each relay, rated 10A at 300VAC.
2. Provide relay retaining clips as required.
3. Provide LED/neon lamp indicator.
4. Provide diode suppression.

2.2 SIGNAL RELAY SWITCHES (CURRENT TRIPS)

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. Acromag.
b. Action Instruments Slim Pak.

B. Type:

1. Solid state, ASIC technology, electronic type.

C. Functional:

1. Input: 4-20 mA.
2. Output: Isolated contact output, double pole double throw, rated 5A at 120VAC.
3. Accuracy: 0.1 percent.
4. Protection: Provide RFI protection.
5. Deadband: Adjustable between 0.1 and 5.0 percent of span.
6. Set point Adjustment: Single Point alarms adjustable to trip on rising or falling input signal, dual point alarms adjustable to trip on rising and falling input signals.
7. Repeatability: Trip point repeatability at least 0.1 percent of span.

D. Physical:

1. Mounting: DIN rail.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where relays will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Refer to Section 406717 “Industrial Enclosures.”

3.2 INSTALLATION

A. UL: Comply with UL508A for installation of relays.

B. NFPA: Comply with NFPA 70 (NEC) for installation of relays.

C. Comply with NECA 1.

D. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

E. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 CONNECTIONS

A. Refer to Section 260526 “Grounding and Bonding for Electrical Systems.”

3.4 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections in accordance with the following Sections:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 407000 “Instrumentation for Process Systems.”

C. Annunciators will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports in accordance with the following Sections:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
   Section 406121.20 “Process Control System Testing.”

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Test relays during the loop testing from the field device, through the relay, to the PLC I/O module and to the HMI/SCADA graphics.

3.7 DEMONSTRATION

A. Refer to Section 406717 “Industrial Enclosures.”

END OF SECTION 407853

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SECTION 407856 - ISOLATORS, INTRINSICALLY SAFE BARRIERS, AND SURGE SUPPRESSORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Isolators, intrinsically safe barriers, and surge suppressors.
2. Lightning/surge protection to protect electronic instrumentation system from induced surges propagating along the signal and power supply lines.
3. Analog surge protection for all 4-20 mA signals to and from field and PLC, or pumps and PLC.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements.
2. Section 406717 “Industrial Enclosures.”
3. Section 407000 “Instrumentation for Process Systems.”
4. Section 406733 “Panel Wiring.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions. Shop Drawings:

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Isolators, Intrinsically Safe Barriers, and Surge Suppressors: Furnish two of each type installed.

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.9 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Warranty Period: Provide next day on-site service covering parts and labor 2 years from date of purchase. On-site service is to be performed by an authorized representative of manufacturer.

PART 2 - PRODUCTS

2.1 SIGNAL ISOLATORS/BOOSTERS/CONVERTERS

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. Acromag.
b. Action Instruments Slim Pak.

B. Type:

1. Solid state, ASIC technology; electronic type.

C. Function/Performance:

1. Accuracy: 0.15 percent.
2. Inputs: Current, voltage, frequency, temperature, or resistance as required.
3. Outputs: Current or voltage as required.
4. Isolation: Complete isolation between input circuitry, output circuitry, and the power supply.

5. Adjustments: Zero and span adjustment.
6. Protection: Provide RFI protection.

D. Physical:

1. Mounting: DIN Rail.

2.2 INTRINSIC SAFETY BARRIERS

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:
   a. Gems – 54800 (4-20mA) and 65800 (dry contacts).
   b. R. Stahl - Intrinspak
   c. Siemens Water Technologies – IS1 (4-20mA) and IS6 (dry contacts).

B. Type:

1. Solid state electronic type in which the energy level of the sensing or actuation circuit is low enough to allow safe usage in hazardous areas.

C. Function/Performance:

1. Provide a barrier for instrumentation and equipment transmitting analog or digital signals that originate in a hazardous area as indicated in the design documents.
2. Locate in non-hazardous areas.
3. Match power supply provided.

D. Physical:

1. Mounting: DIN Rail.

2.3 INTRINSIC SAFETY BARRIERS (FOR 2-WIRE TRANSMITTER SYSTEMS)

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following:
   a. Gems.
   b. P&F.
   c. Unitech.

B. Type:

1. Passive devices requiring no external voltage supply.

C. Function/Performance:

1. Supplied with series resistors, series fuse and shunt zener diodes to limit the transfer of energy to levels required by intrinsically safe protection between safe and hazardous locations.
2. Factory Mutual approved and certified for use in accordance with National Fire Protection Association (NFPA 493).

D. Physical:

1. Mounting: DIN Rail.

2.4 SURGE PROTECTION FOR CONTROL SYSTEMS

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. Citel DLA series.
b. MJ8 series.
c. MTL Surge Technologies (Telematic) NP Series.
d. Phoenix Contact PlugTrab Series.
e. Transtector FSP Series.

B. Function/Performance:

1. Provides surge protection of electronic instrumentation from induced surges propagated along the signal and power supply lines from lightning, utility, or the plan electrical systems.
2. Protection system lower than the instrument withstand level, while not interfering with normal operation.
3. Maintenance free and self-restoring.
4. Response time: Less than 50 nanoseconds.
5. Discharge surge current: At least 8kA (at an 8x20µs impulse waveform).

C. Required Surge Protection:

1. Analog Signal (4-20mA) Circuits:

a. Provide surge protection where any part of the circuit is outside of the building envelope.
b. Protect circuits at both the transmitter and the control system end of the circuit.
c. Mount transmitter surge protectors in separate NEMA 4X enclosure or conduit mount.
d. Use of a single device to protect both 120VAC and 4-20mA wires is acceptable.
e. Provide surge protector from one of the following or equal:

1) Phoenix Contact PT Series.
2) MTL Surge Technologies (Telematic) TP48.
3) Citel DLA or CAD series.

2. Control Panel Power Feed (120VAC):

    a. Provide protection of 120VAC power feed into control panels, instruments, and control room equipment.
    b. Provide surge protector from one of the following or equal:

        1) Citel DS40 series.
        2) MCG Surge Protection 400 Series.
        3) Phoenix Contact “Mains-PlugTrab”.
        4) Transtector ACP-100BW Series.

3. Non-Fiber Based Data Highway or Communications Circuits:

    a. Provide protection on all communication and data highway circuits that leave a building or are routed external to a building.
    b. Provide circuit protection at both ends of the line.
    c. Provide surge protector from one of the following or equal:

        1) Phoenix Contact PlugTrab Series.
        2) Transtector FSP Series.
        3) MTL Surge Technologies (Telematic) NP Series.
        4) Citel DLA series.
        5) MJ8 series.

4. RF Coaxial Cable:

    a. Provide protection on communication cables between radios and antennas, mounted either inside the panel, or in the wall of the enclosure.
    b. Protected in accordance with NEMA and UL 497E standards.
    c. Provide surge protector from one of the following or equal:

        1) Citel P8AX series.
        2) Polyphaser.

5. Inductive Loads:

    a. Provide coil surge suppression devices, such as varistors or interposing relays, on all process controller outputs or switches rated 120VA or less that drive solenoid, coil, or motor loads.

6. Telephone Circuits:

    a. Provide Telephone Company approved line protection units for all telephone lines used for telemetry or SCADA system use under this Contract.
    b. Provide surge protector from one of the following or equal:

        1) Citel DLA-170.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and rooms for suitable conditions where computers will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 IDENTIFICATION

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121.20 “Process Control System Testing.”

B. Isolators, intrinsically safe barriers, and surge suppressors will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports in accordance with the following:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions.”
2. Section 406121.20 “Process Control System Testing.”

3.5 STARTUP SERVICE

A. Perform startup service

1. Complete installation and startup checks according to manufacturer's written instructions.

END OF SECTION 407856

SECTION 407859 - POWER SUPPLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes power supplies.

B. Related Requirements:

1. Section 406100 “Process Control and Enterprise Management Systems General Provisions” for submittal requirements.
2. Section 406717 “Industrial Enclosures.”
3. Section 407000 “Instrumentation for Process Systems.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Refer to Section 407000 “Instrumentation for Process Systems.”

B. Shop Drawings:

1. Refer to Section 407000 “Instrumentation for Process Systems.”

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions” for any PCSS requirements regarding informational submittals for instruments.

B. Product Test Reports: For each Power Supplies, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Refer to Section 406100 “Process Control and Enterprise Management System General Provisions.”

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Power Supplies: 10 percent of quantity installed for each size indicated, but no fewer than 1 unit.

1.7 QUALITY ASSURANCE

A. Provide components compatible with functions required to form complete working system.

1.8 FIELD CONDITIONS

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

1.9 WARRANTY

A. Refer to Section 406100 “Process Control and Enterprise Management Systems General Provisions.”

B. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of power supplies that fails in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 POWER SUPPLIES (24VDC)

A. Manufacturers:

1. Manufacturers and their products are subject to compliance with requirements. Provide one of the following or equal:

a. Allen-Bradley.
b. Phoenix Contact.
c. SOLA HD.

B. Type:

1. Redundant power supplies that operate in parallel with an independent redundancy module to power field instruments and panel devices as shown on Drawings.

C. Function/Performance:

1. Input Power: 115VAC, plus or minus 10 percent, 60 Hz.
2. Output Voltage: 24VDC.
3. Output Voltage Adjustment: 5 percent.
4. Line Regulation: 0.05 percent for 10V line change.
5. Load Regulation: 0.15 percent no load to full load.
6. Ripple: 3 mV RMS.
7. Operating Temperature: 32 to 140 degrees F.
8. Sized to accommodate the design load plus a minimum 25 percent spare capacity.

D. Physical:

1. Mounting: DIN rail. Mounted such that heat dissipation does not adversely affect other panel components.
2. Equipped with power on/off circuit breaker.
3. Provide relay contact (internal to the power supply and redundancy module or external if the power supply is not so equipped) to indicate on/off status of the power supply.
4. Provide relay contact to indicate power supply fault.
5. Output overvoltage and overcurrent protective devices to protect from damage due to power supply failure and external failure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, roofs, and process area for suitable conditions where power supplies will be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Refer to Section 406717 “Industrial Enclosures.”

3.2 INSTALLATION

A. UL: Comply with UL508A for installation of power supplies and associated equipment.

B. NFPA: Comply with NFPA 70 (NEC) for installation of power supplies and associated equipment.

C. Comply with NECA 1.

D. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

E. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.3 IDENTIFICATION

A. Refer to Drawings for tagging designations.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Verify voltage regulation fall within performance specifications.
2. Perform redundancy failover checks.

B. Power supplies will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service

1. Complete installation and startup checks according to manufacturer's written instructions.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 407859

SECTION 431118 - VERTICALLY SPLIT MULTISTAGE CENTRIFUGAL BLOWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Multistage Centrifugal Blowers for:

1. San Gabriel WWTP Aeration Tanks.

B. Necessary and ancillary accessory equipment and auxiliaries, whether specifically mentioned in this Section or not. Include supervisory services during installation and field testing of each unit and instructing the regular operating personnel in the proper care, operation and maintenance of the equipment.

C. Related Requirements:

1. Section 260519 “Low-Voltage Electrical Power Conductors and Cables” for wiring to blower motor and manufacturers local control station.
2. Section 400523 “Stainless Steel Process Pipe and Tubing” for Stainless Steel piping
3. Section 400507 “Hangers and Supports for Process Piping” for pipe hangers and supports.
4. Section 400551 “Common Requirements for Process Valves” for valves except as specified in this Section.
5. Section 400593.23 “Low-Voltage Motor Requirements for Process Equipment” for electric motors.
6. Division 26 for electrical work, except as specified in this section.
7. Section 406100 “Process Control and Enterprise Management Systems” for instrumentation and control wiring, except for factory wired equipment and lockout stop pushbutton stations.
8. Section 406121.20 “Process Control System Testing”.
9. Section 406126 “Process Control System Training”.
10. Section 406196 “Process Control Descriptions”.
11. Section 407000 “Instrumentation for Process Systems”.
12. Section 465136 “Ceramic Fine Disc Bubble Diffusers”

1.3 ACTION SUBMITTALS

A. Product Data:

1. General:

a. Manufacturer's name and address.

b. Manufacturer's model number.
c. Descriptive literature bulletins and/or catalogs of instrumentation, equipment, materials, etc. provided by blower manufacturer/supplier. Clearly document exact size, type, and/or manufacturer's model number of equipment or instrumentation being provided.
d. Bill of materials for equipment supplied.
e. List of required materials, not supplied, but necessary to complete installation of supplied equipment.
f. Total weight of equipment including the weight of all major items or components.
g. Center of gravity and lifting point locations for free-standing equipment.

2. Blower and Base Frame: Minimum data to be included on nameplates.

a. Shaft Coupling: Make, model number, dimensions, materials of construction and alignment tolerances.
b. Bearings: Make, model number, dimensions, materials of construction, installation tolerances, and bearing life in hours.
c. Lubrication System: Materials of construction information.
d. Vibration Sensor: Make, model number, mounting details, wiring details, performance data and limitations, and materials of construction.
e. Bearing Temperature Sensor: Make, model number, mounting details, wiring details, performance data and limitations, and materials of construction.
f. Compressor: Impeller diameter, impeller speed (design and maximum allowable), and materials of construction for all components.

3. Silencer Data (Inlet and Discharge) Manufacturer:

a. Model Number.
b. Size.
c. Dimensions.
d. Attenuation Data.
e. Head loss at rated flow (as specified).
f. Materials of construction.

4. Valve and Operator Data (all valves):

a. Manufacturer.
b. Model number.
c. Size and weight.
d. Dimensions.
e. Details and materials of construction.
f. Head loss at rated flow for non-throttling valves.

5. Filter Data (Inlet):

a. Manufacturer.
b. Model Number.
c. Size.
d. Dimensions.
e. Head loss at rated flow (as specified).

f. Materials of construction.

6. Monitoring and Control System: Supplied local control station.

   a. Written description of operating functions describing logic and sequences associated with blower startup, operation, surge suppression protection, and shutdown.
   b. Descriptive Literature Bulletins and/or Catalogs for the Following:

      1) Components installed panel.
      2) Components installed as part of panel.
      3) Supplied field instrumentation.

7. Blower Local Control Station:

   a. Dimension and layout details.
   b. Materials of construction.
   c. Bill of Materials: Complete and detailed including brand names, OEM catalog numbers and literature on control devices such as, but not limited to:

      1) Fused disconnects.
      2) Terminal blocks.
      3) Alarm devices.
      4) Switches and lights.
      5) Timers, relays and related equipment.
      6) Programmable Logic Controller (PLC).
      7) Operator Interface Terminal (OIT).

   d. Screen shots of OIT screens.
   e. PLC database including available monitoring and alarm tags to be monitored.
   f. Detailed point-to-point wiring diagrams showing terminal blocks and internal wire tag numbers and block wiring diagrams that show number, type and size of conductors connected externally to blower local control station.

8. Complete Wiring Diagrams: Elementary or control schematics, including coordination with other electrical control devices such as the blower motor reduced voltage starter and the plant PLC.

   a. Suitable control panel outline drawings before proceeding with manufacture.

      1) Standard preprinted sheets or drawings marked to indicate applicability to this contract is not acceptable.
      2) Individual electrical control schematics and wiring diagrams for each valve operator with external interfaces, identified exactly as detailed on electrical and instrumentation Drawings.

         a) Standard catalogue cut sheets that show typical wiring diagrams only are not acceptable.

B. Electric Motor: Design and product information as specified in Section 400593.23 “Low-Voltage Motor Requirements for Process Equipment” for electric motors.

1. Motor to be compatible with the Reduced Voltage Solid State Starter.
2. Motor Manufacturer to certify that the motors are capable of specified ramp time.
3. Preliminary Blower Performance Data: Expected performance of blower units at inlet conditions specified.

    a. Submit curves for each of the performance condition specified in PART 2 showing how each is affected by variations under the following conditions:

        1) Atmospheric Pressure: 14.5 to 15.0 psia.
        2) Ambient Air Temperature: 20 to 110 F.
        3) Relative Humidity: 30 to 95 percent at the specified inlet conditions.

C. Certified Shop and Installation Drawings: Signed and sealed by a Professional Engineer licensed in the state where specified equipment is installed. Include at a minimum:

1. Materials, details of construction, dimensions, and anchor bolt locations.
2. Blower Unit Assembly:

    a. Dimensioned and scaled general arrangement drawings.
    b. Cross-sectional view drawings.
    c. Point-to-point wiring diagrams identifying all wire and terminal numbers uniquely.
    d. Drawings cross-referenced to replacement parts list including part number and materials of construction.

3. Motor outline drawings identifying location of field wiring termination cabinets.
4. Process and instrumentation diagram drawings.
5. Control Panel:

    a. Ladder logic diagram drawings for control panel resident hardwiring. Identify internal devices, wire tag numbers, terminal tag numbers, and interconnections with external devices and signals.
    b. Dimensioned and scaled outline drawings identifying the location of internal and external panel mounted equipment and devices along with a description of such equipment and devices.

D. Manufacturer Reports: Test reports and certificates for the following tests:

1. Compressor performance tests per ASME testing method PTC-10.
2. Equipment installation certificates: Furnish a certificate from each equipment manufacturer stating installation of his equipment is satisfactory, and ready for operation and operating personnel have been suitably instructed in the operation, lubrication, and care of each unit.
3. Impeller balance.
4. Motor tests.
5. Certified blower performance curves and design point in accordance with this Specification.
6. Certified dBA noise level for entire package which satisfies noise level requirements specified.
7. Certified report attesting to the date and place of dynamic balancing, the accuracy achieved, and the type of balancing machine used.
8. Bearing life calculations. Bearing types and L-10 life in hours.

1.4 INFORMATIONAL SUBMITTALS

A. Description of shop surface preparation, shop prime painting, and shop finish painting systems.

B. Manufacturer's Certificate: Products meet or exceed specified requirements.

C. Test and Evaluation Reports.

D. Manufacturers' Instructions: Submit with Installation and O&M Manual.

E. Source Quality Control Submittals: Results of factory tests and inspections.

F. Field Quality Control Submittals: Results of Contractor furnished tests and inspections including field test reports for blower unit field acceptance tests.

G. Qualifications Statements:

1. Qualifications for manufacturer.
2. Manufacturer installation list of similar installations indicating discharge pressure, discharge air flow, motor horsepower, motor speed, and facility contact name and phone number.
3. Qualifications of service engineer for approval.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and final orientation of equipment.

B. Warranty and Service Agreements: Submit a detailed description of the Manufacturer’s warranty and service agreement for review.

C. Service Agreements: Include a detailed description of the Manufacturer’s service options. Include pricing structure in description.

D. Operating and Maintenance Manuals:

1. Prepare specifically for this installation and include required cut sheets, drawings, equipment lists, descriptions, maintenance recommendations, troubleshooting recommendations, etc. required to instruct operating and maintenance personnel unfamiliar with such equipment. Include the following at a minimum:

    a. Step-by-step disassembly and reassembly instructions including tolerances and torque requirements.
    b. Dimensional drawings of provided equipment with component weights.
    c. Recommended frequency and duration of blower unit operation to prevent deterioration during long periods of disuse.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts, Manufacturer Recommended: Ordering information including name, phone number of nearest service center, and pricing. Include gaskets, seals, bearings, and lubrication products.

B. One set of special wrenches, gages, and other devices required for normal operation and maintenance.

1. Package in a steel case, clearly and indelibly marked on the exterior to indicate equipment for which tools are intended. Complete with lock and duplicate keys.

C. List of blower unit and blower unit motor repair facilities within the United States including addresses, contact names and phone numbers.

D. Recommended summer and winter grades of lubricants along with alternative references to equal products of other manufacturers.

E. Materials in manufacturer's packaging including application and installation instructions.

F. Operation and Maintenance Data: Operation and maintenance manuals for all systems and components.

G. Suitably packaged and clearly identified and indelibly marked on the exterior, to indicate equipment for which tools are intended.

H. One complete set of equipment supplier's recommended spare parts.

1. Blowers to have the following spare parts as a minimum:

a. One level sight glass oiler.
b. One bearing kit with gaskets.
c. One spare set of carbon rings, seals, and spring (if applicable).
d. One year supply of lubricants. Include summer and winter grades with reference to equal products of other manufacturers including lubricant specifications such as viscosity, AGMA numbers, etc.

I. A list of spare and replacement parts with individual prices and locations where available. Prices to remain in effect for a period of one year after startup and final acceptance.

1.7 QUALITY ASSURANCE

A. Steel, Cast Iron, and Ductile Iron Fabrications: Conform to applicable AWWA, ANSI, and ASME, standards. Heat treatment of metal is required for reduction of stresses due to welding, bending, forming, and machining, etc.

B. Like items of materials/equipment are to be the end products of one manufacturer in order to provide standardization for appearance, operation, maintenance, spare parts, and manufacturer's service.

C. Air blowers and appurtenances specified in this Section:

1. Single manufacturer, fully experienced, reputable and qualified in manufacture of equipment specified. Responsible for the blower package including accessory equipment.
2. Blowers to be standard catalogued product, modified as required providing complete compliance with construction documents, and service conditions.

3. Factory assemble blower, motor, base, coupling, and accessories as a single coordinated unit on a common base.

D. Substitution: Equipment other than specified but equal in performance, will be acceptable only if any revisions in the structure, piping, appurtenant equipment, electrical work, etc. required to accommodate the substitution is made at no additional cost to the Owner and approved by the Engineer.

1.8 QUALIFICATIONS

A. Blower Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

1. Successful installations of manufactured blower units in the United States similar in design, type and service, and comparable in size, head, and capacity to those specified in this Section.
2. Comparable blower units in operation for a period of no fewer than five years.

B. Motor Manufacturer: At least 10 years prior experience in design and manufacture of motors specified.

1.9 MANUFACTURER’S MANUALS

A. A minimum of three approved installation manuals to be shipped to the Contractor upon Engineer’s approval of the submitted installation manual.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's packaging including application instructions.

B. Inspection: Accept blowers on Site. Inspect for damage.

C. Store blowers according to manufacturer's instructions.

D. Skid mount or crate equipment to protect against damage during shipment.

E. Protect parts so no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and units and equipment are ready for operation.

F. Ship equipment, material, and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.

G. Mechanical and electrical equipment to be coated, wrapped, and otherwise protected from snow, rain, drippings of any sort, dust, dirt, mud, flood, and condensed water vapor during shipment and while installed in place during construction. Protective coverings to remain in place until work areas are substantially free of construction dust and debris. Submit details of proposed protective measures for approval to Engineer prior to shipment. Follow manufacturer's instructions for long term storage and maintain warranty on equipment.

H. Protect finished surfaces of exposed flanges. Protect by wooden blank flanges, strongly built and securely bolted thereto.

I. Protect un-painted finished iron or steel surfaces to prevent rust and corrosion.

J. Equip each blower motor and gear reducer with a space heater in the motor enclosure to maintain a motor temperature above the dew point preventing condensation in the enclosure. Contractor will energize the space heaters as soon as motors are delivered to the Site. Heaters are to remain energized until the motors are electrically connected in place and energized by the control circuit.

K. Factory Assembled Parts and Components: Not to be dismantled for shipment unless permission is received in writing from the Engineer.

L. No shipment will be made until approved by the Engineer in writing.

M. Store all equipment delivered to Site.

1.11 AMBIENT CONDITIONS

A. The blower unit will be installed in the following ambient conditions and, accordingly, shall be designed to operate and perform as specified under such conditions:

1.	Mean Sea Level Elevation:	690 feet at San Gabriel WWTP
2.	Atmospheric (Barometric) Pressure Variation:	14.5 to 15.0 psia
5.	Ambient Temperature Variation:	20 to 110 degrees F
6.	Ambient Relative Humidity Variation:	30 to 95 percent

1.12 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Document field measurements on Shop Drawings.

1.13 WARRANTY

A. Provide blowers with a warranty for replacement of all defective parts, assuming Owner has operated the blower under normal conditions, for a period of 2-years from the date of Substantial Completion. Warranty covers all defects or failures of materials or workmanship resulting from normal operation and service during the warranty period.

1. The warranty must stipulate equipment furnished is suitable for purpose intended and is free from defects of material and workmanship for duration of the extended warranty. If equipment fails to perform as specified, promptly repair or replace defective equipment. without additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers:

1. Lone Star Blower.
2. Continental Blower.
3. Hoffman Lamson by Gardner Denver.
4. Or approved equal.

B. Basis of Design: Layouts shown on the Drawings are based on equipment manufactured by Lone Star Blower.

C. Blower Motor: Product of a motor manufacturer listed above.

D. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

E. Like Items of Materials/Equipment: End products of one manufacturer providing standardization for appearance, operation, maintenance, spare parts, and manufacturer's service.

F. Furnish materials according to standards set by authorities having jurisdiction.

2.2 SYSTEM DESCRIPTION

A. Equipment specified to be standard equipment for use in low pressure air systems.

1. For 24-hour continuous duty service at all points within the defined operating range without surging, abnormal noise, excessive vibration or strain, hunting, overloading the main drive motor, or excessive heating of the bearings.
2. Limit heat generation and gain to that specified over the defined capacity operating range.
3. No harmful nor damaging vibrations occur at all points within the defined operating capacity range.

B. Blowers Operation: Able to operate with multiple units running at a time discharging into a common header. The condition of several units running at a time shall be met and the safety margin between delivery pressure and surge pressure shall be maintained at the same value for each machine operating in parallel.

C. Blowers: Vertically split, multi-stage, integrally geared centrifugal type direct coupled to an electric motor. Factory mounted on a common base with accessories required for a complete system.

D. Blower systems consist of the following:

1. Vertically split multistage centrifugal blower.
2. Electric motor.
3. Base frame.

4. Inlet air filter/silencer.
5. Compressor and main drive motor bearing temperature monitoring system.
6. Flanged suction and discharge expansion joints.
7. Flanged discharge check valve.
8. Discharge butterfly isolation valve.
9. Inlet modulating (non motor-operated) butterfly valve.
10. Expansion joints.
11. Flexible coupling for motor connection.
12. Blower local control station.
13. Instrumentation specified herein.

E. Blowers specified will be used to supply:

1. San Gabriel WWTP: Process air for:

    a. Aeration Basin 1 & 2 fine bubble diffusers.
    b. RAS Airlift Pumps.
    c. WAS Airlift Pumps.
2. Install blowers for San Gabriel WWTP at the existing outdoor blower canopy at grade level.
3. Discharge air flow from blowers to be manually controlled by inlet throttling to provide the air flow rate through the blower, as adjusted manually by the Owner's personnel.
4. Install the local control station for each blower adjacent to the blower.

2.3 PERFORMANCE REQUIREMENTS

A. Each blower to be designed for the following conditions of service:

1. Site Conditions:

    a. San Gabriel WWTP:
        1) Atmospheric Pressure Variation: 14.7 psia.
        2) Maximum Inlet Temperature: 110 degrees F
        3) Minimum Inlet Temperature: 20 degrees F
        4) Maximum Relative Humidity: 95 percent.
        5) Minimum Relative Humidity: 20 percent.

2. Blower Requirements:

    a. San Gabriel WWTP:

        1) Number of units: 4 total / 3 firm and 1 standby

            a) Total Firm Capacity: 5,600 scfm
            b) Design Air Flow for Each Blower: 1,867 scfm
            c) Minimum Inlet Pressure at Inlet Flange: 14.3 psia
            e) Discharge Air Pressure: 8.5 psig

f)	Maximum Motor Power Requirements:	150 HP
g)	Minimum Rise to Surge at Design Air Flow:	0.75 psig
i)	Motor Speed:	3600 RPM

B. Limit operating sound pressure levels (sum of all octave bands) in a factory test environment to 85 dBa in any direction at a distance of 3 feet from the equipment over the defined capacity range.

C. Deliver compressed air against a pressure of no less than 6.2 psig without surging.

D. Blowers operating at or between any combinations of design conditions:

1. Electrical Power Draw of Job Motors: Not to exceed nameplate rating of 150 HP and blowers (new or existing) will not surge.

E. Balancing of Blowers: Statically and dynamically balanced limiting vibration in any plane to a maximum of 1.5 mils (peak to peak displacement) when operating over the defined capacity range and measured at any bearing housing on the blower unit.

1. Inlet Filters: Headloss of 0.30 psi at maximum inlet flow of 3165 scfm.

F. Materials:

1. Equipment: Designed and proportioned to have strength, stability and stiffness for the intended service. Provide ample room and facilities for inspection, repairs and adjustments.
2. Structural Steel Used in Equipment Fabrication: Conform to requirements of ASTM A36. Welding to conform to latest standards of AWS.

G. Nameplates: Provide equipment information nameplates for each major piece of equipment including compressor, main drive motor, valves, local control stations, etc.

1. Construct information nameplates of stainless steel and affix to equipment using stainless steel mechanical fasteners. Nameplate Lettering: Embossed.
2. At a minimum, include the following information on each nameplate:

a. Blower nameplate: Manufacturer's name, make, model number, serial number and date of manufacture.
b. Motor nameplate: Electrical voltage requirements and ampere draw at rated voltage.
c. Blower Unit's Compressor nameplate: Include the following information.

1) Rated capacity: scfm.
2) Rated discharge pressure: psig.
3) Rated impeller speed: rpm.
4) Impeller diameter inches.
5) Isentropic efficiency at rated capacity and discharge pressure (percent).
6) Brake horsepower requirement at rated capacity and discharge pressure.
7) Lubrication oil requirements.

d. Blower unit main drive motor nameplate:

1) All information required by NEMA MG1 20.60.1.

2) Efficiency at rated horsepower output.
3) Power factor at rated horsepower output.
4) Winding insulation system designation and type.
5) Power lead current transformer ratio.
6) Bearing model and serial number.

H. Blower:

1. Electric motor driven, horizontal shaft, multistage centrifugal type with outboard mounted bearing construction.

2. Blower to be of the type in which the diaphragm which receives air from the impeller and guides the air to the next impeller is cast integrally with the casing to ensure optimum operating efficiency.

3. Compressor Casing:

a. Type: Cylindrical.
b. Material: Cast iron construction per ASTM A278, Class 30B or ASTM A48, Class 30.
c. Fit the rigid cast iron sections with rabbet joints held securely between inlet and outlet heads by steel tie rods.
d. Compressor casing to be designed for:

1) Minimum design temperature of 300 degrees F.
2) Minimum design pressure of 20 psig .
3) If the housing is not rated for 20 psig, then the manufacturer will hydrostatically test the blower casing at 20 psig before shipment and furnish test results.

4. Inlet and outlet connections to be ANSI Class 125 drilled and tapped flanges and be an integral part of the heads.

I. Shaft Coupling:

1. Type: Furnish flexible, double disc, dry type spacer coupling to connect the motor shaft to the compressor shaft.
2. Material: Forged Steel.
3. Balance: Coupling and spacer to AGMA, Class B or better, and sized with a minimum service factor of 1.5.
4. Allows either shaft of the blower unit to be decoupled and removed without disturbing or adjusting the other.
5. Provide an OSHA approved steel guard the coupling. Paint guard safety yellow.

J. Base Frame:

1. Mount blower and motor on a common structural steel base plate of adequate size to support the compressor and main drive motor.

a. Corners to be rounded smooth and welds ground.
b. Base frame to be free of warping or cupping.

c. To prevent distortion and facilitate accurate alignment during installation machine contact points between the blower and motor feet and base plate.

2. Provide blower with a minimum of eight molded synthetic rubber base pads, a minimum of 0.5 inches thick.
3. Blower unit base frame is to serve as the mounting platform for the field wiring termination cabinet for the compressor and motor bearing temperature sensors.
4. Cabinet: NEMA 4X stainless steel and sized to adequately contain all required terminations.
5. Terminal blocks, base frame mounted conduit, and wires to be as specified in Division 26.
6. Provide lifting lugs for equipment weighing over 100 pounds.
7. Foundation Bolts, Plates, Nuts and Washers: Type 316 stainless steel to facilitate installation of the blower unit and control panel.
8. Anchorage and Bearing Pads: As required to mount each blower on its independent concrete base.

    a. Anchors of a size recommended by the manufacturer to be furnished by the equipment manufacturer.

K. Shafts and Seals:

1. Shafts: AISI 4140 carbon steel, ASTM A108 Grade 1045 or better.
2. Sufficient diameter to operate below first critical speed.
3. A cooling rotating shield to reduce heat transfer along the shaft to the bearing and lubricant.
4. Seals provided to prevent air leakage:

    a. Outlet Heads: Labyrinth Type or Carbon Ring Type.

        1) Labyrinth Seals: Zinc Alloy 12.
        2) Carbon ring seals: High density, molded carbon-graphite with steel housing.

    b. Replaceable without having to disconnect inlet or discharge piping.
    c. Interstage Labyrinth shaft seals.

L. Bearings:

1. Type: Anti-friction.
2. Lubrication: Constant level oiler.
3. Sight Gauge: To observe of oil level at each bearing assembly.
4. Sized for a minimum expected L-10 bearing life of 100,000 hours in accordance with AFBMA Standards.
5. Capable of being inspected or replaced without disconnecting any piping or disassembling the blower.
6. Bearing Housing:

    a. Material: Cast Iron ASTM A48 Grade 25.
    b. Type: Open-air space to separate the bearing housing from the casting.
    c. Fitted with resistance temperature detector-type (RTD) temperature sensing elements and vibration sensing elements as specified herein.
    d. Provide labyrinth seal to eliminate lubricant leakage.

M. Impeller:

1. Cast in one piece from high strength ASTM A356 aluminum alloy and accurately machined.

    a. Statically and dynamically balanced.
    b. Vibration: 1.25 mils total amplitude maximum when measured on the bearing housing in either the horizontal, vertical or axial direction.
    c. Certified report attesting to the date and place of dynamic balancing, the accuracy achieved and type of balancing machine used.
    d. Operating speed of blower: A minimum of 30 percent below the first critical speed of the impeller assembly.

2.4 ELECTRICAL

A. Motors:

1. Refer to Section 400593.23 “Low-Voltage Motor Requirements for Process Equipment” for electric motors.
2. Squirrel Cag Induction, Premium efficiency and in accordance with latest NEMA, IEEE, ANSI and ABMA standards where applicable.
3. Power Factor: As required per NEMA MG1
4. Connection: Direct Coupled.
5. Motor Rating: For a minimum turndown of 3:1.
6. Enclosure: Totally enclosed fan cooled.
7. Operate on a 460-volt 3 phase, 60 Hz alternating current system.
8. Motor Speed and Horsepower: As specified in “Performance and Design Criteria”
9. Do not overload motors, nor the service factor reduced when the blowers are operated at any point on the design speed performance curve at the design differential pressure across the blower.

B. Reduced Voltage Solid State Motor Starter (RVSS)

1. Capable of a slow ramp startup of up to 30 seconds.
2. Compatible with the specified motor.
3. Enclosure: NEMA 4X.

2.5 CONTROL

A. Each blower shall be furnished with a PLC-based local control panel (LCP). All controls and instruments shall fail into a safe condition.

B. Communication with SCADA system: Use: Ethernet cable capable of communicating with Allen Bradley PLC.

C. The enclosure shall be (Type 4X) rated. Each assembled LCP shall carry a UL label (UL-C for Canadian service) certifying the complete assembled industrial control panel complies with UL 508A.

D. The control panel shall be powered by a 120VAC source as shown in the project drawings and a 120VAC Type2/3 SPD (surge protection device) shall be provided in the panel.

E. Each LCP shall contain provisions for signals to interface with the main motor starter. The starter for the main drive motor shall be installed by the CONTRACTOR as shown in the project drawings.

F. Blower Controls: Through a L-O-R switch at a Local Control Station provided by Division 43 by the Blower vendor incorporated with the blower unit.

1. When placed in “Local” position at the Local Control Station, the blower will start. When placed in “OFF” the blower will not run.
2. When placed in “Remote” position at the Local Control Station, the blower will start and stop manually or automatically based on settings at SCADA.
3. All alarms (low suction pressure, high discharge pressure and high discharge temperature) will be hardwired from the enclosure to the motor starter to automatically stop the blower.
4. The blower will also stop by an E-Stop at the Local Control Station provided by Division 26.

G. Readouts and Totalizers: Program the following readouts and totalizer values back to SCADA from each supplied blower.

1. Current (amperes)
2. Power (kW)
3. Run Time (hours)
4. Alarms (type, count)
5. Pressure (psig)
6. Temperature (fahrenheit)

H. I/O channels from the PLC shall be pre-wired to terminal blocks and each circuit shall be individually fused. Discrete output channels shall be pre-wired to interposing relays to provide dry contacts for output signals.

I. Use destination tagging printed on a wire sleeve marker to identify each wire. Destination tagging identifies the landing point of the other end of the wire.

J. Panel mounted selector switches, pushbuttons, and indicators shall include:

1. Emergency stop mushroom button
2. Remote / Local Selector Switch
3. Running indicator / pilot light (Green)
4. Alarm indicator / pilot light (Amber)

K. The local control panel shall be equipped with the following additional accessories and hardware at a minimum:

1. 24VDC power supply for control power
2. HMI cover with hinged clear lid

3. 120VAC Receptacle for temporary laptop use

L. The PLC shall be a model AXC F 2152 as manufactured by Phoenix Contact, or pre-approved equal. At a minimum, the PLC shall meet the following requirements.

1. Ambient temperature operation up to 60°C
2. Dual Core 800MHz Processor or faster
3. 512 Mbyte DDR3 SDRAM
4. 8 Mbyte Program Memory
5. 16 Mbyte Mass Storage
6. Realtime Clock
7. X2 RJ45 Ethernet ports capable of 10/100 Mbps (full duplex)
8. Developed according to security standard IEC 62443
9. Integrated and configurable firewall

M. The HMI shall be a model BWP 2102W as manufactured by Phoenix Contact, or pre-approved equal. At a minimum the HMI shall meet the following requirements:

1. 7” or larger color touchscreen.
2. HTML5 capable
3. 1024 x 600 pixel resolution
4. Minimum 65° viewing angle from the sides
5. X1 RJ45 Ethernet port capable of 10/100 Mbps
6. X1 USB Host 2.0 interface

N. The HMI programming shall be part of the PLC program and accessible from the controller via HTML5. This functionality is to allow temporary HMI functionality from a device with a web browser in the event of an HMI failure or easy integration of HMI functionality to additional workstations in the facility.

O. A copy of the PLC and HMI programming software shall be provided to the owner.

P. The operating screens (pages) shall provide not only start-stop and operational mode interfaces, but also alarm status and diagnostics. The following features shall be provided as part of the operator interface screens:

1. Status Bar (all screens) – The top of every screen shall provide a status bar giving status information for primary functions such as running state, alarms, local/remote, and operation mode. Additionally, it should be indicated on the status bar if there are any bypass or override values enabled (see Settings Screens).
2. Main Menu Buttons (all screens) - The left side of each screen shall provide navigation buttons to primary screens starting below the status bar. Navigation buttons should be provided for run control, monitoring, alarms, vendor contact info screen, and a settings menu.

3. Run Control Screens – The run control screens shall provide the primary interface for starting/stopping the blower and changing its output.
4. Monitoring Screens – The monitoring screens shall allow for viewing the blower data and status in different formats at the preference of the operator. The displayed values shall update according to the engineering units selected. At least two visual modes shall be available:

    a. Equipment view showing the blower package with live values and status indicators.
    b. List view showing the live values for each parameter in a list format with readings for related instruments grouped together.

5. Alarm Screen – The alarm screen shall show any recent alarm conditions from the equipment. The list of alarms shall be configurable to show the alarm history (active and inactive alarms) or only active alarms. The alarm history shall only be resettable from a settings screen and only when using a technician or administrative level login. The alarm screen shall show a date and time stamp of the last time the alarm history was cleared.
6. Settings Screens – Settings shall be viewable under all login levels but shall only allow changes to setpoints and configuration under a technician or administrative level login. Any settings related to the operation of the equipment shall be available via the HMI. This includes, but is not limited to, scaling values, alarm and trip setpoints, timer settings, and other configuration related items. Additionally, each instrument shall have options for an override value or to bypass trips related to the instrument. A bypass or override may only be enabled under a technician or administrative level login and is intended only for temporary use but would provide capability for the blower to be operated in the event of a failed sensor until a replacement can be installed.

Q. Each blower LCP shall contain controls for blower motor starting, blower output control, surge and overload detection, monitoring and protection from other instruments equipped, shutdown control, alarm and emergency shutdown systems.

R. The LCP shall be capable of being operated in either a Manual or Auto mode. Auto mode shall operate the blower either based on a constant power output or constant discharge pressure (operator selected). No matter what mode the control system is operating in, set point constraints shall be provided to keep the blower in an acceptable operating range between surge and overload.

S. The blowers shall start when initiated by the local start signal or a remote start signal when in remote mode. Once all pre-start permissives are confirmed, the blower motor shall be started. A feedback signal from the main motor starter shall confirm that the main drive motor has been energized. Provide a sequence fail alarm and trip if any portion of the start, run, or stop sequence is not properly executed.

T. Monitoring and Safety Shutdowns / Alarms: Each instrument shall be able to be enabled, disabled, or remapped to a different input/output channel via the HMI interface without any programming changes needed. While not all the following functionalities might be used with the initial instrumentation, the functionality shall be capable of being enabled if instruments are added in the future. The LCP shall contain alarm and shutdown logic for the following functionality.

1. E-Stop
2. Main Motor Starter Monitoring
3. Blower Surge
4. Motor Overload
5. Motor Bearing Temperature
6. Blower Bearing Vibration
7. Motor Winding Temperature

U. Surge and overload events shall be avoided using active measures performed by the control system. If the blower system is approaching a surge or overload condition, the control system shall intervene and adjust the blower inlet valve and output setpoint to avoid surge or overload. If avoidance of surge or overload is not possible, the control panel shall trip the blower offline.

V. When a blower inlet temperature sensor in equipped and enabled, the local control panel shall be capable of providing temperature compensated surge protection to increase blower flow range.

W. Data communication shall be provided between the PLC and the plant systems via the EtherNet IP protocol. Configuring the interface to the plant system shall be the responsibility of the systems integrator; however, the MANUFACTURER shall actively participate by providing proper interface documentation and support as needed.

2.6 FINISHES

A. Blowers and Discharge Piping Accessories:

1. Factory finish paint per manufacturer's standard for high temperature paint. Submit description of surface preparation and paint with shop drawings.
2. Appurtenances to receive surface preparation and shop prime paint as part of the work of this Section.
3. Do not paint stainless steel surfaces.

2.7 VALVES AND JOINTS

A. Check Valves:

1. On each blower discharge to main air header.
2. Refer to Section 400565.29 “Double-Disk Check Valve” for check valve requirements.

B. Butterfly Valves:

1. Provide each blower unit with the following valves:

   a. Manually operated inlet throttling butterfly valve for modulation of blower output.
   b. Manually operated discharge butterfly valve for open close control.

2. Valves shall be wafer type, except for dead end service where flanged valves shall be used.

Valve body shall be cast iron ASTM A126 Class B. Disc shall be ductile iron ASTM A536 with a disc edge of Monel, Type 316 stainless steel, or welded nickel machined to a smooth surface. Valve shall have an air profile (undercut) disc. Resilient seat shall be reinforced Nordel (EPDM or PTFE).

3. Air butterfly valves shall be suitable for 250°F continuous and 300°F intermittent operation.
4. All valves shall be furnished with self-lubricated bearings of TFE coated stainless steel. Shaft seals shall be provided to prevent air leakage and to protect bearings from internal or external corrosion. Use EPDM or Buna-N "O" rings or self-adjusting packing.
5. Shafts shall be one piece and shall be of Type 316 stainless steel. Shafts shall be finish ground and polished to minimize bearing and shaft seal wear. Shafts of 8 inches and larger valves shall have a non-adjustable thrust collar.
6. Valves 8 inches and smaller shall have 10-position levers. All manually actuated valves 10 inches and larger shall be operated using a geared actuator. All units to have adjustable open and closed position stops with provision to prevent accidental adjustment changes. Operating shaft shall be supported axially and radially at input end by permanently lubricated bronze thrust and sleeve bearings. Actuators for throttling service shall conform to AWWA C504.
7. Butterfly valves for air service shall high performance type meeting ANSI B16.104 and MSS-SP-67, except as modified herein. They shall be model by DeZurik High Performance, Bray Series 30 or engineer-approved equal.
8. Manual Actuator: As specified in Section in 400557 “Actuators for Process Valves and Gates.”

C. Expansion Joints

1. Provide on each blower discharge.
2. Refer to Section 400506 “Couplings, Adapters, and Specials for Process Pipe”.

2.8 INSTRUMENTATION

A. RTD Monitor System:

1. Include 100 ohm platinum RTD's embedded in motor windings (two each phase; one active, one spare) and in each loaded bearing of both the motor and blower/gearbox.
2. RTD's monitored by the blower LCP. The LCP to include a protective relay system to shut down the motor on high winding temperature and annunciate the fault.
3. The system must monitor and display actual bearing temperature.
4. Include an adjustable alarm feature such that when bearings reach the selected temperature, an alarm light illuminates until reset and the unit shuts down.

△3 B. Vibration Monitoring System:

1. Each blower shall be provided with vibration transmitter on the inlet and outlet bearings to detect and monitor vibration level. Exceeding the vibration warning set point will initiate a vibration warning alarm. Exceeding the vibration shutdown set point will shut off the blower.
2. The LCS will receive and display the vibration probe signals. Include an adjustable alarm feature such that when bearings reach the selected vibration, an alarm light illuminates until reset and the unit shuts down.

C. Vacuum and Pressure Gauges: Inlet and discharge provided for each blower.

1. Refer to Section 407313 “Pressure and Differential Pressure Gauges” for pressure gauge requirements.
2. Connect to taps in inlet piping and discharge piping as close as possible to the expansion joint joining the blower.
3. Furnish tubing to connect each gauge to its tap on the air piping, plus fittings, adaptors and shut-off and vent valves as required for a complete installation.

D. Anchorage and Bearing Pads:

1. As required to mount each blower on its independent concrete base. Anchors of a size recommended by the manufacturer to be furnished by the equipment manufacturer.

2.9 ACOUSTICAL ENCLOSURE (NOT USED)

2.10 ACCESSORIES

A. Inlet Filters/Silencers: For blower units.

1. Provide each blower unit with an inlet air filter with integral silencer and weather hood.
2. Inlet filter vertically mounted in the configuration shown on the Drawings.

a. Dry type Panel style.
b. 120 percent of design volume.
c. Manufacturers:
d. Panel Style by:

1) TriVent PO9 Series by Endustra.
2) FSH Series by Universal Silencer.
3) FCRH Series by Universal Silencer .

e. Engineer-approved equal.

3. Furnish each air filter/silencer with:

a. Tap for connection of gauge to the filter/silencer housing.
b. Mounting hardware.
c. Other appurtenances required for a complete differential pressure indication system.

4. Maximum clean filter pressure drop of the inlet filter/silencer with the elements installed to be 0.09 psig. Maximum pressure drop with dirty inlet filters to be 0.30 psig.

5. Filter Elements:

a. Cartridge Style:

1) Circular, interchangeable element options.
2) Removable weather hood for easy access to filter element.

3) Filter element media: Pleated felt with 98% removal of particles greater than 10 microns.

b. Size filters for a maximum face velocity of 575 ft/min at peak air flow.

6. Install each inlet filter/silencer by press fitting a 1-inch foam rubber gasket, provided by the Manufacturer between the air inlet connection and the flange around the periphery of the inlet filter frame.
7. Connect the filter/silencer to the blower inlet via the flexible connector provided.

2.11 SOURCE QUALITY CONTROL

A. Test sound pressure level from the equipment in accordance with CAGI S5.1 or AMCA 300-67 and include contributions from the main drive motor.

1. Each motor to be given a complete, non-witnessed test.
2. Test for noise and vibration in accordance with IEEE test procedures.
3. Furnish a certified motor data sheet for approval prior to shipment.

B. At least 30 days prior to scheduled testing, submit test procedures to the Engineer for review.

C. Test one of each blower model in accordance with ASME PTC-10.

D. Upon completion of assembly, each blower, motor and oil lubrication skid to be functionally tested with the local control station (LCS) connected to all skidded instruments, electric valves and appurtenances as applicable.

1. The oil lubrication system must be run and tested for leaks, all start/stop sequences and all safety and alarm systems tested, stimulating start of the blower motor.

E. Test Results of Motors, Blowers and Package Functional Tests: Include in the Operations and Maintenance Manual.

F. Certificate of Compliance: When fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation: According manufacturer's instructions.

B. Install the blower unit and appurtenances in strict accordance with the blower manufacturer/ supplier’s instructions and recommendations. Make necessary adjustments to provide complete and satisfactory operation upon completion of the Contract.

C. Provide blower field alignment by a qualified millwright to meet blower manufacturer instructions and specifications.

D. Support new piping to preclude the possibility of exerting undue forces and moments on the blower flanges. Provide suitable expansion joints to isolate the blowers from the piping system. Mount blower on a flat and level concrete equipment pad of the dimensions shown on the Drawings.

E. Install blower base on suitable anti vibration strips. Install blower and motor parts so that all items revolve smoothly and are free of excessive noise and vibration.

F. Deviation of Pipe Connection and Arrangements from Drawings: Acceptable, if new air pipe arrangement is furnished as approved by the Engineer.

G. Installation to include furnishing the required oil and grease for initial operation. The grades of oil and grease to be in accordance with the manufacturer's recommendations.

H. Field Tests: Do not conduct until such time that the entire installation is complete and ready for testing.

I. Install a temporary heavy wire mesh using Type 304 stainless steel wire, providing a 1/2 inch maximum mesh on blower inlet, to prevent objects inadvertently left in the air inlet system from entering the blower. Remove mesh after initial operation and just prior to field testing.

3.2 FIELD QUALITY CONTROL

A. After the installation of the blowers, motors, controls and all appurtenances, each complete blower unit will be subject to field acceptance tests under actual operating conditions.

B. Conduct field acceptance tests under the direct supervision of a qualified representative of the blower manufacturer and in the presence of the Engineer.

1. Provide, calibrate and install all temporary gauges and motors, making necessary tapped holes in the piping and install all temporary piping and wiring required for the field tests.
2. Submit written test procedures to the Engineer for approval 30 days prior to testing.

C. The field acceptance tests will determine the characteristics of each blower unit and in addition will demonstrate that under all conditions of operation each unit:

1. Has not been damaged by transportation or installation.
2. Has been properly installed.
3. Has no mechanical defects.
4. Is in proper alignment.
5. Has been properly connected.
6. Is free of overheating of any parts.
7. Is free of objectionable vibration and noise.
8. Is free of overloading of any parts.

D. Conduct field acceptance testing after installation of all equipment has been completed and operated for a sufficient period to make all desirable corrections and adjustments. Tests to prove that operation of each blower unit and all associated equipment is satisfactory and in compliance with this Section.

E. During the field acceptance tests, each unit to be operated for a minimum of 24 hours.

F. Take readings at 30-minute intervals and record on suitable log sheets.

1. Include data from the following:

a. Pressure and temperature gages.
b. Driver output RPM's.
c. Relative humidity readings.
d. Power kW.
e. SCFM output.
f. All other information necessary to calculate the actual performance characteristics of the blower, driver and ancillary equipment.

G. Submit a written report to the Engineer tabulating equipment tested, test results, problems encountered and corrective action to be taken within two weeks after test completion

H. Mutually arrange and coordinate with Owner's plant personnel and representatives.

1. Schedule testing procedures with the full knowledge and consent of the Engineer.
2. Schedule should not adversely affect the operation of plant facilities.

I. Units Failing to meet Performance Test:

1. Take corrective action and retest to assure full compliance with the Specifications.
2. Submit a revised written report to the Engineer.

J. A 7-day operating period of stable and vibration-free operation is required for each blower unit prior to final acceptance.

K. Noise and vibration tests:
1. No harmful vibration in the blower units or in the system piping.
2. Vibration not to exceed specified limits.

L. Manufacturer Service:

1. Provide the services of a factory certified service engineer specifically trained in the installation, start-up, testing, operation and maintenance of the equipment as herein specified.
2. A direct, full-time employee of the blower manufacturer or a representative who is factory-trained and certified to perform these services. Submit qualifications of service engineer for approval.
3. Services of the blower manufacturer/supplier to be in accordance with this Section.

a. Service time to include assistance as required with installation, startup, testing, programming, calibration, and training.
b. Provide for a total of five 8-hour days for services at each site.

1) Hours suggested are exclusive of travel time and do not relieve the Contractor of the obligation to provide sufficient service to place the equipment in satisfactory operation.

c. Provide one 8-hour day at each site for service inspections during the first year of actual operation, in addition to the days indicated above, for use at the Owner's request and exclusive of repair, malfunction or other troubleshooting service calls.

4. Blower manufacturer/supplier will advise, consult and instruct on installation procedures and adjustments and inspect the equipment during installation (i.e. provide installation oversight).
5. Blower manufacturer/supplier is responsible for the inspection and start-up of the equipment. Additionally, blower manufacturer/supplier is to certify the equipment has been properly assembled, lubricants have been properly installed, electrical connections have been properly made, protective set points have been properly adjusted, and that the equipment is ready for service.

3.3 DEMONSTRATION AND TRAINING

A. Manufacturer's representative will provide both operational and maintenance instruction of the Owner's personnel.

B. Training will be given at times convenient to the operations and maintenance teams being trained considering operational shifts and duties while on shift.

1. Operational training to include the following at a minimum:

a. Theory of operation.
b. Troubleshooting guidance.
c. Recognizing normal and abnormal operating conditions.
d. Step-by-step startup and shutdown procedures.
e. Discussion of operational limitations.

2. Maintenance training to include the following at a minimum:

a. Replacement part identification and ordering procedures.
b. Lubrication procedures, including drain-down and refill procedures.
c. Recommended routine preventive maintenance procedures.
d. Troubleshooting and diagnostic procedures.
e. Adjustment and calibration of all temperature, pressure, level, flow amperage, speed, and vibration instrumentation.

3. Contractor is responsible for requesting and coordinating services of manufacturer's representative, including coordination with all affected trades. The Contractor is also responsible for documenting the delivery of all manufacturer/vendor on site services.
4. Instruction of Owner's personnel is to be scheduled at least 10 days in advance with the Owner and take place prior to acceptance by the Owner.

END OF SECTION 431118

SECTION 431133 - ROTARY LOBE BLOWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Rotary Lobe Blower packages for San Gabriel WWTP:

1. Aerobic Sludge Holding Tank (ASHT).
2. Wet Weather Storage Basin (Wet Weather).

B. Provide necessary and ancillary accessory equipment and auxiliaries, whether specifically mentioned in this Section or not and as recommended by equipment manufacturer. Include supervisory services during installation and field testing of each unit and instructing the regular operating personnel in the proper care, operation and maintenance of the equipment.

C. Related Requirements:

1. Section 400523 “Stainless Steel Process Pipe and Tubing” for Stainless Steel piping.
2. Section 400507 “Hangers and Supports for Process Piping” for pipe hangers and supports.
3. Section 400551 “Common Requirements for Process Valves” for valves except as specified in this Section.
4. Division 26 for electrical work, except as specified in this section.
5. Section 400593.23 “Low-Voltage Motor Requirements for Process Equipment” for electric motors.
6. Section 406100 “Process Control and Enterprise Management Systems General Provisions”, for instrumentation and control wiring, except for factory wired equipment and lockout stop pushbutton stations.
7. Section 260519 “Low-Voltage Electrical Power Conductors and Cables” for wiring to blower motor and manufacturers local control panel.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Submit manufacturer’s product data for Blowers and accessories including electrical characteristics.

a. Manufacturer’s name and address.
b. Size, type, dimensions, model number of equipment or instrumentation provided.
c. Material of Construction.
d. Bill of materials and Nameplate data for supplied equipment.

e. List of required materials, not supplied, to complete installation of the supplied equipment.
f. Weight of equipment including the weight of major items or components.
g. Center of gravity and lifting point locations for free-standing equipment.
h. Variations from Project Requirements: Highlight, note, and explain why variation is included in submittal.
i. Rated Capacity.
j. Silencer Certification: Suitable for service within entire speed ranges specified herein for variable or multiple speed positive displacement blowers. (Where applicable).
k. Headloss at rated flow (where applicable).

2. Blower:

a. Bearing Information: Make, model number, dimensions, materials of construction, installation tolerances, and bearing life in hours.
b. Speed at specified operating points, (rpm).
c. Capacity: cfm.
d. Discharge pressure.
e. Maximum gear tip speed: fpm.
f. Rated maximum pressure rise of blowers.
g. Maximum temperature rise across blower.
h. Power Rating: HP required at rated capacity and pressure for entire package, per ISO-1217 (slip test not permitted).

3. V-Belt Drives:

a. Number and size of V-belts.
b. Rated Capacity of V-Belt Drive: hp.
c. Service factor.
d. Size and rpm of driving and driven sheaves (for 3 air flow rates).

4. Electric Motors:

a. Driven Equipment: Include motor nameplate data, and test characteristics in accordance with NEMA Standard MG1-12.54:

1) Data and information for motors under Section 400593.23“Low-Voltage Motor Requirements for Process Equipment” for electric motors.
2) Enclosure type and list of accessories. (Where applicable)

5. Shop and Installation Drawings: Include but are not limited to the following:

a. Materials, details of construction, dimensions, and anchor bolt locations, types, sizes, with minimum edge distances, depth of embedment, and locations.
b. Dimensioned and scaled general arrangement drawings for the blower unit assembly and acoustical enclosure (if applicable).
c. Cross-sectional view drawings for the blower unit assembly.
d. Drawings cross-referenced to a replacement parts list that includes part number and material of construction information.

e. Point-to-point wiring diagrams for the blower unit assembly identifying all wire and terminal numbers uniquely.
f. Motor outline drawings identifying location of all field wiring termination cabinets.
g. Process and instrumentation diagram drawings.
h. Bearing life calculations.

B. Adhesive Anchors: Manufacturer's specifications and data including recommended design values and physical characteristics.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Products meet or exceed specified requirements.

B. Shop surface preparation shop prime painting, and shop finish painting systems.

C. Test and evaluation reports.

D. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

E. Installation Manuals: Provide two to the Contractor upon Owner's and Engineer's approval of the submitted installation manual.

F. Field Quality-Control Submittals: Indicate results of Contractor furnished tests and inspections including field test reports for the blower unit field acceptance tests.

G. Manufacturer Reports: Submit test reports and certificates for the following tests:

3

1. Compressor performance tests in accordance with ISO 1217, Annex B.
2. Equipment installation certificates.
3. Impeller balance and overspeed tests.
4. Motor tests.
5. Certified blower performance curves and design point in accordance with this Specification and include the following:

    a. Discharge Air Flow: scfm.
    b. Inlet Pressure: psia.
    c. Discharge Pressure: psig.
    d. Discharge Temperature: degrees F.
    e. Brake Horsepower: HP.
    f. Bearing types and life.
    g. Speed: RPM.

6. Certified dBA noise level for the entire package which satisfies the noise level requirements specified.
7. Heat dissipation calculations to confirm sound enclosure cooling fan is sized for sufficient heat removal throughout the speed range of the blower. Calculate at a maximum ambient temperature of 110 degrees F at 80-percent relative humidity. Manufacturer to verify the temperature dissipation provides necessary protection of internal components.

H. Qualifications Statements:

1. Qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of blower systems.

B. Operating and Maintenance Manuals:

1. Prepare specifically for this installation and include required cut sheets, drawings, equipment lists, descriptions, maintenance recommendations, troubleshooting recommendations, etc. required to instruct operating and maintenance personnel unfamiliar with such equipment. Include the following at a minimum:

a. Step-by-step disassembly and reassembly instructions including tolerances and torque requirements.
b. Dimensional drawings of provided equipment with component weights.
c. Recommended frequency and duration of blower unit operation to prevent deterioration during long periods of disuse.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Special Tools and Appliances: Necessary to disassemble, service, repair, and adjust the equipment and appurtenances, in a suitable steel lockable tool chest and duplicate keys.

B. List of blower unit and blower unit motor repair facilities within the United States including addresses, contact names and phone numbers.

C. Suitably package spare parts. Clearly identify with indelible mark on the exterior of packaging, to indicate equipment for which tools are intended.

D. Provide one complete set of recommended spare parts from the manufacturer. Minimum spare parts for the blower:

1. Filtering media for inlet filter for each blower filter: two sets.
2. Complete sets of gaskets, seals, O rings if applicable, etc., for each blower: two sets.
3. Belts for each size of blower: one set.
4. Special tools as required to perform maintenance.
5. Lubricants. One year supply. Include summer and winter grades. Provide reference to equivalent products of other manufacturers including lubricant specifications such as viscosity, AGMA numbers, etc.

E. Spare and replacement parts and price list and their available locations. Pricing to remain in effect for a period not less than one year after startup and final acceptance.

1.7 QUALITY ASSURANCE

A. Steel, cast iron, and ductile iron fabrications are to conform to applicable AWWA, ANSI, and ASME, etc. standards. Heat treatment of metal is required for reduction of stresses due to welding, bending, forming, etc.

B. Structural steel used in the fabrication of equipment to conform to the requirements of ASTM A36.

C. Welding to conform to the latest standards of the AWS.

D. Like items of materials/equipment are to be the end products of one manufacturer to provide standardization for appearance, operation, maintenance, spare parts, and manufacturer's service.

E. Blower Manufacturer: Responsible for the blower package including accessory equipment, skid mounting and enclosure.

F. Blowers: Furnished as part of an equipment package skid which includes the inlet filter,, base frame, motor, check valve,,, instrumentation, inlet and discharge flex connectors,,, and other specified accessory equipment.

1. Manufacturer's standard cataloged product, modified as required to provide compliance with the construction documents, and the service conditions specified and indicated herein.

G. Single Source Blower Manufacturer:

1. Obtain blowers, motors, intake air filters, silencers, enclosures, controls, and all appurtenances from a single manufacturer, as a complete and integrated package.
2. Fully responsible for the blower package including accessory equipment. Location of silencers, and other appurtenances, with respect to the blowers are the responsibility of the blower manufacturer.

H. Equipment Warranty: Provide statement that blower package is intended and designed for continuous, problem-free operation at any speed within the specified speed ranges for the specified application.

I. Routine Tests: Performed on representative motors and include the information described on NEMA MG1-12.54 "Report of Test Form for Routine Tests on Induction Motors". Efficiency to be determined in accordance with IEEE Publication No. 112, Method B.

1.8 QUALIFICATIONS

A. Blower and Appurtenances Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

1. A single manufacturer who regularly manufactures the type of equipment furnished.
2. Successful installations in the United States similar in design, type and service, size, head, and capacity to blowers specified.

a. Comparable units must be in operation for a period of five years.

3. Prior Experience: At least 10 years in design and manufacture of motors specified.

B. Blower and Motor Manufacturer: Maintenance and repair facilities established and operating in the State of Texas for a period no fewer than three years. Equipped and staffed with qualified personnel repairing damaged blowers and motors; and carry or have direct access to spare parts.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Equipment: Skid mounted or crated and delivered to protect against damage during shipment.

B. Parts: Protect such that no damage or deterioration occurs due to prolonged storage from time of shipment until installation is completed and the units and equipment are ready for operation.

C. Ship equipment, material, and spare parts assembled and complete except where partial disassembly is required by transportation regulations or for protection of components.

D. Protection from Weather and Elements: Mechanical and electrical equipment to be coated, wrapped, and otherwise protected from snow, rain, drippings of any sort, dust, dirt, mud, flood, and condensed water vapor during shipment and while installed in place during construction.

1. Protective Covering: Remain in place until work areas are substantially free of construction dust and debris.
2. Submit full details of proposed protective measures to the Engineer for approval prior to shipment.
3. Follow manufacturer's instructions for long term storage and maintain warranty on equipment.

E. Finished Surfaces of Exposed Flanges: Protected by wooden blank flanges, strongly built and securely bolted thereto.

F. Finished, Unpainted Iron or Steel Surfaces: Protected to prevent rust and corrosion.

G. Blower Motors: Refer to Section 400593.23 “Low-Voltage Motor Requirements for Process Equipment” for delivery, handling and storage of electric motors.

H. No shipment to be made until approved by the Engineer in writing.

I. Inspection Upon Delivery: Note observed damage and immediately notify equipment manufacturer.

1.10 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

1.11 WARRANTY

A. Blower Manufacturer: Provide warranty for replacement of defective parts, assuming Owner has operated the blower under normal conditions, for a period of 2-Years from the Date of Substantial Completion

a. Defects or failures of materials or workmanship occurring as result of normal operation and service during the warranty period.
b. Shipping or transport of equipment.

1. In the event the equipment fails to perform as specified, promptly repair or replace the defective equipment without additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Blowers supplied by one of the following manufacturers:

    a. Aerzen
    b. Universal Blower
    c. Gardner Denver
    d. Kaeser

2.2 EQUIPMENT

A. Description: Equipment specified is intended to be standard equipment for use in coarse bubble mixing system for sludge storage tanks for:

    a. Aerobic Sludge Holding Tank (ASHT).
    b. Wet Weather Storage Basin (Wet Weather).

B. Continuous duty, 24-hour service at all points within the defined operating range without surging, abnormal noise, excessive vibration or strain, hunting, overloading the main drive motor, or excessive heating of the bearings.

C. Blowers installed on outdoor slab-on-grade concrete pads as shown on the Drawings.

D. Blowers: Tri-lobe rotary positive displacement type delivering oil-free air at the quantities and pressures specified

    1. Blower Systems.
    2. Rotary lobe blower.
    3. Electric motor.
    4. Base frame.
    5. Inlet air filter.
    6. Inlet and discharge silencer.
    7. Flanged discharge expansion joints.
    8. Flanged discharge check valve.
    9. Discharge butterfly isolation valve.
    10. Flexible coupling for motor connection.
    11. Enclosure.
    12. Instrumentation specified herein.

a. Blowers supply mixing, air to coarse bubble diffusers.

    1) Aeration Sludge Holding Tank Blowers operate singly or with multiple units at a time discharging into a common header.
    2) Wet Weather Storage Basin Blower operates singly discharging into a pipe that may also receive air from the multistage blowers as a backup supply of air.

b. Blowers operate at a constant speed to provide mixing air to Sludge Holding Tank and Wet Weather Storage Basin, as shown on the Drawings.

13. Blowers Discharge Air Flow: Manually controlled by the operators to provide the air flow rate through the blower as required by the tanks for mixing.

E. Inlet and Discharge Connections:

1. Machine flanged.
2. Orient as shown on the Drawings the same size as the inlet and discharge silencers.
3. Threaded or slip-on connections are not permitted.

F. Blower Casing: Sliding vane type blowers are not acceptable.

1. Material: Single piece of close-grained cast iron, ASTM A48, with flanged connections and suitably ribbed to prevent distortion.
2. Hydrostatic Pressure Rating: 1.5 maximum continuous design pressure rating at operating temperatures.
3. Separate side plate, of the same material, bolted and pinned to the housing.
4. Casing to incorporate a proven means of pulsation cancellation such that vibration is reduced 90 percent or greater.
5. Regardless of the operating pressures specified, designed to operate at a 10 psig pressure differential across the blower.
6. For blowers that do not incorporate pulsation cancellation, provide design and sizing calculations of blower package components demonstrating compliance with this requirement over the entire operating range of the blower.

G. Impeller:

1. Material: Ductile iron or close-grained cast iron (ASTM 395-77).
2. Type: Tri-Lobe.
3. Lubrication: No Lubrication.
4. Seal: No Seal.
5. Balancing: Done internally and not accomplished by drilling to removing or adding material to the outside of the rotor Statically and dynamically balanced per ISO 1940.ANSI S2.19CG.3.
6. Speed: "Stiff" design with lateral critical speed at least 120 percent of the maximum allowable operating speed.
7. Press fit and keyed onto a solid single piece shaft made from carbon steel AISI 1043.
8. Drop forged in one single piece of AISI 1043.

H. Support Rotor Shaft: (A293 CL I): Supported by liberally proportioned anti friction bearings:

1. Type: Solid single piece shaft.
2. Material: Ductile Iron.

I. Timing Gears:

1. Type & Material Single helical, steel timing gears with hardened and ground teeth manufactured to AGMA 12 standards: Mounted on the shafts with tapered interference fit and secured by a locknut. Pinned gears are unacceptable.
2. Lubrication: Oil splash lubricated from an oil-tight housing.
3. Service Factor: Minimum 1.7 per AGMA at maximum operating point.

J. Bearings:

1. Type: Cylindrical roller.
2. B-10 Bearing Life Expectancy: 100,000 hours. As defined by the ABMA.
3. Lubrication: Oil splash lubricated from an oil-tight housing.

K. Lubrication:

1. Grease lubrication is not allowed.
2. Oil Sight Glasses: Directly attached on each oil sump to observe the oil level in the reservoirs.
3. Mount oil drain valves on the oil sump covers.
4. Blower Stage: Removable from its base without having to drain the oil.
5. Provide an oil fill and drain kit.

L. Oil Seal: To prevent lubricant from contaminating the air stream:

1. Type: Double seal arrangement. May not utilize lip seal.

a. Four rotary piston ring shaft seals, an oil slinger, and an O-ring seal provided at the point where the shaft passes through the side plate.

2. Vent the impeller side of the oil seal to atmosphere to eliminate any possible carry-over of lubricant into the air stream.

M. Drive Mechanism: V-Belt Drive Heavy duty, High-capacity type, oil and heat resistant.

1. Belt Tensioning: Automatic without the use of any devices or operator interaction Incorporate means to easily adjust belt tension. Arrange to allow substitution of pulleys and belts to change blower speed.
2. Do not use side rails or adjustable spring.
3. Sheaves: Dynamically balanced for linear tip speeds greater than 6500 ft/min.
4. Belt Guard: Perforated galvanized steel per OSHA regulations.

a. Removable for belt inspection and replacement.

5. Manufacturer responsible for coordinating the starting torque requirements of the blower and motor.

N. Blower Base: Blowers and ancillary equipment to be installed on a concrete slab without grouting No special foundations required. Blower manufacturer to provide the following:

1. Vibration Isolators: To dampen and contain the dynamic forces of the blower package from transmission to the building or piping. Vibration isolating feet and flexible pipe connectors with a minimum efficiency of 80 percent.
2. Special mounts for the specified seismic zone: Corresponding calculations supporting the selection of the mounts.
3. Anchor bolt sizing and templates for bolt installation.
4. Foundation Bolts, Plates, Nuts and Washers: Type 304 stainless steel.
5. Lifting lugs for equipment weighing over 100 pounds.
6. Anchorage and Bearing Pads: As required to mount each blower on its independent concrete base. Provided by the equipment manufacturer as recommended by the blower manufacturer.

O. Design anchorage embedded into supporting structure per ACI 318 Appendix D or the appropriate ICC ES Acceptance Criteria.

1. Anchorage to Concrete: Assume cracked condition. Assume existing concrete has a 28-day compressive strength of 3000 psi.

P. Anchor Bolts: Adhesive anchor system, for fastening to solid concrete substrate.

1. A system manufactured for the installation of post installed studs including anchoring hardware and chemical dispenser.
2. Injection Adhesive: Two-component epoxy system including a hardener and a resin, furnished in pre-measured side-by-side cartridges which keep the two components separate.
3. Side-by-Side Cartridges: Designed to accept a static mixing nozzle which blends the components and allows injection directly into the drilled hole.
4. Provide zinc plated carbon steel or Type 316 stainless steel stud assemblies as indicated on the Drawings consisting of an all-thread anchor rod with nut and washer.
5. Adhesive Anchor System: Per ICC ES AC308.

a. Manufacturers and Products:

1) Hilti HIT-RE 500-SD.
2) Simpson Strong-Tie SET-XP.
3) ITW Ramset Red Head Epcon G.
4) Or approved equivalent.

6. Design anchorage embedded into supporting structure per ACI 318 Appendix D or the appropriate ICC ES Acceptance Criteria.
7. Anchorage to Concrete: Assume cracked condition. Assume existing concrete has a 28-day compressive strength of 3000 psi.

2.3 PERFORMANCE CRITERIA:

A. Each blower to be designed for the following conditions of service:

1. Site Condition:

a.	Elevation:	690 feet above mean sea level.
b.	Atmospheric Pressure Variation:	14.5 to 15.0 psia.
c.	Maximum Relative Humidity:	95 percent.
d.	Minimum Relative Humidity:	20 percent.
e.	Maximum Inlet Temperature,	110 degrees F.
f.	Minimum Inlet Temperature,	20 degrees F.

2. Blower Requirements – ASHT Blower:

a.	Number of units:	2.
b.	Design Pressure Differential Across Blower:	8.0 psig.
c.	Maximum Air Flow:	1650 scfm.
d.	Maximum Motor Horsepower, HP:	150 HP.
e.	Maximum Design Blower speed:	3600 rpm.

f. Operating Sound Pressure Levels at 36 inches distance (sum of all octave bands on dBA scale) 85 dBA when tested in per ISO 2151 at free-field conditions.

3. Blower Requirements – Wet Weather Blower:

a. Number of units: 1.
b. Design Pressure Differential Across Blower: 10 psig .
c. Maximum Air Flow: 1500 scfm.
d. Maximum Motor Horsepower, HP: 125 HP.
e. Maximum Design Blower speed: 3600 rpm
f. Operating Sound Pressure Levels at 36 inches distance (sum of all octave bands on dBA scale) 85 dBA when tested in per ISO 2151 at free-field conditions.

B. Electrical Power Draw (Horsepower) of Job Motor:

1. ASHT Blowers: Not to exceed nameplate rating of 150 HP.
2. Wet Weather Blower: Not to exceed nameplate rating of 150 HP.
3. Blowers: Not to surge when operating at or between any combination of design conditions.

C. Vibration:

1. Balancing: Statically and dynamically balanced. Limit vibration in any plane to a 1.5 mils, peak to peak displacement, when operating over the defined capacity range and measured at any bearing housing on the blower unit.
2. Curves for the following performance indices showing how each is affected by variations in:

a. Atmosphere Pressure: 14.5 psia to 15.0 psia.
b. Ambient Air Temperature: 20 degrees F to 110 degrees F.
c. Relative Humidity: 20 to 95 percent at the specified inlet conditions:

3. Operate: Singly.
4. Heat Generation and Gain: Limit to what is specified over the defined capacity operating range.

2.4 CONTROLS

A. Control Panels:

1. The Manufacturer shall provide a NEMA 4X 120V control panel meeting the requirements of Section 406717 “Industrial Enclosures”, and as modified herein.
2. PLC control is allowed rather than the relay control specified in Section 262500, but the PLC must conform to Division 40 requirements and an internal UPS in accordance with Division 40 shall be required. Internal PLC wiring shall be allowed to be 18 AWG, but shall be rated 600 volts. Internal dividers or barriers shall be provided to allow instrumentation technicians to access the PLC components without being exposed to 480 volts.
3. The local alarm beacon and horn is not required.
4. Panel SCCR: 35 kA.
5. Communication with SCADA system: Use: Ethernet cable capable of communicating with Allen Bradley PLC.

B. Constant Speed Blower Controls: Through a L-O-R switch at a Local Control Station provided by Division 43 by the Blower vendor embedded into the blower enclosure.

1. When placed in “Local” position at the Local Control Station, the blower will start. When placed in “OFF” the blower will not run.
2. When placed in “Remote” position at the Local Control Station, the blower will start and stop manually or automatically based on settings at SCADA.
3. All alarms (low suction pressure, high discharge pressure and high discharge temperature) will be hardwired from the enclosure to the motor starter to automatically stop the blower.
4. The blower will also stop by an E-Stop at the Local Control Station provided by Division 26.

C. Readouts and Totalizers: Program the following readouts and totalizer values back to SCADA from each supplied blower.

1. Current (amperes)
2. Power (kW)
3. Run Time (hours)
4. Alarms (type, count)
5. Pressure (psig)

2.5 MOTORS

A. Premium efficiency and in accordance with latest NEMA, IEEE, ANSI and ABMA standards where applicable.

1. Maximum Motor Speed: As specified. Coordinate rpm and rotation with the rotary positive displacement type blowers specified.
2. Motor Rating: For a minimum turndown of 3:1.
3. Operate on a 460-volt, 3 phase, 60 Hz alternating current system.
4. Motor Horsepower: As specified above. Motors will not be overloaded, nor the service factor reduced when the blowers are operated at any point on the design speed performance curve at the design differential pressure across the blower. TEFC and rated for 130F.
5. Insulated Bearings: On the non-drive end side and an AEGIS Bearing Protection Ring on motors 100 HP and above.
6. Mounted on a pivoting base to provide automatic tensioning of the belts.
7. Blower and Drive Motors: Factory mounted on a common base of cast iron or steel fabrication, suitably constructed to support the weight of the equipment.
8. Supply motor windings with a normally closed thermostat, one per phase, wired in series to form a fail-safe motor protection circuit for the external fault circuit of the motor controller.

2.6 FINISHES

A. Blowers and Discharge Piping Accessories: Factory finish with manufacturer's standard for high temperature paint.

1. Submit description of surface preparation and paint with shop drawings.

2. Appurtenances receive surface preparation and shop prime paint as part of the work of this Section.
3. Aluminum, brass and stainless steel surfaces do not get painted.

B. Furnish one quart of touch up paint for each color finished.

2.7 ACCESSORIES

A. General: Provide blowers with the following accessory equipment:

1. Outside inlet pipe cover to protect from weather intrusion.
2. Inlet Filter: One.
3. Inlet Silencer: One.
4. Discharge Silencer: One.
5. Pair of Flexible Connectors: One.
6. Check Valve: One.
7. Pressure Relief Valve: Two.
8. Discharge High-Pressure Switch: One.
9. Differential Pressure Gauge to Measure Pressure Drop Across Inlet Filter: One.
10. Pressure Gages to Indicate Inlet and Discharge Pressure: Two.
11. Discharge Air Thermometer: One temperature indicator.
12. A high temperature switch, as shown on the Drawings.
13. Provide blowers with inlet and discharge flanges to connect to the process piping.
14. Blower Nameplate.

B. Nameplates: Stainless steel with embossed lettering, for each major piece of equipment including compressor, main drive motor, valves, local control panels, etc.

1. Affix to equipment using stainless steel mechanical fasteners.
2. Include the following minimum information on each equipment information nameplate:

    a. Manufacturer’s name, make, model number, serial number and date of manufacture.
    b. Motor nameplate: Electrical voltage requirements and ampere draw at rated voltage.

3. Blower Unit Nameplate Information:

    a. Rated capacity: scfm.
    b. Rated discharge pressure: psig.
    c. Rated impeller speed: rpm.
    d. Impeller diameter: inches.
    e. Isentropic efficiency at rated capacity and discharge pressure. Percent.
    f. Brake horsepower requirement at rated capacity and discharge pressure: hp.
    g. Lubrication oil requirements.

4. Blower Unit Main Drive Motor Nameplate: In addition to the above, include the following information on its equipment information nameplate:

    a. All information required by NEMA MG1 20.60.1.
    b. Efficiency at rated horsepower output.
    c. Power factor at rated horsepower output.
    d. Winding insulation system designation and type.
    e. Power lead current transformer ratio.
    f. Bearing model and serial number.

C. Nameplates: 16-gauge brass, aluminum, or stainless steel nameplates giving the name of the manufacturer, serial number of the item, rated capacity, speed, and all other pertinent data, attached to each item of equipment.

D. Inlet Filter: Supplied with blowers.

1. Separate inlet filters and silencers is acceptable if they are standard design for the equipment furnished.
2. Heavy-duty, all welded steel construction.
3. Working pressure of at least 15 psig.
4. ASHRAE 52.2 MERV 7.
5. Inlet Filter Silencer: Suitable for indoor installation and mounted directly to the inlet flange of the blower.
6. Filter Element: Washable by maintenance personnel.
7. Filter Performance Losses: Included by the blower vendor in the blower performance calculation.

E. Inlet and Discharge Silencers: Heavy duty, all welded steel construction with a working pressure of at least 20 psig.

1. Proven design for continuous operation with positive displacement blowers at any speed within the speed ranges specified.
2. Discharge Silencers: Chamber type with no absorption material.

    a. Absorption Material: May be used with the inlet silencer if the absorption material is located upstream of the blower inlet filter.

3. Materials for Shell and Supporting Internal Parts: Pressure vessel quality steel such as ASTM A283 Grade B or ASTM A285 Grade C or equivalent.
4. Shell and Nozzles: Designed and welded per ASME pressure vessel code.
5. Do not use fibers as packing material.
6. Inlet and Outlet Flanged Connections: Drilled to 125/150 lb ANSI specifications.

F. Flexible Connectors: Bellows or arch type with internal sleeves to connect the inlet and outlet of each blower to the silencers.

1. Place as directed by manufacturer to ensure blower isolation from connecting piping.
2. Standard flanged connections designed to withstand the maximum temperature, pressure and vibration that may result from the operation of the system.
3. Connector Size: Same as inlet and discharge silencer connections.

G. Check Valves on Discharge Lines: Full-bore low pressure-drop, flapper type design with a steel body and steel flap embedded in EPDM with full-contact seal.

1. Stainless steel pin and spring and two semicircular bronze plates.
2. Installed on the exterior of the blower package is not allowed.
3. Housed in the sound enclosure on the blower discharge.
4. Removable without disturbing piping.
5. Include pressure losses produced by check valve in the blower performance calculation.

H. Pressure Relief Valve: Spring-loaded type recommended by the blower manufacturer.

1. Supply blowers with a relief valve having the capacity of relieving the entire discharge flow of blower.
2. Set Pressure: 1 lb. greater than the maximum discharge pressure rating.
3. Housed in the sound enclosure and relieves into a segmented section of the enclosure.
4. Weighted relief valve in the enclosure is not allowed.
5. Permit the discharge of the relief valve to be piped away.

I. Discharge Isolation Valve:

1. Supply blowers with a discharge butterfly valve for blower isolation.
2. Discharge butterfly valves: As specified in Section 400564.
3. Manually actuated gear operator and either handwheel or chainwheel as specified in Section 400564 “Butterfly Valves”.

J. Pressure Gauges: Provide to indicate the pressure in the inlet and discharge line of each blower.

1. Liquid filled and designed for base plate panel mounting.
2. Scale: Duplex type with one side graduated in psig.
3. Body: Aluminum construction with 1/4-inch NPT pressure connections.
4. Stainless bourdon tube and socket material.
5. Provide with tubing, fittings, adapters, shutoff valves, and common gage panel required for complete installation.

K. Discharge Air Thermometer Gauge and Switch: Supply with blowers.

1. Accuracy: Plus or minus 5 degrees.
2. Thermometer Range: 32 to 575 degrees F.
3. Gauge Size: 2.5 inch diameter.
4. Provide with tubing, fittings, adapters, and shutoff valves required for complete installation.
5. Dual, general purpose switch with NEMA 4 enclosure, contacts rated 5A at 250V, two single pull double throw microswitches which are not independently adjustable and UL/CSA listed.
6. Provide with tubing, fittings, adapters, and shutoff valves required for complete installation.
7. Automatic trip on temperature rise.
8. Manual reset after temperature fall.
9. Easily adjustable trip setting and adjustable dead band.
10. Initial Setting: As recommended by equipment manufacturer.

L. Discharge High Temperature Switch: Suitable air temperatures up to 300 degrees F installed discharge headers.

1. Automatic trip on temperature rise.
2. Manual reset after temperature fall.
3. Easily adjustable trip setting and adjustable dead band.
4. Initial Setting: As recommended by equipment manufacturer.
5. Contacts:

    a. Snap-action type.
    b. Two sets normally open.
    c. Two sets normally closed.
    d. Rated for 10 amperes at 120 volts AC.

6. Enclosure: NEMA 4 watertight/dust tight enclosure of heavy gauge steel with metallic acrylic enamel finish and glass front.
7. Manufacturer: Mercoid Control or equivalent.
8. Provide with tubing, fittings, adapters, and shut off valves required for complete installation.

M. Discharge Pressure Switch: Supplied on blowers.

1. Type 400, in a NEMA 4X enclosure.
2. Dual general purpose 15A, 110-480 V with two single pull double throw snap-acting switches which are not independently adjustable.
3. Viton actuator seal and an internal and operating range scale of 0 to 15 psig

N. Differential Pressure Gauge: Provide a differential pressure gauge or filter restriction gauge across the inlet filter/silencer to measure pressure drop.

O. Blower mounted switches: Wired to a labeled terminal strip mounted on blower enclosure.

P. Acoustical Enclosure: Factory assembled around the entire blower, broken down, as required for shipment.

1. Removable or Hinged Doors: To access entire blower assembly for service and maintenance.
2. Panel Size: Allow easy access to blower assembly by a single operator.
3. Panels: Galvanized steel sheet, internally and externally powder coated.
4. Acoustic Material: Per UL 94 - HF1 for fire-retardant, self-extinguishing, non-dripping materials. Materials with a lesser rating are not acceptable.

    a. Non-flammable packing materials such as compressed mineral fibers are only acceptable if lined with appropriate retaining mat and supported by galvanized perforated sheet.

5. Hinges, Fasteners and Appurtenances: Galvanized or stainless steel materials for extended life.
6. Construct in a manner allowing for removal once in place without the need for lifting the enclosure over the blower.
7. Free Field A-Weighted Sound Pressure Level: Average 85 dBA or less. Measured in four quadrants at 36 inches from the enclosure.

    a. Measure by a Type 1 instrument suited for checking compliance with Environmental & Occupational Noise Rating Recommendations.
    b. Meter used for testing: Comply with IEC 6S1 Type 1 and ANSI S1.4 Type S1A.

2.8 SOURCE QUALITY CONTROL

A. Sound Pressure Level from Equipment and Main Drive Motor: Tested per CAGI S5.1 or AMCA 300-67 and include contributions from the main drive motor.

B. Test Procedures: Submit to Engineer for review 30 days prior to scheduled testing.

C. Blowers and Appurtenances, Including Baseplates and Silencers: Assembled at manufacturer's production facility and tested by the blower manufacturer.

1. Tests include a performance test under full load conditions and at performance conditions specified.
2. Provide a performance test report.
3. Test Method: Per ISO 1217, Annex B.

    a. Verify flow and brake horsepower at blower maximum conditions.
    b. Run Equipment for ample time to allow for thermal adjustment before data can be taken.
    c. Testing to include ambient conditions, flow, bhp, slip, inlet and outlet temperature.
    d. Provide specified test reports to the Engineer through the submittals process.
    e. A slip test only is not acceptable.

D. Analyze blower-drive assemblies for torque, vibration and critical speed. Correct abnormal conditions and retest.

E. Test Results of Motors, Blowers and Package Functional Tests: Include in the Operations and Maintenance Manual.

F. Do not ship blowers until testing shows units comply with the specified conditions.

G. Certificate of Compliance: When fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation: According to manufacturer's instructions.

B. Blower Units and Appurtenances: Installed by Contractor in strict accordance with the blower manufacturer/ supplier’s instructions and recommendations in the locations as shown on the Drawings.

1. Make all necessary adjustments to provide complete and satisfactory operation upon completion of the Contract.
2. Field align by a qualified millwright to the blower manufacturer instructions and specifications.

C. New Piping: Supported to preclude the possibility of exerting undue forces and moments on the blower flanges.

1. Suitable expansion joints furnished to isolate the blowers from the piping system.
2. Mount the blower on a flat and level concrete equipment pad of the dimensions shown on the Drawings.

D. Blower Base: Installed on suitable anti vibration strips. All items to operate free of excessive noise and vibration.

E. Provide required oil and grease for initial operation.

1. Oil and Grease Grade: In accordance with the manufacturer's recommendations.

F. Anchor Bolts: Set by Contractor in accordance with approved shop drawings.

G. Supports and Bracing: As required to support the blowers, silencers and piping to prevent excessive or harmful vibration or movement of the equipment or piping resulting from system operation.

H. Deviation of Pipe Connections and Arrangements from the Drawings: Acceptable, if new air pipe arrangement is furnished as approved by the Engineer.

I. Field Tests: Not to be conducted until the entire installation is complete and ready for testing.

J. Install a temporary Type 304 stainless steel heavy wire 1/2 inch maximum mesh on the blower inlet, to prevent objects inadvertently left in the air inlet system from entering the blower.

1. Remove mesh after initial operation and just prior to field testing.

3.2 FIELD QUALITY CONTROL

A. After the installation of the blowers, motors, controls and all appurtenances, each complete blower unit will be subject to field acceptance tests under actual operating conditions.

B. Testing:

1. Field acceptance test blower package system and appurtenances under actual operating conditions.
2. Operate systems for 24 hours.
3. A 1-day operating period of stable and vibration-free operation is required for blower units prior to final acceptance.
4. Demonstrate that under conditions of operation each unit:

a. Has not been damaged by transportation or installation.
b. Has been properly installed.
c. Has no mechanical defects.
d. Is in proper alignment.
e. Has been properly connected.
f. Is free of overheating of any parts.
g. Is free of objectionable vibration and noise.
h. Is free of overloading of any parts.

C. Equipment Acceptance:

1. Take corrective measures and retest units.
2. Assure full compliance with the Specifications at no additional cost to the Owner.
3. Submit a revised written report to the Engineer.

D. Noise and Vibration Tests:

1. After equipment installation and as soon as conditions permit, conduct acceptance tests under actual operating conditions, to determine operation is satisfactory and free from excessive vibration.

2. Tests to consist of 3 hours of operation of each blower with readings taken and recorded at 30-minute intervals.
3. Noise level in Blower Area: 85 dBA free field when measured 36 inches from equipment being tested.
4. No harmful vibrations in the blower units or the system piping.
5. Vibration not to exceed specified limits.

E. Manufacturer Services:

1. Provide services of a factory certified service engineer specifically trained in the installation, start-up, testing, operation and maintenance of equipment specified.
2. A direct, full-time employee of the blower manufacturer or a representative who is factory-trained and certified to perform these services.
3. Submit qualifications of service engineer for approval.
4. Services to be in accordance with this Section.

    a. Service includes assistance as required with installation, startup, testing, programming, calibration, and training.
    b. Provide a total of two, 8-hour days for services.

        1) Hours suggested are exclusive of travel time and do not relieve the Contractor of obligation to provide sufficient service to place equipment in satisfactory operation.

    c. In addition to the two days indicated above, provide one, 8-hour day for service inspections during the first year of actual operation, for use at the Owner's request and exclusive of repair, malfunction or other troubleshooting service calls.

5. Advise, consult and instruct the Contractor on installation procedures and adjustments and inspect the equipment during installation (i.e., provide installation oversight).
6. Responsible for the inspection and start-up of the equipment.
7. Certify the equipment is properly assembled, lubricants installed, electrical connections made, protective set points adjusted, and equipment is ready for service.
8. Provide operational and maintenance instruction of Owner's personnel.

    a. Training to be given at times convenient to operations and maintenance teams being trained considering operational shifts and duties while on shift.
    b. Operational Instruction to Include the Following:

        1) Theory of operation.
        2) Troubleshooting guidance.
        3) Recognizing normal and abnormal operating conditions.
        4) Step-by-step startup and shutdown procedures.
        5) Discussion of operational limitations.

    c. Maintenance Training to Include the Following:

        1) Replacement part identification and ordering procedures.
        2) Lubrication procedures, including drain-down and refill procedures.
        3) Recommended routine preventive maintenance procedures.
        4) Troubleshooting and diagnostic procedures.
        5) Adjustment and calibration of temperature, pressure, level, flow amperage, speed, and vibration instrumentation.

9. The Contractor is responsible for:

    a. Requesting and coordinating services of manufacturer's representative, including coordination with affected trades.
    b. Responsible for documenting delivery of manufacturer/vendor on site services.

10. Schedule Instruction of Owner's Personnel 10 days in advance with the Owner and prior to equipment acceptance by the Owner.

END OF SECTION 431133

SECTION 432335 – RECESSED IMPELLER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Recessed impeller pumping system, including, but not limited to, pumps, motors and starters.
2. Supervisory services during installation and field testing of each unit and instructing the regular operating personnel in the proper care, operation, and maintenance of the equipment.

B. Application:

1. Pumping units pump grit slurry from the stacked tray grit removal unit processing equipment underflow to the grit washing units and dewatering units.

C. Related Requirements

1. Section 055000 “Metal Fabrications”: Fasteners, brackets, and other miscellaneous metal fabrications as required by this Section.
2. Division 26 “Electrical” for electrical motors and equipment .
3. Section 400593.23 “Low Voltage Motor Requirements for Process Equipment”: Electric motors and accessories normally supplied as part of equipment assemblies.
4. Section 406100 “Process Control and Enterprise Management Systems”.
5. Section 406121.20 “Process Control System Testing”.
6. Section 406196 “Process Control Descriptions”.
7. Section 407000 “Instrumentation for Process Systems”.
8. Section 407313 “Pressure and Differential Pressure Gauges”
9. Section 407336 “Pressure and Differential Pressure Switches”
10. Section 462323 “Stacked Vortex Tray Grit Separator Equipment”
11. Section 462363 “Grit Classifying and Washing Equipment”

1.3 DEFINITIONS

A. AESS – Applications Engineering System Supplier. Refer to Section 406100 “Process Control and Enterprise Management Systems” for additional information.

B. AOR – Allowable Operating Region

C. POR – Preferred Operating Region

D. LCP – Local Control Panel.

E. I/O – Input/Output (signals).

F. PCSS – Process Control System Supplier. Refer to Section 406100 “Process Control and Enterprise Management Systems” for additional information.

G. P&ID – Process and Instrumentation Diagram.

H. Failsafe - Normally closed contacts that open on alarm condition.

I. Failsafe: Normally closed contacts that open on alarm condition.

J. Unit Responsibility – Sole responsibility for all components provided as part of pumping system.

1.4 COORDINATION

A. Coordinate installation with the installation of the Stacked Tray Equipment and the installation of the grit classifying and washing equipment.

1.5 ACTION SUBMITTALS

A. If manufacturing techniques differ, completely describe all aspects that do not conform to specifications.

B. Product Data: Submit literature, which may include drawings, describing the equipment in sufficient detail, including materials of construction, to indicate full conformance with the specifications.

1. The total weight of the equipment including the weight of the single largest item.
2. A complete materials table for all equipment establishing compliance with these specifications.
3. A list of the Manufacturer's recommended spare parts with the Manufacturer's current price for each item. Include gaskets, packing, etc. on the list. List all bearings by the bearing manufacturer's numbers only. Pricing shall remain in effect for a period of not less than one year following start up and final acceptance.

C. Shop Drawings:

1. Descriptive literature, bulletins, and/or catalogs of the equipment.
2. Certified shop and erection drawing showing parts arrangement, details and materials of construction and dimensions.
3. Complete Bill of Materials.
4. Data on the characteristics and performance of each pump.

    a. Catalog sheets showing a family of curves covering full range selection of impeller diameter.

b. Guaranteed performance curves, based on actual shop tests on similar units, showing the specified requirements for head, capacity, efficiency, NPSHR, and brake horsepower.
   1) Curves plotted on 8 1/2-inch by 11-inch sheets at as large a scale as practical specifically for the pump proposed from no flow at shut off head to pump capacity at minimum specified TDH.

5. Equipment base drawing:

   a. Indicate size and location of bolt holes for anchorage plus details of anchorage of equipment to foundation including anchor bolt type, size, materials, embedment depth, and minimum edge distance.
   b. Summary of external weight and thrust loads applied to the supporting structure.
   c. Summary of maximum vertical and horizontal reactions at each anchor bolt considering all applicable loads and load combinations, based upon the applicable seismic design category.
   d. Submit manufacturer's specification and data including recommended design values and physical characteristics for the selected anchors to the concrete foundation.

6. Description of painting and protective coatings.
7. Complete master wiring diagrams, elementary or control schematics, including coordination with electrical equipment and control devices, and suitable outline drawings showing such details as are necessary to locate conduit stub-ups and field wiring.
8. Data for electric motors in accordance with Section 400593.23 "Low Voltage Motor Requirements for Process Equipment".
9. Data for variable speed drives in accordance with Section 262923 "Variable-Frequency Motor Controllers".

1.6 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate:

1. Certify that products meet or exceed specified requirements.
2. Certify bearing life.
3. Certify setting plan with details of anchorage

B. Manufacturer Instructions:

1. Storage and handling instructions.
2. Installation instructions, including anchoring layout and details.

C. Source Quality-Control Submittals:

1. Certified results of hydrostatic testing.
2. Shop testing procedures, pump and piping set up, equipment to be used and testing tolerances.
3. Certified shop testing results.

D. Field Quality-Control Submittals:

1. Field testing procedures, equipment to be used, and testing tolerances.
2. Field testing results.

E. Manufacturer Reports: Certificate from manufacturer's representative attesting that equipment has been properly installed according to manufacturer's instructions and is ready for startup and testing.

F. Qualifications Statement: Manufacturer Qualifications, as required by Article Quality Assurance.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Manual:

1. Provide an Operating and Maintenance Manual for the equipment specified herein, specifically prepared for this installation and including all required drawings, equipment and materials information, descriptions, complete bill of materials, etc., as required to instruct operating and maintenance personnel unfamiliar with such equipment.

B. Warranty Documentation: submit warranty complying with requirements herein.

C. Project Record Documents:

1. Submit Project Record Documents recording actual locations and final orientation of all equipment and accessories.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. General:

1. Submit instructions prepared specifically for this installation and shall include all required catalog cuts, drawings, equipment lists, and descriptions necessary to instruct operating and maintenance personnel unfamiliar with such equipment.
2. Submit installation drawings, wiring diagrams, and maintenance requirements and schedules, and safety information.

B. Manufacturer's Recommended Spare Parts List:

1. Include gaskets, packing, and related materials.
2. List all bearings by the bearing manufacturer's numbers only.
3. Include Manufacturer's current price for each item; pricing to remain in effect for not less than one year after final acceptance.
4. Provide spare parts and any special tools.

C. Provide one set of the following:

1. One mechanical seal cartridge kit and throat bushing.
2. One complete set of gaskets, "O"-rings, etc.
3. One shaft sleeve.

4. One set of radial and thrust bearings.
5. One impeller matching installed impellers with lock nut.

D. Provide oil and grease required for initial start-up and a one-year supply of lubricates. Lubricants shall be synthetic and include summer and winter grades along with alternate referenced to equal products of other manufacturers including AGMA numbers, viscosity, etc.

1.9 QUALITY ASSURANCE

A. Furnish recessed impeller pumps, all appurtenances and controls from a single manufacturer regularly engaged in the manufacturer of this type of equipment for wastewater treatment.

B. Equipment specified in this Section is to be furnished by a manufacturer of recessed impeller pumps who has sole responsibility for designing and furnishing the parts and components required for a complete and operable system. Factory assemble the recessed impeller pumps, base, coupling and accessories as a single coordinated unit on a common base.

C. Manufacturer Qualifications:

1. Company specializing in manufacturing products specified in this Section with minimum ten years documented experience.
2. Minimum of ten operating installations in North America with pumps of the same size or larger and in the same service as specified herein, which have been in operation for at least ten years.

D. Conform to applicable Standards of the Hydraulic Institute for Rotodynamic Pumps, ANSI/HI 1.1 – 1.4.

1.10 DELIVERY, STORAGE AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage. As necessary, provide inspection report to Manufacturer identifying any damage and rework necessary prior to installation.

B. Storage: Store pumps and all appurtenances according to manufacturer's instructions.

C. Do not disassemble factory assembled parts and components for shipment unless written permission received from Engineer.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote for construction operations areas.
2. Provide additional protection according to manufacturer's instructions.
3. Protect unpainted finished iron and steel surfaces to prevent rust and corrosion.
4. Protect finished surfaces of exposed flanges with wood or equivalent blank flanges.
5. Protect bearings against formation of rust in accordance with bearing manufacturer's recommendations. Apply lubricant or corrosion inhibiting treatment during transportation, storage, handling, installation, and lapse of time prior to start-up.

Intermittently manually rotate equipment prior to start-up to ensure distribution of lubricant/protection.

1.11 SITE CONDITIONS

A. Ambient temperature range: 20 to 110 degrees F.

B. Field Measurements: as applicable confirm field measurements and interferences prior to fabrication. Indicate field measurements on Shop Drawings.

1.12 WARRANTY

A. Submit written manufacturer's warranty that equipment shall be free of defects of material and workmanship.

B. Warranty Period: Two-Years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the manufacturers listed in the following paragraph.

B. Manufacturer List:

1. Wemco Torque-Flow Pump 3 inch Model C.
2. Egger Turo Pump.

C. Any required revisions in the layout and installation of the equipment, piping and appurtenances, electrical work, etc. required to accommodate a particular manufacturer shall be made at no additional cost to the Owner.

2.2 SYSTEM DESCRIPTION

A. Rotodynamic, non-clogging, recessed impeller type pump, with electric motor, continuous speed, direct or belt drive, and equipment base, specifically designed for pumping grit slurry.

B. Impeller: fully recessed, slurry type design, mounted completely out of flow path between the pump inlet and discharge such that solids do not to flow through impeller.

C. All flow path clearances within pump equal to or greater than 4 inches, so that all solids that pass-through discharge will pass through pump.

D. Pump head-capacity curve to slope upward toward shutoff in one continuous curve with no points of inflection to cause hunting at any pump operational speed.

E. Pumps to be horizontal end suction with tangential discharge oriented vertically as shown on the Drawings.

F. General:

1. Provide stainless-steel nameplates giving the name of the manufacturer, rated capacity, head, speed and other pertinent data permanently attached to each pump.
2. Provide lifting lugs on equipment/components weighing greater than 100 pounds.
3. Provide equipment base to be rigidly and accurately anchored into position on concrete foundation. Provide all foundation bolts, plates, nuts, and washers of Type 304 stainless steel and as specified in Section 055000 "Metal Fabrications."
4. Pump power to not exceed motor nameplate rating at 1.0 service factor at any point on the pump characteristic.
5. Pump with motor, base, belt drive shaft coupling to be factory assembled and delivered to the project site fully assembled ready for installation.
6. Pump and pump base to have provisions to collect leakage and drain to a piped drain.
7. Pumps to conform to applicable Standards of the Hydraulic Institute for Rotodynamic Pumps.

2.3 PERFORMANCE AND DESIGN CRITERIA

A. Performance Criteria:

1. Pumps of same service type shall be identical in every respect with all parts interchangeable.
2. Design each pump for design conditions listed herein.
3. Head – Capacity Performance Curve: continuously rising from runout to shutoff with no points of inflection at any operational speed for stable operation within the AOR.
4. Operate throughout the specified range within the vibration.

B. Design Criteria:

1. Pumped Fluid: Settled grit from screened wastewater.
2. Temperature Range: 20 to 110 degrees F.
3. Number of Units: Duty: 1, Standby: 1.
4. Location: Grit Facility.
5. Service: Grit Slurry.
6. Pump Equipment Tag Numbers:

    a. PMP-2130-1.
    b. PMP-2130-2.

7. Configuration: Horizontal.
8. Type of Drive: Belt, Constant speed.
9. Design Point Flow Rate: 250 gpm.
10. Design Point Flow Total Dynamic Head: 17.6 feet.
11. Design Point Flow Minimum Efficiency: 27 percent.
12. Design Point Flow Operating Speed: 775 rpm.
13. Shutoff Head: 25 feet.
14. Suction Connection Size: 3 inches.
15. Discharge Connection Size: 3 inches.

16. Maximum NPSH Required at Maximum Flow: 43 feet
17. Motor Operating Speed: 1,700 rpm.
18. Motor Rated Power: 10 hp.

2.4 DRIVER

A. Motor:

1. Comply with Section 400593.23 “Low Voltage Motor Requirements for Process Equipment”.
2. Pump power not exceeding motor nameplate rating at 1.0 service factor at any point on pump characteristic curve.
3. Power Data:

    a. Horsepower: as specified above.
    b. 460 Volt, three phase, 60 Hz.
    c. Constant speed.
    d. Service Factor: 1.15 (Constant Speed).
    e. Starting Method: Full Voltage.

4. Environmental Data:

    a. Load type: Variable Torque.
    b. Continuous duty, 40 degrees C ambient, 3300 feet maximum elevation.
    c. Space Classification: Class 1, Division 2

5. Physical Data:

    a. Construction and nameplate: comply with Section 400593.23 “Low Voltage Motor Requirements for Process Equipment”.
    b. Orientation: horizontal.
    c. Solid Shaft
    d. Speed: 1,700 RPM.
    e. Enclosure: TEFC.
    f. Premium Efficiency.

6. Features and Accessories:

    a. Winding Temperature Protection: Bi-metallic winding temperature switches.
    b. Space heaters.

B. Adjustable Ratio Belt Drive:

1. Manufacturer List:

    a. Dodge Division of ABB Motors and Mechanical Inc.
    b. T. B. Woods Inc.
    c. Lovejoy Inc.

2. Mechanical type, static, adjustable center, variable speed belt drive.
3. Horsepower rating of V-Belt drive to equal or exceed motor nameplate horsepower with 1.5 service factor throughout adjustment range.
4. Variable speed output range of approximately 2:1.

5. Select speed range based on specified design point to be at approximately 85 percent of maximum speed rating.
6. Belts heavy duty, oil and heat resistant, static conducting, minimum life rating of 8,000 hours.
7. Sheaves of high-tensile close-grained cast iron.
8. One or both sheaves with manually adjustable pitch diameter arranged to maintain belt alignment throughout entire pitch range.
9. OSHA compliant fabricated steel or expanded metal belt guard, galvanized after fabrication.
10. Adjustable motor mount to adjust belt tension.

2.5 CONTROLS

A. Description:

1. Recessed impeller pumps will operate continuously when stacked vortex tray grit unit is in service.
2. Controlled by MCP – 2110- 1 as indicated on SG-IB-1 and SG-IB-2.

B. Grit pump placed in “Local” control will start pump from LCS-2130-1 and LCS-2130-2. Grit pump will run unless E-stop or push button is pressed, or the High Temperature or High Pressure hard-wired interlock is activated. Grit Pump may also be controlled from the MCC motor starter compartment by placing the LOR switch in “Remote”. Under normal operation, the HOA switch at the MCC should be placed in “Auto”. In the “Hand” position the Grit Pump will run in a manual mode thus bypassing upstream/downstream conditions.

C. Refer to the P&IDs for I/O signals to plant control system.

D. LCP Furnished by Division 26:

1. Refer to P&IDs for devices and controls.
2. Refer to Electrical Drawings for wiring diagrams.

2.6 PUMP CONSTRUCTION

A. General:

1. Pump with motor, base, and belt drive fully factory assembled and delivered to the project site fully assembled ready for installation.
2. All flow path clearances within pump equal to or greater than discharge diameter.
3. Provide stainless steel nameplates giving the name of the manufacturer, rated capacity, lift, speed and other pertinent data permanently attached to each pump.
4. Provide lifting lugs on all major equipment/components.
5. All pump components to be interchangeable in pumps of same size.
6. Provide access for maintenance of all pump components.

B. Casing:

1. Material: Ni-Hard conforming to ASTM A532 with minimum Brinell hardness of 650.
2. Casing of sufficient thickness and ribbed to withstand all stresses and strains of service at full operating pressure and to account for internal wear from abrasive pumping.

3. Casing to be constructed so it can be reversed for opposite rotation.
4. Volute to be a separate casting from the suction head and the back head bolted through special cast-in casing slots and slotted flanges in both the suction head and back head.
5. Provide a removable Ni-Hard wearplate in back of impeller, designed to direct flow from behind impeller to center of volute and reduce wear of volute.
6. Suction and discharge end connections: 125 lb ANSI pattern raised face flanges with slotted bolt holes.
7. Stationary guides not permitted on either suction or discharge side of casing. No clearance wear rings.

C. Impeller:

1. Fully recessed, slurry type design, mounted completely out of flow path between the pump inlet and discharge such that solids do not to flow through impeller.
2. Recessed cup-shaped design, to direct flow toward the center of the volute.
3. Material: Ni-Hard conforming to ASTM A532 with minimum Brinell hardness of 650.
4. Attached to a tapered shaft with key and lock bolt.

D. Shaft:

1. Shaft proportioned for operating thrusts and moments.
2. Material: Steel, ASTM A108, Grade 1141.

E. Bearings (radial and thrust):

1. Type: Anti-friction, ball and angular contact ball bearings.
2. Minimum L-10 Life: 50,000 hours at continuous maximum load and speed, according to ABMA 9.
3. Lubrication:

    a. Oil bath lubricated, with oil level, fill, and drain taps, and level indicator.
    b. Grease (re-greaseable)

F. Bearing Housing:

1. Cast iron ASTM A48, Class 30 or better of sufficient thickness and suitably ribbed to withstand all stresses and strains of service at full operating pressure.
2. Arrange bearing housing to provide access to stuffing box.
3. Dust and moisture proof.

G. Mechanical Seal

1. A single cartridge mechanical seal requiring no external flushing to be furnished in the pump.
2. Utilize a rotational sealing ring with an o-ring or elastomeric cup mounted rotational ring, a stainless-steel rotating body with an o-ring mounted stationary ring loaded by a non-fouling, conical spring encapsulated in Viton. Installation of the seal to require no measurements or scribe marks on the shaft.
3. The rotational sealing ring material of tungsten carbide with a 6% cobalt binder, the surface to be lapped to a flatness not to exceed three helium light bands.
4. The stationary sealing ring to be constructed of sintered silicon carbide. The surface to be lapped to a flatness not to exceed three helium light bands. The stationary ring must

be o-ring mounted into the stainless-steel stationary body. Stationary sealing rings of converted carbon or other surface-only treatments are not acceptable.

5. The spring that loads the rotational sealing ring to be cone-type, non-fouling design and shall run in the pumped product without fouling or hang-up. The spring metal material shall be SAE1075 Carbon Steel, ASTM A-684 heat-treated to a Rockwell C hardness of 42 to 46 and be totally encapsulated in Viton for protection from the pumped fluid. The product side of the spring shall have a minimum 1/4" thick Viton rubber covering for corrosion/abrasion protection. Seals which use single coil, multiple coil, bellows and rubber-in-shear designs are not acceptable.

6. To minimize the number of points where the slurry must be sealed, the mechanical seal assembly shall have no more than four (4) o-rings: two (2) seal face o-rings, one (1) shaft sleeve o-ring, and one (1) retainer o-ring. O-rings are to be made of Viton. Seals using more than four (4) o-rings are not acceptable.
7. The seal to be fitted with an integral shaft sleeve. The shaft sleeve to be made of CD4MCu ASTM A-743 duplex stainless steel or type 316 stainless steel. The rotating body of the seal to be positively driven by no less than two (2) stainless steel drive keys.
8. All metal components not encapsulated in Viton must be constructed of abrasion-resistant CD4MCu ASTM A-743 duplex stainless steel or type 316 stainless steel. Surface finish to be a maximum of 64 RMS.
9. The seal must be capable of running with up to ± 0.025" radial shaft deflection and ± 0.040" axial shaft deflection without damage or loss of performance.
10. A seal chamber of Hi-chrome iron, ASTM A-532, minimum 600 Brinell hardness, to be provided to mount the seal and to provide a reservoir of adequate volume for the pumped product to contact and to lubricate the seal faces. The seal to be installed into the seal chamber from the impeller side of the pump so that only the casing/suction piece and impeller need to be removed to gain complete access to the seal for inspection and/or maintenance.
11. Seals requiring a water or product flush may be furnished in lieu of the non-flushed seal, provided the contractor furnishes, at no extra charge, all of the external auxiliary equipment necessary for the flushing system, including, but not limited to:

    a. Isolated water/flush supply system to the seal, including pump, reservoir, pressure reduction valve, solenoid valve, bypass piping and check valve, all furnished in a suitable enclosure, associated wiring, and modifications to the motor control center to actuate the solenoid valve.
    b. A pressure gauge, flowmeter, shutoff and isolation valves, manual throttle valve, and strainer at the pump.
    c. All tubing/piping shall be stainless steel.

H. Pump Base:

1. Mount pump and motor assembly on a base of welded structural steel or cast iron to support all weight and operating loads of pump and motor.
2. Machine finish all pump, motor, and base mating surfaces.
3. Provide drip rim and drain connection.
4. Anchorage:

    a. Provide all foundation bolts, plates, nuts, washers and setting templates required for installation.

b. Anchors: Type 316 stainless steel with silicon bronze or Monel nuts, conforming to the requirements of Section 055000 “Metal Fabrications”.

I. Factory Coatings: Prepare and shop prime all equipment surfaces as part of the work of this Section.

2.7 ACCESSORIES

A. Pressure Gauges and Switches:

1. Provide in accordance with Section 407313 “Pressure and Differential Pressure Gauges” and Section 407336 “Pressure and Differential Pressure Switches”.
2. Provide diaphragm seals in accordance with Section 407363 “Diaphragm Seals”.
3. Provide cartridge type pressure snubbers to reduce gauge pointer pulsations.
4. Install in tapped holes on piping adjacent to pump discharge
5. Range as recommended by the manufacturer based upon range of operating pressure and normal operating pressure at mid-scale of gauge.

2.8 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Notify Owner and Engineer at least fourteen days before inspections and tests are scheduled.

C. Shop Test:

1. Perform shop test of each pump to be furnished under this Work in accordance with ANSI/HI 14.6, American National Standard for Rotodynamic Pumps for Hydraulic Performance Acceptance Tests, Acceptance Grade 1U, for pump hydrostatic test and performance test.
2. Submit certified test results including pump performance curves showing head, flow, brake horsepower and pump efficiency for each pump.

D. Motor shop testing in accordance with Section 400593.23 “Low Voltage Motor Requirements for Process Equipment”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that items provided by other Section of Work are ready to receive Work of this Section.

B. Verify layout, orientation and connections.

3.2 INSTALLATION

A. Install pumping units as shown and according to Manufacturer’s instructions.

B. Install pumping units on concrete foundation to elevation to align with piping as shown.

C. Equipment base anchorage:

1. Rigidly and accurately anchor equipment base into position on concrete foundation.
2. Provide all foundation bolts, plates, nuts, and washers as specified in Section 055000 “Metal Fabrications”.
3. Bolts and washers: Type 316 stainless steel with Monel nuts.
4. Use expansive, non-shrink low exothermic epoxy grout, Five Star DP Epoxy Grout or equal, mixed and applied according to manufacturer’s directions.
5. Remove or back down jacking nuts prior to placing grout.
6. Protect all bolt threads during placement of grout. Fill space between anchor bolts and bolt sleeves with expanding urethane foam.

D. Connect piping accurately aligned with pump flanges, imposing no external loading on the pump.

E. Provide and connect power and control conduit and wiring to make system operational and ready for startup.

F. Provide lubricants in accordance with Manufacturer’s recommendations.

G. Flush piping with clean water.

3.3 FIELD QUALITY CONTROL

A. Prior to system startup, submit installation documentation from equipment Manufacturer’s representative attesting that equipment has been properly installed and is ready for startup and testing.

3.4 SYSTEM STARTUP

A. Prior to operating system or components, perform the following:

1. Check pump and motor alignment.
2. Check for proper motor rotation.
3. Check pump and drive units for proper lubrication.

B. Startup and Performance Testing:

1. Operate pump on clear water at design point for continuous period of two hours, under supervision of manufacturer's representative and in presence of Engineer.
2. Confirm pump operation at secondary design points, as applicable, with period of operation at Engineer’s discretion.
3. At 15 minute intervals, record flow, head, pump speed and power required. Utilize approved field test data log sheets.
4. Flow measurement: utilize timed-drawdown test or timed-fill test, installed flow meter, or temporary flow meter provided by Contractor
5. Head (pressure) measurement: utilize installed or Contactor furnished pressure gauges on pump suction and pump discharge.

6. Pump speed: utilize tachometer.
7. Power: utilize volt and ampere (or kilowatt) meters.
8. Check pump and motor for high bearing temperature and excessive noise or vibration according to Manufacturer instructions. Check for motor overload by taking ampere readings.
9. Under direction of Manufacturer’s representative, adjust, repair, modify, or replace system components that fail to perform as specified and rerun tests.
10. Submit written report tabulating equipment tested, test results, problems encountered, and corrective action taken within two weeks after test completion.

C. Long Term Performance Testing:

1. Utilizing clean water, operate each pump for a total period of 24hours.
2. Confirm that each pump operates without excessive noise, vibration, or overheating.

D. Vibration Testing:

1. Upon completion of startup and performance testing, retain services of an independent mechanical testing firm to perform a detailed vibration signature analysis of each pump, including both "Bump Tests" and X-Y vibration profiles.
2. Demonstrate compliance with specified vibration limitations.
3. Demonstrate that there are no field installed resonant conditions due to misalignment, the foundation, or connecting piping and its supports, when operating within the specified operating range.
4. Prepare and submit a written report including the following:

    a. Sketch of pumps indicating location and direction of vibration measurements.
    b. For each test point: (a) peak to peak displacement, in mils, (b) frequency, and (c) peak velocity level in inches per second.
    c. A complete analysis of findings, any issues encountered, probable causes, and specific recommendations for corrective actions.

E. Manufacturer Services:

1. Provide on-site services of manufacturer's representative experienced in installation of equipment provided under this Section.
2. Services include equipment installation, inspection, start-up, field testing and instructing Owner's personnel in operation and maintenance of equipment.
3. Services on-site shall meet minimum time requirements listed below. Time requirements do not relieve Contractor of obligation to provide sufficient service to place equipment in satisfactory operation.
4. Installation/Inspection:

    a. 1 day.
    b. Inspect grouting, location of anchor bolts, setting, leveling, alignment, field erection, coordination of piping, electrical and miscellaneous utility connections.

5. Startup/Testing:

    a. 1 day.
    b. Place equipment into operation and make necessary adjustments.

c. Complete functional and performance testing.

6. Operation and Maintenance Instruction:

a. 2 days.
b. Instruct representatives of the Owner on proper operation and maintenance. Provide training agenda and utilize approved O&M manuals.

7. Service Inspection:

a. 2 days.
b. During the first year of operation, provide additional Service Inspection at Owner's request, exclusive of repair, malfunction, or other trouble shooting service calls.

3.5 ATTACHMENTS (NOT USED)

END OF SECTION 432335

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SECTION 432513 - SUBMERSIBLE SOLIDS HANDLING PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Submersible Solids Handling Pumps and their respective motors for the San Gabriel WWTP Influent Lift Station.

    a. Mounting Configuration: Wet pit.

2. Manufacturer Supervisory and Support Services: During installation and field testing, of each unit and instruction of the regular operating personnel in the proper care, operation and maintenance of the equipment.

B. Related Requirements:

1. Section 017300 “Execution”.
2. Section 055000 “Metal Fabrications” for fasteners, brackets, and other miscellaneous metal fabrications as required by this Section.
3. Section 099676.23 “Wastewater Preliminary Treatment Coatings”.
4. Section 099679 “Atmospheric Protection and Plant Service Areas Coatings”.
5. Section 260519 “Low-Voltage Electrical Power Conductors and Cables” for connections and terminations.
6. Section 260523 “Control-Voltage Electrical Power Cables” for connections and terminations.
7. Section 400593.23 “Low Voltage Motor Requirements for Process Equipment.” For electric motors, features and accessories normally supplied as part of equipment assemblies.
8. Section 406100 “Process Control and Enterprise Management Systems General Provisions”.
9. Section 406121.20 “Process Control System Testing”.
10. Section 406126 “Process Control System Training”.
11. Section 406196 “Process Control Descriptions”.
12. Section 407000 “Instrumentation for Process Systems”.

1.3 COORDINATION

A. Coordinate installation and startup of Work of this Section with Owner’s operations.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer’s product data for system materials and component equipment, including weight, electrical characteristics, and connection requirements.

1. Total Weight of Equipment: Include weight of single largest item.
2. Materials List: For equipment specified.
3. Bill of Materials: For equipment specified.
4. Manufacturer's Recommended Spare Parts List:

    a. Manufacturer's current price for each item.
    b. Include gaskets, seals, etc.
    c. List bearings by bearing manufacturer's numbers only.

B. Shop Drawings:

1. Certified dimensional drawings showing details of pump construction and auxiliary apparatus.
2. Hatch Openings: Demonstrate sufficient clearance for pump. Hatch access shown on drawings is maximum opening allowed for concrete sawcut.
3. Pump Supports: Design details, anchor bolt locations, sizing information, and installation requirements.
4. Complete wiring diagrams and schematics of all power and control systems showing wiring requirements between all system components, motors, sensors, control panels and related systems
5. Complete Motor Data: Including, but not limited to the following.

    a. Type of enclosure design.
    b. Rated horsepower.
    c. Rated voltage.
    d. FLA.
    e. Starting current.
    f. LRA.
    g. LR KVA.
    h. NEMA starting code letter and insulation code letter.
    i. RPM.
    j. Input power in kW at nameplate rating.
    k. Starting calculations.
    l. Cable size.
    m. Efficiency: At 100 percent load.
    n. Power Factor: At 100 percent load.
    o. Winding temperature rise.
    p. Vibration design limits.
    q. Speed torque curves.
    r. Recommended trip and alarm settings for temperature and vibration protective devices.

s. Power and control cable size and materials of construction, details of cable sealing method, description and type of motor thermal protection, description of insulation system and service factor.

C. Manufacturer's Certificate:

1. Manufacturer's certification of installation meeting Manufacturer’s installation, operation and maintenance manuals and as specified in PART 3.
2. Manufacturer's field report as specified in PART 3.
3. Certify installation is completed according to manufacturer's instructions.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Instructions: Detailed instructions on installation, requirements, storage and handling procedures.

B. Field Quality-Control Submittals: Identify the entity and qualified individual who will inspect the installation in accordance with “Inspection and Testing” Article in Part 3.

C. Qualifications Statement: Submit qualifications for Manufacturer.

D. Complete description of surface preparation and shop painting for pumps and motors.

E. Design Data, Characteristics and Performance:

1. Guaranteed performance curves per ANSI/HI 11.6.

a. Grade 1U for specified (intermediate) design point.
b. Grade 1E for other specified points.
c. Actual factory tests results of similar units, showing they met specified requirements for total head (TH), flow rate, overall efficiency, guaranteed maximum net positive suction head required (NPSH3), submergence, and horsepower.

2. Submit curves on 8-1/2 by 11-inch sheets, as large a scale as practical. Plot from zero flow at shut-off head to pump flow rate at minimum specified total head (TH).
3. The preferred operating range (POR) and (acceptable operating range) AOR per ANSI/HI 9.6.3 shall be clearly shown on the curves.
4. Catalog sheets showing a family of curves are not acceptable.

F. Warranty Information: Demonstrate conformance to “Warranty Article.”

1. Authorized Warranty Center: Within a 3-day shipping radius of job site; fully staffed with factory trained mechanics, and equipped with stock of strategic spare parts for each pump model furnished for Project. Document warranty center location prior to delivery of equipment.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Document actual locations and final orientation of equipment and accessories.

B. Operation and Maintenance Data Manual:

1. Prepare for this project installation. Include cuts, drawings, equipment lists, descriptions, etc. required to instruct operating and maintenance personnel unfamiliar with equipment.
2. Include trouble shooting data, full preventative maintenance schedules, and complete spare parts lists with ordering information.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Manufacturer to Furnish the Following:

1. Special tools and test equipment required for proper servicing of equipment. Furnish in a steel tool chest with lock and duplicate keys. No special tools to be required to service or repair pump.
2. List of recommended spare parts, gaskets, lubricants, sealants, and heat transfer medium necessary for the first five years operation of each pumping system.
3. Furnish the following spare parts for each size pump:

    a. One impeller matching installed impellers with lock nut or lock washer.
    b. Repair kit to include all bearings, seals, o-rings and mechanical seals necessary for a complete overhaul.

1.8 QUALITY ASSURANCE

A. Manufacturer:

1. Coordination Responsibilities: Pumps, motors, guide rails, access hatches, and other auxiliary equipment as depicted on the Drawings.
2. Equipment Furnished: New, unused, and standard. Furnished with accessories required and meeting specified requirements.
3. Service Record: Successful five-year record servicing equipment and systems similar to that specified.
4. Certified to ISO 9001 Standard: For design and manufacture of submersible solids handling pumps.

B. Both Contractor and Manufacturer: Share responsibility for satisfactory installation and operation of entire pumping systems including pumps, motors, and accessories.

C. Equipment Specified in this Section:

1. To be standard pumping equipment of proven ability.
2. Manufactured by companies experienced in production of equipment used in system applications as stated in the “System Description,” Article in Part 2.

    a. Manufacture per Hydraulic Institute Standards, unless otherwise specified.

3. Furnish from single manufacturer.
4. Must operate satisfactorily when installed as shown on Drawings, as specified, and as approved by Engineer.

1.9 DELIVERY, STORAGE AND HANDLING

A. Protect equipment and parts against damage during shipment.

B. Store equipment per Manufacturer's recommendations.

C. Long Term Storage: Protect and store parts so no damage or deterioration occurs during prolonged delays from time of fabrication to installation; per Manufacturer’s requirements.

1. On-Site Long-Term Storage: Follow Manufacturer's detailed long term storage requirements.

D. Factory Assembled Parts and Components: Do not dismantle for shipment without written permission from Engineer.

E. Finished Surfaces; Exposed Pump Openings: Protect with blank flanges of rigid wooden or equivalent material. Secure with bolts or other manufacturer approved means.

F. Unpainted Finished Iron or Steel Surfaces: Protect to prevent rust and corrosion.

G. After Hydrostatic or Other Tests: Drain entrapped water prior to shipment. Protect to prevent entrance of water and moisture during shipment, storage and handling.

H. Box or Package Markings: Contents and net weight.

I. Engineer’s Approval: Do not ship until given written approval by Engineer.

1.10 EXISTING CONDITIONS

A. Special Requirements:
1. Contractor required to make or verify field measurements prior to start of work.

B. Field Measurements: Verify prior to fabrication. Document on Shop Drawings.

1.11 WARRANTY

A. Manufacturer Warranty: Pump and motor for period of 2-Years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. San Gabriel WWTP: System will be comprised of pumps that pump raw wastewater and process drain water from the Influent Lift Station to the Headworks Facility as shown on the civil drawings. The equipment to be furnished under this Section includes three submersible pumps, motors, guide rails, access hatches, control panels and control systems, and accessories.

B. Refer to Section 406196 “Process Control Descriptions” or overall system description and control loop descriptions control narratives and functional control description.

C. Contractor to coordinate and be responsible for proper operation and compatibility between items in this scope of work and items in Division 40 scope.

D. Pump Motors, Cables, and Appurtenances: Rated for operation in a Class I, Division 1, Group D hazardous environment, as approved by Factory Mutual.

E. Pumping Units: Totally submersible, solids handling, rotodynamic with submersible close coupled motors. Each unit to be aligned and balanced. Designed to pump raw, screened wastewater, filtrate and drain water. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially adapted for the work to be done. Ample room shall be provided for inspection, repairs, and adjustments.

1. Wet Pit Applications: Pumping units to be automatically connected to discharge piping when lowered into place on discharge connection, providing a water tight seal.

    a. Pumps: Easily removable from discharge connections and wet well for inspection or service. Lifting pumps from discharge connections and wet well is not to require removal of fasteners or fastenings or require personnel to enter the pump well.

F. Base Elbows for Pumps: Rigidly and accurately anchored in position.

1. Anchor Bolts, Plates, Nuts and Washers: Furnished as specified herein and installed by the Contractor and conform to the recommendations and instructions of the Manufacturer.

G. Nameplates: Stainless steel. Permanently attached to each pump and/or motor.

1. Give name of manufacturer, rated flow rate, head, speed, and other pertinent data.
2. Wet Pit Applications: Contractor to install additional stainless steel nameplates on termination cabinet enclosures other above grade locations as instructed by Engineer. Orient and locate so pumps do not need to be moved to gather information.

2.2 CONDITIONS OF OPERATION

A. Manufacturers and Products: Provide pump units from one of the following:

1. San Gabriel WWTP Influent Lift Station
   a. Wilo
   b. Hydromatic
   c. Myers
2. Or equal substitution product meeting detailed requirements of this specification. Substitution must be submitted to design Engineer two weeks before the bid date for pre-approval.
3. Pumps Within Each Service Type: Identical in every respect. All parts interchangeable.

B. Pumps: Designed for conditions of service tabulated as follows and operate within the system head curve envelope as appended.

1. Specific Speed Less Than 4,500 (US units): Continuously rising head performance curve, from runout toward shutoff. For stable pump operation from minimum head operating point to shut-off head.
2. Specific Speed Greater Than or Equal to 4,500: The intersection of pump head and system head curves to be used to demonstrate stable operation.
3. Pumps Operation Throughout Operating Range: Within vibration limitations specified in "Dynamic Vibration Analysis" Paragraph in the "Quality Assurance" Article in Part 1.
4. Pumping Units and Driving Equipment: To withstand maximum turbine run-away speed due to back flow through the pump.

C. Each pump is to be designed for the conditions of operation tabulated as follows.

Conditions of Operation – San Gabriel WWTP Influent Lift Station

Item Description	Design Conditions
Service	Raw Wastewater
Tag Number	PMP-2010-1, PMP-2010-2, PMP-2010-3
Number of Pumps (operating/standby)	3 (2/1)
Maximum Motor Full Load Speed (FLS) (rpm)	1,190
Maximum Allowable Motor Horsepower (non-overloading throughout operating range) (HP)	50
Motor Design Voltage/Phase/Frequency	460/3/60
Maximum Anticipated Pumped Fluid Temperature (degrees F.)	90
Minimum Pump Discharge Size (inches)	8
Pump Shut-Off Head at Motor FLS Acceptable Range (minimum/maximum) (feet)	75 (max) 10 (min)
Design Point Flow Rate – (gpm)	3,650
Design Point TH (minimum/maximum) (feet)	46
Minimum Overall W/W Efficiency at Design Point (percent)	77
Maximum NPSH3 at Design Point TH (feet)	12
BEP Location Relative to Primary Design Point	Right
Flow Rate at Secondary Operation Point (gpm)	1,825
Secondary Operation Point TH (feet)	44
Minimum Overall Efficiency at Secondary Operation Point (percent)	77
Maximum NPSH3 at Secondary Operation Point (feet)	10
Minimum Size Solids Passing (inches)	3
Minimum Submergence Above Pump Casing (feet) / Maximum Duration at Min. Submergence (minutes)	3.5 feet

* Note that minimum overall efficiencies listed are “wire-to-water” in accordance with ANSI/HI 11.6 – latest edition.

2.3 PUMP CONSTRUCTION

A. Overall Pump Design: Combine high efficiency and low required NPSH3.

1. Wastewater Applications: Handle high solids concentrations effectively.

2. Impellers/Casings: Must have passage surfaces to which solid or fibrous materials cannot adhere. Capable of passing fibrous and nonwoven materials found in domestic wastewater. Permit low liquid velocities, gradual acceleration, and change of flow direction of pumped media.

B. External Pump and Motor Parts: Close grained cast iron, ASTM A48 Class 35B construction, with all parts in contact with wastewater protected by corrosion resistant coatings.

1. External Bolts and Nuts: Type 304 or 316 stainless steel.

C. Impellers:

1. Construction: ASTM A48 Class 35 B or Class 30 minimum gray cast iron. Dynamically balance impellers as specified below.
2. Rotodynamic: Two-plane dynamically balanced per ISO 1940-1 quality grade G2.5 standard to provide smooth, vibration free operation.

a. Wastewater Applications with Flushable Fibrous and Non-Woven Material:

1) Semi-open, solids handling type.
2) Capable of passing solids due to internal clearances or other features facilitating solids processing including a wear plate with groove.
3) Wear Plate to Impeller Clearance: Easily externally field adjustable without pump disassembly or the need to add or remove shims.
4) Impeller may include pump out vanes on upper shroud reducing axial thrust and minimize clogging due to debris accumulation around the mechanical seal.

D. Casing Wear Ring or Plate: Provides efficient sealing between casing and impeller. A stationary stainless steel ring fitted to casing inlet or stainless steel wear plate installed in lower half of casing.

1. Semi Open Impeller Designs: Stationary wear ring or wear plate to have minimum 50 points Brinnell hardness greater than rotating wear ring or semi-open impeller vane tip hardness.
2. Alternative Materials and Design Approaches: Approved by Engineer.

E. Balanced Tandem Mechanical Shaft Seal System.

1. Upper (Inner) Tandem Seal Set:

a. Operate in seal lubricant chamber located just below the stator housing.
b. One Stationary Ring: Silicon carbide.
c. One Positively Driven Rotating Ring: Carbon.
d. Function: Independent secondary barrier between pumped liquid and stator housing.

2. Lower (Outer) Tandem Seal Set:

a. One Stationary Ring: Tungsten carbide or silicon carbide.
b. One Positively Driven Rotating Ring: Tungsten carbide or silicon carbide.
c. Function: Primary barrier between pumped liquid and stator housing.
d. Each Interface: Held in contact by its own Hastelloy-C® or Elgiloy® spring system.
e. Seal Body: Type 316 stainless steel.
f. O-Rings: FKM (Viton).
g. Must require no maintenance and adjustment, but be easily inspected and replaced.
h. Provide pressure applied to outside diameter of face.
i. Not Acceptable: Conventional double mechanical shaft seals containing either a common single or double spring, acting between the upper and lower units.

F. Minimum Pump Discharge Size:

1. Wet-Pit Application: Minimum allowable nominal diameter of discharge connection provided for attachment to discharge piping, as shown on Drawings. Unless otherwise noted, the diameter of the opening at the connection between the pump and the discharge should normally be the same as the minimum specified discharge size.

G. Pump Seal Against Discharge Connection:

1. Wet-Pit applications: Pump must tightly seal against discharge connection. Accomplish with simple linear downward motion of pumping unit guided by two guide rails. No portion of the pump is to bear directly on the wet well floor.

a. Sliding Guide Bracket: An integral part of or bolted to the pumping unit.
b. Pump Casing Machined Connection System: For attachment of the ASTM A48, Class 35, cast iron discharge connection.
c. Sealing System: Positive leak proof system providing easy pump removal. Two machined metal-to-metal flanges or flanges with a replaceable rubber seal, form fitted to the machined discharge coupling.
d. Discharge Connection:

1) Rigidly and accurately anchored to floor of wet well.
2) Precisely leveled and aligned.
3) Completed Installation: Free from stress or distortion with Type 316 stainless steel sleeve cast-in anchor bolts, monel nuts and accessories.
4) Must receive the pump connection without need of any bolts or nuts.

H. Lifting Cable for Wet-Pit Applications:

1. Lifting Chain: Type 316 stainless steel cable and short piece of suitably sized Type 316 stainless steel chain between bail and cable.

a. Rating: Five times pump weight; minimum.
b. Combined Length: Equal to wet well depth; top slab finished grade to wet well bottom, plus six feet to permit raising pump for inspection and removal.

2. Attach lifting cable to a lifting bail on the pump.
3. Eyebolts are not an acceptable alternate to a lifting bail.

2.4 SUBMERSIBLE MOTORS

A. Pump Motors: Inverter duty rated, housed in an air filled, water-tight casing.

1. Insulated Windings: Class H or better, non-hygroscopic and moisture resistant.
2. Motors Greater than 15 HP: Oil filled motor housings are not acceptable.
3. Suitable for use with solid-state starters.
4. Motor Stator: Dipped and baked three times in VPI process and heat shrunk fitted into stator housing.

a. Alternative: Trickle impregnation method may be used for motor stator windings.
b. No penetrations of stator housing, such as bolts, pins or other fastening devices.

5. NEMA Design B;

a. Service Factor: Minimum 1.15 as defined in NEMA MG1, based upon nameplate horsepower rating for across-the-line service.

6. Insulation System: Rated at 155 degrees C or better.
7. Capable of continuous operation at ambient 40 degrees C continuously with Class A temperature rise, and 15 starts per hour without affecting bearing and winding design life.
8. NEMA Starting Code G or H, or better.
9. Non-overloading. Capable of fifteen starts per hour.
10. Minimum Power Factor at Full Load: 0.80.

11. Motor Efficiency: minimum 90 percent at full load to meet wire-to-water efficiency specified in “Conditions of Operation” Article in Part 2.

B. Pump Motor Cooling Characteristics:

1. Permit continuous operation in partially submerged condition.
2. Three overheat, self-resetting sensing devices: One in each motor winding. Trip at 140 degrees C**.** Wire devices into controls. If a device activates, pump must shut down. The temperature device shall be self-resetting.

C. Non-overloading within range of operation between shutoff and low head run-out conditions shown on pump conditions of operation data table above.

1. Where specific speed is 4,500 or greater, the range from the pump head and system head curves intersection point and low-head run out conditions shall be used to demonstrate non-overloading over the range of operating conditions.
2. Wet Pit Applications: Capable of running continuously in totally dry condition under full load without damage for a cleaning cycle; 15 minutes maximum.

D. Pump/motor shaft: Type 420 or 431 stainless steel.

1. Operating at Pump Design Point:

a. Shaft Deflection at Lower Seal Face: 0.2 mm maximum
b. Shaft Deflection at Wear Ring Area: 0.45 mm maximum.

2. Permanently lubricated ball bearings sized to withstand axial and radial forces.
3. Bearing Life: ABMA Minimum L-10: 100,000 hours rated at pump BEP.

E. Pump motor, its Appurtenances, and Cable: Capable of continuous submergence underwater without loss of watertight integrity to depth of 65 feet. Mating surfaces: Machined, fitted with O-rings for watertight sealing.

F. Power and Control Cable Entry System: Design precluding specific torque requirements ensuring a water tight and submersible seal.

1. Certified by UL or FM to have passed pull-testing requirements.
2. Chamber and motor: Separated by a stator lead, sealing gland or terminal board, which isolates the motor interior from foreign material gaining access to pump motor top.
3. Field serviceable.
4. Entry Into Lead Connection Chamber: Epoxy encapsulated for positive moisture sealing.
5. Cable Grommet: BUNA-N, in addition to epoxy sealed leads.

G. Power Cables, Conduits and Accessories:

1. Supply pumps with power and sensor conductors.
2. Pump motor cables: Sized to meet applicable NEC requirements.
3. Cables: Exceed industry standards for oil, gas and sewage resistance.

a. Type SPC or SEOW insulated cables with double jacketed protection system.

1) Outside: Neoprene or chlorinated polyethylene.
2) Inside: Synthetic rubber.

b. Individual conductors: Type RUW.
c. Sufficient length so cables are continuous between pump and disconnect. No splices allowed.
d. If more than one cable is provided per pump: Contractor must furnish and provide for installation of additional conduits, etc. as required for each additional cable.
e. One cable per conduit allowed at pump station.
f. Conduit: Sized per manufacturers recommendations. Not smaller than 3/4-inch.

4. Contractor: Furnish required stainless steel conduit hardware and fittings.
5. Water tight connectors equal to Crouse-Hinds Type "CGB", with neoprene lands to be furnished and installed in control panel enclosure or disconnect to terminate each conduit and seal each cable entry.
6. Conduit Seals: Equal to Crouse-Hinds Type "EYS".
7. Coordinate the installation of the above materials with the Manufacturer.

2.5 PUMP/MOTOR PROTECTION SYSTEM

A. Pump/Motor Protection System: To monitor machine temperature and moisture.

1. Warning and shutdown protection.
2. UL listed.
3. Protective and Monitoring Sensors: Connected to electronic module which provides a signal from the pump/motor sensors to motor starter in Motor Control Center.

B. Relay Modules:

1. Provide relay modules manufactured by Benshaw, or equal to Section 262419 “Motor Control Center Supplier”.

C. Protection and Monitoring Sensors:

1. Over Heating Protection:

a. Motor Winding Bi-Metallic Thermal Switches or Thermistors: Quantity of three.

1) One installed in each motor stator phase winding. Connect in series to monitor and protect winding from over temperature operation.
2) Upon a High Temperature Event: Thermal switches shall open, activating an alarm and stopping the motor.

2. Water Intrusion Detection:

a. Motor Stator Chamber: Float-type moisture leakage sensor (stator FLS). If activated, FLS to activate an alarm.
b. Motor Electrical Connection (Cable Junction) Chamber: Float-type moisture leakage sensor (electrical connection FLS). If activated, FLS to activate an alarm.
c. Mechanical Seal Lubrication Chamber; Between Inner and Outer Mechanical Seals: Water-in-oil or water-in-air capacitive type moisture sensor. If activated, to activate an alarm.

2.6 GUIDE RAILS AND PUMP LIFTING DEVICE

A. Pumping Station: Furnish with necessary, stainless steel upper guide holder and level sensor cable holder.

B. Lower Guide Holders: Integral with discharge connection.

1. Dual guide rails: Schedule 40, welded 2 inch minimum diameter, Type 316 stainless steel pipe of length as required by Drawings.
2. Single guide rails and guide cables are not acceptable.

C. Intermediate Guide Brackets: Furnished and installed.

1. Unsupported Guide Rails: No longer than 20 feet, Type 316 stainless steel.

D. Cable Holders Including Cable Hooks: Fabricated from Type 316 stainless steel plate.

1. No sharp corners or edges that would abrade or cut electrical cable insulation.
2. Cable Holders: Sufficient length and strength to support each separate cable.
3. Pump power and lift cables may use the same hook position, provided cables do not foul one another and lift cable is easily accessed from hatch opening.

E. Chain and Latch Device: To facilitate pump removal from wet well without a series of incremental lifts. Design device to be lowered along guide rails and remotely latch to pump lifting bail without requiring wet well entry.

2.7 SHOP PAINTING

A. Pump and Associated Equipment: Shop-primed and finished-coated per Manufacturer's standard practice prior to shipment. Color: Manufacturer’s standard.

1. Touch-Up Paint: Supplied by Manufacturer.

B. Interior and Exterior Pump Surfaces, Motor Enclosure: Supplied with Manufacturer’s standard epoxy coatings. Cleaned, dry, free of rust, mill scale, grease, dirt, and other foreign matter.

C. Coatings on Wetted Surfaces: Epoxy type complying with AWWA E-103, ANSI/NSF 61, and ANSI/NSF 372 for use with drinking water systems. Surface Preparation: Per coating manufacturer's recommendations.

D. Nameplates: Protect during painting.

2.8 ACCESS HATCHES

A. Single leaf or double leaf doors as indicated by the Drawings. Dimensions indicated on drawings depict the overall hatch dimension which include the opening and the hatch frame width and length. The hatch dimensions shown on the Drawings are the maximum length and width permitted for the entire hatch + hatch frame.

1. Material: 1/4-inch aluminum diamond pattern plate with welded stiffeners, as necessary, to withstand a 300 psf live load.
2. Angle Frame: 1/4 inch aluminum with perimeter anchor flange or strap anchors for concrete embedment around the perimeter.
3. Pivot torsion bars for counterbalance or spring operators;. For easy operation along with automatic door hold open; unless otherwise noted on Drawings.
4. Hardware: Durable and corrosion resistant Type 316 stainless steel hardware used throughout.
5. Removable lock handle.
6. Finish: Factory mill finish for aluminum doors and frames. Bituminous coating on exterior of frames in contact with concrete.
7. Floodtight with no drainage channel.
8. Manufactured by Bilco Company, New Haven, CT or Halliday, or equal.

2.9 SOURCE QUALITY CONTROL

A. General:

1. The Engineer has the right to inspect any equipment furnished under this Section prior to shipment from place of manufacture and may choose to witness the factory pump performance test.
2. Notify Engineer in writing ten working days prior to the factory performance test, so arrangements can be made for inspection by the Engineer.

B. Factory Pump Testing: Performed by Manufacturer.

1. Test pumps as described in ANSI/HI 11.6, American National Standard for Rotodynamic Submersible Pumps for Hydraulic Performance Acceptance Tests, as specified.

2. Perform hydrostatic test on pressure-containing components per ANSI/HI 11.6 on pumps prior to shipment.
3. Examine cast surfaces of components by visual inspection per MSS SP-55.
4. Factory pump tests are the basis of acceptance of hydraulic performance of pumps.

    a. Factory test pumps prior to shipment per Hydraulic Institute standards.
    b. Test and Record: Flow rate, total head, overall efficiency and input KW for at least five points on pump performance curve.

        1) Perform test to demonstrate pumps meet ANSI/HI 11.6, acceptance grade 1U for specified (intermediate) design point and acceptance grade 1E for the other specified points except that maximum pump power input at any point on the pump curve is to be limited to the nameplate Brake Horsepower rating of the motor size specified in “Conditions of Operation” Article in Part 2.
        2) Include the points specified in “Conditions of Operation” Article in Part 2.

    c. Pumps failing to meet specification requirements are required to be modified to meet specification requirements. If reasonable attempts to correct inefficiencies are unsuccessful, replace pumps with units meeting specified requirements.

5. Certified Pump Performance Curves: Submit test data to Engineer for approval prior to shipment. Include total head, flow rate, overall efficiency and total brake horsepower for each pump supplied.
6. If Manufacturer does not have historical test records for NPSH3 at specified design pump speed, test one pump to demonstrate NPSH3 versus flow rate.
7. Meters, Gauges, and Other Test Instruments: Calibrated within manufacturer's established time period prior to scheduled test.

    a. Provide calibration certification data.
    b. If Manufacturer has no ISO standard calibration period, Hydraulic Institute Standards governs.

8. Test pumps at 100 percent of design speed.
9. Test pumps through specified range of flow, and head/flow rate/ efficiency curves plotted at maximum output speed.

a. During each test, run pumps at each head condition for sufficient time to accurately determine flow rate, head, power input, and efficiency.
b. Determine the overall efficiency at each test point.
c. Modify pumps under test until specified conditions are met or replace with pumps meeting specified conditions.

10. All pumps are to receive a non-witness factory test.
11. Manufacturer to perform the following test pumps prior to shipment from factory:

a. Megger motors and pumps for insulation breaks or moisture.
b. Prior to submergence, pumps to be run dry and checked for correct rotation.
c. Run pumps for 30 minutes in a submerged condition.
d. Pump shall be removed from test tank, metered immediately for moisture. Check upper and lower seal units for water intrusion.
e. Submit for Approval Prior to Shipment: A written certified test report regarding above tests.

PART 3 - EXECUTION

3.1 PREPARATION

A. Take necessary field measurements. Determine exact dimensions for Work and required sizes of equipment under this Contract. Verify all pertinent data and dimensions.

3.2 INSTALLATION

A. Install equipment per Manufacturer’s instructions and recommendations in locations shown on Drawings.

B. General: Unless instructed otherwise by Manufacturer’s instructions.

1. Oil and Grease for Initial Operation: Supplied by Contractor.
2. Base Elbows for Pumps: Installed by Contractor conforming to Manufacturer recommendations and instructions.
3. Anchor Bolts: Set per Manufacturer’s recommendations.
4. Pump Seal Against Discharge Connection:

a. Baseplate and Associated Accessories: Installation requirements.

1) Sole Plates: Install, level and grout per API RP 686, Chapter 5 – Mounting Plate Grouting.
2) Jacking Bolts: Back off after grouting so they do not support any of the load.
3) Jacking Bolt Bearing Disks: Placed under each jack bolt.
4) Plastic Vent Tubes: Spaced as recommended by manufacturer.
5) Grout: Mix and apply according to manufacturer's directions.
6) Manufacturer Representative Presence: Is mandatory during pouring of epoxy grout as well as use of rigid non-absorbing formwork and a head box.

7) Surface of formwork in contact with epoxy grout must be covered with a layer of paste wax to facilitate removal.
8) Clearance between the concrete surface and bottom surfaces of sole plates to be per Manufacturer's recommendation.
9) Concrete surface in contact with epoxy grout:

    a) Chipped to present a slightly rough surface and remove the laitance.
    b) The surface must then be cleaned of all dust, moisture and oil.
    c) Place thin layer of leveling grout under jacking bolt bearing discs.
    d) Place Plastic Vent Tubes: Sized and spaced per manufacturer's recommendation, under sole plates to vent air during grouting and prevent voids in epoxy grout.

10) Annular Space Between Anchor Bolts and Anchor Bolt Sleeve: Filled with expanding urethane foam.

    a) Threads of anchor and jack bolts in contact with grout to be covered with paste wax and a layer of duct tape.
    b) After alignment tolerances are met: Tighten anchor bolts snug to prevent movement during the pour.
    c) Epoxy grout is not to extend above the top edge of the sole plates.
    d) After the epoxy grout has fully cured, within 24 to 48 hours after pouring, remove jack bolts and tighten anchor bolts tightened to torque levels recommended by Manufacturer.

11) Threaded Jack Bolt Holes: Coat with grease. Clean jack bolts of paste wax and duct tape then reinsert and secure in position with a lock nut to within 1/4 inch of bottom of hole.
12) After grouting, chip and patch edges to present a smooth finish.

C. Upon Completion of Each Pump Application: Manufacturer shall inspect installation.

1. Satisfactory Inspection: Submit certificate stating equipment installation is satisfactory and meets Manufacturer’s installation, operation and maintenance manuals. State equipment is ready for operation, and operating personnel have been suitably instructed in operation, lubrication and maintenance of each unit.

D. Ensure Proper Installation: If Contractor does not provide qualified installation staff during installations, the Engineer may require Contractor to provide services of Manufacturer's factory representative to give necessary instruction and supervision.

3.3 INSPECTION AND TESTING

A. General:

1. Prior to Shipment from Place of Manufacture: Engineer reserves right to inspect furnished equipment meeting this Section’s specified requirements. Include the phrase regarding witness testing if pump performance test to be witnessed.

2. Field Tests: Not be conducted until pumping system, including controls, is complete and ready for testing.

B. Field Pump Test:

1. Manufacturer to furnish services of a representative having complete knowledge of proper operation and maintenance to inspect final installation and supervise test run of equipment.

    a. Pump Pricing: Include minimum eight hours of representative's time for field pump testing.

2. Written Test Procedures: Submit to Engineer for approval 30 days prior to testing.
3. Contractor to furnish water, power, facilities, labor, materials, supplies and test instruments required to conduct field testing.
4. Final Acceptance Tests: Demonstrate these Specification requirements have been met by equipment as installed.

    a. Contractor to, at a minimum, verify the following:

        1) Quick Release Lift Out: Functions properly allowing pump to be raised and lowered without draining pit.
        2) Pumping units are properly installed and in correct alignment.
        3) Correct lubrication per manufacturer's instructions.
        4) Correct direction of rotation of motors and reverse connections, if necessary.
        5) Pump units operate without overheating or overloading and without objectionable vibration.
        6) No mechanical defects in any of the parts.
        7) Pump units deliver specified total head and flow rate to demonstrate units generally meet requirements specified. Factory performance test is basis of pump acceptance.
        8) Sensors and controls perform satisfactorily as to sequence control, correct start and stop elevations, and proper level alarm functions.

5. If pump unit performance does not meet specifications, take corrective measures or remove and replace with pumps which satisfy conditions specified.
6. Continuous Operating Period: A five-day period of pump units’ operation is required before acceptance. Pump units failing during this period shall be repaired or replaced. Continuous operating period shall then be restarted; resetting run time to zero.

3.4 MANUFACTURER SERVICES INCLUDING OPERATING INSTRUCTIONS

A. Installation Inspection and Startup:

1. Contractor to include in bid price, providing services of Manufacturer’s factory representative having complete knowledge of proper operation and maintenance.

    a. Representative to instruct Owner representatives and Engineer on operation and maintenance.

b. Instruction may be conducted in conjunction with inspection, installation and start-up of pump units.
c. If there are difficulties in equipment operation due to design or fabrication, additional service to be provided until performance is as specified.
d. Listed Service Requirements: To be exclusive of travel time, and will not limit or relieve Contractor of obligation to provide sufficient service necessary to place equipment in satisfactory and functioning condition.

2. Installation Inspection: Complete review of installation.

a. Written Installation Certification: Installation is complete and operable in all respects, per Manufacturer’s information and instructions and no conditions exist which may affect warranty.
b. Manufacturer to supply installation inspection services of experienced Manufacturer’s factory representative to verify proper pump installation.
c. Qualified supervisory services, including Manufacturers' Factory representatives, to be provided to ensure installation is done in a manner approved by Manufacturer.
d. Manufacturer's factory representative to supervise and approve**:**

1) Installation and alignment of pumps with motors.
2) Grouting.
3) Alignment of connecting piping and installation of field installed packing or mechanical seal.

e. Start-Up or Operation Difficulties due to Manufacturer's Design or Fabrication:

1) Manufacturer to provide additional service until performance is as specified.

f. Services of Manufacturer’s factory representative and training to be provided when first pump unit is started, with follow-up visits upon start-up of each subsequent pump unit.
g. Minimum Time On-Site: One 8 hour day per pump.

3. Start-Up:

a. Written Field Report. Summarize test procedures and results. Include tested and measured variables. Show installation meets performance requirements of this specification and project.
b. Tested and Measured Variables: Including but not limited to the following.

1) Flow rates.
2) Total heads.
3) Shaft-speed.

c. Minimum Time On-Site: One 8 hour day per pump.

B. Training:

1. Field and classroom instruction on operation and maintenance of the equipment.

a. Include start-up, shut-down troubleshooting, lubrication, maintenance, and safety.

2. Manufacturer to provide detailed manuals to supplement training courses.

a. Include specific details of equipment supplied and operations specific to project.
b. If required, make use of teaching aids, slide/video presentations, etc.

3. After Completing Training Services: Deliver training materials used by Manufacturer to Owner.
4. Minimum Time On-Site: One 8 hour day per group of identical pumps.

C. Contractor is solely responsible for the following:

1. Requesting inspection and training services
2. Coordinating requests with other relevant trades.
3. Ensuring effectiveness of Manufacturers' service.
4. If lack of coordination by Contractor results in need to recall Manufacturer’s factory representative, time lost will not be counted against above days.

END OF SECTION 432513

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SECTION 460200 – TANK AND STRUCTURE CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Cleaning and removal of settled wastewater solids, grit, sand, debris, and sludge from the following concrete structures which have a top of wall that is above-grade:
    a. Grit Chambers
    b. Aeration Basins
    c. Irrigation Water Clearwell
    d. Aerated Sludge Holding Tank

2. Cleaning and removal of settled wastewater solids, grit, sand, debris, and sludge from the following below-grade concrete structures:
    a. Coarse Bar Screen Channels
    b. Influent Lift Station Wet Wells

1.3 UNIT PRICES

A. Unit price per ton of grit/debris/solids and sludge removed and disposed.

1.4 ACTION SUBMITTALS

A. Disposal Methods: Details.

B. Transport and Sludge Disposal Forms: Copies of forms generated within ten days.

C. Dewatering Operations Approval: Submit request fourteen (14) days before start of operations.

1.5 QUALITY ASSURANCE

A. Landfill Site: Approved to accept Resource Conservation and Recovery Act (RCRA) wastes.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify condition of each structure and its contents.

3.2 PREPARATION

A. Provide adequate protection of persons and property. Executed work to avoid hazards to persons and property.

B. Furnish signs, lights, barricades and other equipment for safe prosecution of this work. Remove protection when work is completed.

C. Deactivate electrical power connected to the tank or its ancillary equipment and dismantle wiring at the circuit breaker.

D. Provide positive ventilation of tanks or structures when work is being performed inside.

3.3 TANK CLEANING

A. General:

1. Structures will be taken out of service at time of draining and cleaning.
2. Include material removal from structures, down to the concrete slab and walls.
3. Dispose of residue, fluid, sludge, cleaning material, and rinse waters from tanks at approved waste disposal facility.
4. Maintain traffic while sludge removal is in process.

B. Remove mixed liquor/grit/sludge in a two-step process – Draining and Cleaning.

1. Draining:

a. Owner shall remove majority of tank contents through normal facility processing operations and drain structure to greatest extent possible.
b. Allow the following time durations to drain structures:
    1) Grit Chamber, Coarse Bar Screen Channels and Influent Lift Station Wet Wells will each take 1 day.
    2) Each Treatment Unit Aeration Tank will take 3 days.
    3) Irrigation Water Clearwell time will vary depending on time of year.
    4) Aerated Sludge Holding Tank will take 3 days.

c. Obtain dewatering operations approval prior to start.
d. Further drain tank until either completely empty or until Owner deems remaining material in tank unsuitable for introduction into the liquid treatment process.

2. Cleaning:

a. Remove remaining unsuitable material following draining stage.
b. Remove material from tank and dispose of off-site.
c. Obtain approval of removal method when quantity and nature of material is revealed during draining stage.

END OF SECTION 460200

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SECTION 462113 – MULTI-RAKE BAR SCREENS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Mechanically cleaned coarse bar screen designed to positively clean and remove debris from the influent flow stream and transport the retained debris to the discharge point. This screen system shall be fully automated and controlled by the manufacturer-supplied control system.
2. Variable frequency drives (VFD) shall be furnished by the multiple rake bar screen manufacturer.
3. Control panel and local control station shall be furnished by the multiple rake bar screen manufacturer.
4. Manually cleaned coarse bar screen to clean and remove debris from the influent flow stream in the event of a scenario where the mechanical bar screen is to be bypassed.

B. Related Requirements:

1. Section 055000 “Metal Fabrications” for miscellaneous metalwork and fasteners as required by this Section.
2. Section 400593.23 “Low-Voltage Motor Requirements for Process Equipment” for electric motors and accessories normally supplied as part of equipment assemblies.
3. Section 407213 “Ultrasonic Level Meters” for level measurement as required by this Section.

1.3 DEFINITIONS

A. EL: Elevation.

B. MGD: Million Gallons per Day

C. PLC: Programmable logic controller.

D. SCADA: Supervisory Control and Data Acquisition; computer system that monitors and controls industrial, infrastructure, or facility-based processes.

E. UHMWPE: Ultra-high molecular-weight polyethylene.

1.4 ACTION SUBMITTALS

A. Submit, in accordance with Section 013300, copies of all materials required to establish compliance with this Section. Submit the following information to the Engineer:

1. Drawings: Showing general dimensions, confirming equipment size and weight side seal height, motors, drives, anchor bolt locations, and piping connections.
2. Manufacturer's Data: Materials of construction, construction details of equipment, wiring diagrams, weight of equipment, and lifting points.
3. Factory preinstallation testing results and certification.
4. Component, System and Operational Test Phases testing procedures.
5. Summary report of Component, System and Operational Tests.
6. List of comparable screen installations. Include name and telephone number of contact at each installation.
7. Catalog Data: Ancillary electrical components. Include electrical requirements, schematic diagrams, and details of components included.
8. Anchor and Mounting Bolt Design: Calculations and details.
9. Range and settings of indicators, instruments, timers, and other related devices.
10. Operating and maintenance information.
11. Motor product data.
12. Equipment warranty.
13. Manufacturer's Calculations: Show frame and screen assembly can structurally handle conditions specified.
14. Installation Manual: Instructions for installation of the screen, motor, and gearbox, containing the following information at a minimum:

    a. Major parts list including weights of component parts.
    b. Instructions and Procedures:

        1) Unpacking and unloading.
        2) Methods for moving equipment.
        3) Field assembling of match-marked components.
        4) Alignment and leveling screen and spray system, if required.
        5) Installation of screen and spray system, if required.
        6) Anchoring and securing the screen.
        7) Wiring for alignment and connection of screen and motor.
        8) Grounding motor.
        9) Connection of power cabling, lubrication lines, and lifting cables.

    c. Site storage and protection requirements for screening equipment prior to installation.
    d. Installation and assembly drawings: Manufacturer's dimensions, weights, and loadings; location of piping, electrical, instrumentation, and structural connections.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate:

1. Products meet or exceed specified requirements.
2. Certify bearing life.
3. Certify setting plan with details of anchorage.

B. Manufacturer's Instruction:

1. Storage and handling instructions.
2. Installation instructions, including anchoring layout and details.

C. Source Quality-Control Submittals: Results of factory tests and inspections.

D. Field Quality-Control Submittals: Results of Manufacturer-furnished tests and inspections.

E. Manufacturer Installation Reports: Certificate from manufacturer's representative attesting that equipment has been properly installed according to manufacturer's instructions and is ready for startup and testing.

F. Operations and Maintenance (O&M) Data including:

1. O&M Manuals.
2. Electronic CMMS compatible maintenance data.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Manual:

1. Provide an Operating and Maintenance Manual for the equipment specified herein, specifically prepared for this installation and including all required drawings, equipment and materials information, descriptions, complete bill of materials, etc., as required to instruct operating and maintenance personnel unfamiliar with such equipment.

B. Project Record Documents:

1. Submit Project Record Documents recording actual locations and final orientation of all equipment and accessories.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Draft O&M Manuals are required with the shop drawing submittals.

B. Furnish the following spare parts, where applicable:

1. Two complete rake assemblies.
2. Two lower bearing assemblies, if required.
3. Two upper head shaft bearings.
4. Two wipers for scrapers.
5. One proximity switch.
6. Two of each size and type of fuse used in the control panel.
7. Two of each type of indicator light used in each control panel.
8. Two of each type of relay used in each control panels.
9. Two of each type of I/O card used for the PLC in the control panels.
10. One spare PLC power supply used for the PLC in the control panels.

C. Spare and replacement parts and price list and their available locations. Pricing to remain in effect for a period not less than one year after startup and final acceptance

1.8 QUALITY ASSURANCE

A. Furnish Multi-Rake Bar Screen systems/equipment, appurtenances, and controls from a single manufacturer regularly engaged in the manufacturer of this type of equipment for wastewater treatment.

B. Equipment specified in this Section is to be furnished by a manufacturer of Multi-Rake Bar Screens who has sole responsibility for designing and furnishing the parts and components required for a complete and operable system. Factory assemble the Bar Screen and accessories as a single coordinated unit, where applicable.

C. All materials used shall be new, of high grade, and with properties best suited to the working environment. All materials covered by these specifications are intended to be standard equipment of proven reliability. The equipment furnished shall be designed and constructed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Drawings and operated per the manufacturer’s recommendations.

D. Bar screen manufacturer shall coordinate closely with contractor to ensure compatibility of physical interface of the multiple rake bar screen discharge and the screenings dumpster.

E. Headloss calculations shall be performed assuming a 30 percent blinding factor on the screen field.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience, and at a minimum of five installations in North America of equal or greater size, which have been operating for at least two years.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Storage: Store screens and all appurtenances according to manufacturer’s instructions.

C. Protection: Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

D. Provide additional protection according to manufacturer instructions.

1.11 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Document field measurements on Shop Drawings.

1.12 WARRANTY

A. Furnish 2-Year manufacturer's warranty for screens and components from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. No deflection, damage, or distortion by loads imposed by three foot water differential between upstream and downstream side of bar rack at any water depth in downstream channel.

B. Structural Supports and Fasteners: Located above maximum water level, except bar rack supports.

C. Design Requirements: Screen capable of continuous duty and suitable for installation under the following conditions:

1. Number of Units: 1.
2. Type: Multiple Rake Bar Screen
3. Bar Shape: Tapered, Rectangular, or Teardrop.
4. Bar Spacing: 3/4 - inch
5. Bar Dimensions: 3/8-inch x 1 1/2 - inch
6. Peak Flow: 3.75 MGD.
7. Average Dry Weather Flow (ADWF): 0.75 MGD.
8. Channel Width: 3 feet-6 inches.
9. Channel Depth: 10 feet
10. Discharge Height, EL: 685.75
11. Operating Deck, EL: 680.75
12. Channel Invert, EL: 670.75.
13. Maximum Top of Screen, EL: 691.00
14. Water Surface Upstream of Screen at Peak Flow, EL: 672.39 feet.
15. Water Surface Downstream of Screen at Peak Flow, EL: 672.05 feet.
16. Blinding Factor: 30 percent.
17. Angle of Inclination of Screen from Horizontal: 75 degrees.
18. Provide variable speed control with Rake Engagement Frequency at Normal Speed.
19. Minimum Rake Speed: 10-20 ft/min.
20. Minimum Number Rakes: 5
21. Screen Drive: Hp: 2 (maximum).
22. Voltage: 460 V, 3-phase, 60 Hz

2.2 MANUFACTURERS

A. Manufacturers:

1. Kusters Water
2. Huber.
3. Vulcan.

4. Headworks International
5. Engineer Approved Equal

2.3 EQUIPMENT

A. Description:

1. Channel-mounted bar screens cleaned by chain-driven rake heads, which mesh with bar rack and travel up rack, cleaning and collecting trapped material.
2. Configuration: Front flow, front-cleaning, provisions to prevent rake from sliding over accumulated material.
3. Replaceable Rake heads: Capable of carrying trapped material up and out of sewage channel, across a dead plate to discharge into a garbage can.
4. Frame: Integral and self-supporting.
5. Discharge Wiper: Pivoted, brushless, automatic, and self-positioning with return to rest. Replaceable material UHMWPE.
6. Foot Shaft Sprockets: Mounted on permanently lubricated idlers without external lubrication.
7. Enclosure: Full covers and enclosed discharge chutes.

B. General:

1. Screens:

    a. Material: AISI 304L stainless steel shapes (rods, angles, and channels), pipes, and sheets. Side frames and guides, bar rack, rake assembly, scarper assembly, shafting, discharge chute, fasteners (bolts & nuts, etc.) and anchor bolts shall be made of this material.

2. Manufactured either in a stainless steel only factory to prevent contamination of the stainless steel with ferric oxide dust, or in a factory that has measures in place to prevent contamination of stainless steel with ferric oxide dust. Submit measures utilized to prevent contamination. Stainless Steel Components and Structures: Cleaned, descaled, and passivated per ASTM A380-99.
3. Bar Screens: Provide with a dead plate extending from the bar rack to the discharge chute. Securely fasten dead plate to the side frames.
4. Screenings Transported to Top of Screen: Discharged positively by means of multiple rake heads to the discharge chute.

    a. Scraper Mechanisms: Fit with a compression spring, shaft mounted dampening collars, or shock absorbers allowing scrapers to return to resting position smoothly without shock.

5. A discharge chute shall be provided that fully encloses the discharge section of the screen to the point of screenings discharge. An access hatch with hinges and a handle shall be provided in the chute permitting easy access.

6. Support Frame:

    a. Supporting all required loads.
    b. Connect side frames to support frames which are securely anchored onto the operating floor.

7. Side Frames:

    a. Include separate roller tracks to guide the chains and rakes.
    b. Bolt roller tracks to frame so they can be easily replaced.

8. Drive Chains for Rakes:

    a. Roller type chains made of stainless steel. Drive chains, chain guides, sprockets and their bearings to be replaceable without removing screen from channel.
    b. Sprockets: 4 stainless steel sprockets per screen.

9. Mechanical Bar Screening Equipment:

    a. Assemble in manufacturer's shop ensuring proper fitting of parts.
    b. Pre-wire control panel.
    c. Test and match-marked for erection.
    d. Disassemble for shipment.

10. Neoprene Strips:

    a. Fastened to side frames to seal the lateral gaps between the side frames and the channel walls.

C. Bar Rack:

1. Rectangular, Tapered, or Teardrop shaped stainless steel bars.
2. Minimum upstream dimension: 3/8 - inches.
3. Minimum depth: 1 ½-inch with required clear spacing between the bars.

    a. Do not use round bars.
    b. Lower Ends of Bars: Minimum 4 mm thick curved base plate or curved parallel bars enabling rakes to positively remove screenings from the bottom of the bar rack.

4. Equally spaced, straight bars inclined from the horizontal at inclination angle specified and span the full width of the inside of the bar screen side frames.
5. Securely fastened to and supported by the screen frame, and readily removable.
6. Bars welded to framework are not acceptable.
7. Replacement screen bars to be available from screen manufacturer.
8. Fasten bars to a dead plate that extends to the point of discharge.
9. Bars to extend a minimum of 8-inches above the maximum water level.

D. Welding:

1. Per AWS D1.6 or AWS D1.1, as applicable.
2. All stainless steel components subject to welding to be low carbon grade.
3. Weld spatter: Use spatter-prevention paste at welded joints to prevent spatter.
4. Remove weld slag.
5. After welding operations, clean stainless steel components of organic contamination using a solvent that is free of chlorides.
6. Provide continuous seal welds between full penetration skip welds.
7. Field welding of stainless steel not permitted.

E. Frame Assembly:

1. Structurally self-supporting frame assembly unit.
2. Screen Framework: Cross-section 1/4 inches minimum thickness.

    a. Anchor support frames securely to the operating floor.

3. Side Frames:

    a. Thickness: 1/4 inches minimum, formed to a channel profile.
    b. Connect side frames to support frames.
    c. Shrouds: Around foot-shaft sprockets designed to prevent debris from interfering with proper meshing of chains and sprockets and prevent grit accumulation at chain and sprocket location.
    d. Lifting Lugs: Provide lifting lugs of size and at locations recommended by screen manufacturer.
    e. Chain Guides: Attached to frames to align rake teeth into screen bars and maintain engagement in the bar rack.

        1) Assist in deflecting flow and solids away from chain and lower sprockets minimizing materials catching on the sprockets and chain.

4. Bottom Frame: 1/4 inches minimum thickness.
5. Support Beams: U-profile, 1/4inches minimum thickness on the front above the maximum water line.
6. Wrap Around Stiffeners: 1/4 inches thickness formed to a channel profile and placed along the screen frame above the maximum water line for rigidity, if required.
7. No braces, gussets or stiffeners inside the screen frame below the maximum water line.
8. Supporting Framework for the Bar Screens: Design conforming with requirements of the AISC Standards for Design, Fabrication and Erection of Structural Steel for Buildings.

    a. Base support loads on a completely loaded screen plus dead weight of equipment.
    b. Shop connections may be welded, riveted, or bolted.
    c. Self-supporting and designed to a minimum of twice the natural frequency of the bar screen unit under all loading conditions.
    d. Design and constructed so screen is independently supported, allowing the bar screen to be installed and disassembled without disturbing ancillary screening equipment.
    e. Structural Members and Connections: Designed to not exceed AISC allowable stresses by more than 1/3 when subject to loading of twice the running torque of the drive motor.
    f. Supports: Installed using welded constructions with bolted connections to bar screen casings, feet and support points.
    g. Field Connections: Bolted using reamed, sub-punched holes and finished bolts.
    h. Supporting Members: Attach to concrete by stainless steel anchor bolts.

        1) Use a minimum of two bolts per supporting member.
        2) Attach to structural steel elements using stainless steel hex bolts with flat washers and lock washers; a minimum of two bolts at each connection point.

F. Screens:

1. Of a design utilizing structural side frames to which are bolted the bar rack and dead plate resulting in a structurally self-supporting unit. Designs in which side frames or chain guides are supported from the channel walls shall not be acceptable.

2. Side Wall Seal Plates: 5/32 inches minimum thick neoprene strips furnished with screen closing the area between the side frames and channel walls. Extend from channel invert to 6 inches above maximum water surface in the screen channel.
3. Screen Covers: Easily removable without tools, sufficiently stiffened. enclosing entire screen above screen channel. Constructed of either clear impact-resistant Polycarbonate material (thickness of 6 mm), or of stainless steel (thickness of 1.5 mm) with edges on all sides

    a. Provide with handles and quarter turn clamp fasteners allowing for easy installation and removal.

G. Rakes:

1. Mount between 2 strands of chain running over two sets of sprocket wheels.
2. Stainless steel, with raking tines of suitable shape to effectively clean the front and sides of the bars.
3. Run in guides on both sides to ensure engagement.
4. Rake bars:

    a. Channel Profile: 1/4 inch thick.
    b. Cross Section: 105 mm x 60 mm.

5. Rake Blades: Bolted to the rake bars. Consists of several pieces with raking tines such that only one portion of the rake blades needs to be replaced in case a tine is damaged.

    a. Blade Thickness, minimum: 8mm
    b. Blade Depth: 170 -mm.

6. Raking Tines: Attached to rake blades.

    a. Match and engage the bars of the bar rack.
    b. Of suitable shape to effectively clean the front and sides of the bars.
    c. Tooth Profile: Precision cut from a single continuous bar of thickness and depth specified to insure adequate stiffness and strength.

7. Rake Pivoting Wiper Mechanism: At point of discharge. Manufactured of stainless steel.

    a. Wiper Blade: Replaceable ultra-high molecular weight (UHMW) polyethylene; 3/8- inch minimum thickness.
    b. No moving parts to extend beyond the framework or the discharge chute.
    c. Mechanism and wiper arms to be fully contained inside framework of bar screen.
    d. During cycles, blades contact the rake heads on the inner surface during upward travel and scrape debris off the end of the rake head and through the discharge chute.
    e. Rake to have design features that reposition the wiper mechanism and allow the rake assembly to operate in reverse, through the wiper mechanism, without the need to manually lift the wiper assembly.
    f. Grease Fittings for Wiper Arms: Extend and secure to side frames where they can be easily accessed by plant personnel or use self-lubricating plastic wiper bearings.
    g. Shock Absorbers: To cushion release of the wiper.

8. Rake and Chain Assembly, and Sprockets: Consist of multiple rakes attached to roller links of the roller chain.

a. Roller Type Chain: Engage onto adjustable upper sprockets and fixed lower sprockets (if used) on each side of the screen.

1) Material: Stainless steel of high tensile strength and resistance to corrosion.
2) Average Ultimate Strength of Chain: 19,800 lbs/f (minimum).
3) Chain Pins: Stainless steel and hardened.
4) Chain Rollers: Either stainless steel or polyamide. Minimum diameter of 48 mm and be a minimum of 25 mm wide.

b. Upper and Lower Sprockets: Solid stainless-steel hub and sprocket teeth. 25 mm minimum thickness (tooth width). Pitch and width to match roller chain.

1) Upper Sprockets: Key mounted onto drive shafts and may utilize a split design.

c. Chain Guide: Stainless steel. Chain guides to securely fixed to screen side frames for full height of travel.

1) Bolted to side frames so they can be easily replaced.
2) Do not protrude guides into the flow.
3) Assure proper meshing between rake tines and bar rack, and proper clearance between the rake tines and the dead plate.
4) Replaceable wear strips on chain guides located below the water level are not allowed.

H. Shafting and Bearings:

1. Drive Shaft: Solid stainless steel, fitted with a shear pin device with bronze bushing, with auto reverse feature, to provide full protection of the drive unit.

a. Keyways with fitted keys to be provided where necessary.
b. Shaft to be equipped with an adjustable screw type take-up providing for a minimum of 100 mm adjustment of the screen chains.
c. Take Up Screw: 18-8 stainless steel.
d. Lower sprockets to rotate on a stainless steel stub shaft attached to the frame.
e. Lower sprockets and bearing must be replaceable without removing the screen from the channel.

2. Upper bearings:

a. Flange bearings with grease nipples for easy lubrication.
b. Designed for use with biodegradable grease.
c. Sealed self-lubricating upper bearings may be utilized.

1) Self-lubricating bearings must meet the same criteria as that for lower bearings, described below.

3. Lower bearings:
a. Type: Shall meet one of the following criteria:
1) Lower bearings shall be of proven self-lubricating PE (Polyethylene) material and be maintenance-free. Provide either a ceramic collar that shall be bonded on-to the lower stub shaft or a stainless steel stub shaft with an RC-50 high strength steel sleeve.

2) Lower bearings shall be slide bearings in a stainless steel casing. The bearings shall include white cast iron shafts and silica carbide slide bushings with a length of 50 mm and an internal diameter of 59 mm.

b. No lower bearing requiring lubrication will be allowed.

I. Dead Plate:

1. Stainless steel. 1/4 inch thick minimum.
2. Flat without undulation so that rake tines will ride no closer than 1/16 inch and no further than 1/4 inch from the dead plate.
3. Securely fastened to side frames of screen and extend from the top of the bar rack to the point of discharge. Provide a lip at the discharge point of the dead plate.
4. The lower portion of the bar rack may be curved to optimize the bar rack flow area. The curve of the bars must match the path of screen rakes such that the rakes positively remove all captured screenings.

J. Discharge Chute and Enclosure: Fully enclosed discharge section of screen to the point of screenings discharge.

1. Stainless steel. 4 mm thick minimum.
2. Guides debris from the lip at top of the dead plate to the discharge point.
3. Minimum angle of 60 degrees from horizontal and direct screenings into the receiving devices as shown on the Drawings.
4. Flanged Rubber Discharge Chute Guide: 1/4 inch thick.to direct raw screenings to receiving devices.
5. Access Door: With handle, to facilitate wiper replacement. Cover full width of the screen.

K. Drive Unit Assemblies: Complete with adjustable mounting frame, motor, and gear reducer.

1. Designed for continuous service and intermittent spray water contact, if required.
2. Mounted on an adjustable drive chain take-up base at the top of the screen.
3. Assembled by manufacturer and shipped as complete assembly ensuring proper assembly of all components.
4. Motors: Explosion proof, and inverter duty rated as specified in Section 400593.23 “Low-Voltage Motor Requirements for Process Equipment”.

    a. Motor: 2 hp (maximum)
    b. 460 Volts, 60 Hz, and 3 phase
    c. 1.0 service factor, rated for continuous duty
    d. Controlled by a VFD, rated for continuous operation.
    e. Rated for operation in a 110 degree F environment,
    f. Conform to NEMA standards.
    g. Sized to start when screen is fully blinded and continuously operate under normal operating conditions without overloading.
    h. Drive unit, including the reduction gearbox, shall be directly shaft-mounted and shall be positioned to facilitate maintenance work.
    i. Winding Temperature Protection: Bi-metallic winding temperature switches.
    j. Space heaters.

5. Gear Reducers: Fully housed, totally enclosed, running in oil, with anti-friction bearings throughout.

    a. Ball or roller bearings throughout with all moving parts immersed in oil.

1) Maximum Oil Temperature: 200 degrees F.

b. Periodic disassembly of unit and manual re-greasing of bearings is not acceptable.
c. Nominal Input Power Rating: At least equal to nominal horsepower of drive motor.
d. Designed and manufactured per applicable AGMA or equivalent standards.

6. Drive Shaft: Include an integral rocker arm or torque arm assembly on the drive end that flexes if the screen rakes get jammed and triggers the jamming protection features. In lieu of torque arm, a motor current monitor within the VFD may be used.
7. Anchorage: Manufacturer to perform the anchor and mounting bolt design calculations and provide them in the submittal.

a. Anchor Bolts: approved by the Manufacturer.

1) Type 316 stainless steel unless otherwise specified.
2) Minimum 5/8-inch diameter.
3) Ample size and strength for purpose intended and as shown on the Drawings.

2.4 MANUAL BAR RACK

A. Design Requirements:

1. Number of Units: 1.
2. Type: Manual
3. Bar Spacing: 1 inch.
4. Bar Dimensions: 1/4 x 2-1/2 inch
5. Screen Incline from Horizontal: 63 degrees
6. Drainage Platform Dimensions: 2 x 3.5 ft
7. Drainage Platform Perforation Size: ½ inch
8. Peak Flow: 3.75 MGD.
9. Average Dry Weather Flow (ADWF): 0.75 MGD.
10. Channel Width: 3 feet-6 inches.
11. Channel Depth: 10 feet
12. Discharge Height, EL: 685.75
13. Operating Deck, EL: 680.75
14. Channel Invert, EL: 670.75.
15. Maximum Top of Screen, EL: 691.00

B. General:

1. Mount:

a. 1/4” x 2” x 2” 304 SST angle on each side to mount to concrete channel walls
b. 1/2" x 3” SST epoxy capsule anchors spaced at 6” centers to attach to concrete wall

2. Shop fabricated and assembled to be set in place and field erected by the Contractor with minimal field assembly.
3. Rake:

a. Type 304L stainless teel
b. Head: 18-inches wide

c. Prongs: 1-1/4 inch centers
d. Handle: Aluminum 12-ft in length
e. Manufactured for the specific service of removing trash from the bar rack.

4. Drainage Platform:

a. Material: 304L stainless steel
b. Thickness: 3/8- inch
c. Drain Perforation Diameter: 3/8- inch
d. Mount:

1) 1/4" x 2” x 2” 304 SST angle along each side to mount to concrete channel walls
2) 1/2" x 3” SST epoxy capsule anchors spaced at 6” centers to attach to concrete wall

2.5 CONTROLS

A. General:

1. Coordinate the requirements of this Section with those included in Section 406196 “Process Control Descriptions” for complete operations control capability of the Multi-rake Bar Screen**.**
2. Include software licensing for PLC and HMI separate from Plant SCADA.
3. Coordinate all mechanical, electrical and controls interfacing between the screen and its associated systems to form a complete, single operating system.
4. Master Control Panel is located in E-House II.
5. Panel Construction: Conform to Section 406717 “Industrial Enclosures” and Section 262505 “480V Control Panels”.

B. Local Control Station:

1. Tag Numbers:

a. LCS-2000-1.

2. Location: Adjacent to equipment as shown.
3. One NEMA 7 rated proximity switch for monitoring of the rocker arm position, if applicable.
4. One NEMA 7 rate proximity switch to allow parking of the rake heads following a completion of a cleaning cycle, if applicable.
5. One NEMA 7 rated Class 1, Division 1 approved cast aluminum local control station, installed near the screen. The local control station must have 3 holes for the following devices:

a. Push-to-Stop/ Pull-to Run emergency stop maintained push button with lockout
b. HAND/OFF/AUTO selector switch
c. FORWARD/OFF/REVERSE selector switch. Switch shall spring return from REVERSE to OFF.

6. Factory assembled with wiring conforming to Section 406733 “Panel Wiring”.

7. Mounting: Free standing or on handrail.
8. Conduit Entry: As shown on drawings.
9. Power Supply: 120-Volt, 1 Phase, 60 Hz, from Control Panel.

C. Control Panels

1. Furnish one control panel for the multiple rake bar screen. All controls shall be manufactured by a UL listed control panel facility and shall bear a UL label. The control system shall be provided by the screen manufacturer.
2. The control panel (MCP-2000-1) shall be located in the E-House II as shown on The Drawings. NEMA 1 suitable rating for indoor conditions.
3. Mounting: Free standing.
4. Main circuit breaker with flange mounted operating handle.
5. Power Supply: 480-Volt, 3 Phase, 60 Hz.
6. Bar screen manufacturer shall provide continuous monitoring of the upstream and downstream water levels for control of screen operation. Contractor shall install the transducers and provide wiring to the control panel.
7. Construction of the control panel shall be stainless steel with indicating devices, switches, and operator interface terminal (OIT) mounted on the front door. Legend plates for each indicating device and switch shall be provided.
8. The control panel wiring shall contain all power and control devices shown on the drawings (wiring diagrams). Each control panel shall include, but not be limited to, the following:

    a. One control power ON-OFF selector switch.
    b. One white pilot light for screen control power.
    c. One momentary "Reset" push-button for screen over current reset.
    d. Spare contacts for remote indication of "Screen Over Current" situation and "Screen Run" status.
    e. One adjustable, digital, repeat cycle timer to automatically initiate operation of the bar screen.
    f. Control relays, wiring and circuitry required to implement the control logic.
    g. One variable frequency drive unit
    h. One main circuit breaker
    i. One ultrasonic differential level controller.
    j. One elapsed run time meter
    k. One control power transformer, single phase, 480 to 120VAC with branch circuit fuses.
    q. One surge protective device (SPD), 120VAC single phase.
    r. One programmable logic controller (PLC). Refer to Section 406343.
    s. One operator interface terminal (OIT), which shall include the following:

        1) Elapsed run time meter displayed at the OIT.
        2) Failures indicated by text messages which get displayed at the OIT.
        3) Screen run indication (red for running)
        4) Screen overcurrent indication (amber indication)
        5) Upstream water level
        6) Downstream water level
        7) Water level differential
        8) Adjustable, digital timers for run time of the screen and time between screen operation.

t. One Fiber optic patch panel to provide Ethernet communication back to the plant SCADA.

9. All selector switches, pushbuttons and pilot lights shall be NEMA rated components. IEC rated components are not acceptable.
10. Each control panel shall utilize a VFD to control the screen motor. The VFD shall be sized as required for the screen motor horsepower and suitable for use with variable torque loads. VFD shall have solid state overload integral. VFD shall include discrete and analog input and outputs as required by control panel manufacturer. No bypass starters will be required.
11. The VFD shall be controlled by the control panel PLC. The PLC shall be used to control the VFD to operate the screen at two speeds, through the automatic reversing/cleaning shuttle sequence, and control the operation of the upstream screen isolation gate. The PLC shall include discrete and analog inputs and outputs as required.
12. The control panel shall have an operator interface terminal (OIT) to allow push button adjustment of counter values, timers and level set points without connecting to the PLC, as discussed in Section 406263.The OIT shall be rated NEMA 4X, display alarm messages, and provide fault and troubleshooting information. The OIT shall be a color thin film transistor (TFT) touchscreen.

D. Sequence of Operation:

1. Auto Control:

a. When the Local/Off/Remote switch at the LCP is in REMOTE, the Screen to be controlled from the Control Panel.
b. Manual: The operator can start and stop screen running from the OIU.
c. Auto: Screen runs based on level differential between upstream and downstream of screen.

1) Level sensors provide screen upstream and screen downstream levels to a level transmitter.
2) Level transmitter calculates difference in level and sends signal to the Control Panel.
3) Screen will run when the differential level increases above the setpoint and remains above the start level setpoint for the time set in the level start delay timer or when the screen has not run for the time set in the screen off timer. Once screen is running, it will run for a preset time period, then rest for the time set in the screen timer. If the start condition is still present after completing the preset running time, the screen will continue running until the start condition is removed.

2. If the screen rakes experience a jam, the force will cause the rocker arm or torque arm assembly (if applicable) described above to rotate around the drive shaft. This motion shall be limited by a rocker guide. When the rocker arm rotates out of the normal operating position a proximity sensor will send a signal to the PLC causing the motor to enter a self clearing mode. An alternative jam sensor may be provided using the current monitor in the VFD. The self clearing mode with attempt to reverse the direction of travel of the rakes for a set period before resuming forward operation. This cycle will be attempted up to three times; if the self clearing mode should prove unsuccessful then the system shall initiate an alarm signal ("Screen Over Current").
3. Reset is manually performed after correction of any cause for a trip-out

4. In HAND position at the local control station, the operator shall be able to run the rake assembly selecting the respective FORWARD or REVERSE direction from the FORWARD-OFF-REVERSE selector switch.

E. Instruments:
1. The screen manufacturer shall provide two ultra-sonic level elements and one indicating transmitter for both level elements. One level element will be mounted in a channel area upstream of the screen, while the second level element will be mounted in a channel area downstream of the screen. The level elements will be mounted at the location shown on the drawings, and will transmit the water levels to the screen control panel. The level elements and indicating transmitter shall be UL rated for operation in a Class 1, Division 2 environment and shall be intrinsically safe without the use of additional barriers. Level elements and indicating transmitter shall meet the requirements specified in Section 407231 “Ultrasonic Level Meters”. Each level element shall send a 4-20 mA signal to the control panel.
2. The level elements will be utilized to determine the water surface differential across the screen. The Programmable Logic Controller (PLC) in each control panel will calculate and display the water surface differential and use the signal for operation of the multiple rake bar screen. In addition, the water surface levels will be displayed at the control panel.

2.6 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

1. Develop a test plan to be approved by the Owner.

B. Owner Inspection: Make completed equipment available for inspection at manufacturer's factory prior to packaging for shipment.

1. Notify Owner at least 15 days before inspection is allowed.

C. Certificate of Compliance: If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

1. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify layout, orientation, and connections.

3.2 INSTALLATION

A. According to manufacturer instructions.

1. Provide unobstructed path for rack cleaning mechanism when installing side frames.

2. The screen will be installed in accordance with the manufacturer's instructions and the drawings and specifications. All conduit and interconnecting wiring between the control panel, local control station, level elements and level element indicating transmitters will be supplied and installed by the Contractor.

3.3 FIELD QUALITY CONTROL

A. Manufacturer Services:

1. Furnish services of manufacturer's representative experienced in installation of products furnished under this Section on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.
2. Provide the services of a factory certified service engineer specifically trained in the installation, start-up, testing, operation, and maintenance of the installed system as herein specified.
3. A direct, full-time employee of the Manufacturer or local representative certified by the Manufacturer in installation and startup of the equipment. Services include:

    a. Providing instruction to the Owner’s personnel in the proper operation and maintenance of the equipment in this section.
    b. Advise, consult, and instruct on installation procedures and adjustments and inspect the equipment during installation as a condition of acceptance of the work.
    c. Assist during installation for adjusting and checking.
    d. Verify the location of anchor bolts, placement, leveling, alignment, field erection of equipment, as well as control panel operation and electrical connections.
    e. Present during all start-up and testing operations to make final adjustments as a condition of acceptance of the work.
    f. Do not energize or “bump” to check the electrical connection for motor rotation without the service technician present.

B. Training Requirements:

1. Provide operational and maintenance instruction of Owner’s personnel.

    a. Training to be given at times convenient to operations and maintenance teams being trained considering 12 hour operational shifts and duties while on shift.
    b. Some operational training may have to be conducted during hours outside a normal Monday through Friday, 8:00 am to 5:00 pm, workday.
    c. Training dates and times must be requested in writing to the Owner.
    d. Operational training includes the following, at a minimum:

        1) Theory of operation.
        2) Process flow description.
        3) Unit capacity and design criteria.
        4) Operational troubleshooting and diagnostics procedures.
        5) Step-by-step start-up and shut-down procedures.
        6) System operation and optimization practices.
        7) Control set-point modification procedures.

    e. Owner’s training to include maintenance instructions to one maintenance team on two occasions to accommodate personnel who is unable to attend the first training session.

1) Conduct maintenance training during the hours of 8:00 am to 5:00 pm, Monday through Friday, with the exact schedule being determined in light of ongoing maintenance team duties.
2) Maintenance training to include the following, at a minimum:

a) Step-by step, "hands-on" assembly and disassembly procedural instructions.
b) Replacement part identification and ordering procedures.
c) Lubrication procedures, including drain-down and refill procedures.
d) Recommended routine maintenance procedures.
e) Troubleshooting and diagnostic procedures.

2. Man-day requirements tabulated below are exclusive of travel time. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, provide additional service.

TABLE OF MANUFACTURER'S REPRESENTATIVES' DUTIES

Services Provided by Factory Representative	Minimum No. of Trips (1)	Minimum Time (1) On-Site Per Trip (8 hr. working days)
1. Supervise Installation	1	2 days
2. Inspect and Approve Installation (2)	1	1 day
3. Supervise Initial Adjustment (3)	1	1 day
4. Supervise and Assist in Testing (4)	1	3 days
5. Instruct Owner and Engineer in proper start-up and O&M (5)	1	3 days

(1) Manufacturer's factory representative: Present at frequent enough intervals to ensure proper installation, testing and initial operation of the equipment.
(2) Manufacturer's factory representative: Provide to the Engineer a written certification that the system has been installed in accordance with the manufacturer's recommendations.
(3) May be done upon completion of Item 2 if acceptable to the Engineer.
(4) May be done upon completion of Items 2 and 3 if acceptable to the Engineer.
(5) Instruction may be given upon completion of Item 4, provided that the test is successful and the O&M manuals have been submitted to and accepted by the Engineer.

3. Equipment Acceptance: Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.

a. Make final adjustments to equipment under direction of manufacturer's representative.
b. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.4 ADJUSTING

A. Adjust control functions as required.

3.5 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 462113

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SECTION 462323 –STACKED TRAY VORTEX GRIT SEPARATOR EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Stacked Vortex Tray Grit Unit (HeadCell®):

1. Capable of separating, collecting, and removing grit from screened raw wastewater. Settled solids/grit slurry will be collected at the bottom of the unit and removed by pumping. Dewatered gritted wastewater will overflow from the grit basin by the weir. The grit concentrator equipment, Section 462363, is to operate on a continuous basis while receiving varying flows.

B. The stacked vortex tray grit unit includes:

1. Stacked vortex tray grit removal unit.
2. Inlet flow distribution header.
3. Grit slurry underflow collector.
4. Grit scouring and fluidizer system.

C. Equipment to be furnished by one manufacturer.

1. Components need not to be manufactured by the same manufacturer.
2. Manufacturer assumes sole responsibility for all parts and equipment.

D. Related Requirements:

1. Section 055000 “Metal Fabrications” for fasteners, brackets, and other miscellaneous metal fabrications as required by this Section.
2. Section 432335 “Recessed Impeller Pumps”.
3. Section 462363 “Grit Classifying and Washing Equipment”.
4. Section 400562 “Plug Valves”.
5. Section 406196 “Process Control Descriptions”.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's product data for system materials and component equipment.

B. Shop Drawings:

1. System materials and component equipment.

2. Certified shop and erection drawings showing all important details of construction, dimensions, installation and anchoring requirements, fasteners, and other details.
3. Total weight of equipment including the weight of the single largest item.
4. Supporting calculations indicating conformance with maximum hydraulic loss requirements.
5. A complete bill of materials of all the equipment.
6. Performance Testing protocol.

1.4 INFORMATIONAL SUBMITTALS

A. Descriptive literature, bulletins, and/or catalogs of the equipment.

B. Manufacturer's Certificate: Submit certificate notarized by stacked tray grit separator equipment manufacturer indicating the following:

1. Installation Certificate.

C. Manufacturer's Instructions: Detailed instructions on installation requirements, including storage and handling procedures.

D. Testing and Reports:

1. Functional demonstration testing procedures.
2. Summary report of successful functional demonstration test.

E. Field Quality-Control Submittals: Results of Contractor-furnished tests and inspections.

F. Qualifications Statement: Qualifications for manufacturer.

1.5 QUALITY ASSURANCE

A. Furnish stacked vortex tray grit units, all appurtenances and controls from a single manufacturer regularly engaged in the manufacturer of this type of equipment for wastewater treatment.

B. Equipment furnished under this Section shall be furnished by a manufacturer of stacked vortex tray grit units who has sole responsibility for designing and furnishing the parts and components required for a complete and operable system. Factor assemble the units and accessories as a single coordinated unit.

C. Stacked tray vortex grit separator system supplier shall demonstrate experience in design and production of grit removal systems. Materials, method of construction, controls, etc. must be approved by Engineer, and supported by full-scale plants operating for a minimum of 5-years on waste streams where the desired objective is to remove grit from screened raw wastewater.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in design and manufacturing of products specified in this Section with minimum five years' documented experience with a minimum of 20 successful separate installations meeting desired performance requirements specified in this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, and Receiving:

1. Do not ship stacked vortex tray grit unit from manufacturer to project site until all aspects of required concrete construction and water tightness testing has been completed.
2. Ship equipment, material, and spare parts complete except where martial disassembly is required by transportation regulations, for protection of components, or for installation.
3. Have machinery on-site available at time of delivery permitting proper unloading and hoisting of equipment.
4. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which they are intended.

B. Storage and Protection:

1. Store and temporarily support equipment prior to installation in strict accordance with manufacturer’s recommendation and instructions.
2. Keep records of storage parameters and dates that storage procedures were performed.
3. Be responsible for work, equipment, and materials until they are inspected, tested, and accepted.
4. Protect the equipment from being contaminated by dust, dirt, vibration, and moisture.

1.8 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

1.9 WARRANTY

A. Manufacturer's Warranty: Submit written warranty against defects in material and workmanship for stacked tray vortex grit separator equipment and accessories.

1. Warranty Period: 2-Years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Subject to compliance with requirements, provide products by one of the manufacturers listed in the following paragraph.

B. Manufacturers List:

1. Hydro International; Headcell® Grit Concentrator Unit.

C. Substitutions: Not permitted.

2.2 SYSTEM DESCRIPTION

A. Stacked Vortex Tray Grit Units:

1. Placed in existing concrete grit basin to receive the incoming screened flow.
2. Provide sufficient surface area to remove the specified grit particles from the specified peak flow and concentrate the grit in a sump at the bottom of the unit.
3. Discharge de-gritted effluent over weirs as shown on drawings.
4. Flow shall transition from the inlet channel to the trays via an inlet duct positioned above the trays. Each tray shall be connected to the inlet duct by a horizontal nozzle with a rectangular cross section and large clear openings.
5. Unit shall be characterized by a controlled boundary layer flow to enhance settleable solids concentration and removal.
6. Unit shall be all-hydraulic consisting of self-cleaning corrosion resistant, nonmetallic trays with no moving parts within the unit.
7. Flow passages shall be self-cleaning and free of sharp projections or fittings that may snag stringy or fibrous materials.
8. Water shall be intermittently supplied to the solids underflow sump.
9. Grit Suction Pipe: An integral part of the collection system, running from the grit underflow collector into grit pump to be provided by the Contractor.
10. Suction end at least 5 inches from chamber floor to prevent chance of blockage.

B. Includes nameplates providing:

1. Manufacturer name.
2. Model number.
3. Serial number.
4. All other pertinent data.
5. Nameplate will be mounted outside headcell tank.

C. Contractor Shop Drawings: Drawings have been prepared based on the grit collection equipment manufactured by Hydro International.

2.3 PERFORMANCE AND DESIGN CRITERIA

A. Performance Criteria:

1. Removal Efficiencies:

a. Peak Hydraulic Flow: 95 percent removal of all grit (Specific Gravity 2.65) greater than or equal to 105 microns.
b. Removal efficiency will be calculated as follows:

$$Performanœ\ Value\,(\%) = 1 - \left(\frac{G_{DW}\ (lbs)}{G_{UP}\ (lbs)} \right)$$

G_{DW} – Weight of grit captured at specified mesh size sampled downstream of vortex grit unit.
G_{UP} – Weight of grit captured at specified mesh size sampled upstream of vortex grit unit.

2. Headloss:

    a. Peak Hydraulic Flow: 12 inches or less.
    b. Average Treatment Flow: 1 inch or less

B. Design Criteria:

1. Service: Screened Influent (INF).
2. Gravity fed.
3. Flow Conditions:

    a. Peak Hydraulic Flow per Unit: 7.5 MGD.
    b. Average Treatment Flow per Unit: 1.86 MGD.

4. Number of Units: 1.
5. Size: 9 foot diameter.
6. Number of Trays per Unit: 7.
7. Surface Area per Unit: 445 ft^2.
8. Loading Rate at Peak Treatment Flow: 11.7 gpm/ft^2.
9. Inlet Duct Opening: As Shown.
10. Discharge: Two Weirs:

    a. Flow Diversion to Plug Flow = 8 feet-1 inch length.
    b. Flow Diversion to Step Feed = 2 feet-8 inch length.

11. Underflow Connection: 4 inches.
12. NPW Connection: 1-1/2 inch plant service water.
13. Water Supply System Capacity: intermittent 32 gpm at 50 psig.

2.4 FABRICATION – GENERAL

A. Design, fabricate, and assemble equipment in accordance with recognized and acceptable engineering and shop practice. Manufacture individual parts to standard sizes and thicknesses so repair parts can be field installed. Make like parts of duplicate units interchangeable. Equipment shall not have been in service prior to delivery.

B. Materials of Construction: Provide the following materials.

1. Support Structure/Inlet Flume/Fluidizing Ring: Type 316L stainless steel.
2. Trays: Low density polyethylene (LPDE).
3. Bolts, Nuts, Washers, Fasteners and Anchor Bolts: Type 316 stainless steel.
4. Latches, Hinges, and Metal Accessories: Type 316 stainless steel.

C. All stainless steel used for the fabrication of the equipment shall conform to the following standards:

1. Plate and Sheet: ASTM A 167, ASTM A 240.
2. Bar: ASTM A 276, ASTM A 479.
3. Tube: ASTM A 312.

D. Exterior Surface Finishes:

1. Be free of sharp edges, weld spatter, and residue with welds ground smooth.
2. Acid wash stainless-steel surfaces.

2.5 COMPONENTS

A. Inlet Flume: Constructed of Minimum 14 gauge formed stainless-steel sheet with minimum 3-inch clear openings.

B. Trays:

1. Shall be molded thermoplastic with a minimum 1/4-inch thick LDPE on pans and sidewalls.
2. Stack of trays shall securely fit into a stainless-steel support frame. Support frame shall fit and secure to bottom of concrete support structure.

C. Grit Fluidizing Ring:

1. Provide for fluidizing of settled solids prior to pumping out of the unit via Grit Pumps.
2. Install in concrete tank with incorporated threaded fluidizing pipe connections.

D. Grit Fluidizing System:

1. Grit Fluidizing Pipe:

a. Deliver water to agitate grit settled in sump section prior to pumping.
b. Run parallel with grit pump suction pipe from underflow grit collector section to pump room and connect to water supply system.

2. Valves:

a. One isolation ball valve, one motor operated ball valve, and one globe valve, as shown.
b. Motor operated valve operation and the fluidizing cycle to be controlled through the grit pump starter.
c. Motor operated valve to operate using 120 VAC 50/60 Hz.
d. Motor operated and manual isolation valves to be ball valves per Section 220523.12 and capable of regulating the water flow rate.
e. Solenoid valve will not be accepted in lieu of the motorized ball valve.

3. Flow Meter:

a. One 10 - 50 gpm acrylic flow meter.

2.6 SOURCE QUALITY CONTROL

A. Submit full scale field test data, from a similar size unit, no less than 40 percent of the maximum rated capacity of the unit provided:

1. These test results demonstrate compliance with the performance requirements stated
2. Test data to include:

a. Location of the equipment,
b. Date of actual test and name,
c. Address and telephone number of the contact familiar with the actual test and complete test procedure.
d. The accuracy certified by a third party independent from the manufacturer.

PART 3 -

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install stacked tray grit removal equipment according to manufacturer instructions.

B. Attach inlet flume to concrete in accordance with the following:

1. Anchor Assembly: Hilti 316SS 3/8” x 5 1/8”

a. HAS Anchor Rods for use with HIT HY 200 Anchor System for the frames and fluidizing ring
b. Hilti 3/8” HDI 3/8 SS Drop in anchors for fastening the inlet duct to channel.

2. Epoxy System: Hilti – RE-500-V3.
3. Size and Installation Requirements: Per equipment manufacturer.

3.2 FIELD QUALITY CONTROL

A. Criteria listed in this Section is subject to change based on actual flow conditions that are available at time the test is scheduled to be conducted. Owner/Engineer reserves right to reduce these requirements as necessary to accommodate the actual available conditions for testing.

B. Grit Performance Tests shall be done in the field (in-situ). Specified performance shall be met before the equipment is accepted and considered substantially complete. All costs associated with these field tests shall be paid by Manufacturer.

C. The following conditions to be met before running the tests via visual inspection:

1. Inspection of the influent channel to verify the channel has no accumulations of grit that can re-suspend during the test and alter the results.
2. Inspection of the effluent weir prior to placement of the VIS to confirm there is no accumulation of grit that can re-suspend during the test and alter the results.
3. Complete cleanout and inspection of the equipment being tested to verify there are no areas of accumulated grit that can alter the test results.

D. Performance shall include, but not be limited to, conformance to the operating parameters defined in this Specification. Manufacturer shall be allowed a minimum of 30 days to demonstrate compliance with all operating parameters and to make modifications. Additional time may be allowed if all parties agree.

E. Conduct performance test in the field (in-situ) as required for Substantial Completion.

1. Furnish performance testing by an independent third-party testing agency by Engineer or Owner-approved and selected equal.
2. Schedule grit performance testing for grit collector in coordination with grit performance testing for grit washer. Grit collector testing to happen the day prior to the grit washer testing.

F. Complete one grit performance test under approximately steady-state conditions. Performance of the grit removal system will be based on the Performance and Design Criteria.

G. One test will be conducted with plant influent – 8 hours total. Monitor and record flow throughout test period. Coordinate with Owner to monitor and record flow throughout test period.

H. Test Equipment:

1. One Grit Unit.
2. Sampling ports, samplers, and sampling barrels sized to capture a particle of less than a 50 micron with a specific gravity of 2.6 (3.2 gpm/ft^2 loading rate). Provide sampling barrels, necessary hoses, splitters, and connections to install the sampling equipment for test duration.

I. Samples will be taken at the following points:

1. Grit Unit influent chute (isokinetic flow sampling):

   a. One sample per hour.

2. Grit Unit effluent (isokinetic flow sampling):

   a. One sample per hour.

J. Composite sampling of the grit collector influent and effluent will be done with an isokinetic vertically-integrated sampler or a weir sampler as necessary whichever one is suitable, to capture a representative distribution of the grit being carried by the flow. If deemed necessary, effluent sampling may be done using a “T” shaped slotted sampler installed horizontally on top of the effluent weir.

K. Performance will be evaluated using native and seeded grit. A minimum influent grit concentration of 300 mg/L is required. When there is insufficient native grit, seeded material shall be Granusil 5010. Seed sand shall be wetted prior to introduction into the flow and shall be fed at a concentration based on the native grit.

L. Feed influent and effluent samples tangentially and continuously into separate settling barrels with an overflow of no more than 3.2 gpm per square foot of surface area. This ensures capture of all 50 micron and larger, 2.65 S.G. grit particles in the samples. At the end of the test interval, apply a quiescent settling period of 2.3 minutes per foot of barrel depth before decanting water from barrel to obtain settled solids.

M. Each settled solids sample will be composited for laboratory testing and evaluated according to Standard Method procedures. Samples shall be evaluated at an independent test facility approved by Owner/Engineer.

N. The two settled solids samples (from the influent and effluent) will be analyzed to determine Total Solids (TS), Volatile Solids (VS) and Fixed Solids (FS). Laboratory analysis of the samples will include wet sieve analysis of the settled solids using 75, 106, 150, 212, and 300 micron (200, 140, 100, 70, and 50 mesh) sieves. Measurement of the solids retained on each sieve will be documented, including pan dry weights before and after the muffle furnace. Analysis will be carried out using the following standard methods:

1. Total Solids per Standard Methods 2540G
2. Volatile Solids per Standard Methods 2540G
3. Sand Equivalent Size (SES).

O. Percent grit removal of grit particles 75, 105, 150, 212, and 300 micron shall be determined from SES and sieve analysis data from the composite influent and effluent samples, according to the following:

$$Removal\ efficiency\ (\%) = \frac{Total\ Mass\ -\ Effluent\ Mass}{Total\ Mass}$$

P. Equipment manufacturer is to prepare a final report summarizing all test data and results. Report shall include a mass balance calculation of the grit removal efficiency of the grit collector based on the amounts and size distribution of grit collected in the grit collector influent and effluent sampling containers.

Q. In the event the equipment fails to meet the above tests, the necessary changes shall be made and the equipment retested. If the equipment remains unable to meet the test requirements, it shall be removed and replaced with satisfactory equipment at no cost to Owner.

3.3 MANUFACTURER'S SERVICES

A. Manufacturer’s technical representative is required to attend the submittal kick-off workshop.

B. Provide the services of a factory-certified service engineer who has complete knowledge of proper installation, startup, PLC and OIT programming, testing, operation, and maintenance of specified equipment. Submit qualifications of service representative for approval who is a direct, full time employee of the manufacturer.

C. Manufacturer shall advise, consult, and instruct Contractor on:

1. Installation procedures and adjustments and inspect the equipment during installation as a condition of acceptance of the work.
2. Startup and testing of the finished installation.

D. Provide classroom training and hand-on demonstrations.

1. Develop and submit to Engineer and Owner a training lesson plan. Submit proposed lesson plans for scheduled instruction 30 days prior to commencement of training. Lesson plans will be approved by Engineer a minimum of 7 days prior to scheduled instruction.
2. Lesson Plans: Detail specific instruction topics. Where applicable, reference and attach training aids to be utilized in the instruction. Describe "Hands-on" demonstrations planned for the instruction, including estimated duration for each training segment.

E. Provide Owner's training including operational and maintenance instruction to two separate operational and maintenance teams over two separate time periods. Give training at times convenient to operational or maintenance teams being trained in coordination with Owner. Accordingly, some training may be conducted during hours outside a normal Monday through Friday, 8:00 a.m. to 4:00 p.m. workday. Include following operational training as a minimum:

1. Theory of operation.
2. Process flow description.
3. Unit capacity and design criteria.
4. Operational troubleshooting and diagnostics procedures.
5. Step-by-step startup and shutdown procedures.
6. System operation and optimization practices.
7. Control set point modification procedures.

F. Minimum maintenance training topics:

1. Step-by step, "hands-on" assembly and disassembly procedural instructions.
2. Replacement part identification and ordering procedures.
3. Recommended routine maintenance procedures.
4. Troubleshooting and diagnostic procedures.

G. Man-hour requirements listed below are exclusive of travel time and do not relieve the manufacturer of the obligation to provide sufficient service to place equipment in satisfactory operation. *1

1. Attend Submittals Kick-Off Workshop: Not Required.
2. Supervise Installation: Trips - 0 Hours/Trip - 0.
3. Inspect and Approve Installation *2: Trips - 1 Hours/Trip - 8.
4. Supervise Initial Adjustment *3: Trips - 0 Hours/Trip - 0.
5. Instruct Owner's personnel in proper startup and O&M *4: Trips - 1 Hours/Trip - 24.
6. Supervise and Assist in Testing *5: Trips - 1 Hours/Trip - 16.
7. Notes:

    a. *1 - Manufacturer's factory representative shall be present at frequent enough intervals to ensure proper installation, testing and initial operation of the equipment. Minimum time on site per trip based on 8-hour working days.
    b. *2 - Manufacturer's factory representative shall submit to Engineer a written certification that the system has been installed in accordance with the manufacturer's recommendations.
    c. *3 - May be done upon completion of Item 3 if acceptable to Engineer.
    d. *4 - Instruction may be given upon completion of Item 4, provided that the O&M manuals have been submitted to and accepted by Engineer.
    e. *5 - May be done upon completion of Item 5 if acceptable to Engineer. The time required for performance testing is in addition to the above specified hours.

3 Attachment 462323-A: Hydro International Firm Price Proposal for equipment specified in this section.

END OF SECTION 462323

Attachment 462323-A, Stacked Tray Vortex Grit Separator Equipment

Hydro International Firm Price Proposal

April 6, 2023

To: **All Bidding Contractors**

RE: Stacked Tray Grit Separation - Spec Section 462323
San Gabriel WWTP
San Gabriel, TX
File #20_11_0567

Hydro International is pleased to present our quote for a HeadCell® Grit Removal Unit. The unit will meet the requirements described in Section 462323 with comments noted below.

Comments

1. Hydro's requested Payment Terms are as follows and are prefaced on the following timeline:
   Receipt of a purchase order by August 18, 2023, release to fabrication by January 5, 2024, and shipment of the equipment prior to May 24, 2024.

Milestone	Incremental Payment	Cumulative Payment
Upon Fully Executed PO	10%	10%
Upon Approval of Shop Drawings	10%	20%
Upon Release to Fabrication	10%	30%
Upon Delivery of Equipment to Site	65%	95%
Upon Final Acceptance or 45 days following completion of equipment start up	5%	100%

2. Velocity at the mouth of the HeadCell® unit at peak flow must be ≤3 ft/s.
3. All piping connected to Hydro equipment must be supported by other means than the Hydro equipment.
4. Please see the exclusions detailed in the proposal below.

Equipment Summary

1. One (1) 9' 7 tray HeadCell® Grit Concentrator unit shall be supplied. The HeadCell® shall consist of a stack of nested trays. The trays shall be fabricated from UV stabilized LDPE and shall be supported by a 316L SS frame integral to the unit. All flow passages shall be self-cleaning and free of sharp projections or fittings that may snag stringy or fibrous materials. The HeadCell® trays shall be constructed with a minimum ¼ inch material pans and sidewalls. The Tray Supports shall be fabricated to provide a means to independently support each tray and transfer the weight of each tray to the support structure frame. The HeadCell® will securely fit into a support structure frame containing the screened raw wastewater inlet connection, necessary hardware, and connections. The HeadCell® Concentrator shall be equipped with a 316L SS fluidizing ring with1.5" NPT NPW connection for collection and removal of settled solids. The settled solids are pumped to the Grit Washing / Dewatering unit by others from the HeadCell® unit.

   The unit shall remove 95% of all grit (S.G. 2.65) 106 micron and larger at a peak flow of 7.5 mgd. The unit shall have 12 inches of headloss at the peak flow.

Appurtenances Per Unit

HeadCell® Grit Concentrator

DESCRIPTION	QTY
Fluidizing Water Throttling Globe Valve 1.5" Crane Globe Valve, Bronze	1

Hydro International
2925 NE Aloclek Suite 140 · Hillsboro, OR 97124
Tel: (866) 615-8130 Fax: (503) 615-2906 Web: hydro-int.com

Fluidizing Water Shut-off Valve 1.5” Apollo Ball Valve, Bronze	1
Motorized Ball Valve 1.5” Flow-Tek Ball Valve, Stainless Steel with RCS Actuator (120VAC, NEMA 7)	1
Fluidizing Water Flow Meter 1.5” Blue White Flow Meter, 10-50 gpm, Acrylic	1
Anchor Bolts –Frames Hilti 316SS 3/8” x 5 1/8” HAS Anchor Rods for use with HIT HY 200 Anchor System	4
Anchor Bolts –Fluidizing Ring Hilti 316SS 3/8” x 5 1/8” HAS Anchor Rods for use with HIT HY 200 Anchor System	5
Anchor Bolts – For Fastening Inlet Duct to Channel Hilti 3/8” HDI 3/8 SS Drop-in anchors	set

Utility Requirements

Clarified NPW or Reuse Water:

The HeadCell® unit requires intermittent 32 gpm @ 50 +/- 10 psig of clarified water for “fluidizing” to function properly.

Start-up

One (1) factory trained representative, three (3) trips, for start-up and instruction services as required totaling seven (7) days.

Performance Test

Testing in accordance with specification section 462323-3.2.

Exclusions

Any item(s) not specifically described above are excluded and are not to be supplied by Hydro International including but not limited to the following:

- Field assembly, erection, and installation
- Interconnecting piping and valving not expressly stated above
- Pipe connections and fittings not expressly stated above including bell-mouth grit slurry suction line
- All pipe supports, hangers, and braces
- Controls, switches, control panels and instrumentation of any kind not expressly stated above
- Wiring and conduit
- Grit pump(s) and associated piping, valving, gauges, sensors
- Field or touch-up paint, painting, blasting and touch-up of surface finish
- Spare parts not specifically stated above
- Unloading, hauling and storage charge
- Lubricating oil and greases
- Grit study and associated sampling and reports
- All concrete and grouting work
- Insulation and heat tracing of any kind
- Structural / Seismic analysis
- Bonds of any kind (Performance, Payment, Warranty, Efficacy and/or Supply Bond)
- Grit dumpsters
- Translation Services
- Extended Discharge chutes (flexible or rigid)
- Access platforms, ladders, stairs, walkways, railing, hatches
- Equipment covers/grating
- Washing and dewatering equipment

Insurance Limitations

- Commercial General Liability is limited to $1,000,000 each occurrence
- Automobile combined single limit of $1,000,000 each occurrence
- Worker's Compensation is limited to $1,000,000 each accident
- Excess Liability $4,000,000 on each of the above

Warranty

Hydro International's two (2) year warranty from substantial completion shall apply per the Terms and Conditions of Sale (estimated start date 8/17/2025).

Delivery

Please allow 14-16 weeks after receipt of purchase order for approval drawings. Shipment is typically 18-20 weeks after receipt of "Approved" or "Approved As Noted, Resubmittal Not Required" submittal package. In current market conditions, these times may require adjustment. Price includes truck freight to jobsite but does not include any state or local taxes if required. Timelines are based on typical workloads and with current market conditions they are taking longer. The grit removal unit shall be delivered to site fully fabricated, subject to size, packaging and transportation constraints. The General Contractor must inspect equipment prior to unloading and notify Hydro International of any damage to equipment within 5 days to effect proper remedial action. Failure to notify Hydro International of damage to equipment prior to unloading will void all warranties pertaining to subject equipment.

Terms & Conditions

Hydro International payment terms are detailed in the attached terms and conditions. Price includes truck freight to jobsite and does not include any state or local taxes if required. The prices quoted are firm based on a receipt of a purchase order by August 18, 2023, release to fabrication by January 5, 2024, and shipment of the equipment prior to May 24, 2024. For any delays in delivery which are beyond Hydro International's responsibility, a finance charge of 1.5% of the contract value per month will be due and payable to Hydro.

Pricing $ 274,050.00

Purchase Order

Please make purchase orders to:
Hydro International
2925 NE Aloclek Drive, Suite 140
Hillsboro, OR 97124

Local Representative

Plant Representative:
Mr. Miguel Vera
HRM Environmental
3118 Media Drive
Cedar Park, TX 78641
Ph: (512) 565-1681
Fax: (512) 337-7824
mvera@hrmenv.com

If you have any questions or concerns, please do not hesitate to contact me.

Regards,

Hydro International

Sam Randall
Applications Engineer

Standard Terms and Conditions of Sale

1. **DEFINITIONS.** "Hydro" is Hydro International with an address of 2925 NE Aloclek Drive #140 in Hillsboro, Oregon. "Buyer" is the party purchasing the goods from Hydro.

2. **ENTIRE AGREEMENT**. Hydro's agreement is based on these terms and conditions of sale. This document, together with any additional writings signed by Hydro, represents a final, complete, and exclusive statement of the agreement between the parties and may not be modified, supplemented, explained, or waived by parol evidence, Buyer's purchase order, any course of dealing, Buyer's payment or acceptance, or in any other way except in writing signed by Hydro through its authorized representative. These terms and conditions are intended to cover all activity of Hydro and Buyer hereunder, including sales and use of products, parts, and work, and all related matters (references to products include parts and references to work include construction and installation). Hydro's obligations hereunder are expressly conditioned on Buyer's assent to these terms and conditions. Hydro objects to any terms that are different from, or additional to, these terms and conditions. Any applicable detail drawings and specifications are hereby incorporated and made a part of these Terms and Conditions of Sale insofar as they apply to the material supplied hereunder.

3. **SPECIFICATIONS.** Products are supplied in accordance with information received by Hydro, or its duly authorized agent, from Buyer. Hydro shall have no responsibility for products created or sold based upon inaccurate and/or incomplete information supplied to it. Buyer shall ensure that Hydro receives all relevant information in time to enable it to supply the appropriate products.

4. **INSTALLATION AND APPLICATION OF PRODUCTS.** Products supplied hereunder shall be installed and used only in the application for which they were specifically designed. Buyer should not presume that any products supplied by Hydro may be utilized for any applications other than those specified; nor shall Hydro's obligations, including, without limitation, any warranty obligations, survive Buyer's transfer of products supplied hereunder to third parties unless the products are transferred with Hydro's consent. In addition, Buyer shall not use any product supplied hereunder at any location other than at the location for which Hydro has previously received notice from Buyer. Any breach of any of the foregoing restrictions may amount to an infringement of the patent for the products in question and will in any event void all express or implied warranties relating to the products supplied hereunder.

5. **PURCHASE PRICE AND PAYMENT TERMS.** All prices are in U.S. dollars and all payments shall be made in U.S. dollars. Payment terms are as follows:

	Incremental Payment	Cumulative Payment
Upon Fully Executed PO	10%	10%
Upon Approval of Shop Drawings	10%	20%
Upon Release to Fabrication	10%	30%
Upon Delivery of Equipment to Site	65%	95%
Upon Final Acceptance or 45 days following completion of equipment start up	5%	100%

If payments are not made in conformance with the terms stated herein, any unpaid balance shall be subject to interest at a rate 1½% per month, but not to exceed the maximum amount permitted by law. If shipment is delayed by Buyer, the previously agreed date of readiness for shipment shall be deemed to be the date of shipment for payment purposes. If manufacture is delayed by Buyer, a payment shall be made based on purchase price and percentage of completion, with the balance payable in accordance with the terms as stated. If at any time in Hydro's judgment Buyer may be or may become unable or unwilling to meet the terms specified, Hydro may require satisfactory assurance or full or partial payment as a condition to commencing, or continuing manufacture, or in advance of shipment.

Until payment in full has been received by Hydro, this Standard Terms and Conditions of Sale shall constitute a security agreement and Buyer hereby grants Hydro a purchase money security interest in and to the products produced by Hydro hereunder, and any products or proceeds thereof. In particular:

a. Hydro will retain an express purchase money security interest in and to the products and all proceeds thereof.

b. Until full payment for the products is received by Hydro, Hydro reserves the right to retake possession of the products at any time and for this purpose Buyer authorizes Hydro or its duly authorized agent to enter upon land or premises where it believes the product may be.

c. Proceeds of any disposal of the products shall be held in trust for Hydro pursuant to the terms of the Maine Uniform Commercial Code.

d. Buyer grants Hydro a power of attorney for the purpose of filing a UCC-1 financing statement in the name of Buyer to evidence Hydro's security interest in the products.

6. **BACKCHARGES.** In the event that Buyer is required to make repairs, corrections or modifications to the goods supplied by Hydro, it shall only do so upon written approval from Hydro. Backcharges shall be limited to the costs directly associated in making the repairs, corrections or modifications to the goods supplied by Hydro. The costs of such backcharges shall be subject to approval by Hydro and shall be limited to: (1) directly related labor and material costs, (2) directly related equipment and tool rental at prevailing rates in the project location and (3) Buyer's overhead & supervision costs to make repairs, corrections or modifications to the goods supplied by Hydro. Buyer shall submit complete documentation to Hydro's satisfaction including but not limited to labor time sheets, material lists, and rental fees detailing the nature of the back charges. Backcharges shall be in the form of an adjustment to the contract price or reduction in retained payments and not a direct payment. No incidental or consequential backcharges shall be allowed.

7. **DELIVERY.** The goods are sold DDP (Incoterms 2010) jobsite, freight prepaid to Buyer at job site. Except as outlined in Paragraph 8 below, the risk of loss passes to Buyer after Hydro delivers the goods to the jobsite. Hydro reserves the right to select the method of shipment and carrier. Delivery dates are approximate only and are not a guarantee of delivery on a particular day. Hydro is not liable for failure or delays in deliveries of any cause whatsoever beyond the control of Hydro.

8. **TITLE & INSURANCE:** Title to the product(s) and risk of loss or damage shall pass to Buyer upon delivery to a carrier as outlined in Paragraph 7 above, or, in the event Buyer delays shipment, by the previously agreed date of readiness for shipment, except that a security interest in the product(s) or any replacement shall remain in Hydro's name, regardless of the mode of attachment to realty or other property, until the full price has been paid in cash. Buyer agrees to protect Hydro's interest by adequately insuring the product(s) against loss or damage from any external cause with Hydro named as insured or co-insured.

9. **ERECTION:** Unless otherwise stated in writing, the goods provided hereunder shall be assembled and erected by and at the expense of Buyer.

10. **CANCELLATION & BREACH:** Orders placed cannot be canceled, nor shipments of goods made up, or in process, be deferred beyond the original shipment dates specified, except with Hydro's written consent and upon terms which shall indemnify Hydro against all loss. In the event of cancellation or the substantial breach of Buyer's obligations, as by failing to make any of the payments when due, the parties agree that Hydro will suffer a serious and substantial damage that will be difficult, if not impossible, to measure, both as of the time of entering into this purchase agreement and as of the time of such cancellation or breach. Therefore, the parties agree that, upon such cancellation or breach, Buyer shall pay to Hydro the sums set forth herein below, which sums the parties do hereby agree shall constitute agreed and liquidated damages in such event:

    a. If cancellation or breach shall occur after the acceptance of the purchase order but prior to mailing of submittal documents by Hydro to Buyer, liquidated damages shall be 10% of the selling price.

    b. If cancellation or breach shall occur within thirty (30) days from the mailing of submittal documents by Hydro to Buyer, the liquidated damages shall be 20% of the selling price.

    c. If the cancellation or breach occurs after thirty (30) days from the mailing of submittal documents by Hydro to Buyer, but prior to notification that the order is ready for shipment, the liquidated damages shall be the total of 30% of the selling price plus the expenses incurred, cost of material, and reasonable value of the work expended to fill the order involved herein by Hydro's engineers and other employees, agents and representatives after the mailing of general arrangement drawings by Hydro to Buyer, said sums to be determined at the sole reasonable discretion of Hydro; provided, however, that the total liquidated damages under this provision shall not exceed the total selling price.

    d. If cancellation or breach shall occur after Hydro has notified Buyer that the order is ready for shipment, then the liquidated damages shall be the total selling price, less costs associated with startup or field testing.

11. **MATERIALS OF CONSTRUCTION, PAINTS AND COATINGS**: Buyer is responsible for determining the suitability of, and for giving final approval of, the materials of construction, paints, coatings, etc. to be used by Hydro.

12. **WARRANTY:** Any product that proves defective in material, workmanship or design within two (2) years after substantial completion (estimated start date 8/17/2025) will be, at the discretion of HYDRO, modified, repaired or replaced, or Buyer's payment for the products will be refunded. This shall be Buyer's sole remedy. HYDRO EXPRESSLY EXCLUDES AND DISCLAIMS ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHER WARRANTIES, EXPRESS OR IMPLIED.

    This warranty does not cover any defects or costs caused by: (1) normal wear and tear of equipment from designed operation. (2) modification, alteration, repair or service of the goods by anyone other than Hydro; (3) physical abuse to, or misuse of, the goods, or operation thereof in a manner contrary to Hydro's instructions; (4) any use of the goods other than that for which they were intended; (5) chemicals or components which were not disclosed to Hydro; (6) storage contrary to Hydro's instructions; or (7) failure to maintain the goods in accordance with Hydro's instructions.

This warranty does not apply to component parts of the goods that were not both originally designed and manufactured by Hydro, including, but not limited to, valves and controls. These component parts do not carry any warranties by Hydro, and only carry the warranties, if any, of their manufacturers.

In order for Buyer to make a claim under this warranty, Buyer must promptly, and within the warranty period, notify Hydro in writing of any defect(s) in the goods covered by this warranty. If any defect(s) in the goods covered by this warranty are visible at the time of delivery, Buyer must notify Hydro of the defect(s) in writing within five working days. To make any claim under this warranty, Buyer must also fully comply with written authorization and return instructions from Hydro.

13. **FIELD SERVICE:** Startup/Field Service will only be scheduled upon written request. Buyer shall notify Hydro of schedule requirements at least ten (10) working days in advance, or additional charges may be added to cover late-scheduled travel costs. Additional costs will be limited to those arising out of late-scheduled costs. Should Buyer have outstanding balances due Hydro, no startup / field service will be scheduled until such payments are received by Hydro. Hydro will send documents to Buyer defining the service or startup requirements. Buyer assumes all responsibility for the readiness of the system when it requests startup service. Should Hydro's Field Service Engineer arrive at the jobsite and determine that the system cannot be started up within a reasonable time, Hydro shall have the option to bring the Field Service Engineer home and bill Buyer for time, travel and living expenses. Additional field service is available from Hydro at the prevailing per-diem rate at the time of the request for service plus all travel and living expenses, portal-to-portal. A purchase order or change order will be required prior to scheduling this additional service.

14. **LIMITATION OF HYDRO'S LIABILITY.** Hydro assumes no liability or responsibility for the misuse of its products by Buyer, Buyer's employees, agents or assigns, or other use inconsistent with the use appropriate to the performance specification requirements submitted to Hydro, and Buyer agrees to indemnify and hold harmless Hydro for any loss, costs, expense or liability that it may incur or be put to as a result of misuse or inconsistent use of the products. In addition, Hydro shall have no liability to Buyer for any consequential or incidental damages incurred by Buyer in connection with the contract documents or the products purchased by Buyer. Hydro shall not be liable for any loss which results from delay in delivery caused by any reason beyond its control, including, but not limited to, acts of God, casualty, civil disturbance, labor disputes, strikes, transportation or inability to obtain materials or services, any interruption of its facilities, or act of any governmental authority. The total liability of Hydro to Buyer in the form of liquidated damages for any loss, indemnity, damage or delay of any kind will not under any circumstances exceed 25% of the Contract Sum.

15. **DELAYS AND EXTENSIONS OF TIME**. In the event of any delay in delivery caused by any reason beyond Hydro's control, including, but not limited to, acts of God, casualty, civil disturbance, labor disputes, strikes, pandemics, transportation or inability to obtain materials or services, including related to supply chain disruptions, any interruption of its facilities, or act of any governmental authority, the time for delivery shall be automatically extended during the continuance of such conditions.

16. **INTELLECTUAL PROPERTY**. Hydro shall retain sole ownership of all of its intellectual property used or produced in connection with the Project, including but not limited to all drawings, specifications, software, written materials, manuals, marks, business methods, and all other property that is capable of protection by a patent, copyright or trademark (whether or not such protection has actually been sought). Buyer shall not use such intellectual property except for the purpose of confirming the quality of design and/or manufacturing of the products and services set forth in the Proposal. Buyer shall not photocopy, duplicate or in any way copy such intellectual property except for the Buyer's internal purposes only (but not for rendering services or selling products to third persons). Buyer shall not sell, license, assign or transfer the intellectual property protected by this paragraph to anyone. Buyer shall ensure that Owner is in possession of valid licenses for all third-party software (not provided by Hydro) used for the Project, and shall indemnify and hold harmless Hydro against all claims by licensors of such software. Hydro makes no warranty regarding the effect of such third-party software on the performance of the software to be developed by Hydro for the Project and Hydro shall be released from any warranties given to Buyer to the extent that such software causes or contributes to problems. Following acceptance and final payment to Hydro, Hydro will grant to the Owner a non-transferable, non-exclusive license to use the software for the Owner's internal purposes only in the form of the license agreement attached as Exhibit A.

17. **TAXES.** Prices stated herein do not include any tax, excise, duty or levy now or hereafter enacted or imposed, by any governmental authority on the manufacture, sale, delivery and/or use of any item delivered. An additional charge will be made therefore and paid by Buyer unless Hydro is furnished with a proper exemption certificate relieving Hydro of paying or collecting the tax, excise, duty or levy in question.

18. **INTERPRETATION OF CONTRACT.** This contract shall be construed according to the laws of the State of Maine.

19. **CHOICE OF FORUM**. Buyer and Hydro hereby consent and agree that the United States District Court for the District of Maine or the District Court or Superior Court located in the City of Portland, County of Cumberland, Maine will have exclusive jurisdiction over any legal action or proceeding arising out of or relating to the contract documents, and each party consents to the personal jurisdiction of such Courts for the purpose of any such action or proceeding. Buyer and Hydro further hereby consent and agree that the exclusive venue for any legal action or proceeding arising out of or relating to the contract documents will be in the County of Cumberland, Maine. Each party hereby waives all rights it has or which may hereafter arise to contest such exclusive jurisdiction and venue.

20. **ATTORNEYS' FEES.** If any judicial or non-judicial proceeding is initiated for the purpose of enforcing a provision of this contract, the prevailing party shall be awarded reasonable attorneys' fees in addition to all other costs associated with the proceeding, whether or not the proceeding advances to judgment.

21. **SEVERABILITY.** If any provisions of this contract are held invalid by a court of competent jurisdiction, the remainder of this contract shall not be rendered invalid, and such invalid provisions shall be modified, in keeping with the letter and spirit of this contract, to the extent permitted by applicable law so as to be rendered valid.

22. **ANTI-BRIBERY.** Hydro International will not engage in any form of bribery or corruption. The offering, giving or receiving of bribes is contrary to Hydro International's values and can play no part in the way in which it carries out its business. Hydro requires you to support our approach and implement provisions consistent with our policy through your own organization and your supply chain. Please find a copy of our Anti-Bribery and Corruption Policy on our website at: https://www.hydro-int.com/sites/default/files/hydro_international_anti-bribery_and_corruption_policy_-_july_2018.pdf

SECTION 462363 - GRIT CLASSIFYING AND WASHING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Grit classifiers and washers.

1. Capable of separating and dewatering pumped grit slurry from grit removal equipment.
2. Include all labor, materials, equipment, and incidentals required to install complete and ready for operation a fully functioning grit washing system. Contractor and manufacturer to coordinate all division of responsibility for a complete system as shown on the Drawings and specified herein.

B. The grit washing equipment includes:

1. Grit washing tank.
2. Screw conveyor.
3. Electric actuated plug valve or ball valve.
4. Instrumentation, controls and other accessories as specified herein.

C. Equipment to be furnished by one manufacturer

1. Components need not be manufactured by the same manufacturer.
2. Manufacturer assumes sole responsibility for all parts and equipment.

D. Related Requirements:

1. Division 03 “Concrete” includes concrete work and the installation of anchor bolts.
2. Section 055000 “Metal Fabrications” for fasteners, brackets, and other miscellaneous metal fabrications as required by this Section.
3. Section 400593.23 “Low Voltage Motor Requirements for Process Equipment”.
4. Section 406196 “Process Control Descriptions”.
5. Section 407000 “Instrumentation for Process Systems”
6. Section 432335 “Recessed Impeller Pumps”.
7. Section 462323 “Stacked Tray Vortex Grit Separator Equipment”
8. Section 406717 “Industrial Enclosures”.
9. Section 051200 “Structural Steel Framing”.
10. Section 262505 “480V Control Panels”.

1.3 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's Product Data for system materials and component equipment, including electrical characteristics.

B. Shop Drawings:

1. Descriptive literature, bulletins, and/or catalogs of the equipment.
2. System materials and component equipment.
3. Certified shop and erection drawings showing all important details of construction, materials, dimensions, installation and anchoring requirements, fasteners, and other details.
4. Total weight of equipment including the weight of the single largest item or component and lifting points.
5. List of manufacturer’s recommended spare parts and special tools.
6. A complete bill of materials of all the equipment.
7. Factory testing protocol.
8. Performance testing protocol.
9. Wiring and control diagrams, complete motor data, instrument and controls data, and other details.
10. Complete description of surface preparation and shop prime painting.

C. Indicate all specific information applicable to the provided equipment (e.g. circle relevant information and/or cross out irrelevant information).

D. Describe of all nonconforming aspects to this Section, in the event that it is impossible to conform to certain details due to different manufacturing techniques.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that equipment meets or exceeds specified requirements indicating the following:

1. The unit was installed in direct accordance with the manufacturer’s recommendation.
2. The unit meets the performance requirements as outlined below.

B. Manufacturer's Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

C. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

D. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

E. Manufacturer Reports: Indicate that equipment has been installed according to manufacturer's instructions.

F. Qualifications Statement: Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit maintenance instructions for equipment and accessories.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Maintenance materials requirements:

1. Instructions prepared specifically for this installation and shall include all required catalog cuts, drawings, equipment lists, and descriptions necessary to instruct operating and maintenance personnel unfamiliar with such equipment.
2. Installation drawings, wiring diagrams, and maintenance requirements and schedules, and safety information.

B. Tools and Spare Parts:

1. Furnish all special tools required for normal operation and maintenance of the equipment.
2. Spare parts:

a. One extra set of bearings for one grit screw conveyor.
b. Ten pilot lamps and fuses.
c. Other spare parts as recommended by manufacturer.
d. One of each size and type of fuse used in the control panel.
e. One of each type of indicator light used in each control panel.
f. One of each type of relay used in each control panels.
g. One of each type of I/O card used for the PLC in the control panels.
h. One spare PLC power supply used for the PLC in the control panels.

3. Provide all special tools required for normal maintenance. Package tools in a steel case, clearly and indelibly marked on the exterior to indicate equipment for which tools are intended.
4. Provide Owner with a complete list of all spare and replacement parts with individual prices and location where they are available. Prices to remain in effect for a period of not less than one year after start-up and final acceptance
5. Provide oil and grease required for initial start-up and a one-year supply of lubricates.
6. Lubricants shall be synthetic and include summer and winter grades along with alternate referenced to equal products of other manufacturers including AGMA numbers, viscosity, etc.

1.7 QUALITY ASSURANCE

A. Furnish grit classifying and washing equipment, all appurtenances and controls from a single manufacturer regularly engaged in the manufacturer of this type of equipment for wastewater treatment.

B. Equipment specified in this Section is to be furnished by a manufacturer of grit classifying and washing equipment who has sole responsibility for designing and furnishing the parts and components required for a complete and operable system. Factory assemble the grit classifying and washing equipment and accessories as a single coordinated unit.

1.8 QUALIFICATIONS

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience, at a minimum of five installations in North America of equal or greater size, which have been operating for at least five years.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's packaging including application instructions. Mark each box or package properly to show its total weight and net weight of the contents.

B. Inspection: Accept grit classifiers and washers on-Site in original packaging and inspect for damage.

C. Store materials according to manufacturer's instructions.

1.10 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.11 WARRANTY

A. Furnish 2-Year manufacturer's warranty for grit classifiers, washers, and accessories beginning on date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GRIT CLASSIFIERS AND WASHERS

A. Manufacturers:

1. Hydro International, GritCleanse.
2. Huber Technology, Inc., Co. Grit Washer RoSF4.

B. The design and layout were based upon the Hydro International GritCleanse. If necessary, include in the bid price the cost associated with any revisions (electrical, structural, foundation, process mechanical, civil, etc). to the layout, design, or equipment as required to accommodate the installation of a full functioning system of a different manufacturer. Revised design shall be sealed by a registered professional engineer in the state of Texas and submitted to the City and Engineer for review and approval. Any changes that occur based on the Engineer's review shall be at no additional cost to the City.

C. Description:

1. Washing tank, screw conveyor, and accessories.

    a. Rotary motion is induced when grit slurry is pumped into the grit classifier tank. Organic-laden water flowing in from the side or top, depending on manufacturer, adheres to the grit classifier tank and follows its line sending the grit-free discharge over the weir. Denser grit separates from the organics and water to form a grit bed.
    b. Grit washer shall be self-cleaning with no additional brush of flushing device required.
    c. Routine maintenance to be performed without draining the grit settling tank.

2. All components and spare parts supplied from single manufacturer,
3. Use of a manufacturer's name and model or catalog number is to establish the standard of quality and general configuration desired.
4. Position equipment and anchor into position using hardware supplied by the manufacturer.
5. All structural steel used in fabrication of the equipment to conform to ASTM A36.
6. All welding to conform to the latest standards of AWS.
7. Provide lifting lugs for all components and equipment weighing over 100 pounds.
8. Install 16-guage brass or stainless-steel nameplates on the equipment showing:

    a. Name of the manufacturer.
    b. Model number.
    c. Serial number.
    d. Horsepower.
    e. Voltage.
    f. Amperes.
    g. Capacity.
    h. Service Factor.
    i. All other pertinent data.

9. Provide removable, all-metal corrosion resistant guards in complete conformance with OSHA are to be provided for all motor couplings or belts and similar exposed rotating elements.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. No. of Units: One (1).

B. Feed: Grit slurry underflow, pumped from the Headcell grit removal equipment.

C. Capacity: 250 gpm, continuous flow.

D. Grit out: 1.5 wet tons/hr .

E. Grit Removal Efficiency: Minimum 95 percent of particles ≥ 75 micron.

    1. Use grit testing method outlined in Part 3.

F. Final Grit Moisture Content: Maximum 10 percent, based on standard intermittent operation

G. Final Organics Content: Maximum 5 percent, based on standard intermittent operation

H. Inlet Pipe: 4 inches.

I. Overflow Pipe (outlet): 8 inches.

J. Organics Discharge: 4 inches.

K. Service Water Connection: 1 inch.

L. Drain Connection, maximum: 3 inch NPT Pipe.

M. NPW Requirement Fluidized Bed: 25 gpm @ 50 psig Continuous.

N. NPW Requirement Organics: 25 gpm @ 50 psig (20-30 sec. hourly).

2.3 DRIVERS

A. Motors:

1. Power Data:

a. Horsepower, Grit Mixer: 1 hp maximum.
b. Horsepower, Screw Conveyor: 2 hp, maximum.
c. 480 Volt, three phase, 60 Hz.
d. Constant Speed.
e. Service Factor: 1.0 for inverter duty rating to be used with VFD's or 1.15 without VFD's.
f. Starting Method: Full Voltage.

2. Environmental Data:

a. Continuous duty, 40 degrees C ambient.
b. Space Classification: Class 1, Division 2

B. Equipment Tag Numbers: GC-2111-1.

C. Materials:

1. Grit Chamber: 3/16 inch thick type 304L stainless steel.
2. Grit Settling Tank : 3/16 inch type 304L stainless steel wall; picked an passivated in acid bath.
3. Covers: 3/16 inch thick type 304L stainless steel sections with handles.
4. Shafted Screw Conveyor: Type 304L stainless steel with abrasion-resistant wearing shoes with a minimum of 500 Brinell hardness and of Ni-Hard material.
5. Conveyor Trough: 3/16 inch thick Type 304L stainless steel.
6. Inlet and Outlet Piping: 3/16 inch thick Type 304L stainless steel properly and accurately soldered to the body of the chamber and equipped with 125 lb ANSI/ASME B16.1 standard flat-face flanged connections.
7. Supports: Type 304L stainless steel.
8. Flanges: Cast iron or type 304L stainless steel, 125 lb ANSI/ASME B16.1 standard flat-face.
9. All anchorage and fastening (i.e., Bolts, nuts, washers, fasteners) type 316 stainless steel
10. All bolts shall be provided with self-locking nuts with nylon inserts, or reusable locknuts to prevent accidental loosening of the nuts. Lock washers are not acceptable.
11. Local Control Station: See 2.4.C below.

D. Grit Washer Components:

1. Tank and Chamber:

a. Materials as specified in Section 2.2 above.
b. Construct to dissipate the energy generated from the grit pump to minimize the disruption of the classifier pool.
c. Set accurately into position and anchor securely into place by fixing the support legs to the floor or equipment pads.
d. Tank supports fully bolted to the grit chamber and floor.
e. Motorized actuated plug valve or ball valve for releasing organics.
f. Provide pressure sensor and connection to monitor water level in the tank and chamber.

2. Covers:

a. Material as specified in Section 2.2 above.
b. Washer to be fully enclosed.
c. Provide removable covers or doors for servicing and inspection.

3. Overflow Weir:

a. Material as specified in Section 2.2 above.
b. Locate to minimize short-circuiting to the overflow weir of the classifier and to handle maximum flows.

4. Grit Conveying Screw:

a. Material as specified in Section 2.2 above.
b. Construct the conveyor from preformed flight sections welded to the shaft. Provide sufficient clearance between the screw and tank so that a buildup of sand or grit will provide a bed for the screw, minimizing tank wear.
c. Construct trough to protect shafted screw housing from abrasion damage from the grit.
d. Inlet and outlet piping to be soldered to grit conveying housing.
e. Grit discharge from the grit conveying screw oriented 45 degrees to the horizontal.
f. Discharge end of conveying screw to chute as shown on the Drawings to be provided by the Contractor. Contractor to coordinate the length of the chute with height of grit dumpster.
g. Grit conveying screw drive directly coupled to the drive shaft through the gearbox. Support upper end of the conveyor and conveyor drive.
h. Provide the thrust and radial type bearings with minimum B-10 bearing life of 50,000 hours.
i. Include minimum two top mounted lifting hooks, designed to support the entire weight of the grit classifier when dissembled from the grit chamber. Locate hooks at lengths minimum 1/3 of the length of the screw trough from each end. Auger/trough is to be lifted using straps at multiple lifting points.
j. Provide support for completely submerged operation of the lower end of the screw bearing, housed in a watertight enclosure suitable for operation in grit service. Provide a sealed bronze, sleeve-type bearing, running completely submerged in oil that only requires yearly inspection and oil change. Internal parts of the bearing assembly are to be sealed from outside contamination using floating satellite seals.

k. Provide an emergency power cut-out pushbutton along the side of the classifier. The emergency power cut-out push button to enable emergency interruption of the power to the classifier drive mechanism at any point along the screw.

2.4 CONTROLS

A. General:

1. Include software licensing for PLC and HMI separate from Plant SCADA to supply the documented version for client use of the project.
2. Coordinate all interfacing mechanical, electrical and controls items.
3. Provide one Control Panel for the grit washer classifier and screw conveyor: Grit Classifier Control Panel. Control Panels are in the Electrical House.
4. Provide one Local Control Station for the grit washer classifier and screw conveyor. Local Control Panels are located adjacent to equipment as shown.
5. Panel Construction: Conform to Section 406717 “Industrial Enclosures” and Section 262505 “480V Control Panels”.
6. Manufacturer supplied instruments (elements, switches, transmitters, etc.), valves, and actuators under this Section shall be in accordance with respective instrument and valve sections under Division 40, as applicable.
7. The manufacturer shall coordinate with the Division 40 Process Control Systems Supplier (PCSS) and System Integrator to share data/tag mapping information to registers for the plant PLC/HMI specified herein to provide for a fully functional control system integrated with the plant PCS. In addition to this, the manufacturer shall also need to coordinate with PCSS for Generator Auto recovery control.

B. Grit Classifier Control Panels:

1. Tag Numbers:

   a. MCP-2110-1.

2. Location: Electrical House.
3. Space Classification: None.
4. Enclosure rating: NEMA 1A gasketed.

△3

5. Material: Stainless Steel.
6. Factory assembled with wiring conforming to Section 406733 “Panel Wiring”.
7. Mounting: Free standing.
8. Conduit Entry: As shown.
9. Main circuit breaker, with a flange mounted operating handle.
10. Power Supply: 480-Volt, 3 Phase, 60 Hz.
11. UPS:

    a. In accordance with Section 406763 “Control Panel Mounted UPS”.
    b. Include maintenance bypass switch.
    c. Power the PLC, DC power supplies, instruments and all other communication and low voltage controls equipment.
    d. Provide a calculation to confirm UPS sizing in accordance with runtimes specified in Section 406763 “Control Panel Mounted UPS”.

12. Motor Starter, if applicable: NEMA rated, Full Voltage Non-Reversing or Variable Frequency Drive in accordance with Section 26205 “480V Control Panels”.

13. PLC: In accordance with Section 406343 “Programmable Logic Controllers”.
14. Control power transformer suitable for instrumentation and control power requirements.
15. Switches, indicating lights, control relays, timers and other devices to provide the correct operating sequence for the equipment.
16. Face Mounted Devices:

    a. Pilot Light, White: CONTROL POWER ON.

17. OIT: In accordance with Section 406263 “Operator Interface Terminal”.

    a. At a minimum provide the following signals.

        1) System Emergency Stop
        2) System Reset
        3) System Alarm Silence
        4) Cycle Run ON/OFF
        5) Grit Washing / Dewatering Agitator three position HOA
        6) Grit Washing / Dewatering Agitator Running indicating light
        7) Grit Washing / Dewatering Agitator Fault indicating light
        8) Grit Washing / Dewatering Auger three position HOA
        9) Grit Washing / Dewatering Auger Running indicating light
        10) Grit Washing / Dewatering Auger Fault indicating light
        11) Grit Washing / Dewatering Wash Water three position OPEN/CLOSE/AUTO
        12) Grit Washing / Dewatering Wash Water Opened indicating light
        13) Grit Washing / Dewatering Organics Flush three position OPEN/CLOSE/AUTO
        14) Grit Washing / Dewatering Organics Flush Opened indicating light
        15) Grit Washing / Dewatering Organics Valve three position OPEN/CLOSE/AUTO
        16) Grit Washing / Dewatering Organics Valve Opened indicating light
        17) Grit Washing / Dewatering Organics Valve Closed indicating light
        18) Grit Washing / Dewatering Organics Valve Fault indicating light
        19) Grit Pump Running
        20) Grit Pump Fault
        21) Grit Pump High Temperature
        22) Grit Pump High Pressure
        23) Grit Stacked Tray Removal Fluidizing Valve Opened indicating light
        24) Grit Stacked Tray Removal Fluidizing Valve Closed indicating light

    b. Provide auxiliary contacts as specified in Division 40 and Division 26 or as shown for remote sensing and control.

18. Maximum Dimensions of Each Panel:

    a. Width: 36 inches.
    b. Height: 84 inches.
    c. Depth: 18 inches.

19. Remote connectivity by vendors to PLCs and other devices located in vendor panel which are connected to plant SCADA will not be allowed. There will be a penalty of $5,000 for the first occurrence and $10,000 for any subsequent offences.

C. Local Control Station

1. Tag Numbers:

    a. LCS-2110-1.

2. Location: Adjacent to equipment as shown.
3. Space Classification: Class 1, Division 2.
4. Enclosure rating: NEMA 7.
5. Factory assembled with wiring conforming to Section 406733 “Panel Wiring”.
6. Mounting: Wall Mount, installed by others.
7. Conduit Entry: As shown.
8. Power Supply: 120-Volt, 1 Phase, 60 Hz, from Control Panel.
9. Face Mounted Devices:

    a. Selector Switch - Stirrer: LOCAL-OFF-REMOTE.
    b. Pushbutton – Stirrer: START.
    c. Pushbutton – Stirrer: STOP.
    d. Pilot Light, Red: STIRRER RUNNING.
    e. Alarm Pilot Light, Amber: FAULT.
    f. Pushbutton – Mushroom Head, Push-Pull Type: EMERGENCY STOP
    g. Selector Switch - Conveyor: LOCAL-OFF-REMOTE.
    h. Selector Switch – Conveyor: FORWARD-OFF.
    i. Selector Switch – Conveyor: LOW SPEED.
    j. Pushbutton – Conveyor: START.
    k. Pushbutton – Conveyor: STOP.
    l. Pilot Light, Red: CONVEYOR RUNNING.
    m. Alarm Pilot Light, Amber: FAULT.
    n. Pushbutton – Momentary, Flush Head: SYSTEM RESET.

D. Emergency Stop:

1. Provide the following in addition to Emergency Stop pushbutton on LCP.
2. Emergency Stop Pushbutton station accessible from top of access platform as shown. Emergency Stop shall stop both the grit pumps, stirrer, and the grit conveyor from running.

E. Washer Classifier Level:

1. For the washer classifier, provide a pressure sensor for use in measuring pressure in the washer classifier.
2. Provide Manufacturer’s standard pressure device.

F. Provide the following additional control devices, at a minimum:

1. Motor sensors to detect high motor amperage due to excessive loads (overtorque).
2. Conveyor screw speed monitoring and low speed switch, if VFD is omitted.

G. Operation:

1. Auto Control:

    a. When the Local/Off/Remote switches at the LCP are in Remote, the washer classifier and grit screw shall be controlled from the Control Panel.
    b. Manual: The operator shall be able to start stirrer and grit screw running and stop screen running from the OIU.
    c. Auto:

        1) Permissives:

            a) Grit Unit inlet slide gate open.
            b) Stirrer in Remote.
            c) Grit screw in Remote.
            d) Organics valve in Remote.
            e) Wash water valve in Remote.

        2) Pressure sensor and indicator transmitter will be activated once the automatic feeding cycle starts and remain active unless equipment is turned OFF.
        3) Stirrer starts when flow is entering the unit.
        4) Grit screw starts running at level setpoint. Once running, the grit screw will start and stop based on cycle timers. Grit screw will shutdown based on a low level setpoint.

    d. Organics Valve:

        1) Provide motor operated plug valve or ball valve for use in controlling the organics valve.

            a) Valve: NEMA 7, 120 V, 60 Hz, 1 Ph

        2) Control motor operated plug valve or ball valve via the Grit Classifier Control Panel.
        3) Plug Valve: In accordance with Section 400562 “Plug Valves”.
        4) Ball Valve: In accordance with Section 400563 “Ball Valves”.
        5) Motor Operator: 120 Volt power EIM M2CP as manufactured by Emerson and detailed in Section 400557 “Actuators for Process Valves and Gates”.

    e. Wash Water:

        1) Provide motor operated ball valve for use in controlling wash water supply to the classifier.
        2) Control motor operated ball valves via the Grit Classifier Control Panel.
        3) Ball Valve: In accordance with Section 400563 “Ball Valves”.
        4) Flow Meter: 0-30 gpm polysulfone in line flow meter.
        5) Motor Operator: 120 Volt power actuator in accordance with Section 400557 “Actuators for Process Valves and Gates”.
        6) Motor Operator in Local: Wash water is supplied by use of Open and Stop pushbuttons on the motor operator.
        7) Motor Operator in Remote: Motor operator is controlled through the Grit Classifier Control Panel.

    f. Automatic Shutdown:

1) In shutdown mode, pressure sensor will only remain active for the time set on the pressure sensor off delay timer. After this time has expired the sensor will be deactivated.
2) The grit screw will shut down after the pressure sensor is deactivated.
3) After the pressure sensor becomes deactivated, the organics valve will open for a set duration and then close.
4) After the organics valve closes, the stirrer will run for a time delay and then shut down.
5) After the stirrer shuts down, the wash water will then close.

g. Emergency Stop:

1) Upon activation of any Emergency Stop device or opening the inspection door, the grit pump, stirrer, and grit screw will stop running and the organics valve and wash water valve will close.

2.5 SURFACE PREPARATION AND SHOP PRIME PAINTING

A. Before exposure to the weather and prior to shop painting the ferrous components of the equipment (except stainless steel), thoroughly clean, dry and make free from all mill-scale, rust, grease, dirt and other foreign matter.

B. All stainless-steel components and structures much be submerged in a chemical bath of nitric acid and hydrofluoric acid to remove any residuals that may be present on the material as a result of forming, manufacturing, or handling. After acid wash, the equipment is to be washed with a high-pressure cold water to remove any remaining surface debris and promote the formation of an oxidized passive layer.

2.6 SOURCE QUALITY CONTROL

A. Owner Inspection: Make completed grit classifier and washer available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least seven days before inspection is allowed.

B. Certificate of Compliance: When fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that headworks installation is ready to receive grit classifiers and washers.

3.2 INSTALLATION

A. Install grit classifier and washer according to manufacturer's instructions and as indicated on Drawings.

B. Take all necessary measurements in the field to determine the exact dimensions for all work and the required sizes of all equipment. Verify all pertinent data and dimensions.

3.3 FIELD QUALITY CONTROL

A. After installation, inspect for proper operation.

B. Furnish installation certificate from equipment manufacturer's representative attesting equipment has been properly installed and is ready for startup and testing.

3.4 FIELD TESTING

A. Do not conduct field tests until entire installation is complete and ready for testing and manufacturer's certificate has been submitted.

B. Functional Test:

1. Prior to Plant Start-Up: Inspect equipment for proper alignment, quiet operation, proper connection, and satisfactory performance.
2. Operate equipment for 48 hours without vibration, jamming, leakage, or overheating while performing the specified function.

C. Performance test:

1. Conduct grit performance tests in the field (in-situ), as required for Substantial Completion.
2. Equipment supplier to bear all costs associated with performance testing.
3. Demonstrate conformance to the operating parameters defined herein within sixty (60) days. Additional time may be granted if approved by the Owner.
4. One (1) grit performance tests of four-hour duration under approximately steady-state condition.
5. Performance of system based on particle sizes greater or equal to those outlined in Paragraph 2.2.
6. Tests to be conducted for the flows listed in Paragraph 2.1 at a solids concentration of less than or equal to 1 percent.
7. Monitor and record flows throughout the test period using the grit pump discharge flow meters.
8. Test Equipment:

    a. One (1) grit washing/dewatering unit.
    b. Sampling ports, samplers, and sampling barrels sized to capture a particle of less than a 50 micron with a specific gravity of 2.6 (3.2 gpm/sf loading rate). The sampling barrels, all necessary hoses and connections to install the sampling equipment will be provided for the duration of the test.

9. Sampling Points:

a. Piping inlet to grit washer classifier.
b. Grit washer overflow.
c. Dewatered grit.

10. Conduct with native or seeded grit.

    a. Minimum influent grit concentration upstream of grit collector unit: 250 lbs/MG (30mg/l) for native grit measurement and seeded material.
    b. Seed material: Granusil 5010. Wet the seed material prior to introduction into the flow and feed at concentration necessary based on the native grit.

11. Influent and effluent samples to be tangentially and continuously into separate settling barrels with an overflow of no more than 3.2 gpm per square foot of surface area to ensure capture of all 50 micron and larger, 2.65 S.G. grit particles in the samples. At the end of the test interval, a quiescent settling period of 2.3 minutes per foot of barrel depth will be applied before decanting the water from the barrel to obtain the settled solids.
12. Settled solids sample to be composited for laboratory testing and evaluated according to Standard Method procedures. Samples shall be evaluated at an independent test facility approved by the Engineer.
13. From each 4-hour test, the two settled solids samples (from the influent and effluent) will be analyzed to determine Total Solids (TS), Volatile Solids (VS) and Fixed Solids (FS). Laboratory analysis of the samples will include wet sieve analysis of the settled solids using 75, 106, 150, 212, and 300 micron (200, 140, 100, 70 and 50 mesh) sieves. Measurement of the solids retained on each sieve will be documented, including pan dry weights before and after the muffle furnace.

    a. Analysis will be carried out using the following standard methods:

        1) Total Solid per Standard Methods 2540G.
        2) Volatile Solids per Standard Methods 2540G.
        3) Sand Equivalent Size (SES).

    b. The percent grit removal of grit particles 75, 106, 150, 212, and 300 micron shall be determined from SES and sieve analysis data from the composite influent and effluent samples, according to the following:

        1) Removal efficiency (%)=(Captured Mass)/(Captured Mass + Overflow Mass)

14. Grab samples of the dewatered grit will be collected during each 4-hour test period for solids analysis. Samples of approximately equal volume shall be taken from the top of grit pile, at the start of the 4-hour test period, and every 30 minutes thereafter. The dewatered grit samples from the grit pile generated by each 4-hour test period will be composited for laboratory analysis and evaluated according to Standard Method procedures. Samples shall be analyzed at an independent test facility mutually approved by the equipment manufacturer and Engineer.

    a. Analysis will be carried out using the following standard methods:

        1) Total Solid per Standard Methods 2540G.
        2) Volatile Solids per Standard Methods 2540G.
        3) Paint Filter test per US EPA method 9095B.

15. Provide a report prepared by the equipment manufacturer a final report summarizing all test data and results. The report shall include a mass balance calculation of the grit removal efficiency of the grit collector based on the amounts and size distribution of grit collected in the grit collector influent and effluent sampling containers.
16. A ± 5 percent margin of error will apply to the measured capture efficiency. The specified removal efficiency is as specified in Paragraph 2.1 at the flow rate specified in Paragraph 2.1. While applying the ± 5 percent margin of error to actual results, the following criteria will be used to determine pass/fail for each test.

    a. Results ≥ 90.0 percent will be considered passing

D. If necessary, the equipment will be modified and retested until the total average removal efficiency is satisfactory.

E. In the event of improper installation or failure of the equipment to meet the specified performance, make all corrections of the work and subsequent test runs until the defects are corrected. If the system remains unable to meet the test requirements, remove and replace the equipment.

3.5 MANUFACTURER'S SERVICES

A. Manufacturer’s technical representative is required to attend the submittal kick-off workshop.

B. Provide the services of a factory-certified service engineer who has complete knowledge of proper installation, startup, PLC and OIT programming, VFD settings, testing, operation, and maintenance of specified equipment. Submit qualifications of service representative for approval who is a direct, full-time employee of the manufacturer.

C. Manufacturer shall advise, consult, and instruct the Contractor on:

1. Installation procedures and adjustments and inspect the equipment during installation as a condition of acceptance of the work.
2. Startup and testing of the finished installation.

D. Provide classroom training and hand-on demonstrations.

1. Develop and submit to Engineer and Owner a training lesson plan. Submit proposed lesson plans for scheduled instruction 30 days prior to the commencement of training. Lesson plans will be approved by the Engineer a minimum of 7 days prior to scheduled instruction.
2. Lesson Plans: Detail specific instruction topics. Where applicable, reference and attach training aids to be utilized in the instruction. Describe "Hands-on" demonstrations planned for the instruction, including estimated duration for each training segment.

E. Provide Owner’s training including operational and maintenance instruction to two separate operational and maintenance teams over two separate time periods. Give training at times convenient to operational or maintenance teams being trained in coordination with the Owner. Accordingly, some training may be conducted during hours outside a normal Monday through Friday, 8:00 a.m. to 4:00 p.m. workday. Include following operational training as a minimum:

1. Theory of operation.
2. Process flow description.

3. Unit capacity and design criteria.
4. Operational troubleshooting and diagnostics procedures.
5. Step-by-step startup and shutdown procedures.
6. System operation and optimization practices.
7. Control set point modification procedures.
8. Overall installed control system to include PLC/OIT controls functionality and control panel hardware operations.
9. PLC and OIT program backup procedures.

F. Minimum maintenance training topics:

1. Step-by step, “hands-on” assembly and disassembly procedural instructions.
2. Replacement part identification and ordering procedures.
3. Lubrication procedures, including drain-down and refill procedures.
4. Recommended routine maintenance procedures.
5. Troubleshooting and diagnostic procedures.

G. Man-hour requirements listed below are exclusive of travel time and do not relieve the manufacturer of the obligation to provide sufficient service to place equipment in satisfactory operation. *1

1. Attend Submittals Kick-Off Workshop: Not Required.
2. Supervise Installation: Trips - 1 Hours/Trip - 8.
3. Inspect and Approve Installation *2: Trips - 1 Hours/Trip - 8.
4. Supervise Initial Adjustment *3: Trips - 1 Hours/Trip - 8.
5. Instruct Owner’s personnel in proper startup and O&M *4: Trips - 1 Hours/Trip - 8.
6. Supervise and Assist in Testing *5: Trips - 2 Hours/Trip - 8.
7. Notes:

a. *1 - Manufacturer’s factory representative shall be present at frequent enough intervals to ensure proper installation, testing and initial operation of the equipment. Minimum time on site per trip based on 8-hour working days.
b. *2 - Manufacturer’s factory representative shall submit to the Engineer a written certification that the system has been installed in accordance with the manufacturer’s recommendations.
c. *3 - May be done upon completion of Item 3 if acceptable to the Engineer.
d. *4 - Instruction may be given upon completion of Item 4, provided that the O&M manuals have been submitted to and accepted by the Engineer.
e. *5 May be done upon completion of Item 5 if acceptable to the Engineer. The time required for performance testing is in addition to the above specified hours.

3.6 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 462363

SECTION 463344 - PERISTALTIC METERING PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Peristaltic-Type Metering Pumps and Drivers for the Sodium Bisulfite Facility:
    a. Integral controller and motor enclosure type with local operator interface.
2. Valves and accessories per specifications herein and process & instrumentation diagram drawings.
3. Pump shelves/stands.
4. Factory fabricated and tested complete piped and wired skid systems.

B. Related Requirements:

1. Section 260519 “Low-Voltage Electrical Power Conductors and Cables for execution requirements for electrical connections to pumps specified by this Section.
2. Section 400551 “Common Requirements for Process Valves.”
3. Section 400593.23 “Low-voltage Motor Requirements for Process Equipment.”
4. Section 406121.20 “Process Control System Testing.” (Contractor performs Programming).
5. Section 406196 “Process Control Descriptions.”
6. Section 406717 “Industrial Enclosures.”
7. Section 406733 “Panel Wiring.”
8. Section 407313 “Pressure and Differential Pressure Gauges.”
9. Section 407336 “Pressure and Differential Pressure Switches.”
10. Section 407816 “Indicating Lights.”
11. Section 407819 “Switches and Pushbuttons.”
12. Section 407853 “Relays.”

1.3 DEFINITIONS

A. AESS: Applications Engineering System Supplier. See Section 406100 “Process Control and Enterprise Management Systems General Provisions” for definition.

B. LCP: Local Control Panel.

C. I/O: Input/Output signals.

D. PCSS: Process Control System Supplier. See Section 406100 “Process Control and Enterprise Management Systems General Provisions” for definition.

E. P&ID: Process and Instrumentation Diagrams.

F. Failsafe: Normally closed contacts that open on alarm condition.

1.4 COORDINATION

A. Section CIP 3 for phased construction requirements.

1.5 ACTION SUBMITTALS

A. Furnish tabbed Scope of Supply which clearly indicates equipment, materials, and services included in submittal and provided by supplier/manufacturer. Include following items:

1. Listing of equipment, materials, and services provided by Manufacturer and/or supplier.
2. Specified scope items excluded from submittal, and reasons for exclusion.
3. Exceptions to Scope items and reasons for exception.
4. Clarifications to Scope items.

B. Product Data:

1. Catalog Data Sheets including model numbers, capacity range, dimensions, connection sizes, materials of construction, and finishes.
2. Guaranteed Performance Curves: Showing pump speed (rpm or percent), volumetric output (gph or gpm), and operating head (psi) for specified design conditions.
3. Standard Motor Data per Section 400593.23 “Low-voltage Motor Requirements for Process Equipment” (where applicable).
4. Integral Pump/Motor Controllers Data: Enclosure, insulation, temperature limits, features, wiring diagram, network connection and type, and electrical connection requirements.
5. Wetted Materials Compatibility: Manufacturers chemical compatibility references with respective service chemicals at concentrations and temperature specified.
6. Complete Manufacturers Spare Parts List for pumps, motors, integral controllers, and pump mounted accessories with current itemized pricing.
7. Valve, piping, tubing, fitting, anchor, and accessory catalog data sheets indicating size, manufacturing standards and materials of construction.
8. Complete Lubricant List including type and grade and current itemized pricing.
9. List of Spare Parts.
10. Manufacturer’s warranty, compliant with this Specification.
11. Variable frequency drive data sheets with wiring diagrams and sizing calculations showing compatibility with submitted motor.
12. Control panel component and device data sheets indicating conformance with Division 40.
13. Instrumentation catalog data sheets indicating ranges, specific features/options identified and electrical characteristics/power requirements.
14. Complete Manufacturers Spare Parts List for controllers and panel components, with current itemized pricing.

C. Shop Drawings:

1. Manufacturer’s fully dimensioned shop drawings of pump, motor and baseplate showing materials of construction, total weight, and anchorage.
2. Manufacturer’s fully dimensioned shop drawings with minimum three views of pump skid(s) showing proposed arrangement of skid mounted components, materials of construction, total weight, and anchorage. Reference components to materials table identifying component, quantity, equipment/part number or other pertinent information.
3. Manufacturer’s fully dimensioned shop drawings of pump, motor, reducer, baseplate and anchorage locations. Indicate materials of construction, total weight, and anchorage. Reference components to materials table identifying component, quantity, equipment/part number or other pertinent information.
4. Range and settings for indicators, instruments, pressure regulating valves, back pressure valves, timers, and other related devices.
5. Complete, dimensionally correct control panel drawings showing components, door mounted and internal, with complete wiring diagrams showing signals and adherence to failsafe wiring requirements specific for this project indicated on Electrical and Instrumentation Drawings. Reference panel components to materials table identifying component, quantity, equipment/part number or other pertinent information.
6. Complete listing of I/O signals to/from plant control system.
7. Network interface/communication protocol used to communicate with plant control system.

D. Submit complete description of surface preparation, shop prime painting and finish painting.

1.6 INFORMATIONAL SUBMITTALS

A. Field Quality Control Submittals:

1. Proposed Testing and Training Plan identifying testing methods for field start-up testing and training to demonstrate compliance with contract requirements. Identify Standard Methods or other industry best practices to be used, duration of performance tests, and detailed test procedures. Provide procedure for testing of functions/signals/communication/ integration with associated systems identified on P&IDs and control narratives in Contract Documents.
2. Qualifications of Factory service representative who will perform installation inspection and operator training.
3. Qualifications of Factory service representative who will perform start-up, testing, and integration of any networked components with plant control system.
4. Certificate of Installation, signed by Manufacturer’s authorized representative stating that equipment has been installed according to manufacturer's instructions.
5. Signed performance test report including field pump curves, notes, corrections made.
6. Training services agenda and training materials no less than 30 days prior to proposed training date.
7. Certificate of Owner Personnel Training signed by instructor and Owner’s representative.
8. Documentation of controls revisions performed in field during commissioning by manufacturer’s representative.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Submit manufacturers Installation Operation and Maintenance literature for each product furnished. Label with manufacturer's name and model number.

2. Compile data in Operating and Maintenance Instruction Manual for equipment and accessories supplied specifically for this project. Include tables, drawings, graphics, equipment lists, descriptions, wiring diagrams, panel diagrams (as applicable).

B. Project Record Documents: Record actual locations and final orientation of equipment and accessories.

C. Training and Evaluation Affidavits: Completed by Owner's staff attending training to demonstrate training was deemed satisfactory.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts: Furnish following:

1. For Each Pump:

   a. Two pumphead replacement kits, as applicable.
   b. Two tube replacement kits, as applicable.
   c. Two Cover seal/gasket sets if not furnished with tube kit, as applicable.
   d. Two roller or roller head replacement assemblies, as applicable.
   e. Two replacement volumes each of gearbox oil or other lubricant, as applicable.

2. Accessories:

   a. Tools: Furnish two sets of special tools and other devices required for Owner to maintain and calibrate equipment. Label tools as to their use.

1.9 QUALITY ASSURANCE

A. Equipment of same type: Products of single manufacturer.

B. Equipment manufacturer experience under same name: Minimum 10 years.

C. System supplier/fabricator in business performing similar work: Minimum 10 years.

1. Unit Responsibility:

   a. Furnish pumping systems specified under this Section by single supplier (System Supplier). System Supplier bears sole responsibility for submittal preparation, equipment acquisition, fabrication, manufacturing, assembly, testing, documentation, shipping, delivery, inspection, training, installation and start up assistance, tuning and calibration, repair and warranty of equipment, controls, components, and appurtenances specified.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept pumps and associated equipment on-Site in manufacturer's original packaging. Inspect for damage.

B. Store products in areas protected from weather, moisture, or possible damage.

1. Do not store products directly on ground.
2. Handle products to prevent damage to interior or exterior surfaces.
3. Protect parts from damage or deterioration during prolonged delay from time of shipment until installation completion and made ready for operation.
4. Do not dismantle factory assembled parts and components for shipment unless permission is received in writing from Engineer.
5. Protect finished surfaces of exposed flanges by wooden blind flanges, strongly built and securely bolted.
6. Protect unfinished and machined finished ferrous surfaces to prevent rust and corrosion.
7. Do not ship until approved by Engineer in writing.

1.11 WARRANTY

A. Furnish 2-Year Manufacturer's Warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION:

A. The design and specification were based upon the QDOS Peristaltic Metering Pump. If necessary, include in the bid price the cost associated with any revisions to the layout, design, or specification as required to accommodate the installation of a full function system of a different manufacturer. Revised design is to be submitted to the City and Engineer for review and approval. Any changes that occur based on the Engineer's review shall be at no additional cost to the City.

B. Factory assembled, wired and tested pump skid systems including control panels, motor controllers, piping, pulsation dampeners, pressure gauges, pressure switches, calibration columns, isolation valves, pressure relief valves, and check valves as indicated in Contract Documents.

C. Pumps, motors, gear reducers, and pump bases.

D. Pump skid-mounted shelves.

E. Control panels, instrumentation, valves, and accessories indicated under this Specification Section.

F. Application Schedule:

1. Supply peristaltic metering pumps to convey Sodium Bisulfite from the Chemical Storage Tanks to the Chlorine Contact Mixing Zone within the Treatment Unit:

a. Pump Tag No: PMP-2550-1 and PMP-2550-2.

1) Chemical: Sodium Bisulfite.
2) Formulation: $NaHSO_3$.
3) Solution Strength Weight: 38 percent.

4) Solution pH: 3.5-5.3.
5) Specific Gravity @ 25 degrees C: 1.33.
6) Viscosity, cp@ 25 degrees C: N/A.

G. Peristaltic Metering Pump Schedule:

1. Pump Tag: PMP-2550-1 and PMP-2550-2

a. Pump Type: Peristaltic
b. Operation Range, gph: 0.6 - 2.
c. Max Operating Discharge Pressure, psi: 3.
d. Suction Lift, ft: 4.30
e. NPIPa, psi: 21.40.
f. Pump Discharge Capacity, gph: 8.
g. Pump Pressure Capacity, psi: 50 (minimum)
h. Max RPM: 125.
i. Maximum Motor Power: 1/2 hp or associated DC motor if applicable.
j. Suction and Discharge Piping: 1/2 - inch.
k. P&ID Reference No.: SG-IF-2.

2.2 PERISTALTIC METERING PUMPS

A. Manufacturers: Provide products by the following:

1. Watson-Marlow QDos.
2. Blue-White M Series.

B. Description:

1. Construct pumps, pumpheads, tubing, and appurtenances of corrosion-resistant materials suitable for the chemicals indicated at a maximum temperature of 125°F and as listed below. Manufacturer to confirm wetted parts of all metering pumps and appurtenances a corrosion and erosion-free operation for the chemicals involved. Manufacturer to provide written certification that the equipment and materials have been selected for the chemicals being pumped.

C. Provide positive displacement pumps type complete with replaceable cartridge-style peristaltic pumphead technology or spring-loaded roller design and self-contained variable speed drive as specified. For operator safety, pumphead must be serviceable as a single replaceable component. Pumps that require tools for maintenance are unacceptable.

D. Provide pumps that are self-priming with a maximum suction lift capability of up to 30' vertical water column.

1. Pumps:

a. Capable of pumping both liquids and gases without vapor locking.
b. Not require the use of internal or external check valves, back pressure valves, suction foot valves, strainers, pulsation dampeners, or auto degassing valves and not require dynamic seals in contact with the pumped fluid unless shown on the

plans. Contain process fluid within pump tubing and confirm that process fluid to not directly contact any rotary or metallic components during operation.

2. Housing Construction: Corrosion resistant and high impact resistant glass filled PPS or thermoplastic.
3. Geometry: Pumphead Consist of sealed track housing with in-line porting. Provide suction and discharge ports that are 180 degrees apart with bottom suction and top discharge.
4. Rotor: pumphead rotor to be constructed of glass filled Nylon, sealed within the track housing, and supported by its own bearings. Set peristaltic occlusion level in factory to ensure flow accuracy of +/- 1% and repeatability performance of +/- 0.5% and not require any field adjustment.
5. No-Valve Design: Provide pumps that require no internal or external check or degassing valves. Provide a rotor that provides compression of the peristaltic element at all times.
6. Contact Materials: Provide pumphead components in the fluid path that are NSF61 listed and constructed of materials specified by the manufacturer as compatible with the process fluid.
7. Leak containment/detection: Provide a peristaltic pump that, in the event of peristaltic element failure, the leak sensor shuts the pump down immediately with all process fluid contained within the sealed pumphead.

    a. Sensor type: Provide non-contacting optical sensor or a Patented “TFD” system. Provide a sensor that contains no moving parts, is not dependent on the capacitance of the process fluid, does not require fluid to leak out of the pump housing for engagement, and does not require any sensitivity or calibration adjustment.
    b. Alarm: Provide a sensor that will shut down the pump, give a visual indication on the drive controller, and, if specified, provide an output general alarm signal.
    c. For operator and environmental safety, pumps which do not have leak containment, leak sensor, and shutdown are not acceptable. For additional overpressure safety, the sealed pumphead will be equipped with a controlled drain-to-waste port.

8. Port Connections: Provide a pumphead that utilizes polypropylene/PVDF compression or male fittings which mate to 10mm ID reinforced, transparent PVC interface hose or as required for application. If necessary, provide polypropylene compression by ½” NPT adaptors for connecting interface hose to process line.
9. Drive Rating: Continuous 24-hour operation, 45 degrees C ambient.
10. Drive Voltage: Provide a drive that is suitable for 100-240VAC, 50-60Hz, 1-Phase with an internal switch-mode power supply. Supply minimum six-foot length mains power cord with standard 115VAC three-prong plug.
11. Drive Enclosure: NEMA 4X constructed out of corrosion and impact resistant engineering thermoplastic, 20% Glass filled PPE/PS or as required. By nature of the environmental conditions, painted or unpainted metallic housing including 316SS are not acceptable. Provide an enclosure that houses the drive motor and all control circuitry in one integrated unit. Separate VFDs and motors are not acceptable.
12. Provide direct coupled pumphead with fully protected drive.

    a. Provide a pumphead that direct couple mounts to the controller via a splined drive shaft and is locked in place by two tool-free thumbscrews.
    b. Provide a pumphead that is fully sealed to prevent any contamination of the controller or drive shaft by process fluid.

c. Provide a pumphead that is contained in its own rotor bearings and does not impart an overhung load on the pump shaft.
d. Provide a pumphead that is supplied mounted to the left or right side of the drive enclosure as specified in the drawings. If not specified, mount pumpheads to right side of the enclosure.
e. Confirm that drive stops shaft rotation and gives visual alarm in the event the pumphead is removed.

13. Drive motor: brushless DC motor with integral gearbox and closed loop tachometer feedback.

a. Circuitry complete with temperature and load compensation and protection.

E. Controls:

1. Description:

a. Two sodium bisulfite feed pumps (PMP-2550-1 and PMP-2550-2) will dose chemical from the sodium bisulfite storage tanks to the chlorine contact mix zone. They will operate in a duty/standby configuration.
b. Refer to Control Logic per Section 406196 “Process Control Descriptions” for coordination with plant control system.

2. Control Circuitry: Integral to pump.

a. Pump Motor Speed Adjustment: 5,000:1 or 10,000:1 turndown ratio.

1) Less than 1 percent Motor Speed: 0.01 percent increments.
2) Greater Than 10 Percent Motor Speed: 0.1 percent increments greater than 10 percent motor speed.

b. Pump Output:

1) Manually Controlled: Front panel user touchpad controls.
2) Remote Controlled: 4-20mA analog input.

c. Automatically calculate pump motor speed required to achieve part per million dosing output proportional to fixed system flow rate.

1) User Input:
a) Dispensing chemical percentage concentration from 1 to 100.0 percent in 0.1 percent increments.
b) Dispensing chemical specific gravity from 0.5 to 2.0 in 0.01 increments.

d. Front Panel User Touchpad Control:

1) Stop and start.
2) Configuration menu access and navigation.
3) Operating mode selection.
4) Auto priming.
5) Display options selection.
6) Tube life data.
7) Reverse direction.

e. LCD Display for Menu Driven Configuration Settings:
   1) Tube failure detection system.
   2) Flow verification system or 4-20 mA output reading.
   3) Alarms status.
   4) Remote input signal values.
   5) Tubing life timer value.

f. Remote Stop/Start Pump: 6 to 30 VDC powered loop or non-powered contact closure loop.
g. User Selectable Output Signal: 4-20mA and 0-1000Hz, scalable and proportional to pump output volume.
h. Four Contact Closure Alarm Outputs: Each alarm output assignable to monitor up to 20 separate pump parameters.

   1) Three Rated: 1A-115VAC, 0.8A-30VDC.
   2) One Rated: 6A-250VAC, 5A-30VDC.

i. Roller Revolution Counter Display: Tube life indicator. User programmable alarm set-point from 1 to 999,999,999 revolutions. Can be assigned to any one of 4 contact closure alarm outputs.
j. User Programmable RPM (revolutions per minute): Set-point value from 0.1 to 100.0 RPM in 0.1 increments.
k. User Adjustable Response Delay Time: 0 to 999.9 seconds for remote start/stop input and four contact closure alarm outputs to facilitate closed-loop applications.
l. Power Interruption Pump Restart Option: User programmable to either automatically restart or require user re-start if AC mains power is interrupted.
m. Discrete and Analog Signal Interface Points: As shown in the Contract Documents (at a minimum).
n. SCADA Control:

   1) NEMA 4X rating on control, integral to pump.
   2) Display Output: GPH.
   3) ON/OFF switch.
   4) LED lights for pump running status and alarm conditions.
   5) Variable frequency drive.
   6) Skid mounted and wired to pump motors.

o. Remote Signals to PLC:

   1) Isolated 4 to 20 mA speed to pump (GPH).
   2) Run input signal.
   3) Pump: On output signal.
   4) Fail output.
   5) Remote signals (Ready).
   6) Pressure (PSI).

p. Remote Signals from PLC:

   1) Isolated 4 to 20 mA speed command (percent).
   2) Remote Start Command.

q. Full local control at pump and Local/Remote signal.

r. Control Panel Functions, if required:

1) Communicate to plant PLC via hardwired connection.
   a) Display variables and setpoints.
   b) Pumps are duty/standby, when duty pump fails, then standby pump is brought online.
   c) Receives setpoint from PLC and controls pump output to setpoint value GPH.
   d) Generates alarms and transmits failure signal to PLC.
   e) Provides local power disconnect for pumps per NEC.

3. Motor/Drive Requirements:

a. Motors:
   1) Reversible, brushless DC gear motor rated for continuous duty.
   2) Overload protection.
   3) Gear Motor RPM: 125 RPM maximum.

b. Drive System: Each metering pump to be provided with following:

   1) Factory installed totally enclosed in NEMA 4X, (IP66) wash-down enclosure.
   2) Operating Power Supply: 120 VAC, 60 Hz single phase supply with an internal switch-mode power supply or without user configuration or selection switches.
   3) Integral variable speed drive.
   4) Dedicated variable frequency drive controller.
   5) Local disconnect and drive interface panel in NEMA 4X enclosure.
   6) Tube Failure Detection (TFD) System and Leak Sensing System: Provide local and remote alarms.
   7) Cables: 10-foot pump connecting cable with plug and 10-foot signal input cable, if required.
   8) Disconnect Switch: Factory mounted at equipment.
   9) Enclosure: Corrosion and impact resistant engineering plastic, FRP.

      a) Rated NEMA 4X (IP66).
      b) Floor and Shelf Level Mounting Brackets and Hardware: Type 316 stainless steel.
      c) Wiring compartment for connection of input/output signal wires and alarm output loads to un-pluggable type terminal block connectors.

         I. Terminal board positively secured to rear of pump housing by two polymeric screws and fully enclosed by wiring compartment cover or by factory provided cables.
         II. Not disturbed by removal of wiring compartment cover.
         III. Do not use ribbon cables in wiring compartment.
         IV. Size conduit hubs, liquid-tight connectors, connector through holes and tapped holes in U.S. inches.

   10) Pump Head Cover: Include imbedded magnetic safety interlock that will limit motor rotation speed to 6 RPM when removed, if applicable.

2.3 PUMP MOUNTING SYSTEMS

A. Provide and be responsible for assembly and testing the complete skid system. Pump, drive and accessories to be assembled and tested on a common skid as shown on the Contract Drawings.

B. Skid to be constructed of minimum ½" thick corrosion resistant FRP/ HDPE with structural fiberglass/ HDPE reinforcement to minimize deflection and resin to be compatible with chemical specified. Skid to be floor mounted with 3" minimum sidewall depth for chemical containment. Provide a skid that is able to withstand the weight of the mounted equipment including the chemical during operation and calibration. Provide pipe and equipment support on the skid that is constructed of corrosion resistant non-metallic material. Anchor bolts to be 316 SS.

C. Skid to have maximum dimension as shown on Contract Drawings. Provide pumps, valves, process connection and accessories that are located on the skid such that they are easily accessible for operation and maintenance.

D. For outdoor installations, provide an enclosure constructed of the same type FRP/HDPE or comparable material with Lexan windows and stainless hardware. An exhaust fan and heater to be supplied if required.

E. Floor/Pad Mount Pump Skid: Polypropylene, FRP, or HDPE floor-mounted pump skid suitable to mount 2 pumps per skid.

1. Integral spill containment and splash proof protective housing.
2. Secure mounted piping and tubing to skid per requirements specified in Division 40.
3. Mounting Hardware: Designed by skid manufacturer and furnished with skid.
4. Acceptable Manufacturers: Provide products by one of the following or equal:

    a. Watson Marlow
    b. Blue and White

5. Outdoor skids shall be fully enclosed with ventilation fan provided.
6. Heating elements:

    a. Heating element shall maintain an interior temperature of not less than 40 degrees F with an exterior/outside temperature of 0 degrees F.
    b. Provide heading element with thermostat for the Sodium Bisulfite pump panels.
    c. Provide one hard wire discrete input to SCADA for interior temperature less than 40 degrees F.

F. Furnish foundation bolts, nuts, and washers of Type 316 stainless steel.

G. Skid Piping:

1. Material: PVC.
2. Thickness class:

    a. Thermoplastic: Sch 80.

3. Joint Type:

a. Thermoplastic: solvent cement.

1) Gaskets for flanged joints – low compression O-ring type, material suitable with process fluid.

4. Fittings:

a. Thermoplastic: same as pipe joints, threaded only where required for instrument connections.

2.4 ACCESSORIES

A. Materials of construction compatible with the process fluids specified herein and corrosion resistant.

B. Coordinate size and type of fitting connection (socket, flange, spigot, etc.) needed for piping components necessary for system specified and depict accurately in Shop Drawing submittals

C. Pressure Gauge and Switch Assemblies:

1. Furnished on discharge side of pumps indicating pump discharge pressure.
2. Shuts down pump in event of excessive discharge pressure.
3. Pressure Switch Transmits alarm signals to variable frequency drives.
4. Rating: 10 amp SPDT at 120 VAC.

a. Adjustable deadband and trip setpoint.
b. Repeatability of 1 percent of actual pressure.
c. UL/CSA rated and housed in NEMA 4X enclosure.
d. Automatically trips on pressure rise.
e. Manual reset required after pressure fall.

5. Pressure Gauge: Furnish as part of complete factory assembly, including gauge, snubber, diaphragm seal with flush/vent valve, liquid fill, isolation valve and interconnecting piping.

a. Casing: 4-inch diameter with Type 316 stainless steel Bourdon tube and 300 series stainless steel movement.
b. Dial Face: White background with black markings, sealed to prevent entrance of moist air.
c. Liquid filled with glycerin, or compatible fluid, with filler/breather cap.
d. Socket: Type 316 stainless steel with bottom connection.

6. Equipped with isolation valve and diaphragm seals to protect gauge and switch from contact with fluid in pipeline.
7. Isolation Valve: Ball valve.
8. Valves and diaphragm seal housing constructed of same material as applicable chemical piping system and have either socket weld, socket fuse or flanged process connection.

a. Diaphragm: Teflon.

9. Furnish mineral oil fill with unit for use between diaphragm seal and gauge and seal and switch.

D. Calibration Chambers: Furnished with pumps for measuring pump output. Rigidly installed and not supported from piping system. Arrange pump suction and discharge piping so as not to interfere with location and use of calibration chambers.

1. Materials: Compatible with intended chemical use.
2. Flanged connection to suction piping.
3. End Cap: Fitted with ball valve for air venting, as indicated on Drawings.
4. Permanently calibrated and marked in gph.
5. Height and Diameter: Sized such that measurable capacity of chamber is 2 minutes of discharge of each pump at 50 percent maximum pumping capacity.

E. Pulsation Dampeners:

1. Furnish and install in discharge line of each pump as indicated on Drawings.
2. Hydro-pneumatic type; vertical design.
3. Chambers:

    a. Upper Pressure Chamber: Charged with compressed air to pump manufacturer's recommended charging pressure. Construction to prevent charged air from being dissolved in process fluid.
    b. Lower Process Fluid Chamber. Inert plastic material to prevent corrosion by process fluid. Use materials suitable for intended service.
    c. Chambers are separated by flexible, elastomeric bladder bellow or diaphragm.

4. Minimum Safety Margin: Burst pressure to maximum working pressure of 4:1.
5. Capable of handling pump's maximum stroke volume.
6. Manufacturers:

    a. Primary Fluids.
    b. Pulsafeeder Engineered Products.
    c. Baloch Industries.
    d. Or equal.

F. Pressure Relief Valves: Installed in discharge line of each pump, as indicated on Drawings.

1. Valve Material: PVC, suitable for intended chemical use with Teflon diaphragm and EPDM or Viton O-rings and seals.
2. Sized to pass maximum pump capacity when set at 10 psig above back-pressure valve setting.
3. Working Pressure: 150 psig.
4. Field adjustable with initial setting set at factory.

G. Isolation Valves: True Unition, full port ball type, PVC body suitable for intended chemical use.

1. Seats: PTFE
2. O-Rings and Seals: EPDM

H. Check Valves: Diaphragm ball check type, PVC body suitable for intended chemical use.

I. PVC Multiport Headblock with diaphragm seal.

2.5 ANCHOR BOLTS

A. Skids, Wall Mounts, and Individual Pumps More than 30 lbs in Weight:

1. Sodium Bisulfite: Type 316 stainless steel.
2. Supply nuts and washers of same material.
3. Supply anchor bolt type as defined on Drawings - J type or insert/adhesive.

B. Individual Pumps less than 30 lbs Weight: Vinyl Ester FRP bolts, nuts, and washers. Furnish vinyl ester epoxy adhesive for setting anchor bolts.

2.6 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed factory assembled skids:

1. Hydrostatic pressure test.
2. Point to Point wiring test.
3. Instrument functionality test.
4. VFD functionality tests.

B. Pump Tests:

1. Test each pump through it operating range.
2. Submit certified test results with variable speed pump performance curves showing pressure, flow, and RPM for each pump.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation: In strict accordance with manufacturer's instructions and recommendations in locations indicated on Drawings.

1. Anchor Bolts: Set per manufacturer's recommendations and setting plans.

B. Review Drawing layout with Engineer to confirm equipment placement prior to stubbing up electrical equipment. Review pipe routing, support, and alignment plans with Engineer. Routing is not always detailed fully on Drawings, coordinate routing and alignment to ensure egress and room for equipment maintenance.

C. Install process piping and electrical equipment so that access to equipment for maintenance is provided.

D. Do not install electrical conduits up through floor of chemical containment areas.

E. Complete emergency shower and eyewash test and confirm full functionality prior to introducing any chemicals to any part of storage system, pumping system and associated piping.

F. Complete piping system pressure testing.

G. Flush piping with fluid or gas compatible with chemical piping prior to connecting equipment.

H. Certificate of Installation: Obtain from equipment manufacturer stating installation of equipment is satisfactory, ready for operation, and operating personnel have been suitably instructed in operation, lubrication, and maintenance of each unit.

3.2 FIELD QUALITY CONTROL

A. System Manufacturer Quality Control Procedures: Adequate to ensure fabrications comply with these Specifications.

1. Final Inspection and Testing of System: By manufacturer prior to shipment; documented in writing and submitted as record of completion.

B. Manufacturer Services: Manufacturer's representative experienced in installation of equipment and systems furnished per this Section for not less than 2 days on-site for installation, inspection, and field testing of supplied equipment and system package.

C. Certificate of Installation: Signed by equipment manufacturer's authorized representative, attesting equipment is properly installed and ready for startup and testing.

D. Start-up Testing:

1. Execute testing per approved Testing and Training Plan submittal. Be responsible for resolving any and integration issues at no additional cost to Owner.
2. Functional Testing: During commissioning of instrumentation and control system ensuring pumps respond as required to remote input.
    a. Metering Pump Flow Rate: Test by measuring drawdown rate on suction side leaving discharge undisturbed in its normal, steady-state operating condition.

        1) Compute capacities by measuring time to fill or by draining calibration column with potable water.

    b. Chemical Feed Systems: Operate on clean water for continuous period of four hours, under supervision of manufacturer's representative.
    c. System Piping: Hydrostatically test for leaks at 150 psig.
    d. Document issues and observations.
    e. Component Performance Failure: Adjust, repair, modify, and replace components of system failing to perform.

        1) Repeat clean water tests.

    f. System and Component Adjustments: Under direction of manufacturer's representative.
    g. Test Rejection and Failure: Following items are sufficient cause to reject test. Successfully complete functional testing in five tries; otherwise, construction manager will reject System.

        1) Mechanical or electrical breakdowns.
        2) Unusual vibrations.
        3) Control sequencing problems.

h. System Rejection: Inability to complete functional testing in five attempts will be sufficient cause for Engineer to reject System.
i. Post Test System Preparation: Purge water with high pressure dry air for systems designed for chemicals incompatible with water.

3. Performance Testing: Conduct after installation is complete and ready for testing as demonstrated by successful completion of clean water (or dry) testing.

a. Performed under direction of system supplier representative, and in presence of Engineer.
b. Incidental Costs: Be responsible for costs other than labor provided by System Supplier, including calibrated testing and measurement instruments and waste disposal. Costs include water and power requirements.
c. Chemical Metering Pumps Field Calibration: In presence of Engineer.
    1) Calibrate each pump at maximum flow rate limit using the onboard flow calibration mode.

d. Demonstrate pumps conform to service requirements and design conditions specified.

    1) Continuous uninterrupted 24-hour operation of pumps will be required before acceptance.
    2) Pump does not meet performance requirements: Take corrective measures or replace pumps and retest until performance requirements are met.

e. Test Capacity: Data monitored at point of discharge at selected strokes and speeds to confirm repeatability of settlings. Record following items at 15-minute intervals during testing period:

    1) Metering pump output flow rate.
    2) Metering pump pressure.
    3) Power draw at minimum, maximum and average operating design points.
    4) Operate at maximum design condition for one continuous hour.

f. Failure to Perform as Specified: Adjust, repair, modify, and replace components and repeat testing.

    1) Adjust equipment under direction of manufacturer's representative.

g. System Performance and Functionality Evaluation: For modes of operation controlled by components provided by Package Supplier (e.g., control station, control panel) as required per Contract Documents.

    1) Control functions.
    2) Alarms.
    3) Monitoring status.

4. Signatures on Completed Field Testing Forms:

a. Manufacturer’s representative.
b. Engineer.
c. Owner’s witness.

5. Complete calculations and document performance within Contract requirements.
6. Signed Field Testing Report: Submit to Owner for approval.

E. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

3.3 DEMONSTRATION AND TRAINING

A. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products in this Section for not less than 18 hours on-Site for training of Owner's personnel in operations and maintenance of pumps and associated system package.

1. Demonstrate system performance and functionality including equipment startup, shutdown, routine maintenance, emergency repair procedures, control functions, alarms, and monitoring status for modes of operation (e.g., local, remote, manual, auto, etc.) as required in Contract Documents.
2. Operation and Maintenance Training: Two 8-hour days, non-consecutive. Services include:

a. Execute per approved testing and training plan submittals.
b. Prepare and submit training materials and training plan.
c. Coordinate training schedule with Contractor and Owner.
d. Use approved training materials and follow training plan in training sessions.
e. Deliver training sessions.
f. Deliver specified quantity training materials to Owner.
g. Videotape training sessions.
h. Obtain and submit Training Acknowledgement Certificate with signatures from trainees indicating session attendance.

3.4 IDENTIFCATION AND MARKING

A. Prior to Substantial Completion:

1. Mark and identify chemical pumping systems and applicable components as required by applicable jurisdictional building codes, statues, standards, regulations, and laws.

B. At a minimum, mark and identify health warnings, flammability, and reactivity of hazardous materials.

END OF SECTION 463344

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SECTION 464313.11 – FIBERGLASS REINFORCED PLASTIC (FRP) WEIRS AND BAFFLE WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Weir plates and supports.
2. Baffle walls and supports including Delegated Design.

B. Related Requirements:

1. Section 055000 “Metal Fabrications” for fasteners, brackets, and other miscellaneous metal fabrications.
2. Section 067413 “Fiberglass Reinforced Plastic Components.”
3. Various Sections in Division 03 for concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for weirs and baffles.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.
3. Complete installation and storage instructions.
4. Complete description of materials and resins used, including physical properties and methods of manufacture for the fiberglass weirs and baffles.
5. Complete bill of materials.
6. Complete assembly drawings.
7. Submit certified test reports of manufactured laminates, as specified herein.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include details of wall assemblies. Indicate dimensions, weights, loads, method of field assembly with perforation pattern, components, and location and size of each field connection.
3. Complete description of materials and resins used, including physical properties and methods of manufacture for fiberglass products.

1.4 DELEGATED DESIGN SUBMITTALS

A. Baffle wall / weirs drawings and calculations shall be signed and stamped by a licensed professional engineer registered in the State of Texas experienced and knowledgeable in the design of FRP baffle walls and weirs.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Material Certificates: For each type of weir and baffle.

1. Certification that materials of fiberglass reinforced polyester are resistant to chemical attack from sewage and chemicals.
2. Statement that fabrication conforms to material requirements.

C. Field Quality Controls: Test results and inspection reports.

1.6 QUALITY ASSURANCE

A. Furnish weirs and baffles and all appurtenances and controls from a single manufacturer regularly engaged in the manufacturing of this type of equipment for wastewater treatment.

B. Equipment specified in this Section is to be furnished by a manufacturer of weirs and baffles who has sole responsibility for designing and furnishing the parts and components required for a complete and operable system.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum ten years' documented experience, at a minimum of ten installation in North America of equal or greater size, which have been operating for at least ten years.

D. Contractor is responsible for verifying all field dimensions for development and approval of manufacturer's drawings.

E. Provide material certifications.

F. Engage a qualified representative of the manufacturer to be onsite to inspect the final installation.

1.7 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.8 WARRANTY

A. Manufacturer agrees to repair or replace components of weirs, baffles and supports that fail in materials or workmanship within Contractor's warranty period per Section CIP16.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Enduro Systems Inc, Houston, TX.
2. Fiberglass Fabricators, Inc., Smithfield, RI.
3. Nefco, Inc., Palm Beach Gardens, FL.
4. MFG Construction & Water Products, Union City, PA.

B. Named manufacturers' standard products may or may not conform to these Specifications, and in case of conflict between these Specifications and a manufacturer's standard products, these Specifications shall have precedence.

2.2 SYSTEM DESCRIPTION

A. Supply baffle walls and support brackets for the following:

1. Chlorine Contact Tanks 1 and 2.
2. Field verify existing width and depth of the existing tank zones prior to submitting shop drawings for approval.

B. Supply weir plates for the following areas:

1. Grit Chamber Effluent Weirs: Supply weir plate lengths as shown on Contract Drawings

2.3 FIBERGLASS BAFFLE WALLS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design FRP baffle walls, support columns, and support brackets to be field mounted to the existing walls.

B. Baffle Walls and Associated Supports: Fiber reinforced, polyester plastic resin molded by die-cast method or by pultrusion process.

1. FRP Baffle Panels:
    a. Ribbed profile in 2.75" depth x 24" height coverage (full panel dimension).
    b. Plastic, minimum of 1/4" thick.
    c. Top horizontal ribs that slope downward not less than 10 degrees to minimize sediment build-up.
    d. FRP perforated baffle panels (as required and detailed on plan drawings) must have factory drilled 2.5-inch square holes for 10% void area (maximum).

e. Material: glass fiber reinforcements 50% (minimum) of the material weight embedded within UV Stabilized Polyester Resin.
   1) Color: standard gray.
   2) Corrosion-resistant
   3) Weather Resistant
   4) Smooth, free of voids, porosity, dry spots, cut edges, notches, crazes, or unreinforced area.
   5) Surfacing veil on both top and bottom sides.
f. Factory cut edges and drilled holes sealed with ANSI/NSF approved material.

2. Structural Framing / Angles
   a. Vertical columns type and number: Braced or Bottom Cantilevered, as recommended by Manufacturer.
   b. Angles: minimum of 3/8" thickness and 90 degrees.
   c. Factory attach FRP angles to FRP columns, as applicable.
   d. Installing contractor to field attach FRP angles to concrete structure or steel walls.
3. Other Structural Components and Hardware
   a. Base Plate and Angles:
      1) 316 Stainless Steel
      2) Field attach
      3) Material of FRP is not allowed
      4) Full moment connection required.
   b. Fasteners, anchorage and others:
      1) Material: 316 stainless steel
      2) Submerged anchors: epoxy adhesive type

4. Baffle Wall Design Criteria:

   a. Water Differential: 6 inches.
   b. Design Wind Load: 10 pounds per square foot Uniform Load.
   c. Deflection Limits and Factors of Safety
      1) Baffle Panels: L/D = 90 (not to exceed 2.75"); Factor of Safety = 2.0
      2) Columns: L/D = 100, Factor of Safety = 2.5

5. Minimum physical properties at a temperature of 70 degrees F:

   a. Tensile Strength: 48,000 psi in accordance with ASTM D638.
   b. Flexural Strength: 58,000 psi in accordance with ASTM D790.
   c. Flexural Modulus: 3,220,000 psi in accordance with ASTM D790.
   d. Impact, Notches, Izod: 25 foot-pound per inch in accordance with ASTM D256-A.
   e. Water Absorption, percent 24 hours: 0.20 percent maximum in accordance with ASTM D570.

6. Anchor Bolts, Nuts, Washers, and Other Mounting Hardware: ASTM A276, Type 316 stainless steel.

2.4 FIBERGLASS WEIR PLATES

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design FRP weir plates, support columns, and support brackets to be field mounted to the existing and walls.

B. Weir Plates and Associated Supports: Fiber reinforced, polyester plastic resin molded by die-cast method or by pultrusion process.

1. FRP Weir Plates:
    a. Size: 1/4" thick x 9” high x length as indicated on Drawings SG-MB-1.
    b. Weir Plate:
        1) Straight Across, Flat
    c. Weir Panel Standard Splice Plate: 1/4” thick x 9” high x 6” long, unless otherwise indicated on the Drawings.
    d. Material: glass fiber reinforcements 40% (minimum) of the material weight embedded within UV Stabilized Isophthalic Polyester Resin.
        1) Glass Reinforcement: ECR or boron-free glass
        2) Color: standard gray.
        3) Resin Rich
        4) Corrosion-resistant
        5) Weather Resistant
        6) Smooth, free of voids, porosity, dry spots, cut edges, notches, crazes, or unreinforced area.
        7) Surfacing veil on both sides.
    e. Factory cut edges and drilled holes sealed with resin.
    f. Panel mounting holes shall be oversized to provide for vertical and horizontal alignment of at least +/- 1” (2 inches total) and shall be placed at 24” on center (maximum) for round tanks and 12” on center (maximum) for straight tanks and covered with 5-inch diameter FRP weir washers, or unless otherwise indicated in the plans and specifications.

2. Structural Components and Hardware
    a. Fasteners, Anchorage, or other structural hardware:
        1) 316 Stainless Steel provided by manufacturer.
        2) Mounting Hardware: concrete anchors or bolt type fasteners

3. FRP Weir Design Criteria:

    a. Weir Elevation: 697.27
    b. Required Weir Length to Plug Flow = 8’-1”
    c. Required Weir Length to Step Feed = 2’-8”

4. Minimum physical properties:

    a. Tensile Strength: 30,000 psi in accordance with ASTM D638.
    b. Flexural Strength: 30,000 psi in accordance with ASTM D790.
    c. Flexural Modulus: 1,800,000 psi in accordance with ASTM D790.
    d. Impact, Notches, Izod: 20 foot-pound per inch in accordance with ASTM D256-A.
    e. Water Absorption, percent 24 hours: 0.20 percent maximum in accordance with ASTM D570.
    f. Barcol Hardness: 40 (nominal) in accordance with ASTM D2853.

g. Average Coefficient of Thermal Expansion: 8.0 x 10^{-6} inch per inch deg F in accordance with ASTM D696.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Strictly comply with manufacturer instructions in installation of baffles and weir plates.

B. Baffle Walls:

1. Carefully align and level.
2. Seal to provide watertight fit between the FRP walls and support columns.

C. Weir Plates:

1. Carefully align and level to the elevations shown on the Drawings. No variation greater than 1/8-inches.
2. Seal the entire perimeter to prevent flow of liquid up between the concrete walls and the weir plates

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Fill the tank with water to observe the leveling of the weir plates and baffle walls.
2. Walls exhibiting excessive deflection, as determined by Engineer, shall be removed and replaced with new materials without additional compensation.

C. Furnish labor and materials for tests.

D. Submit test results and inspection reports to Owner.

3.3 ADJUSTING

A. Adjust and correct defects in fabrication and installation allowing proper operation of system and related components.

END OF SECTION 464313

SECTION 465121 - COARSE BUBBLE DIFFUSERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Coarse-bubble diffused aeration systems and pipe support and anchoring system for:

1. San Gabriel WWTP Aerated Sludge Holding Tank (Digester).

1.3 COORDINATION

A. Coordinate Work of this Section with Work of other Sections.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's product information for system materials and component equipment, including:

1. Literature and drawings describing the equipment in sufficient details, including parts list, dimensions, materials and details of construction and installation.

B. Shop Drawings: System materials and component equipment, connections and other installation details for:

1. Diffusers elements
2. Piping, fixed joints, guide joints, expansion joints, piping supports, pipe taps.
3. Anchoring system for the aeration system.
4. Equipment weights including the weight of the largest item or component.
5. Layout drawings.
6. Complete bill of materials for all equipment.
7. Complete details of each air header system showing number, location, type, and details of supports, length of header sections, materials and details of construction, anchor bolt size, number and location.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate:

1. Products meet or exceed specified requirements.

2. Installation is completed according to manufacturer's instructions.

B. Manufacturer's Instructions: Detailed instructions on installation requirements, including storage and handling procedures.

1. Certified erection drawings showing material details of construction, dimensions, anchor bolt locations, and other details required for a proper installation.
2. Description of Contractor's proposed method for ensuring a level installation of equipment and methods of tightening bolts, diffuser hold-down rings, and similar items.

C. Operating and Maintenance Instructions: Prepared specifically for installation, including all required cuts, drawings, equipment lists, descriptions, etc. required to instruct operating and maintenance personnel unfamiliar with such equipment. Include trouble shooting data and full preventative maintenance schedules.

D. Source Quality-Control Submittals: Results of factory tests and inspections.

E. Field Quality-Control Submittals: Results of Contractor-furnished tests and inspections.

F. Manufacturer Reports: Equipment has been installed according to manufacturer instructions.

G. Spare Parts List: Manufacturer's recommended spare parts, including gaskets, packing, etc.

H. Performance Data:

1. Complete data on air flow head losses through the droplegs, headers, and diffusers.
2. Complete oxygen transfer calculations based on guaranteed performance.
3. Complete calculations and drawings demonstrating that the entire system meet requirements for expansion and contraction as specified herein.

I. Test Reports: Test procedure description and certified copies of the results of all tests specified herein.

J. Qualifications Statements:

1. Qualifications for manufacturer and installer.
2. Manufacturer's approval of installer.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and final orientation of equipment.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Provide one set of special tools that are required for normal operation and maintenance. Tools shall be packaged in a steel case, clearly and indelibly marked on the exterior to indicate equipment for which tools are intended.

B. Provide the following spare parts:

1. A number of spare diffusers equal to at least ten percent of the total number of installed diffusers.

a. Include diffusers, gaskets, replaceable air flow control orifices and required bolts, hold-down rings, and nuts.

2. Material to repair five percent of expansion joints supplied under this Contract.
3. Material to replace three percent of pipe supports including nuts and bolts.
4. One complete air purge system.
5. Suitable pack and protect items for long periods of storage.

1.8 QUALITY ASSURANCE

A. Perform Work according to standards set by authorities having jurisdiction.

B. Furnish diffusers by a single manufacturer regularly engaged in the manufacture of diffused aeration systems for wastewater treatment. The equipment shall be manufactured and installed in accordance with best practices and methods.

C. Provide services of manufacturer's representative, specifically trained on the type of equipment installed as specified herein. Submit qualifications of service representative for approval. Instruction requirements listed below are exclusive of travel time, and do not relieve Contractor of obligation to provide sufficient service to place equipment in satisfactory operation.

1. Installation Instruction: As specified herein.
2. Operation and Maintenance Instruction: one eight-hour day.

D. The manufacturer of diffusers specified in the section will have sole responsibility for designing and furnishing the parts and components required for a complete and operable system. Equipment need not be manufactured by a single manufacturer.

E. Quality Control Tests: Prior to initiation of production, submit for the Engineer's review sampling and testing plans to ensure consistently good quality and uniformity of the production of the diffusers.

F. Submit to the Engineer a certified test report within two weeks of test conclusions.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's packaging; include application instructions.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store diffusers according to manufacturer instructions.

D. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.

1. Do not make shipment until approved by Engineer in writing.
2. At Time of Shipment: Deliver in triplicate to Engineer shipping list, original bill of loading, shipping memorandum and shipping invoice.

    a. Shipping Lists: Provide description and net weight of each item, and gross shipping weight.
    b. Shipment will not be accepted until list has been received.

E. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended. Mark boxes or packages to show their net weight.

F. Properly protect components so no damage or deterioration occurs during a prolonged delay between time of shipment and installation, including any prolonged period at site.

1. Wrap components at factory for protection from sunlight, snow, rain, drippings of any sort, dust, dirt, mud, flood, and condensed water vapor.

    a. Protective coverings to remain in place until work areas are ready for installation.
    b. Submit details of proposed protection for Engineer's approval prior to shipment.

2. Finished surfaces of exposed parts: Protect against adverse conditions that may prevail from time of shipment until ready for operation.

G. Protect finished surfaces of exposed flanges with wooden blank flanges or plastic inserts, strongly built and securely bolted.

H. Arrange and mark lateral piping and diffuser holders for tank and grid which they are intended.

I. Protection: Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

1. Provide additional protection according to manufacturer instructions.

1.11 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.12 WARRANTY

A. The manufacturer shall guarantee that air diffusion equipment shall perform in accordance with the specifications when operated at the specified design conditions.

B. Provide an unconditional extended warranty for a period of 2-years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide equipment by one of the following or equal:

1. The diffusers shall be of proven non-clog design with stainless steel fixed headers as manufactured by:

    a. Sanitaire (Xylem), Milwaukee, WI.
    b. Aquarius Technologies LLC, Saukville, WI.
    c. Environmental Dynamics International, Columbia, MO.
    d. Approved equal.

2.2 COARSE BUBBLE DIFFUSERS

A. General:

1. System Description:

    a. Drawings show a schematic configuration of piping, valves, and diffusers. The aeration system manufacturer/supplier is responsible for the detailed design of the system to meet the performance requirements specified herein.
    b. The beginning point of aeration system manufacture/supplier design responsibility is generally defined as the last pipe connection above the maximum water surface elevation, including all air piping, supports, connections, expansion joints, and all air diffusion equipment within or affixed to aeration basins.
    c. Air control valves to be lever-operated butterfly valves with resilient seat.
    d. Total head loss must not exceed 1.0 psi flanging to be as recommended by manufacturer.
2. The air diffusion units shall be fixed in position.
3. The entire system, including the droplegs, distribution headers and diffusers shall allow for expansion and contraction under the following conditions:

    a. Winter conditions, empty full basins 0 degrees F.
    b. Summer conditions, empty basins 125 degrees F.
    c. Operation with air supply at 225 degrees F and aeration tanks full.
    d. Operation with Air Supply at 225 degrees F and water level in tanks 2-feet above diffusers.

B. Materials and Fabrication:

1. Air piping exposed to atmosphere or partially submerged to be Type 304L stainless steel.
2. Submerged piping to be Type 304L stainless steel.
3. All welded parts and assemblies including droplegs, submerged air distribution headers, header connections, diffusers, fabricated supports, flanged joints, and expansion joints shall be fabricated from sheets and plates of Type 304L or (as required) stainless steel with a 2D finish conforming to ASTM A240. Other non-welded parts and pieces such as bolts, washers, and follower flanges shall be made from Type 304 stainless steel. The nuts shall be bronze or brass to eliminate galling.

4. All gaskets shall be 45 to 55 durometer (Shore A) neoprene.
5. The droplegs and air distribution headers shall be of adequate size and thickness to support the diffusers and shall have a minimum wall thickness of 0.109 inch.
6. All welding on this equipment shall be completed in the factory. Field welding shall not be permitted. All welding shall be by the shielded arc, inert gas, MIG, or TIG method. Filler wire shall be added to all welds to provide for a cross section of weld metal equal to, or greater than, the parent metal. Butt welds shall have full penetration to the interior surface and gas shielding shall be provided to the interior and exterior of the joint.
7. All welds shall have a surface finish equal to the smoothness of a 2-D sheet finish. Interior weld beads shall be smooth, evenly distributed, with an interior projection not exceeding 1/16 inch beyond the I.D. of the pipe or fittings.
8. The outside weld area shall be wire brushed. Brushes shall be of stainless steel and used only on stainless steel. All discoloration left by welding shall be removed by pickling.
9. After fabrication, all stainless steel assemblies and parts shall be passivated by immersion in a pickling solution of six percent nitric acid and three percent hydrofluoric acid at 140 degrees F for a minimum of 15 minutes. Parts shall be free of iron particles or other foreign material. A complete neutralizing operation shall be required by immersion in a tri-sodium phosphate rinse.
10. Corrosion protection techniques not utilizing full immersion will not be acceptable. If pickling is not observed by the Engineer, the manufacturer shall certify that pickling has been performed per the above specifications. Non-properly pickled equipment may be rejected at the discretion of the Engineer.

C. Droplegs: Type 304L stainless steel dropleg per tank as shown on the Drawings.

1. Drop legs shall be furnished from the air main connection at the top of each tank. The top connection shall be a loose follower flange. The drop leg connection to the air distribution header to be a slip joint. Support the dropleg from the upper connection.
2. Each dropleg shall have a flange assembly consisting of:

    a. Connecting through bolts for the flange.
    b. A neoprene O-ring to seal the connection.

3. Minimum Wall Thickness: 0.00625 inch (Gauge 16)

D. Air Distribution Headers: One air distribution header per tank in lengths shown on the Drawings.

1. Furnish expansion/contraction system for all headers designed for temperature range of 125° F consisting of simple and fixed supports and expansion joints.Changes in diameter shall be accomplished by using eccentric reducers.
2. Minimum Wall Thickness: 0.00625 inch (Gauge 16)
3. Connections between sections of the air distribution header to be special flanged and expansion joints designed so that individual header sections can be rotated independently of adjacent sections for adjustment purposes. Flanged joins to be of the face ring-follower flange type with through bolts and to be structurally designed to transmit the longitudinal forces caused by expansion and contraction of the header. Expansion joints to be designed to allow for expansion and contraction of the air distribution header. Standard design pipe couplings are not acceptable
4. The bottom elevation of the submerged air distribution header shall be the same throughout the tank. Changes in diameter shall be accomplished by using eccentric reducers. The end of each header shall have welded end caps.

E. Diffuser Connectors for Fixed Headers: Factory welded to top centerline of air header and located as shown on the Drawings and described below:

a. Diffuser connections spaced at 48 inch centers, 3/4 inch diameter.
b. Number of diffuser connections to meet performance requirements specified herein.

F. Supports:

1. Each air header shall be provided with supports as recommended by the manufacturer. Maximum spacing between supports shall not exceed 210 inches.
2. Submerged supports to be fabricated from Type 304L stainless steel. Partially submerged supports and supports above the water to be fabricated from Type 304L stainless steel.
3. The stainless steel supports shall be designed to withstand the weight of the entire dropleg-distribution header assembly when filled with water. Type 304L stainless steel anchor bolts shall be provided to adequately attach the supports to the tank floor.
4. Header supports to include hold-down, adjusting and locking mechanism, header cradle, crosstree, and supporting structure. Each support to have a cradle with a bearing surface contoured to fit a minimum of the bottom 90 degrees of the air distribution header. One support for each header section to include an integral device for rotational adjustment. All adjusting devices to lock to maintain the header position after final adjustment.
5. Each support shall have a cradle with a bearing surface contoured to fit a minimum of the bottom 90 degrees of the air distribution header. The surface shall be a minimum of 2 inches wide.
6. All supports shall include a mechanism to provide for a minimum of plus or minus 2-in vertical and plus or minus 1/2-inch lateral adjustment for alignment of the header.

G. Air Diffusers:

1. Diffusers shall be furnished and installed as shown on the Drawings. The arrangement and spacing shall not exceed the dimensions shown.
2. Construct diffusers with cast end connections welded to the diffuser body.
3. The bottom elevation of the submerged air distribution header shall be the same throughout the tanks. The end of each submerged air header shall have welded end caps.
4. Air diffusers shall be designed to provide wide band aeration. Fit diffusers with balancing nozzle or orifice to provide full wideband aeration. Air shall be uniformly released along a minimum air band of two feet beyond the side of the air distribution header. Air exiting the diffusers shall clear the air header. Diffusers to have a minimum air release perimeter of 48 inches.
5. Each diffuser shall consist of an inverted air reservoir, deflector, air exit ports, and balancing nozzle. The balancing nozzle shall be sized to provide the proper headloss to ensure uniform air distribution throughout the aeration system.
6. Diffuser Connectors: Provide forged stainless steel tee with integral threads factory welded to the bottom centerline of the header and located in compliance with the Drawings. Pipe opening at tee connection to be bell-shaped with flush-welded tee connection. Pipe stubbed into header will not be allowed. Diffuser connectors are to be on a common horizontal plane. Air release from the diffuser into the sewage to be at or below this common horizontal plane. Connectors are to be of such length and so positioned that the air exiting the diffusers to clear the air header
7. Diffuser connectors and headers to be mutually stiffened with gussets to withstand a vertical load that results in a moment of 500 inch-pounds at the diffuser connection without any permanent deformation.

8. The diffusers shall be of proven non-clog design, capable of discharging airflows as specified herein.

H. Description and Performance Requirements:

1. San Gabriel WWTP Aerated Sludge Holding Tank (Inner Section):

a. Basin Diameter: 40 feet
b. No. of Basins: 1
c. Side Water Depth: 10.75 feet
d. Treatment Mode: Complete Mix
e. Maximum Airflow: 1650 scfm per basin (Includes existing annular diffusers)

2.3 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Owner Inspection:

1. Make completed diffuser assembly available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven days before inspection is allowed.

C. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that designated areas, clearances, structural requirements, piping, utility connections, electronic signals, and items provided by other Sections are ready to receive equipment.

B. Locate air header expansion joints above the structural expansion joints.

C. Allowable Tolerances

1. Piping or Tubing Out-of-Plumb: 1/4-inch in 10-feet.
2. Piping or Tubing Out-of-Line: 1/4-inch in 10-feet, maximum of 1-inch accumulative.
3. Elevation of Diffuser Outlet Openings: 3/8-inch across entire system.

D. Support diffusers as recommended by manufacturer.

3.2 INSTALLATION

A. Install equipment and perform Work according to manufacturer's instructions and recommendations. Anchor bolts shall be set in the concrete by the Contractor in accordance with the manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

A. Test for proper operation.

1. Energize blower system equipment and test diffuser operation under supervision of manufacturer's representative and in presence of Engineer.
2. Initial Air Flow Balance: Clear basins of dirt and construction debris. Fill basins with water to sufficient depth to submerge air diffusers in 2 feet of water; with entire system connected, with uniform distribution of air flow by observing bubbles in basins at design air flow; adjust orifices and/or other equipment, as required, and retest until required results are obtained.
3. Final Air Flow Balance: Fill basins with water to design water surface and retest complete system for uniform air flow distribution at design air flows; adjust orifices and/or other equipment as required, and retest until required results are obtained; operation in surging mode will not be allowed.

B. Manufacturer Services: Manufacturer's representative experienced in installation, of products furnished under this Section for not less than two days on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.

1. If there are difficulties in operation of the equipment due to the manufacturer's fabrication or Contractor's installation, additional service shall be provided at no additional cost to the Owner.

C. Upon completion of installation and after the equipment has been operated for a sufficient time to make all necessary adjustments, the Contractor, under the supervision of the manufacturer's representative and in the presence of the Engineer, shall field test each diffuser assembly. The test shall indicate proper air distribution along the header and no leakage at joints.

1. In the event of improper installation or operation, all defects shall be corrected, at no additional cost to the Owner, until the equipment operates to the satisfaction of the Engineer.

D. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

E. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.4 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

3.5 PROTECTION

A. Protect coarse bubble diffused aeration system from traffic or falling objects until placed into service.

END OF SECTION 465121

SECTION 465136 - CERAMIC DISC FINE BUBBLE DIFFUSERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Ceramic disc fine-bubble diffused aeration system, lateral piping, and pipe support/anchoring system for:

a. San Gabriel WWTP Treatment Units (Aeration Tanks) #1 and #2.

2. Delegated Design.

1.3 ABBREVIATIONS

A. DWP: Dynamic wet pressure.

B. EFR: Effective flux ratio.

C. PVC: Polyvinyl chloride.

D. SCFM: Standard cubic feet per minute.

E. SOTE: Standard oxygen transfer efficiency.

F. UPVC: Unplasticized polyvinyl chloride.

G. UV: Ultraviolet.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's information describing system materials of construction, fabrication, and protective coatings.

B. Shop Drawings: System materials and component equipment, connections, and other installation details for:

1. System materials and component equipment, connections, and other installation details for:

a. Diffuser elements, diffuser element holders, retainers, gaskets, and orifices.

b. Piping, fixed joints, guide joints, expansion joints, piping supports, pipe taps.
c. Anchoring system for manifolds and distribution laterals for aeration system.
d. Equipment weights including the weight of largest item or component.
e. Layout drawings.
f. Complete bill of materials for all equipment.
g. Complete details of each air header system showing number, location, type, and details of supports, length of header sections, materials and details of construction, anchor bolt size, number and location.

1.5 DELEGATED DESIGN SUBMITTALS

A. Calculations and Drawings: Demonstrate entire system, including manifolds, laterals, drain lines, and moisture purge system meet requirements for expansion and contraction.

1. Show how system will expand and contract under range of conditions specified.
2. Demonstrate manifold headers, lateral pipes, pipe fittings, expansion joints, piping supports, etc., for entire system comply with requirements specified.
3. Calculate maximum amount of deflection that will occur and compare deflection to maximum allowable for type of joint used. Confirm that joints will not leak, and that expansion and contraction are acceptable for specified condition.

1.6 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate:

1. Products meet or exceed specified requirements.
2. Installation is completed according to manufacturer’s instructions.

B. Manufacturer Instructions: Detailed instructions on installation requirements, storage and handling procedures, including:

1. Certified erection drawings showing material details of construction, dimensions, anchor bolt locations, and other details required for a proper installation.
2. Description of Contractor's proposed method for ensuring a level installation of equipment and methods of tightening bolts, diffuser hold-down rings, and similar items.

C. Operating and Maintenance Instructions: Prepared specifically for installation, including all required cuts, drawings, equipment lists, descriptions, etc. required to instruct operating and maintenance personnel unfamiliar with such equipment. Include trouble shooting data and full preventative maintenance schedules.

D. Source Quality-Control Submittals: Results of factory tests and inspections.

E. Field Quality-Control Submittals: Results of Contractor-furnished tests and inspections.

F. Manufacturer Reports: Equipment has been installed according to manufacturer instructions.

G. Spare Parts List: Manufacturer’s recommended spare parts, including gaskets, packing, etc.

H. Design Data:

1. Complete data on air flow head losses through the droplegs, headers, and diffusers.

2. Complete oxygen transfer calculations based on guaranteed performance.
3. Complete calculations and drawings demonstrating that the entire system meet requirements for expansion and contraction as specified herein.

I. Test Reports:

1. Descriptions of test procedures.
2. Certified copies of results of tests specified.

J. Qualifications Statements:

1. Qualifications for manufacturer and installer.
2. Manufacturer’s approval of installer.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and final orientation of equipment.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Tools: One set required for normal operation and maintenance

1. Package tools in a steel case. Clearly and indelibly marked on exterior of case indicating equipment for which tools are intended.

B. Spare Parts:

1. Spare Diffusers: Equal to three percent of total number of installed diffusers.

a. Include diffusers, gaskets, replaceable air flow control orifices and required bolts, hold-down rings, and nuts.

2. Material to repair five percent of expansion joints supplied under this Contract.
3. Material to replace three percent of pipe supports including nuts and bolts.
4. For each type of diffuser density: One 20-feet section of complete lateral distribution pipes for spacing of diffusers supplied, including diffuser holders.
5. One complete air purge system.
6. Suitable pack and protect items for long periods of storage.

1.9 QUALITY ASSURANCE

A. Furnish diffusers by a single manufacturer regularly engaged in manufacture of diffused aeration systems for wastewater treatment. The equipment shall be manufactured and installed in accordance with best practices and methods.

B. Provide manufacturer's service representative, trained on installation of specified equipment.

1. Submit qualifications for approval.
2. Instruction requirements listed are exclusive of travel time, and do not relieve Contractor of obligation to provide sufficient service to place equipment in satisfactory operation.
3. Operation and maintenance instructions: one 8-hour day .

C. Furnish equipment specified in this Section by a manufacturer of diffusers who has sole responsibility for designing and fabricating parts and components required for a complete and operable system. Equipment need not be manufactured by a single manufacturer.

D. Quality Control Tests:

1. Prior to initiation of production, submit for Engineer's review sampling and testing plans to ensure consistently good quality and uniformity of diffuser production.
2. Testing and Sampling Plans: Follow procedures in "EWRI/ASCE 35-01 Guidelines for Quality Assurance of Installed Fine-Pore Aeration Equipment."

    a. After testing, mark diffusers with their test results.

3. Engineer may witness quality control sampling and testing at manufacturing facility.
4. Submit to Engineer a certified test report within two weeks of testing.
5. Include following tests and measurements:

    a. DWP at minimum, design average, and maximum air flow rates.
    b. EFR: At design average air flow rate.
    c. Uniformity: Visual evaluation of air flow pattern across entire diffuser surface.
    d. Permeability: At 70 degrees F plus or minus 5 degrees F and 10 to 50 percent relative humidity.
    e. Strength: Test by applying a vertical load of 750 lbs to center of 1 inch diameter when supported as in a diffuser element holder.
    f. Diffuser diameter.
    g. Diffuser weight.
    h. Diffuser thickness: At center and edge.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 10 years' documented experience. Professional Engineer: Person legally qualified to practice and who is registered in State where Project is located.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's packaging; include application instructions.

B. Inspection: Accept materials on site in manufacturer's original packaging and inspect for damage.

C. Store diffusers according to manufacturer instructions.

D. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.

1. Do not make shipment until approved by Engineer in writing.
2. At Time of Shipment: Deliver in triplicate to Engineer shipping list, original bill of loading, shipping memorandum and shipping invoice.

    a. Shipping Lists: Provide description and net weight of each item, and gross shipping weight.

b. Shipment will not be accepted until list has been received.

E. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended. Mark boxes or packages to show their net weight.

F. Properly protect components so no damage or deterioration occurs during a prolonged delay between time of shipment and installation, including any prolonged period at site.

1. Wrap components at factory for protection from sunlight, snow, rain, drippings of any sort, dust, dirt, mud, flood, and condensed water vapor.

a. Protective coverings to remain in place until work areas are ready for installation.
b. Submit details of proposed protection for Engineer's approval prior to shipment.

2. Finished surfaces of exposed parts: Protect against adverse conditions that may prevail from time of shipment until ready for operation.

G. Protect finished surfaces of exposed flanges with wooden blank flanges or plastic inserts, strongly built and securely bolted.

H. Arrange and mark lateral piping and diffuser holders for tank and grid which they are intended.

I. Protection: Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

1. Provide additional protection according to manufacturer instructions.

1.12 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.13 WARRANTY

A. The manufacturer shall guarantee that air diffusion equipment shall perform in accordance with the specifications when operated at the specified design conditions.

B. Provide an unconditional extended warranty for a period of 2 years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Provide equipment by one of the following or equal:

1. Sanitaire (Xylem), Milwaukee, WI.
2. Aquarius Technologies LLC, Saukville, WI.
3. Environmental Dynamics International, Inc, Columbia, MO).

4. Approved Equal

2.2 CERAMIC DISC DIFFUSER SYSTEMS

A. General:

1. Supply equipment complete.

   a. Proportion parts to have liberal strength, stability and stiffness and adapted for intended service.
   b. Provide ample room and facilities for inspection, repairs, and adjustments.

2. Furnish equipment suitable for:

   a. Operation submerged in wastewater with biomass concentration ranging from 3,000 mg/L to 6,000 mg/L.
   b. Long term exposure to compressed air at temperatures up to 250 degrees F when submerged in water or wastewater.

3. Drawings show a schematic configuration of piping, valves, and diffusers. The aeration system manufacturer/supplier to provide detailed design of the system to meet the performance requirements specified herein.

B. System Description – San Gabriel WWTP Treatment Unit Aeration Tanks No. 1 and 2:

1. Temperature range of Mixed Liquor:

   1) Maximum, degrees (F) 85.
   2) Minimum, degrees (F) 60.

2. Basin Liquid Depth:

   1) Average: 14.8 feet.
   2) Maximum: 15.4 feet.

3. Available air pressure at top of each dropleg: 8.5 psig.
4. Manifolds and laterals: Capable of carrying 150 percent of design average required airflow rates.
5. Provide diffuser design with four grids in each aeration tank suitable for providing the following minimum standard oxygen transfer rate (SOTR) in pounds per hour (lb/hr):

   a. Each tank: Four diffuser grids with uniform diffuser density
   b. Average SOTR per tank: 532 lb/hr
   c. Maximum SOTR per tank: 741 lb/hr

C. Performance and Design Criteria:

1. Design Air Flow Rates per Diffuser:

   a. Minimum: 0.5 scfm.
   b. Average: 1.0 scfm.
   c. Maximum: 2.5 scfm.

2. SOTEs in Clean Water: 0 mg/L Dissolved Oxygen, at 1.00 atm which equals 14.7 psia, at 68 degrees F, 36 percent Relative Humidity:

    a. At minimum design air flow rate per diffuser: 2.0 percent per foot submergence.
    b. At average design air flow rate per diffuser: 2.0 percent per foot submergence.
    c. At maximum design air flow rate per diffuser: 1.8 percent per foot submergence.

3. Maximum Head Loss: 12 inches water column WC, based on 15 feet submergence.

D. Design Requirements Applicable to all Grids:

1. Provide 5 percent additional blank diffuser saddle/base plates per grid.

    a. Minimum Blanks: Based on number of diffusers required to satisfy specified SOTE percent in addition to active diffusers specified.
    b. Uniformly distribute blanks throughout each grid.
    c. Mounting saddles, diffuser base/holders, and retaining rings of the type to be assembled, installed, and plugged at each blank site.

        1) Future Diffuser Installations: Only require diffuser placement and plug removal.
        2) Blanks and Diffusers: To be in place prior to performing acceptance tests.

2. Arrange diffusers such that each diffuser is easily accessible for manual removal and replacement and for in place diffuser cleaning.

    a. Provide a clear walking space of 18 inches, measured between lateral piping.
    b. Clear walking space may be between every lateral or alternate laterals, provided access to laterals and diffusers is achieved from one side or the other of the walking space.
    c. Base maximum spacing between diffusers on lateral pipes and laterals on manufacturer's recommendations to meet the requirements of this Section and to prevent deposition of solids.
    d. Spacing Between Diffusers: Do not exceed 48-inch center to center of diffusers or 2 feet from center of diffuser to any tank wall, unless otherwise indicated on Drawings.

3. Allow for expansion and contraction in the entire system, which includes the manifold, laterals, drain lines, and moisture purge system, under following conditions:

    a. Winter conditions, empty aeration tanks: 0 degrees F.
    b. Summer conditions, empty aeration tanks: 125 degrees F.
    c. Operation with air supply at 225 degrees F and aeration tanks full.
    d. Operation with air supply at 225 degrees F and water level in aeration tanks 2 feet above diffusers.

2.3 STAINLESS STEEL MATERIALS AND FABRICATION (NOT USED)

A. Air piping exposed to atmosphere or partially submerged to be Type 316L stainless steel.

B. Submerged piping to be Type 304 stainless steel.

C. All welded parts and assemblies including droplegs, submerged air distribution headers, header connections, diffusers, fabricated supports, flanged joints, and expansion joints shall be fabricated from sheets and plates of Type 304L or Type 316L (as required) stainless steel with a 2D finish conforming to ASTM A240. Other non-welded parts and pieces such as bolts, washers, and follower flanges shall be made from Type 304 stainless steel. The nuts shall be bronze or brass to eliminate galling.

2.4 PVC MATERIALS AND FABRICATION

A. PVC Moldings and Extrusions: Produced from PVC compound per ASTM D1784.

1. Compound cell classification 12454-B with a minimum tensile strength of 7,000 psi.
2. PVC parts to be suitable for long term exposure to compressed air at temperatures up to 200 degrees F.

B. Blend PVC resins and limit quantity of fillers to achieve:

1. Minimum K-Value for Fittings: 58.
2. Minimum K-Value for Pipes: 64.

C. Distribution Headers: Hydrostatic design stress rating of 2,000 psi, as shown on Drawings per ASTM D1785 or ASTM D3034.

D. PVC Fittings: As shown on Drawings per ASTM D2466.

E. Solvent Welding: With solvent cements specifically formulated for use with PVC.

1. PVC joints welded in factory in per ASTM D2855 except edges need not be chamfered.
2. Solvent Welding: With solvent cements formulated for use with PVC per ASTM D2564.
3. Field solvent welding not permitted.

2.5 PIPING

A. Furnish connections to stainless steel droplegs and manifolds of minimum sizes shown on Drawings.

B. UV Protection of PVC Piping and Parts: Manufactured of UPVC with a minimum of 1.5 parts by mass of rutile titanium dioxide (TiO_2) per 100 parts of PVC resin for ultraviolet protection.

1. TiO_2 Particle Size: 0.2 micrometer) to 0.3 micrometers (microns)). Include a certificate from raw material supplier confirming this requirement.

C. UPVC piping: suitable for use in wastewater.

1. Dropleg connections and air manifolds to be Schedule 40 UPVC.
2. Lateral pipe: minimum SDR26 with hydrostatic design stress rating of 2,000 psi. Lengths not to exceed 20 feet.

D. Dropleg Connections and Manifolds: Supply with flexible couplings, expansion joints, pipe supports, etc. as shown on Drawings, and as required by Manufacturer for alignment of system and to meet expansion/contraction requirements as specified.

E. Air Diffuser Distribution Laterals: Include piping, diffuser element holders, joints, expansion joints and air purge-drainage system.

1. Distribution laterals connect to side centerline of manifold by flange connections or by fixed joint union-type connections.
2. Provide for Flange Connections: Ply Type 316 stainless steel nuts, bolts, gaskets, backing flange, and other accessories.
3. Fixed Joint Couplings: For airtight connection between distribution lateral and manifold and with positive locking joint and anti-rotation feature. Joints relying on friction as anti-rotational feature is not acceptable.
4. System to meet expansion/contraction requirements as specified.

F. Fixed Joints: Factory solvent welded to distribution laterals. Factory assemble and test solvent welds prior to shipment. Field solvent welding is not permitted.

G. Pipe Support Systems Factor of Safety: 4 or greater against calculated buoyant forces when installed.

H. Anchor Bolts Factor of Safety: 10 or greater against calculated buoyant forces when installed.

I. Level diffusers to plus or minus 1/4 inch. Diffuser piping and diffusers must be capable of being leveled to this tolerance and remaining level under all conditions of operation whether aeration tanks are full, partially full, or empty.

J. Lateral Piping: Include an expansion-contraction system consisting of fixed joints and guide supports.

K. Guide Supports:

1. Allow longitudinal expansion and contraction movement of lateral piping.
2. Provide proper bracing and means for accurate field alignment and adjustment of diffuser piping vertically and longitudinally.
3. At least two supports per pipe section. Support spacing not exceed 90 inches. Join sections of lateral piping with fixed joints which prevent blow-apart and rotation of one pipe section with respect to another.
4. Provide for specified range of expansion or contraction of diffuser piping resulting from temperature change.
5. Expansion joints not to be used for joining pipe sections.

L. Expansion Couplings: Operate at average force of 50 lbsf.

M. Piping Gaskets: butyl rubber, neoprene, or a composition suitable for air to 230 degrees F and suitable for long term immersion in wastewater.

N. One drain line, sump, and air lift purge systems for each grid:

1. One in-line manifold purge sump and air lift purge system to drain entire submerged aeration piping system for each aeration grid.
2. Sump: Integral with manifold. Its bottom elevation lower than invert of air distribution laterals and manifold.
3. Connect drain sump to 3/4 inch diameter airlift line extending from sump invert elevation.

a. Extend airlift line to point above tank water level and terminate with a horizontally mounted PVC ball valve accessible from finished grade.
b. Air lift line will utilize a flexible connection between drain sump and vertical pipe run at aeration tank wall.

2.6 SUPPORTS

A. Manifold Supports:

1. Material: Type 304L stainless steel. Space as specified. Anchor supports to tank floor with Type 304, 3/8 inch diameter wedge anchors.
2. Supports include manifold hold down and supporting structure.
3. Design stands to resist following uplift without exceeding 24,000 psi design stress:

    a. Manifold Diameter: 4 inches. Uplift Force per Support: 102 lbs.
    b. Manifold Diameter: 6 inches. Uplift Force per Support: 325 lbs.
    c. Manifold Diameter: 8 inches. Uplift Force per Support: 325 lbs.
    d. Manifold Diameter: 10 inches. Uplift Force per Support: 543 lbs.
    e. Manifold Diameter: 12 inches. Uplift Force per Support: 543 lbs.

4. Provide supports with a mechanism to provide plus or minus 2 inch vertical and 1/2 inch lateral adjustment for alignment of manifold in field.

B. Air Distribution Lateral Supports:

1. Material: Type 304L stainless steel. Spaced as specified.
2. Fixed Supports: Consist of a hold-down mechanism and self-limiting clamp device.

    a. Provide a wide contoured bearing surface for air distribution lateral.
    b. Clamping Device: Self-limiting to prevent over-stressing lateral if clamp is over-tightened.

3. Intermediate Guide Supports: Consist of self-limiting hold-down and sliding mechanism.

    a. Hold-Down and Sliding Mechanism: Contoured bearing surface with chamfered leading edges to minimize binding of air distribution lateral.
    b. Sliding Mechanism: Provide minimum resistance to movement of air distribution lateral under full buoyant uplift load. Provides 1/8 inch clearance around lateral and is self-limiting if mechanism is over-tightened.
    c. Horizontal Thrust: 20 lbs or less. Sufficient to initiate movement of lateral relative to mechanism under full buoyant uplift load.

4. Supports provided with a mechanism providing plus or minus 2 inch vertical adjustment for alignment of air distribution lateral in field.

    a. Adjusting and Aligning Mechanism: Infinitely adjustable within its limits allowing precise leveling of air distribution lateral and diffuser assemblies to within plus or minus 1/8 inch of a common horizontal plane without removing lateral from support.

5. Anchor supports to tank floor. Type 304L stainless steel 3/8 inch diameter wedge anchor bolts. Anchors designed to withstand 450 lbs of withdrawal force.

a. Anchorage bolts and support rods: 1/2 inch diameter.
b. Anchorage bolts and support rods for guide supports: 5/16 inch diameter.

2.7 EXPANSION JOINTS

A. Expansion Joints: As required to prevent thermally induced stresses due to expansion and contraction over temperature range specified and consisting of a plain end, EPDM O-ring, and threaded union type connection.

1. Airtight.
2. Material: UPVC.
3. Permit free and easy movement of plain end of lateral within coupling barrel.
4. Expansion barrel to accommodate movement over temperature ranges specified.
5. Provide positive means to prevent joint blow-apart.

2.8 ANALOG DIFFUSER PRESSURE MONITORING SYSTEM

A. Monitoring equipment to measure DWP and operating air flow rate of a typical diffuser in each aeration grid.

1. One portable monitoring panel in a NEMA 4X fiberglass enclosure with Type 316 stainless-steel handrail mounting bracket and carrier column assembly per grid.
2. Monitoring Panel:

   a. Differential pressure gauges; orifice and diffuser.
   b. PVC ball valves.
   c. Quick disconnect couplings.
   d. One set of calibration curves.

3. Connections to Measure Following:

   a. Air distributor pressure.
   b. Flow control orifice differential pressure.
   c. Diffuser element operating differential wet pressure (DWP).

4. Flexible tubing from connection box to air distribution lateral pipe, diffuser element holder, and bubbler line.

   a. Install flexible tubing in a single 1-1/2 inch NPS Schedule 40 UPVC carrier pipe with Type 316 stainless steel supports at 5 feet maximum center-to-center spacing.

2.9 GAS CLEANING SYSTEM

A. Pipe manifold for chemical cleaning system for in-situ maintenance of diffused aeration equipment.

1. Cleaning: Defined as ability of system to decrease diffuser head loss or DWP by removal of mineral scale from diffuser (pores/perforations). Time-dependent physical changes which may result in increased DWP are considered to be part of diffuser life cycle.

2. System Description: Gas cleaning with Monel piping. Piping will run from the top of the tank down to the PVC lower drop pipe, and diffuse into the lower drop, upstream of the manifold. Gas must be fed at the drop leg, so the gas goes to each diffuser, not bypassing any laterals.

3. Complete System: Defined as inclusion of mechanical components to provide an acid flow path including:
   a. Valve and hose assembly for connections.
   b. Drop pipe and valve assembly.
   c. Acid feed connection to dropleg.
   d. Associated piping and appurtenances included on Detail E on drawing MZ-7.

4. Capabilities:

   a. Distributing an equal amount of cleaning agent throughout aeration grid for maximum cleaning effect.

5. Cleaning System Materials: Compatible for use with hydrochloric acid.

2.10 SYSTEM FABRICATION

A. Diffuser assemblies consisting of ceramic diffuser, gasket, diffuser holders, air flow control orifice, and retaining device.

B. Diffuser Materials and Fabrication: Ceramic disc type. Guaranteed for oxygen transfer efficiencies specified.

1. Material Characteristics:

   a. Fused crystalline alumina grains thoroughly joined together with ceramic bonding materials forming a strong, uniformly porous, and otherwise homogenous structure
   b. Not deformed. Uniform throughout entire structure.
   c. Free of cracks, soft spots, chipping, spalling, or other structural defects.
   d. No loose, unbonded material that may affect normal and proper operation.
   e. Free of materials soluble in wastewater carrying household or industrial wastes of any character.
   f. Free of holes and impervious material which may cause unequal air distribution.
   g. Specific Permeability Rating: 20 to 30 scfm. Permeable over entire surface.

      1) Permeability Rating: Cubic feet of air per minute at 70 degrees F and 25 percent relative humidity, which will pass through one square foot of diffuser one-inch thick when tested dry under an equivalent pressure differential of two-inches of water column.

2. Outside diameter: 9 inches.
3. Do not exceed following dimensional tolerances:

   a. Diameter: Plus or minus 1/8 inch.
   b. Height: Plus or minus 1/16 inch.
   c. Thickness of active section: Plus or minus 1/16 inch.

C. PVC or fiber reinforced polypropylene diffuser element holders with an air plenum chamber below diffuser support plate.

1. Element Holders: Provide complete peripheral edge support for diffuser element.

a. Attach holders to distribution laterals to resist following torque values.
b. About polar axis of holder: 150 ft-lbs.
c. About longitudinal axis of holder: 100 ft-lbs.

D. Retaining device to securely hold and seal diffuser to holder.

1. Diffuser elements will be secured to diffuser holder assemblies in a manner that will not allow passage of air at gasket.

E. Screw-on Retainer Rings: With positive O-ring seat. 2-1/2 inch complete threads for engagement.

1. Minimum thread cross section: 1/8 inch.

F. Flow Control Orifice: Sized ensuring even air distribution throughout each grid at specified air flow ranges.

1. Air release entering diffuser assembly evenly distributed under horizontal surface of diffuser element when submerged in water. Orifice sized to meet specified requirements of system head losses.
2. Orifice plugs for diffuser assembly blank spaces specified herein. Airtight under all operating conditions.

2.11 SOURCE QUALITY CONTROL

A. Provide shop testing of completed assembly.

B. Owner Inspection: Make completed diffuser assemblies available for inspection at manufacturer's factory prior to packaging for shipment.

1. Notify Owner at least seven days before inspection is allowed.

2.12 FACTORY/SHOP OXYGEN TRANSFER TEST

A. General:

1. Prior to shipment of equipment to site: Conduct performance tests on fine bubble fixed-grid aeration system.

a. Demonstrate clean water transfer efficiency.
b. Test lateral spacing, diffuser densities, and maximum and average airflow rates for each grid as specified.

2. Testing Notification: Forwarded to Engineer least 2 weeks before scheduled test date.

a. List of test equipment, and test procedures.

3. Certified calibration Data: For meters, gauges, and other test instruments.

4. Costs:

    a. Factory oxygen transfer testing: At expense of Contractor.
    b. Cost of Retesting: If required, will be borne by Contractor.

5. At least three tests will be conducted, along with additional tests as required to establish performance and repeatability criteria specified.
6. Performance Tests: Conducted by clean water, unsteady-state method.

    a. Testing performed in a manner acceptable to Engineer and follow procedures set down in ASCE/EWRI 2-06 Measurement of Oxygen Transfer in Clean Water.
    b. Provide support facilities including, but not limited to:

        1) Chemical storage tanks.
        2) Mixing equipment and chemicals as required.
        3) DO probes, instruments, and recorders.
        4) Scales and such other equipment.
        5) Personnel and facilities as may be necessary.

    c. Submit with shop drawings, proposed testing procedures including equipment details, sketches, and supplies.
    d. Provide personnel as are required to set-up and conduct tests.
    e. Authorized representative of diffuser manufacturer must be present for tests.

        1) Authorized representative must be familiar with operation of equipment furnished.

    f. Perform tests and record data using qualified personnel.
    g. Test Results: Required calculations and report preparation must be done by equipment manufacturer and approved by Engineer.
    h. Use information collected as a basis for determining acceptability of equipment.
    i. In case of conflict, interpretations and calculations by Engineer will govern.

7. Air Measurement: Measure air flow during testing with two types of devices, each with test flow at mid-range of scale.

    a. Flow Measurement: With sharp-edge orifice plate, flow tube or similar device.
    b. Air Flow Meter: Calibrated prior to use. Submit certified calibration to Engineer.
    c. Locate device in a location compatible with accurate measurement.
    d. Utilize a direct reading manometer to measure system pressure drop accurate to within one-half inch of water column.
    e. Measure in-line pressure upstream of flow measurement with a manometer accurate to within one-half inch of water column.
    f. Measure in-line temperature upstream of flow measurement device temperature sensor accurate to within plus or minus 5 degrees F.
    g. Measure atmospheric temperature, pressure, and relative humidity on site during testing.
    h. Document air rate cubic feet per minute scfm using calibration curves and correction factors for device.
    i. Measure air flow rate at least two times during each test.

        1) Air flow Rate: Within 0.05 scfm per diffuser element of that to be tested.
        2) Any single observation will be within 2.5 percent of mean for that test run.

8. Water and power for operation of air blowers provided by equipment manufacturer.
9. Test and verify tank size is appropriate to eliminate potential interference resulting from wall effects.

    a. Extraneous piping and other materials in test tank to be minimized.
    b. Diffuser placement, density, and submergence to be identical to those specified for full scale installation.

10. Airflow rate per diffuser, airflow rate per unit volume and area, power input per unit volume, and flow control orifice sizes to be identical to those specified for full scale installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify items provided by other Sections of Work are ready to receive Work of this Section.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install equipment per manufacturer's instructions and as shown on Drawings.

B. Clean air mains, blowers, filters, and droplegs prior to installing diffuser elements.

1. Do not install diffuser elements until entire system, including blowers provided under Section 431118 “Vertically Split Multistage Centrifugal Blowers” have been thoroughly flushed with air for a minimum of 24 hours.
2. Coordinate cleaning operation with blower manufacturer.

C. Protect diffuser elements from freezing.

D. Protect diffuser elements from un-pressurized submergence in wastewater.

3.3 ADJUSTING

A. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

B. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.4 FIELD QUALITY CONTROL

A. Testing:

1. Test for proper operation.
2. Energize system equipment and test operation under supervision of manufacturer's representative and in presence of Engineer.

B. Manufacturer Services: Furnish services of manufacturer’s representative experienced in erection, installation, operation, and maintenance of equipment.

1. Representative must be present during initial installation of diffusion equipment.
2. Ensure satisfactory procedures are followed.
3. Provide a minimum of 2 visits supporting following efforts:

    a. Periodic installation supervision.
    b. Periodic installation inspection.
    c. Field testing.
    d. Startup.
    e. Instructing Owner’s personnel in operation and maintenance of system.
    f. Any other assistance to Contractor necessary to guarantee satisfactory performance of equipment.

C. Provide services of factory representative per specified requirements for a minimum of one day per tank.

D. If there are difficulties in operation of equipment due to manufacturer's fabrication or Contractor's installation, provide services to make required modifications for proper operation.

3.5 FIELD ACCEPTANCE TESTS

A. After installation of aeration system equipment in one aeration tank, equipment to be subject to field acceptance tests as specified.

B. Mounting Tests. Test support and tie-down provisions of UPVC piping ensuring they have a factor of safety of four against calculated buoyant forces. Test anchor bolts for UPVC piping ensuring they have a factor of safety of ten against calculated buoyant forces.

1. After installation of supports and before installation of piping, supports of each type and anchor bolts must be tested.
2. Testing includes ten percent of each support type, chosen at random, and witness tested by Engineer.

    a. Supports chosen for test to be attached to lever which will be placed on a fulcrum.
    b. Apply a static load to opposite end, producing a vertical extracting force equal to four times calculated maximum buoyant force to which support tie-downs will be subjected in normal operations.
    c. Test anchor bolts to a vertical extraction force, ten times calculated maximum buoyant force.
    d. Application of test loads must be such that entire pipe support, including pipe hold down strap and anchor bolts are tested.

C. Inspection of Piping. For proper joints, supports, tie-downs, end plugs, and drain relief valves.

D. Level Test. Flood aeration tanks with clear water to top of ceramic diffusers.

1. Check level of diffusers. Verify they are at same elevation, plus or minus 1/4 inch.

2. Correct diffuser elevation, if necessary, prior to proceeding further.

E. Uniformity and Leakage Test:

1. Flood aeration tanks with protected water to a depth of 1 foot above diffusers.
2. Turn on air flow to air flow rates as approved by Engineer and verify air is supplied evenly to headers.
3. Visibly inspect surface of water to see that air flow is uniformly distributed across tanks and no air leaks are present within piping system.

a. If in opinion of Engineer, there are areas of consistently low or high air quantity release, or leaks within piping system, make necessary adjustments to correct these deficiencies.

F. Cost of Testing: Field tests, including filling, dewatering, restoration, and cleaning of aeration tanks, to be conducted at Contractor’s expense. Costs of retesting: If required, at Contractor’s expense.

G. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.6 FIELD OXYGEN TRANSFER TEST (NOT USED)

3.7 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

3.8 PROTECTION

A. Protect diffusers from traffic or falling objects until placed into service.

END OF SECTION 465136

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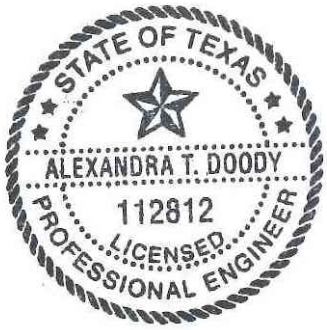
CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

CITY OF GEORGETOWN

SAN GABRIEL WWTP REHABILITATION

ADDENDUM NO. 1

Date Issued: March 3, 2023



Prepared by Alex Doody, PE 112812
CDM Smith Inc Texas Registration No. F-3043

Proposers on this project are hereby notified that this addendum shall be attached to and made a part of the above named Contract Documents and Technical Specifications, dated January 2023.

The following items are issued to add to, modify, and clarify the Contract Documents and Technical Specifications and Drawings. These items shall have full force and effect as the Contract Documents and Technical Specifications, and cost involved shall be included in proposal prices. Proposals to be submitted on the specific proposal date shall conform to the additions and revisions listed herein.

Acknowledge receipt of this addendum by designating receipt of the addendum on the first page of the Proposal. Failure to do so may subject proposer to disqualification.

ADDITIONAL INFORMATION

1) The Meeting Summary and Presentation from the non-mandatory Pre-Proposal meeting held on March 2, 2023 is attached.

2) The City's procurement office address is changing on March 6, 2023 to 510 W. 9th Street. Georgetown, TX 78626. See below for contract document updates.

3) A non-mandatory site visit to San Gabriel WWTP has been scheduled for Wednesday, March 8th, at 11:00am CDT. The address of the facility is 1105 N. College St., Georgetown, TX 78626.

    i. Contact Chris Logan (chris.logan@georgetown.org) to schedule a site visit if the above date is not feasible.

REVISIONS TO CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

SECTION 00100 – REQUEST FOR PROPOSALS

1) Cover Page, REVISE City's address to read as: "510 W. 9th St. Georgetown, TX 78626".

SECTION 00300 – PROPOSAL FORM

1) Page 00300-1, REVISE the address for the proposal submission location to:
   City of Georgetown, Purchasing Department
   510 W. 9th Street
   Georgetown, TX 78626

SSECTION 00500 – STANDARD FORM OF AGREEMENT

1) Page 00500-7, REVISE the address for the giving notices to:
   City of Georgetown, Purchasing Department
   510 W. 9th Street
   Georgetown, TX 78626

SECTION 011000 – SUMMARY

Page 011000-1, REVISE the address of the owner to "510 W. 9th Street Georgetown, TX 78626" on Section 1.4.B.

END OF ADDENDUM NO. 1

MEETING SUMMARY

San Gabriel Wastewater Treatment Plant Rehabilitation

MARCH 02, 2023

- **INTRODUCTION**

1. City of Georgetown Project Personnel (may not be present):

a.	Systems Engineering Director	Wesley Wright, P.E.
b.	Utility Engineer	David Munk, P.E.
c.	Water Utility Director	Chelsea Solomon, P.E.
d.	Assistant Water Utility Director	Chris Graf, P.E.
e.	Wastewater Treatment Superintendent	Randall Swenson
f.	CIP Manager	Chris Pousson
g.	CIP Project Manager	Chris Logan
h.	Inspectors	To Be Determined
i.	Instrumentation	Justin Breithaupt
j.	Buyer, Purchasing	Donna Cantwell

2. Engineer: CDM Smith, Inc.:

a.	Project Principal/Program Manager	Allen Woelke, P.E.
b.	Project Manager	Gerald Furrier, P.E.
c.	Design Manager/EOR	Alexandra Doody, P.E.
d.	Construction Manager	To Be Determined
e.	Project Engineer	Josey Mayer

3. Meeting Purpose
This is a **non-mandatory** Pre-Proposal teleconference for the Project. The project site, which is located **at 1107 N. College St., Georgetown, TX 78628**, will be available for inspection by prospective proposers by request.

- **PROJECT DESCRIPTION**

1. The project consists of furnishing, installing and providing all labor and materials required for construction of rehabilitation improvements to the 2.5 million gallon per day San Gabriel Wastewater Treatment Plant, as more fully described in the Drawings and the Summary of Work contained in Section CIP3. Major items are listed below and summarized in the attached PowerPoint presentation of the Summary of Work:
*Note that the City's procurement office address is changing on March 6, 2023 to **510 W. 9th St., Georgetown, TX 78626***

   - Mobilization – Including move-in costs, insurance, bonds, etc.
   - Complete shop drawing submittal process.
   - Temporary sedimentation and erosion control.
   - Installation of 18-inch Influent (INF) piping, 20-inch buried Aeration Basin Influent (ABI) piping, Non-Potable Water (NPW) piping, Sodium Bisulfite (SBS) piping, Drain (DR) piping, concrete flow meter vaults on top of existing Return Activated Sludge (RAS) piping, installation of buried valve(s), and connection to existing tanks.
   - Installation of buried electrical ductbank, conduit, and wiring from new Electrical Houses and Generator to existing and new equipment as shown on the Drawings.

- Scope of work for all new blower low pressure air (LPA) piping will be above grade with supports from grade as shown on the Drawings.
- Testing of new piping systems.
- Demolition of pumps, blowers, gates, tanks, and valves as shown on the Drawings.
- Modification of existing concrete structures as shown on the Drawings.
- Installation of new process equipment including pumps, blowers, diffusers, mechanically-raked bar screen, grit removal equipment, and valves as shown on the Drawings.
- Installation of new process instrumentation and control system and modifications to the existing SCADA system.
- Electrical and Instrumentation Equipment and Systems Modifications – Consists of power and instrumentation improvements for equipment being furnished.
- Site Work – Includes site preparation, grading, seeding, new asphalt and concrete paving, and related work.
- Re-vegetation, in accordance with the Edwards Aquifer vegetated filter strip requirements, and Site Restoration.
- Demobilization and Clean-up.

PROJECT SCHEDULE

1. Important Proposal Dates:
   a. Deadlines for Questions and Inquiries: March 23, 2023 at 5PM CDT
   b. Proposal Opening (Virtual) Date and Time: March 30, 2023 at 2PM CDT
   c. City Review of Proposals: March 31, 2023 – April 12, 2023
   d. Water Board Meeting: April 13, 2023
   e. City Council Meeting: April 25, 2023
   f. Earliest Award by City: May 2023

2. Substantial Completion: Substantial completion shall be 730 calendar days from the Notice to Proceed (00500 3.02).

3. Final Completion: Final shall be 820 calendar days from the Notice to Proceed (00500 3.02).

4. Liquidated Damages:
   a. Seven Hundred Dollars ($700), per Calendar Day for every calendar day the work remains incomplete after the Substantial Completion date (00500 3.03);
   b. Five Hundred Dollars ($500) per Calendar Day for every calendar day the work remains incomplete after the Final Completion date (00500 3.03);

- **PROPOSAL FORM:**

Gerald Furrier (CDM Smith) stressed the importance of reviewing and understanding the competitive seal proposal requirements and associated documents. There are three rating criteria, where Price is the weighted the heaviest.

1. Nine (9) Proposal Items
2. Proposal Item No. 2 shall include all work except those listed separately in other items.

Item No. 2 acts as a "catch-all" that are not specifically included in the 8 other proposal items.

3. Schedule of Materials and Suppliers
4. Schedule of Subcontractors
5. Proposals to must be submitted electronically in accordance with Section 00100.
   a. Note that Sealed proposals must be electronically submitted no later than 2:00 PM CDT on March 30, 2023 through the City's web site at: E-bid system accessible via City's web site https://gtowntx.ionwave.net/CurrentSourcingEvents.aspx

Donna Cantwell (City of Georgetown) recommended to Register at least 48 hours before the proposal closes. Proposers must be registered in order to submit a proposal.

If you wish to provide an alternative manufacturer than listed, please write the name into the attached schedule.

Chris Graf (City of Georgetown): The City does not have the luxury to take the plant offline for an extended amount of time. Please refer to the requirements in specification Section CIP3 for maintaining plant operations.

- **STATEMENT OF PROPOSER'S EXPERIENCE**

1. Statement of Proposer's Experience (Section 00400) must be provided within 24 hours of the proposal opening, but it is preferred that it is submitted with the bid.
2. Submit information for major subcontractors, defined as any Subcontractors that, due to the nature of the construction work, comprise a critical or essential element of the construction such that the amount of the contract is equal to or greater than 10% of the construction budget.

- **CLARIFICATIONS**

1. The Notary needs to be licensed in Texas.

- *If there is an issue with the Notary being licensed in Texas, please let Gerald Furrier (CDM Smith) and Donna Cantwell (City of Georgetown) know.*

1. The project is tax exempt.

- **ADDENDA**

1. Submit questions either:
   i. On https://gtowntx.ionwave.net/CurrentSourcingEvents.aspx
   ii. Email to Donna Cantwell, City of Georgetown Purchasing Department (Donna.Cantwell@georgetown.org) and Nicole Abrego (nicole.abrego@georgetown.org) and please copy Alexandra Doody, CDM Smith (DoodyAT@cdmsmith.com).

2. Inquiries are permitted until March 23, 2023 at 5PM CDT. Necessary replies will be issued as addenda.

- **QUESTIONS/COMMENTS**

1. *City of Georgetown: Is there any language in the contract documents for how long the proposal language is good for?*

   Gerald Furrier (CDM Smith) clarified that the contract documents indicate proposals are good for 120 days.

2. *Juan Caceres (Prota): Can we have the City coordinate the site visit, as this would be less troublesome for all parties?*

   Scheduled site visit will be considered and discussed with the City and City staff. Response will be in Addendum No. 1. If potential proposer cannot attend the site visit, coordinate with Donna Cantwell and Procurement to request a site visit.

List of Attendees:

Name	Company	Email
Cameron Currie	City of Georgetown	Cameron.currie@georgetown.org
Chris Pousson	City of Georgetown	Chris.pousson@georgetown.org
Chris Logan	City of Georgetown	Chris.logan@georgetown.org
Donna Cantwell	City of Georgetown	Donna.cantwell@georgetown.org
Chris Graf	City of Georgetown	Chris.Graf@georgetown.org
Randall Swenson	City of Georgetown	Randall.swenson@georgetown.org
Joshua Naylor	City of Georgetown	Joshua.naylor@georgetown.org
Brian Cassidy	City of Georgetown	Brian.cassidy@georgetown.org
Alexandra Doody	CDM Smith	DoodyAD@cdmsmith.com
Gerald Furrier	CDM Smith	Furrierg@cdmsmith.com
Allen Woelke	CDM Smith	WoelkeAD@cdmsmith.com
Andrew Kowalkowski	CDM Smith	kowalkowskiAJ@cdmsmith.com
Josey Mayer	CDM Smith	MayerJA@cdmsmith.com
Juan Caceres	Prota	
Luis Marin	Prota	luismarincordero@gmail.com
Damaso Bermudez	Prota	
Ronnie Kirschner	Flintco	
Tim Mielke	Flintco	
Ben Richards	PGC General Contractors, LLC	william.richards@peabodygeneral.com

Adjourn

Pre-Proposal Meeting

San Gabriel Wastewater Treatment Plant Rehabilitation

Gerald Furrier
Alexandra Doody

March 2, 2023

CDM Smith

WATER + ENVIRONMENT + TRANSPORTATION + ENERGY + FACILITIES

Meeting Purpose

- Non-mandatory Informational Meeting
- Provide opportunity to answer questions from contracting community

Agenda

- Introduction and Meeting Purpose
- Project Description
- Schedule
- Proposal Requirements
- Addenda
- Q&A

Introductions

City of Georgetown Project Personnel (may not be present):

a.	Systems Engineering Director	Wesley Wright, P.E.
b.	Utility Engineer	David Munk, P.E.
c.	Water Utility Director	Chelsea Solomon, P.E.
d.	Assistant Water Utility Director	Chris Graf, P.E.
e.	Wastewater Treatment Superintendent	Randall Swenson
f.	CIP Manager	Chris Pousson
g.	CIP Project Manager	Chris Logan
h.	Inspectors	To Be Determined
i.	Instrumentation	Justin Breithaupt
j.	Buyer, Purchasing	Donna Cantwell

Engineer: CDM Smith, Inc.:

a.	Project Principal/Program Manager	Allen Woelke, P.E.
b.	Project Manager	Gerald Furrier, P.E.
c.	Design Manager/EOR	Alexandra Doody, P.E.
d.	Construction Manager	To Be Determined
e.	Project Engineer	Josey Mayer

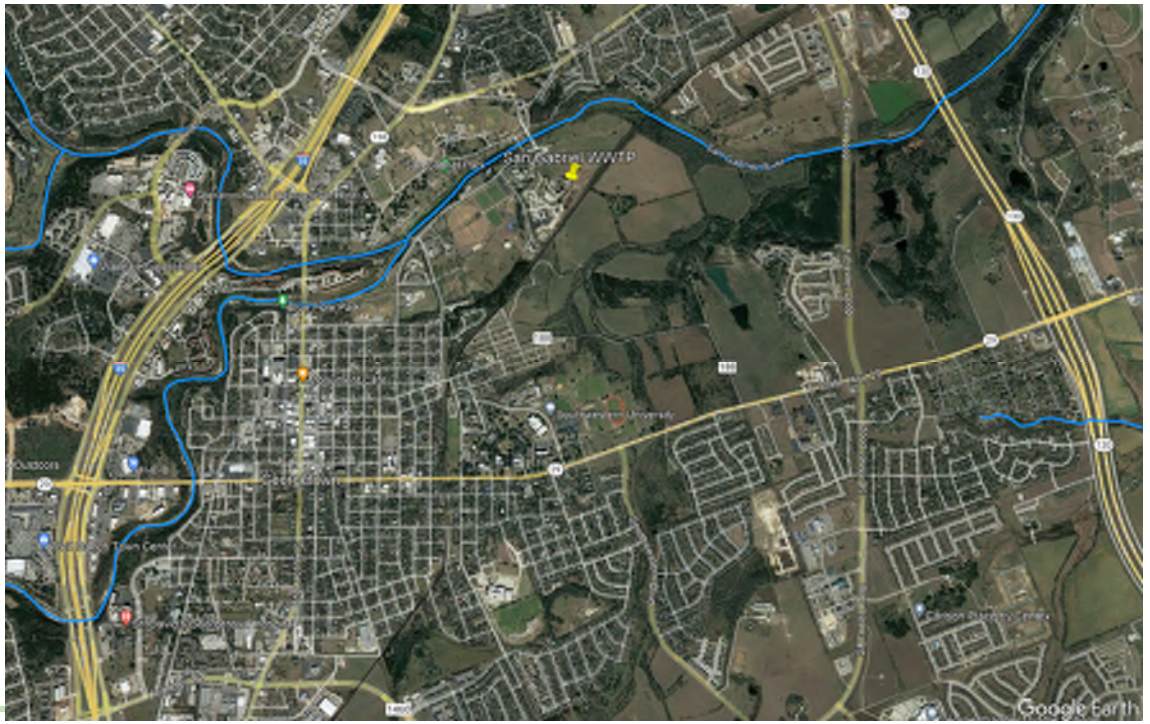
San Gabriel Wastewater Treatment Plant

- WWTP Address: 1107 N. College Street, Georgetown, TX 78626
- Site Rehabilitation
- Owner-funded project

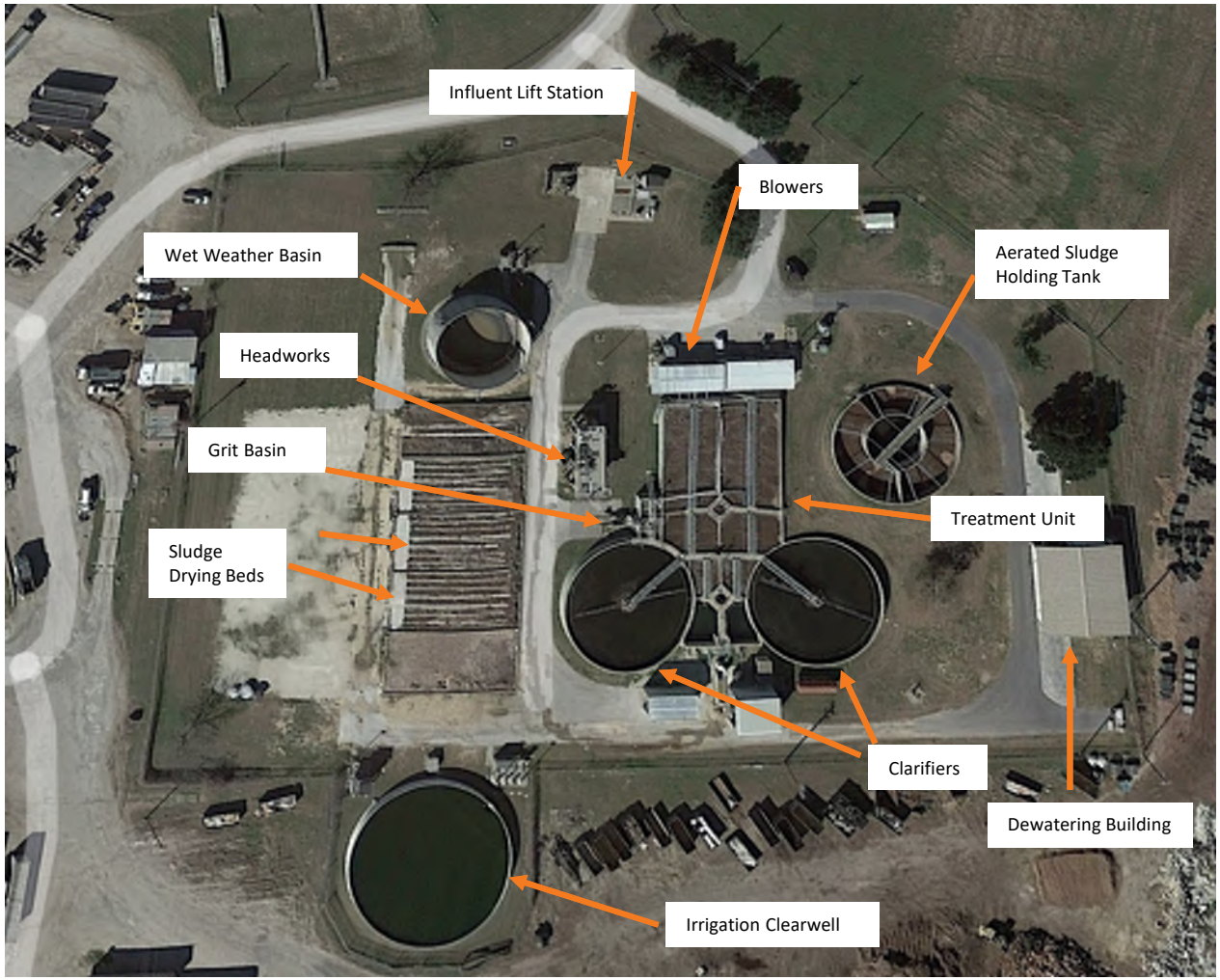
- City's procurement office address is changing March 6:

  510 W. 9th Street

  Georgetown, TX 78626

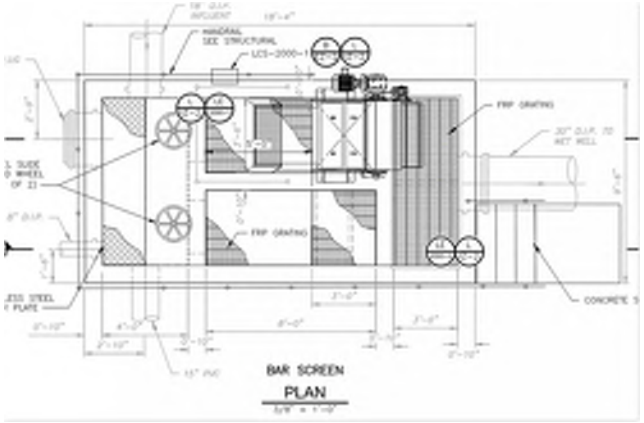


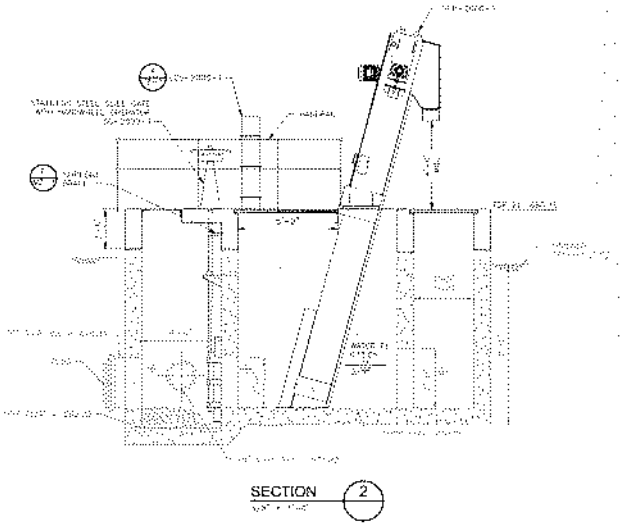
Project Description


Influent Lift Station
Blowers
Wet Weather Basin
Aerated Sludge Holding Tank
Headworks
Grit Basin
Treatment Unit
Sludge Drying Beds
Clarifiers
Dewatering Building
Irrigation Clearwell

Coarse Bar Screen

- (1) Mechanical Multi-Rake Screen and (1) Manual Screen
- Remove and replace existing screen and steel support structure
- Replace gates and grating
- Portions of existing concrete structure to remain





Influent Lift Station

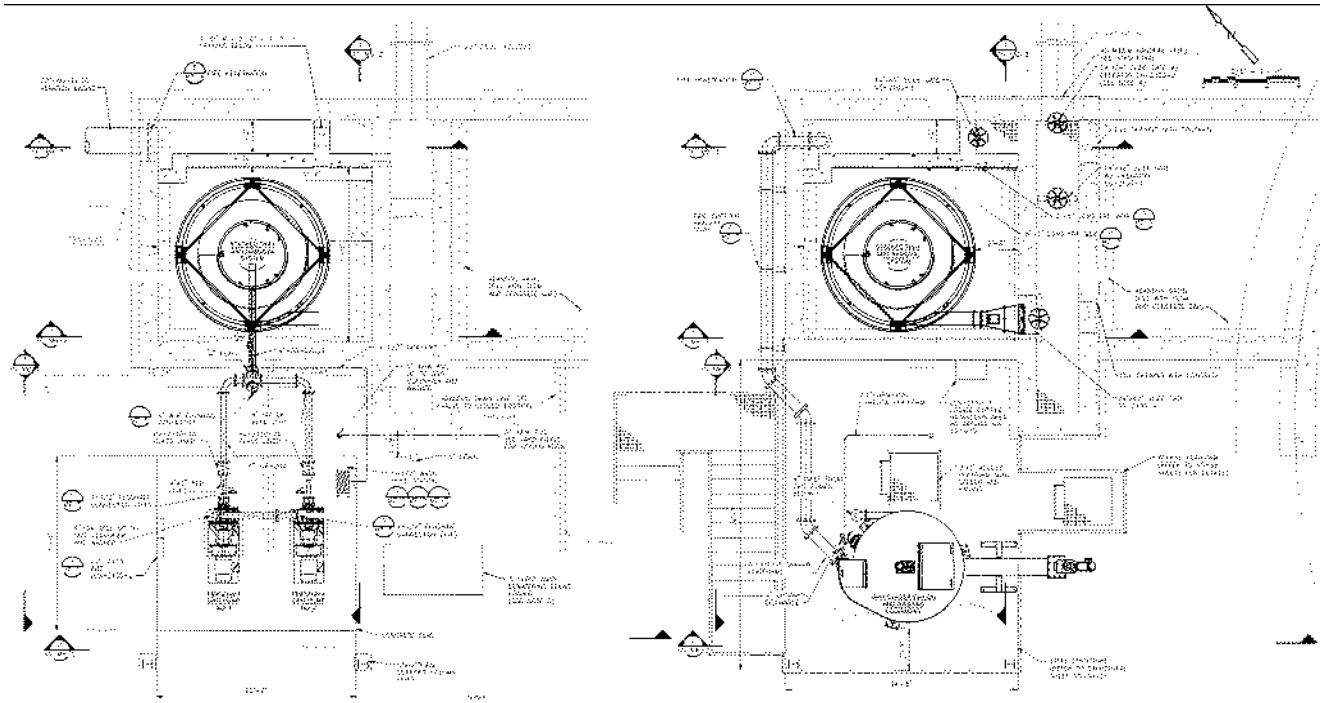
- Remove existing pumps, miscellaneous equipment, and piping in dry well
- Convert one half of existing wet well to submersible lift station with three 50HP pumps

Grit Demolition Scope

- Existing Grit Chamber equipment to be removed and replaced
- Concrete structure to remain in place; walls to be raised

Grit Removal System

- Stacked tray grit removal system
- 2 Grit Pumps (1 duty, 1 standby) and one grit classifier

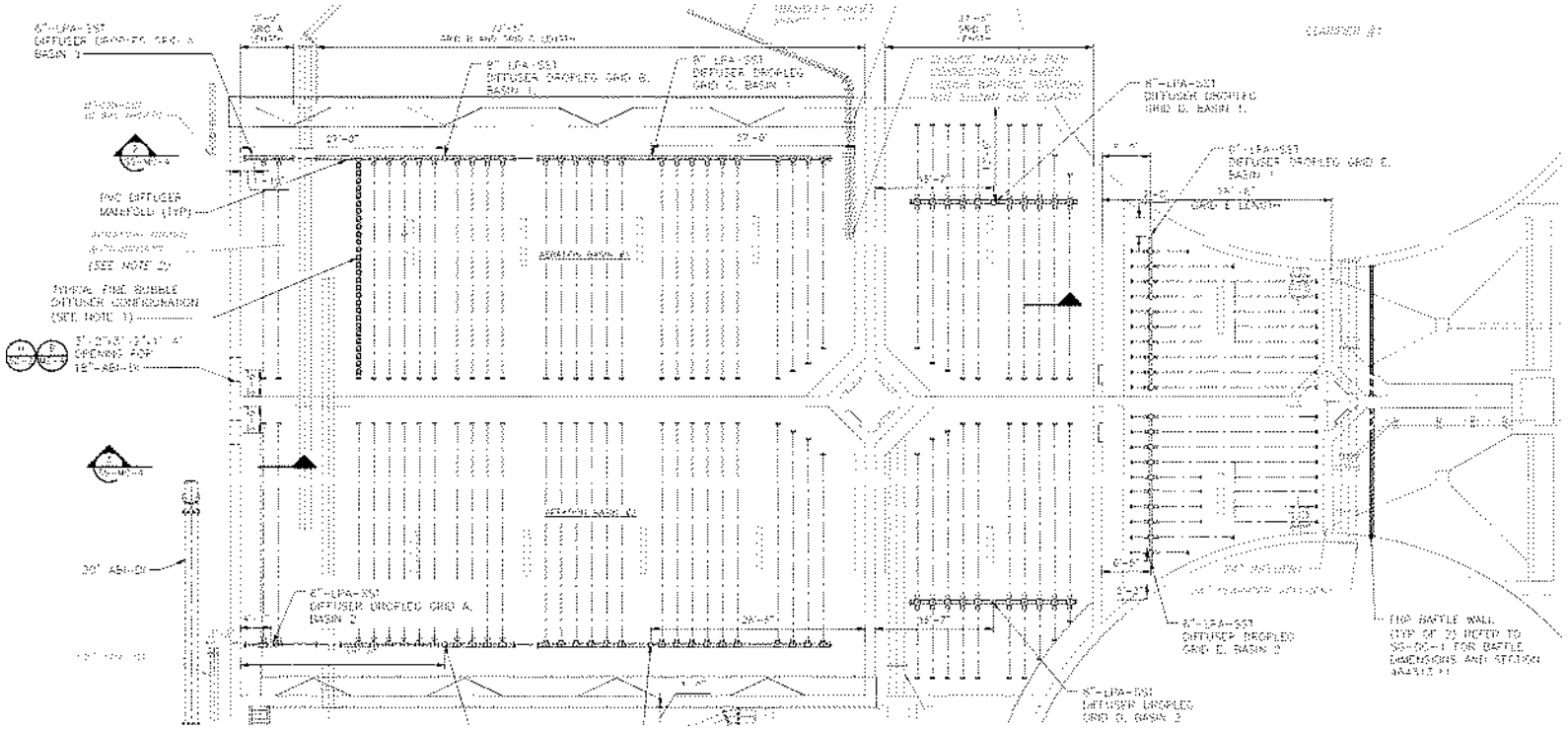


Treatment Unit Demolition

- Blower header and treatment unit air pipe to be replaced
- Existing diffusers to be demolished
- Basin gates to be removed and replaced as shown on drawings

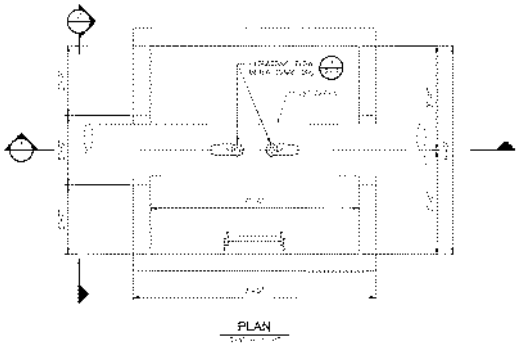
Treatment Unit Modifications

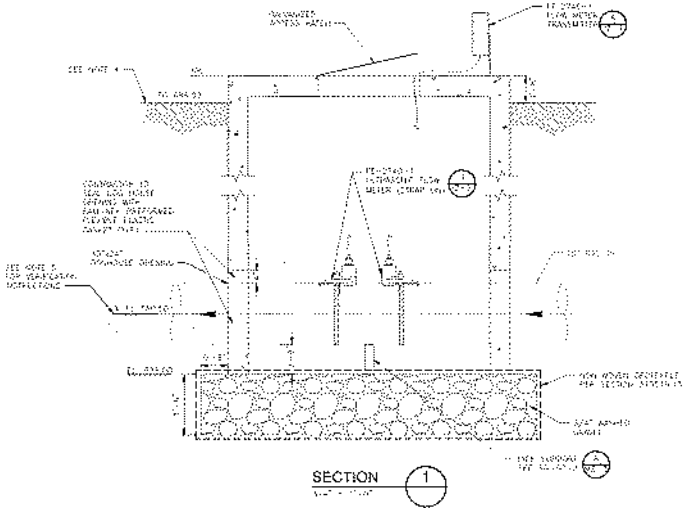
- Fine bubble diffusers to be installed in each basin



RAS Flow Meter Vault

- (2) New pre cast vaults to be installed around existing 18” RAS pipes
- Strap On Ultrasonic Flowmeter with transmitter to SCADA



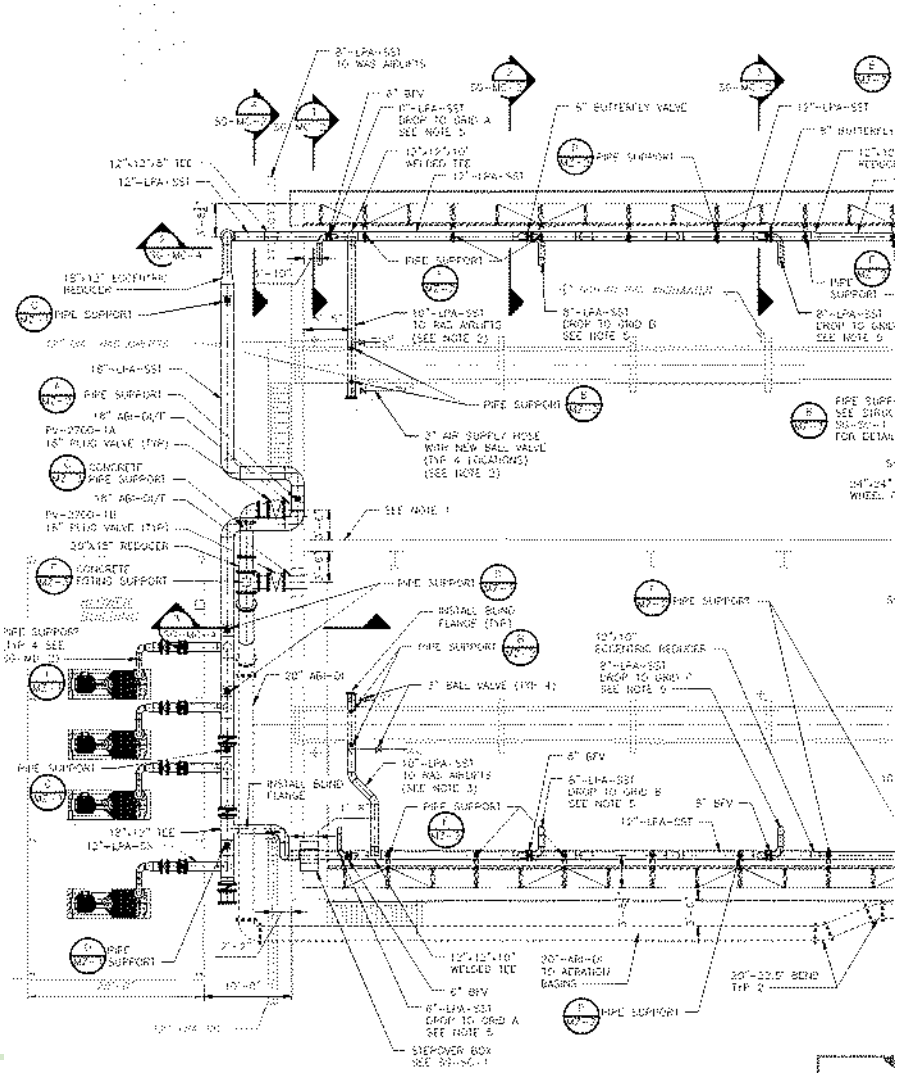


Blower Demolition

- Existing blowers and control panels to be removed and replaced
- Blower header piping to be demolished
  - New blowers will primarily service the treatment unit only

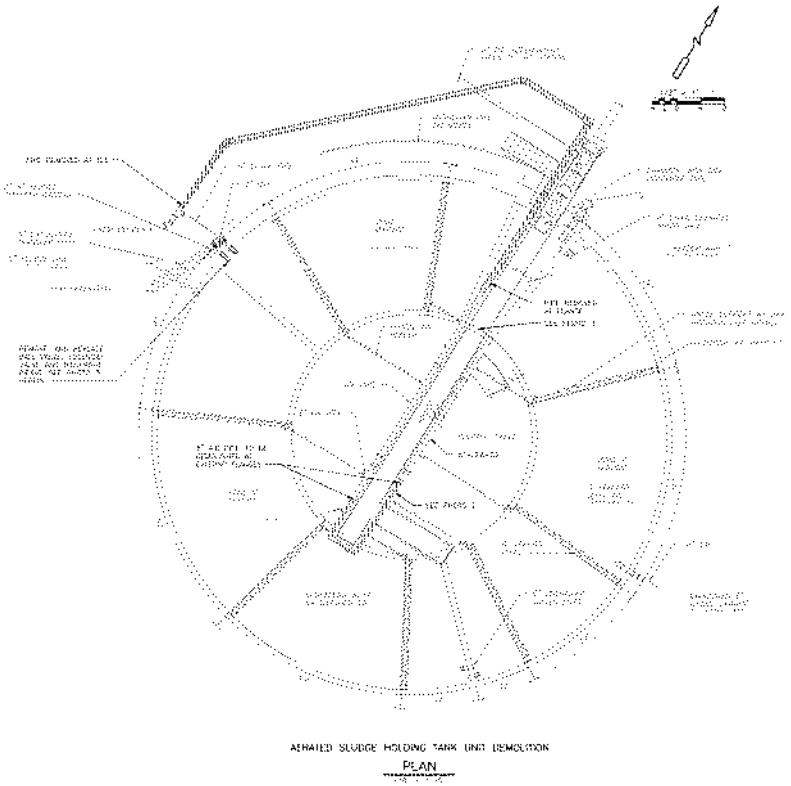
Blower Improvements

- Four new 125HP blowers to be installed in stages



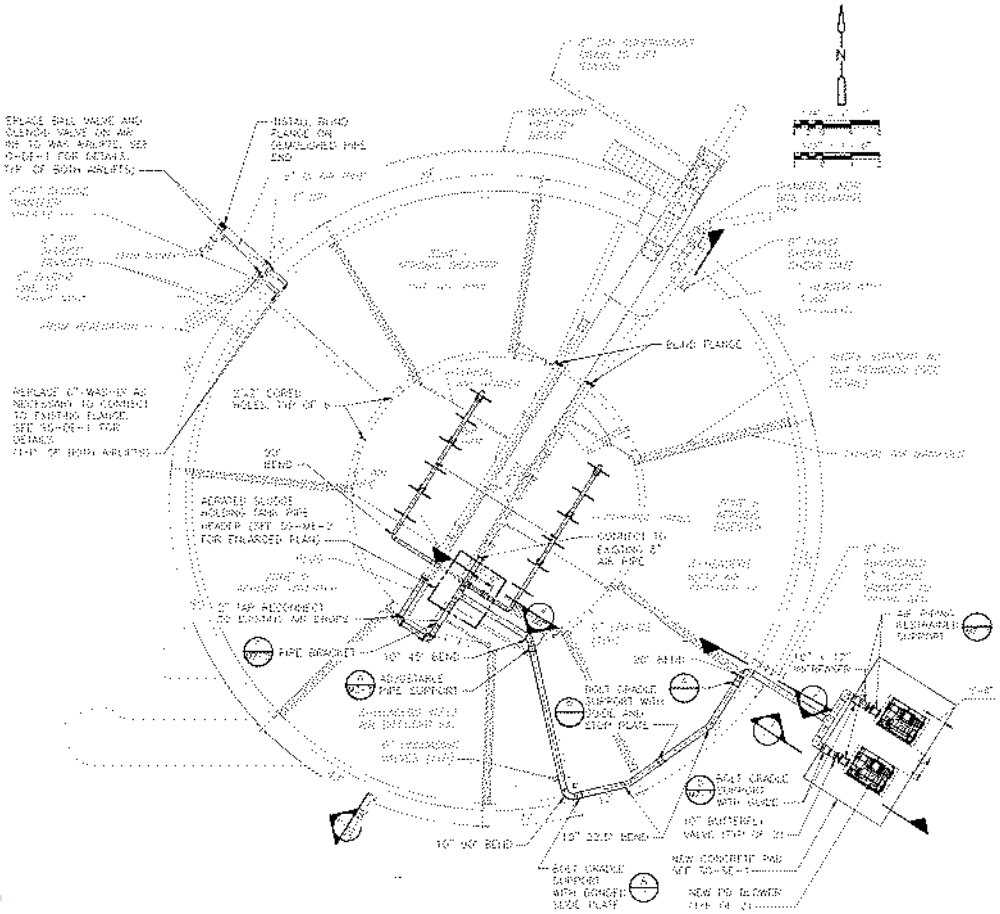
Aerated Sludge Holding Tank Demolition

- Remove air pipe from multistage blowers to the Aerated Sludge Holding Tank
- Replace 8” air header pipe for installation of new tee from PD blowers
- Core (6) 2’x2’ holes in the inner concrete structure to allow flow through the inside and outside of the tank



Aerated Sludge Holding Tank Improvements

- Install new coarse bubble diffusers in inner section of tank
- Install two 150HP positive displacement blowers on pad next to tank
- Replace 8” air header pipe for installation of new 10” pipe from PD Blowers

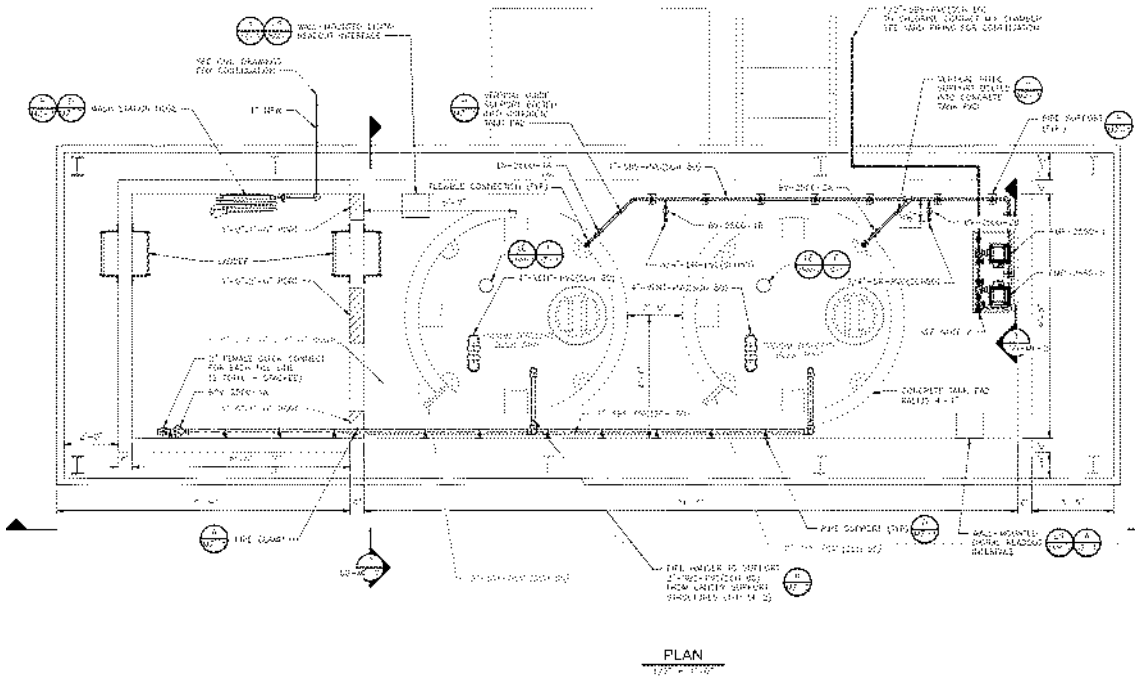


Sodium Bisulfite Demolition

- Remove existing building roof and walls; columns and beams to remain
- New canopy
- Modify existing concrete containment walls and extend wall to the south

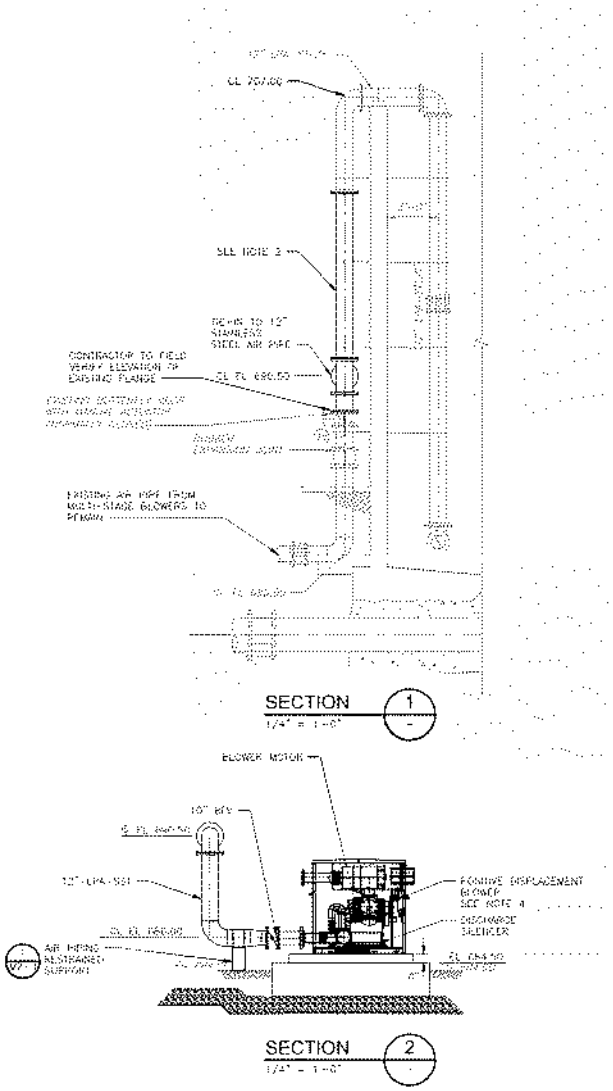
Sodium Bisulfite Improvements

- Install new chemical transfer pumps and insulated and heat-traced bisulfite piping
- Existing tanks to remain; new fill and vent piping



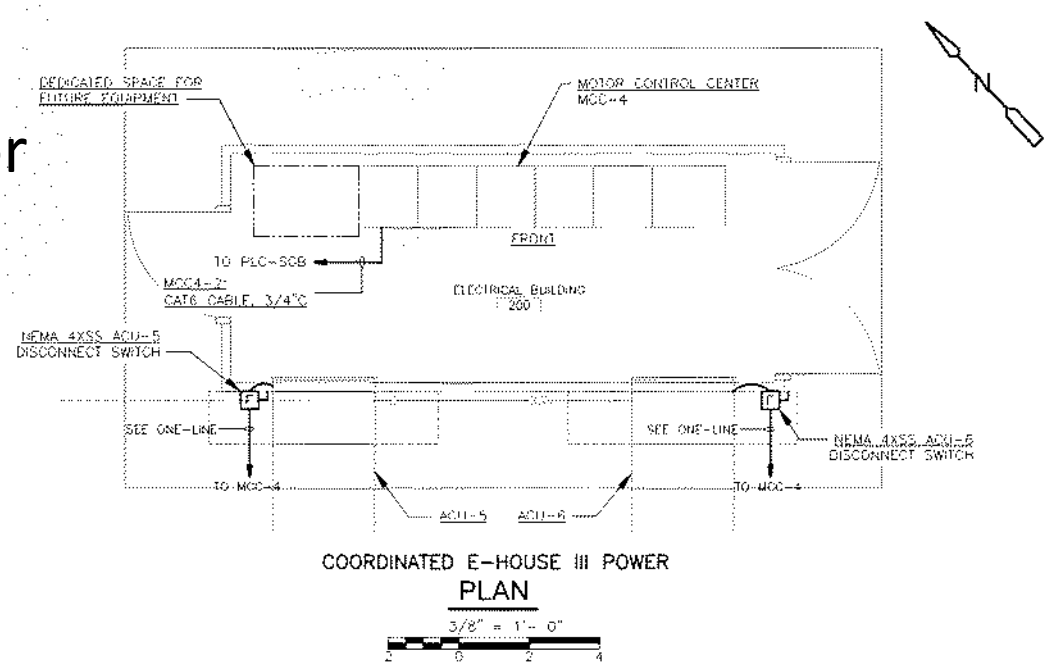
Wet Weather Basin Improvements

- Install one new 125HP Positive Displacement blower next to wet weather basin
- Install new tee into air riser pipe
  - Isolate existing air connection with inline existing butterfly valve



Electrical Improvements

- (3) Pre-fabricated electrical walk-in enclosures
- Emergency Supply Generator
  - 900 kW



Schedule

Bidding Schedule

Deadlines for Questions and Inquiries:	March 23, 2023 at 5PM CDT
Proposals Closing Date and Time:	**March 30, 2023 at 2PM CDT**
City Review of Proposals:	March 31, 2023 – April 12, 2023
Water Board Meeting:	April 13, 2023
City Council Meeting:	April 25, 2023
Earliest Award by City:	May 2023

Schedule Requirements

a. Substantial Completion: 730 calendar days from the Notice to Proceed (00500 3.02)

b. Final Completion: 820 calendar days from the Notice to Proceed (00500 3.02)

c. Liquidated Damages:
   a. Seven Hundred Dollars ($700), per Calendar Day for every calendar day the work remains incomplete after the Substantial Completion date (00500 3.03);
   b. Five Hundred Dollars ($500) per Calendar Day for every calendar day the work remains incomplete after the Final Completion date (00500 3.03);

Proposal Requirements

Proposal Form – Nine Proposal Items

1. Mobilization/demobilization
2. All improvements not included in other proposal items
3. Furnish and install Grit removal and handling equipment
4. Clean and dispose of contents of debris and sludge from tanks
5. Furnish and install Electrical improvements
6. Furnish and install SCADA/I&C improvements
7. Fence relocation allowance
8. Electric utility fees allowance
9. Owner-directed improvements allowance

Schedule of Materials and Suppliers

- Proposers shall circle the manufacturers included in the Proposal table.
  - If nothing is circled, then it shall be the first manufacturer listed that is expected to be provided.

- If the Proposer desires to propose one or more alternate manufacturers/suppliers, the Proposer may write in the name of such alternates in the spaces provided on the attached schedule.
  - Wherever an alternate manufacturer/supplier is proposed, the Proposer must insert the amount to be deducted from the Contract Price (either lump sum or unit price) if the alternate manufacturer/supplier is eventually approved.

PROPOSAL EQUIPMENT

Equipment Item or Material	Spec Section	Manufacturer/Supplier
Multi-Rake Bar Screen	462113	a. Kusters Water b. Huber c. Vulcan d. Headworks
Lift Station Submersible Pumps	432513	a. Wilo b. Hydromatic c. Myers
Stacked Vortex Tray Grit Equipment	462323	a. Hydro International
Grit Classifying and Washing Equipment	462363	a. Hydro International b. Huber
Recessed Impeller Grit Handling Pumps	432335	a. Wemco b. Egger
Multistage Centrifugal Blowers	431118	a. Lone Star Blower b. Continental c. Hoffman Lamson Gardner Denver
Rotary Lobe Positive Displacement Blowers	431133	a. Aerzen b. Universal Blowers PAC c. Hoffman Lamson Gardner Denver d. Kaeser
Ceramic Disc Fine Bubble Diffusers	465136	a. ITT-Sanitaire Xylem b. Aquarius Technologies c. EDI
Coarse Bubble Diffusers	465123	a. ITT-Sanitaire Xylem b. Aquarius Technologies c. EDI
Peristaltic Metering Pumps	432680	a. Watson Marlow b. Blue-White
Stainless Steel Slide Gates	400559.23	a. Whipps b. RW Gate
Programmable Logic Controllers	406345	a. Allen-Bradley

Schedule of Subcontractors

Proposer may change subcontractors after Proposal submittal only as approved in writing by the Engineer. The information provided will be used in the evaluation of the Proposer.

SUBCONTRACTOR	SPECIALTY
1.	Electrical
2.	Instrumentation
3.	
4.	
5.	

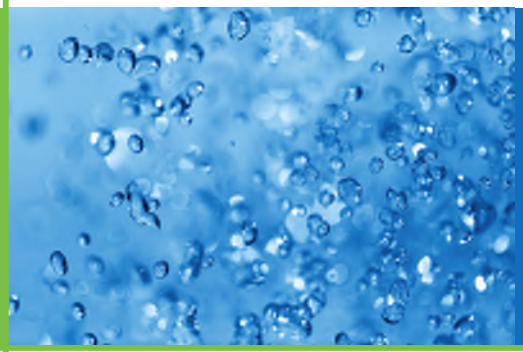
Proposal Submission

- Proposals must be submitted electronically in accordance with Section 00100 at the City's E-bid system:
- https://gtowntx.ionwave.net/CurrentSourcingEvents.aspx

- **Must be submitted by March 30, 2023 at 2PM CDT**

Statement of Proposer's Experience

- Statement of Proposer's Experience (Section 00400) must be provided within 24 hours of the proposal opening, but it is preferred that it is submitted with the bid
- Submit information for major subcontractors, defined as any Subcontractors that, due to the nature of the construction work, comprise a critical or essential element of the construction such that the amount of the contract is equal to or greater than 10% of the construction budget



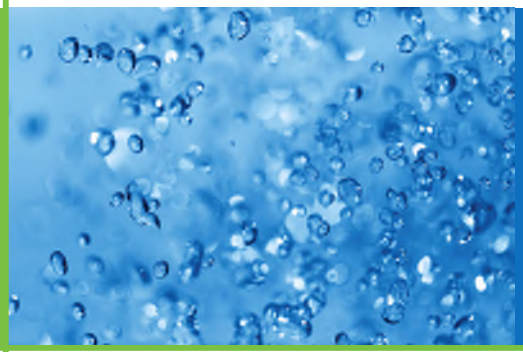
Final Items

Clarifications

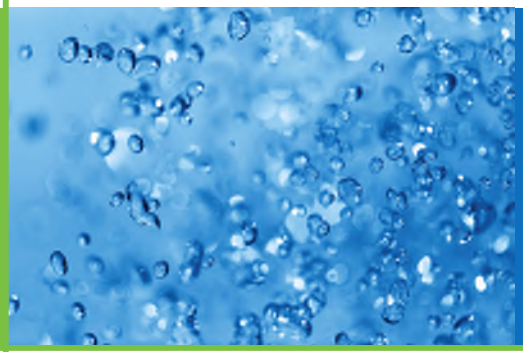
- Notary must be licensed in Texas
- The project is tax exempt

Addenda

- Submit questions to Donna Cantwell, City of Georgetown Purchasing Department
  - Donna.Cantwell@Georgetown.org
- Please also copy Alexandra Doody, P.E.
  - DoodyAT@cdmsmith.com
- Inquiries are permitted until March 23, 2023 at 5PM CDT
- Necessary replies will be issued as addenda



Q&A



Adjourn

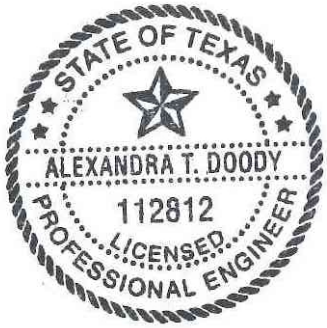
CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

CITY OF GEORGETOWN

SAN GABRIEL WWTP REHABILITATION

ADDENDUM NO. 2

Date Issued: March 23, 2023



Prepared by Alex Doody, PE 112812
CDM Smith Inc Texas Registration No. F-3043

Proposers on this project are hereby notified that this addendum shall be attached to and made a part of the above named Contract Documents and Technical Specifications, dated January 2023.

The following items are issued to add to, modify, and clarify the Contract Documents and Technical Specifications and Drawings. These items shall have full force and effect as the Contract Documents and Technical Specifications, and cost involved shall be included in proposal prices. Proposals to be submitted on the specific proposal date shall conform to the additions and revisions listed herein.

Acknowledge receipt of this addendum by designating receipt of the addendum on the first page of the Proposal. Failure to do so may subject proposer to disqualification.

REVISIONS TO CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATION

REQUEST FOR PROPOSAL SERVICES

a) Cover Page, UPDATE to read as "Due: April 20, 2023, 2:00 PM"
b) Page 3, Section Notice to Offerors, Paragraph A "Notice" REVISE the due date for the RFP Receipt in the first sentence to read as "All Proposals are due on or before 2:00 PM CST on April 20, 2023".
c) Page 3, Section Notice to Offerors, Paragraph D, REVISE the deadline for written questions to be April 13, 2023 at 5:00PM (CST).

d) Page 4, Section Notice of Offerors, Paragraph F "Anticipated schedule of important dates", REVISE to read as:

Release RFP		February 15, 2023
Deadline for Questions and Inquiries	5PM CST	April 13, 2023
Proposals Closing Date and Time	2PM CST	April 20, 2023
City's Review of Proposals		April 21, 2023-May 2, 2023
Earliest Award by City		June 1, 2023

SECTION 00410 – PROPOSAL BOND

a) Page 00410-34, REVISE the RFP DUE DATE to "2:00 PM, April 20, 2023".

END OF ADDENDUM NO. 2

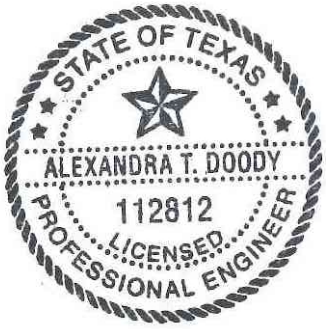
CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

CITY OF GEORGETOWN

SAN GABRIEL WASTEWATER TREATMENT PLANT REHABILITATION

ADDENDUM NO. 3

Date Issued: April 12, 2023



Prepared by Alexandra T. Doody, PE 112812
CDM Smith, Inc Texas Registration No. F-3043

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Acknowledge receipt of this addendum by designating receipt of the addendum on the first page of the Proposal. Failure to do so may subject proposer to disqualification.

QUESTIONS AND ANSWERS

Below are questions received and their associated responses:

1. **Question**: On Drawing SG-IB-1 the (2) PI/PSH-2130-1 and PI/PSH-2130-2 to be provided by Division 43. On the instrument list they show them to be provided by Division 40. Please clarify which division is to provide them.

   ***Answer**: PI/PSH-2130-1 and PI/PSH-2130-2 are to be provided by Division 43. See REVISIONS TO CONTRACT DOCUMENTS AND SPECIFICATIONS in this addendum for revision to the Instrument Device Schedule.*

2. **Question**: The only FRP Weirs on the project are the 8'-1" length and the 2'-8" lengths shown at the Grit Chamber. Can you please confirm this is the complete scope of supply of FRP weirs for this project?

   ***Answer**: Yes, the only two FRP weirs on the project are at the Grit Chamber, shown on Drawing SG-MB-1 at the lengths listed above.*

3. **Question**: The baffle wall length called out on the drawings for the (2) Baffle Walls being furnished on this project are shown on Drawing SG-MC-1, SG-MC-3 and SG-DC-2. The height shows to be 13-ft. Can you please confirm the length for EACH baffle wall here?

   ***Answer**: Assume baffle length of 16 feet for bidding purposes. Contractor shall field verify length of existing baffle prior to submitting shop drawings for review.*

4. **Question**: Drawing SG-ME-1 and SG-ME-2 LPA-SST air piping is unclear. At the blower pipe size is 10" and increases to 12", but the tank plan view differs. Inside the tank it is 10" and reduces to 8" and 6" LPA-SST. Can you please clarify if possible?

   ***Answer**: The blower pipe discharge connection is 8". The reducer shown on Section 1 of Drawing SG-ME-1 after the butterfly valve on the pad is 8"x10". Once the pipe reaches the existing blower header near the center of the tank shown on the Plan view in Drawing SG-ME-1, the tee shall be a 10"x 8" reducing tee. The 8"x6" Tee for supplying air to the inner tank diffusers is shown on Section 4 of Drawing SG-ME-2.*

5. **Question**: Utility to Generator ATO N3R SWGR-1 switchgear line-up with keyed notes to provide GFI and ZSI protection for all Main and Feeder circuit breakers. However, there are NO Feeder breakers. One-line shows a direct bus connection to the horizontal bus. – Is the intent for ZSI between the Mains in SWGR1 and the breakers in SWGR 2? I'm not sure this will be possible - The distance to SWGR 2 may prevent ZSI function.

   ***Answer**: ZSI references in SWGR-1 will be removed in a future addendum.*

6. **Question**: SWGR-1 elevation shows what may be three (3) – Feeder Breaker SPACES but the One-Line doesn't. Are the 'spaces' shown in section 3 of SWGR 1 'blank spaces' or 'Future Equipped Spaces'? If future spaces what rating- 800A, 1600A?

   ***Answer**: Blank spaces to be removed in future addendum. Section 3 is intended to be for outgoing cable terminations.*

7. **Question**: There is three (3) – SPD's indicated on this Utility to Generator ATO N3R switchgear. – As we discussed on previous job the Bus connected TYPE 2 will protect the line side of the mains when the breakers are closed. Is it ok to eliminate the TYPE 1 units?

   ***Answer**: SPD's on the line side and load side of the breakers to remain.*

8. **Question**: Confirming the downstream SWGR-2 feed cable is rated 3200AF/2300AT. One-line shows a direct bus connection to the horizontal bus.

   ***Answer**: Confirmed.*

9. **Question**: Since SWGR-1 is outdoor do we have room to grow another stack/section if needed?

   ***Answer**: The Equipment pad dimensions adjustment shall meet the requirement shown in the Structural Sheets and shall be the responsibility of the Contractor.*

10. **Question**: Section 262300 notes 'Silver Plating' on switchgear bus. Confirm Tin Plating.

    Answer: References to Silver Plated bus will be revised to Tin-Plated in future addendum.

11. **Question**: For the Grit Basin enclosures, can NEMA 4X stainless steel enclosures rated for a Class 1, Division 2 environment be provided?

    ***Answer**: The Grit Classifier and Washer local control station, LCS-2110-1, and the Grit Pump control stations, LCS-1200-1/2, are located within a Class 1, Division 2 classified area per SG-G-5. In rated hazardous areas, a NEMA 7 enclosure is required, unless a NEMA 4X stainless steel enclosure can be certified for a Class 1, Division 2 area which includes the additional requirements outlined in UL 698A standards for a classified area.*

12. **Question**: Will you allow Henry Pratt plug valves? They meet the specification 400562 and can be supplied with glass lining for GR service. You do list Henry Pratt in the Double Door check valve and swing check valve sections.

    ***Answer**: Yes, refer to the REVISIONS TO CONTRACT DOCUMENTS in this addendum where Henry Pratt has been added as an approved manufacturer for plug valves in Section 400562.*

13. **Question**: The physical location of the Grit Basin Master Control Panel, MCP-2110-1 could not be found on the plans. Where is it located?

    ***Answer**: MCP-2110-1 is located in MCC-2 inside Electrical House 1, as indicated on SG-E-5 and SG-E-8.*

14. **Question**: Specification 462363, paragraph 2.4.B.5 requires the Grit Basin Master Control Panel (MCP-2110-1) to be NEMA 1A, 316SS. Drawing SG-E-8 shows the Grit Basin Master Control Panel will be installed in the Electrical room, with MCC structures that are rated NEMA 1/12, painted steel construction. Please advise if the Grit Basin Master Control Panel should be provided as painted steel according to section 406717-2.1.B.1.

    ***Answer**: Painted steel is acceptable to be used for the Grit Basin Master Control Panel that will be located within the electrical room.*

15. **Question**: Both the screen and Grit panels are in the electrical room near NEMA 12, Painted Steel panels. However, they are both specified to be NEMA 1, Indoor rated, 316 SS. It would seem more appropriate if these panels were to be delivered NEMA 12, painted steel. Please advise.

    ***Answer**: Painted steel is acceptable on panels within the electrical room.*

16. **Question**: Hydro International recommends our standard brass D-Torq motorized ball valve. It is rated NEMA 4X and is not suitable for a classified location. For classified environments, we typically offer a FlowTec w/Mar actuator motorized ball valve, but it is huge and will likely require significant mods to the piping layout for the installation. Cutsheets for these valves are attached. Will our standard D-Torq motorized ball valve be accepted?

    ***Answer**: Per SG-G-5, the grit removal area is classified as a Class 1, Division 2 environment and the extent of classified area is within a 10-ft envelope around equipment, therefore the fluidizing line motorized ball valve shall be rated for a hazardous area. If the D-Torq ball valve rated for NEMA 4X can be certified as suitable for Class 1, Division 2 areas then it will be accepted.*

17. **Question**: Is the intent to have the sodium bisulfite metering pump skid in a heated enclosure? Can we provide a floor mounted skid in a heated enclosure? The enclosure/skid can be mounted on a table if they wanted it raised up.

***Answer**: Yes, the sodium bisulfite metering pump skid is to be in a heated enclosure, as specified in Section 463344 Paragraph 2.3.E.6. A floor mounted skid in a heated enclosure is acceptable provided that the pumps are elevated to the same 2'-6" height as the tank support pad as shown on Section 1 Drawing SG-MF-1.*

18. **Question**: In Section 462363, paragraph 2.4.A.1 please advise if a license of development software is to be provided by the Grit System supplier, or if the development software will be provided by the Systems Integrator.

    ***Answer**: The owner must receive both the PLC and OIT software programming license for each individual equipment to be able to make changes in the future without calling the OEM. The Grit System Supplier is to provide the actual program including the documented version that contains all tag names and comments.*

19. **Question**: The Headcell weir elevation is called out at EL = 697.27'. At the peak flow of 7.5 mgd, we calculate ~6.9" of water over the top of the weir, this would put the water level in the grit basin tank at EL = 697.84' during peak flow. An additional 12" of headloss through the grit basin inlet duct is required at peak flow, for a water level of EL = 698.84' in the influent channel. Does the water level of 698.84' in the grit chamber influent channel fit in the plant's hydraulic profile?

    ***Answer**: The design intent for this facility is to convey 75% to the front (i.e. west side) of the basins while the remaining 25% influent is a step feed to the existing influent distribution box. This will be accomplished providing the two new FRP weirs of 8'-1" length and 2'-8" length for plug flow and step feed flow, respectively. At 75% of peak flow (5.63 mgd), the water over the top of the weir is calculated at ~0.51", putting the water level in the grit basin as shown on SG-MB-2 at 697.78'. The grit chamber influent channel top of wall is being raised to 700.77' to provide sufficient freeboard to accommodate the additional foot of headloss through the Headcell resulting in a water surface EL = 698.78'. Additional language is included the REVISIONS TO DRAWINGS in this addendum for clarity on the flow split design intent.*

20. **Question**: Please confirm/advise if all the new air piping on SG-MG-1 labeled LPA is going to be SST? Some of their call-outs are misleading.

    ***Answer**: Yes, all new air pipe on SG-MG-1 will be stainless steel.*

21. **Question**: Section 431118.2.8.B.1 indicates that a blower gearbox pinion shaft (X-Y-Z) is used as well as Bentley Nevada detectors which are not typical for multistage blowers. Please confirm that just 1 vibration sensor is to be installed on each blower bearing housing and clarify if standard high vibration sensors will be sufficient.

    ***Answer**: Yes, the manufacturer's standard vibration monitoring is sufficient. See language in this addendum for Revisions to Contract documents for new vibration monitoring contract language.*

22. **Question**: Section 431118.2.5.T does not list motor bearing vibration but 2.8.B indicates vibration monitoring for blower and motor. Please clarify if motor bearing needs vibration monitoring.

    ***Answer**: Section 2.8.B has been updated in this addendum to clarify that the motor bearing does not need vibration monitoring.*

23. **Question**: Section 431118.2.3.M.1.c specifies for overspeed testing. Due to this application being a constant speed setup, overspeed testing is not typically required and adds significant cost to the project. Is overspeed testing required? If so, will it be required for each impeller for every blower on the project?

***Answer**: Section M.1.c has been updated in this addendum to no longer require overspeed testing.*

24. **Question**: Section 431118.2.3.H.3.d.2 specified for casing rating to be 25 PSI. Proposed blower at this size range will be rated for 20 PSI. Operating pressure is specified to be 8.5 PSIG and we feel that 20 PSI case pressure rating is sufficient without hydrostatic testing. Please confirm.

    ***Answer**: Section H.3.d has been updated in this addendum to reduce the specified casing rating to 20 PSI and to revise the hydrostatic testing requirements.*

25. **Question**: Both the screen and grit system specifications make a similar statement "include software licensing PLC and HMI separate from Plant SCADA to supply the documented version for the client use of the project." Does this imply that OEM is to deliver PLC and OIU development software, or are we only to deliver the PLC and OIU application? Please advise.

    ***Answer**: The owner must receive both the PLC and OIT software programming license for each individual equipment to be able to make changes in the future without calling the OEM. The Equipment Suppliers shall provide the actual program including the documented version that contains all tag names and comments.*

26. **Question**: The Grit Power Plan on SG-EB-2 shows a very large NEMA 7 junction box. Is this to be part of the grit classifier manufacturer's scope or the electrical contractors' scope?

    ***Answer**: To be provided by the electrical contractor.*

27. **Question**: Grit System PID SG-IB-2 has a very non-standard LCS configuration. This format is very different than that shown for the Screen. Please advise if a more standard LCS configuration is acceptable, or if this is truly what is needed.

    ***Answer**: The LCS configuration shown on SG-IB-2 and described in Specification 462363 paragraph 2.4.C.9 is correct as shown.*

28. **Question**: Grit Removal PID SG-IB-1 shows the Grit System Control Panel controlling (2) grit pumps and Grit Vortex Fluidizing Water, BV-2131-1. Note that the Grit Pump motor starters are in remote MCC. However, the Vortex Fluidizing valve has an undefined LCS. Please confirm number of and description for the devices we are to include in this LCS.

    ***Answer**: The LCS for the Grit Vortex Fluidizing Valve BV-2131-1 is integral to the valve actuator with on board control switches; it is included in the Stacked Tray Grit Removal equipment's scope of supply.*

29. **Question**: Note 8 on SG-C-5 informs the contractor that bypass pumping may be needed to work at the Coarse Bar Screen and Influent Pump Station. Can you tell us the GPM and head conditions we should plan for?

    ***Answer**: The bypass pumping flow conditions are described in Section 331210, paragraph 2.3.A.3.a. The head condition is estimated to be approximately 40-45 ft. The actual total dynamic head should be confirmed by the contractor upon the final design of the temporary piping size and routing.*

30. **Question**: On SG-C-6, is the 8"-DR-SDR 26 under the new concrete roadway required to be encased?

    ***Answer**: Yes, the 8"-DR-SDR 26 PVC should be concrete encased.*

31. **Question**: There appears to be exposed CLSM in the Grit Chamber shown on SG-SB-3. Is the intent to leave it exposed or does there need to be a 4-inch concrete cap placed over the CLSM?

    ***Answer**: There is no need for a 4-inch concrete cap placed over the CLSM. The CLSM is not exposed, as it will be covered by the stacked tray grit removal equipment that will be placed in the basin. Details on the mechanical equipment are shown on SG-MB-2 and SG-MB-3.*

32. **Question**: SG-C-6 has a call out for existing lines to be concrete encased under the new concrete road. The lines extend into the area shown on SG-C-5. There are multiple existing lines that will end up under the new road. Does the concrete encasement also apply to areas shown on SG-C-5?

    ***Answer**: No, only existing lines under the new concrete road need to be concrete encased. Concrete encasement of pipes under the new asphalt road is not required.*

33. **Question**: Section 462113, Paragraph 2.4 details a manual bar screen. Is that needed to be in the Multi-Rake Bar Screen manufacturer scope or would that be provided by the contractor / elsewhere?

    ***Answer**: The manual bar screen may be provided by the Multi-Rake Equipment Manufacturer or it can be sourced by others as long as it meets the requirements of the Drawings and Specifications.*

34. **Question**: Section 462113, Paragraph 2.3.K.7 states that the manufacturer shall perform and provide anchor and mounting bolt configurations. Please confirm if these need to be stamped by a PE.

    ***Answer**: Yes. The anchor and mounting bolt configurations are to be stamped by a PE.*

35. **Question**: On CIP 15, is a project sign required for this job?

    ***Answer**: Yes, a project sign is required.*

36. **Question**: CIP 17, Inspection of Projects, details that the contractor shall pay for the expenses for extra inspection required for work outside regular hours at a rate of $50 per hour. If during the normal scope of work, the contractor is required to make piping connections during off peak hours, will the contractor have to pay for inspection services at the rate of $50 per hour? If yes, how many inspectors will be on site for off peak work?

    ***Answer**: CIP 17 is referencing when the Contractor, not the City, is driving the inspection outside of normal working hours. The City will make an exception such that the Contractor does not have to pay for extra inspections if the City requests for the major tie-ins to occur outside of normal working hours. The tie-in date and time must be coordinated with the City to reduce impacts on the plant operation.*

37. **Question**: Section 013100, Project Management and Coordination, requires the contractor to provide web-based Project Manager Software with license to use by the engineer, owner, and vendors. Procore is named along with various others. We do not use any of the named software vendors. Will a drop box type cloud-based system be acceptable?

    ***Answer**: Alternate software types to those listed in the specifications will be considered. However, Dropbox is not an acceptable alternative as this system is blocked by the Engineer's IT department for security reasons.*

38. **Question**: Section 013233, Photographic Documentation calls for 50 photos per month, plus videos, plus aerial photography. Additionally, 100 photos of final work. Will this be required for months when there is no on site work? For instance, the first several months during submittal phase.

    ***Answer**: No, photographs will not be required when there is no work on-site.*

39. **Question**: Section 015000, Temporary Facilities and Controls, please advise size and other information related to engineer's field office.

    ***Answer**: Field engineer's office is not required.*

40. **Question**: Section 015000, Temporary Facilities and Controls, is a site enclosure fence required?

    ***Answer**: Enclosure fence might potentially be required on a temporary basis during construction of the clearwell dome, after securing approval from the City of Georgetown for temporary relocation onto the adjacent city-owned property.*

41. **Question**: Section 460200, Tank and Structure Cleaning, is there a paint filter test needed?

    ***Answer**: This test is not required by the City. Contractor shall include testing costs only if it is required by the hauler or the facility receiving the solids for disposal.*

42. **Question**: Section 460200, Tank and Structure Cleaning, do you anticipate running mixed liquor through a belt press or thickener?

    ***Answer**: Dewatering of liquid in the basins down to approximately 3 ft depth by City staff was assumed in the estimated quantity on the proposal form before the Contractor is required to take over cleaning and removal of heavier solids in the bottom of the tanks.*

43. **Question**: Section 460200, Tank and Structure Cleaning, is there a certain percentage of solids required before you load and haul?

    ***Answer**: While the City will not require a minimum solids content prior to hauling off-site, dewatering solids may be required not only for cost-effectiveness but to also prevent onsite spills as material is removed from structures. The Contractor shall be responsible for containment as needed to ensure material (including liquids) do not spill onto the ground during loading and transferring to the disposal site.*

44. **Question**: Section 460200, Tank and Structure Cleaning, In order to determine how the dewatered sludge is transported and where it may be disposed, it must be tested and profiled. Dewatered sludge must be tested and not exceed EPA thresholds for pH, Total Petroleum Hydrocarbons, TCLP Metals, TCLP Volatile Organic Compound, TCLP Semi-Volatile Organic Compounds, Ignitability and Paint Filter. Even if classified as non-hazardous, some landfills will not accept it or will charge exorbitant fees to accept this type of profile. In 2018, hauling from Hornsby all the way to south San Antonio was more cost effective than paying the fees at local landfills?

    ***Answer**: The City has recently successfully found haulers with vactor trucks to haul away materials similar in nature to this project, including Wastewater Transport, who used a vactor to pump out the liquid sludge and rags. The City is not aware of any special tests being required before disposal.*

45. **Question**: Section 018819, Tightness Testing Performance Requirements, calls for leakage tests at existing structures. Specs specifically call out the following tanks to be water tested. Treatment Unit, Grit, SHT, SB Facility Containment Area, Coarse Bar Screen, and the Geo Dome. Lastly, specs call for leakage tests for Influent Lift Station and J- Boxes. These are all existing structures except the Geo Dome. Is all of this required?

    ***Answer**: Tightness tests are not required except at the new channel for the Lift Station and the Sodium Bisulfite Facility containment area. Refer to revisions to specification included in this addendum.*

46. **Question**: Where does Section 310519, Geotextiles for Earthwork apply on the plans?

    Answer: Geotextile is detailed on SG-SC-2 and SG-MC-5 for the RAS Flow Meter Vaults.

47. **Question**: Where does Section 310900, Geotechnical Instrumentation and Monitoring" apply on the plans?

    Answer: This specification should be referenced during the excavation and construction of the pre-cast RAS Flow Meter Vaults, detailed on SG-MC-5.

48. **Question**: SG-DC-1 indicates to remove all existing steel piping drops into the basin. Please advise how many drops, if known. What material should the treaded caps be?

    ***Answer**: There are estimated to be about (370) 1" stainless steel drops in the entire treatment unit basins. The threaded caps are to be stainless steel material.*

49. **Question**: SG-DC-1 details the removal of (2) 10" valves. Please specify if blind flanges are required and what type of material is preferred for the blind flanges.

    ***Answer**: Yes, upon removal of the 10" valves, connect a blind flange to the extra pipe coming out of the existing aeration bridge. The blind flange material shall be stainless steel.*

50. **Question**: Is the 12" diameter RAS airlift to be removed in the aeration basins?

    ***Answer**: The 12" diameter RAS airlifts are to remain. However, the existing air piping, hoses, valve, and rotameter are to be removed and replaced with new 3" stainless steel piping and ball valve, as detailed on SG-MC-1.*

51. **Question**: Drawing SG-MC-2 calls out drop pipes with restrained flexible coupling with bolts. Please identify what type of coupling is being utilized here, and the end configurations we are to supply for our pipe ends to attach this coupling.

    ***Answer**: This is a sleeve type coupling identified in Section 400506 Paragraph 2.8. Pipe ends are welded in accordance with the Drawings or as required for the sleeve type coupling.*

52. **Question:** Are tank drawings available for the Clearwell such as as-built drawings?

    ***Answer:** No as-builts are available of this at least 20-year-old steel tank. The supplier shall field verify exact dimensions including any eccentricity in the tank.*

REVISIONS TO CONTRACT DOCUMENTS AND SPECIFICATIONS

REQUEST FOR PROPOSALS

a) Page 12, EVALUATION AND SELECTION PROCESS:

a. On Paragraphs C, D, and E, CONTRACTORS EXPERIENCE AND QUALIFICATIONS, DELETE all three paragraphs and REPLACE with the following paragraphs:

"C. COST EVALUATION

Price shall be considered but shall not be the sole determining factor.

Cost Proposal **80 points total**

i. Proposer with the lowest price will be awarded a 5-rating value. All other offerors will be awarded a rating value calculated by dividing the low bid by the proposer's offering and multiplying that ratio times eighty (80).

D. CONTRACTOR'S EXPERIENCE AND QUALIFICATIONS **10 points total**

i. Points will be awarded based on the Offeror's experience relative to the Project, the reputation of the Offeror in similar past projects, and overall reputation and experience of the Offeror.

ii. The Owner will evaluate the projects submitted per Exhibit 00400 Part 3 – EXPERIENCE REQUIREMENTS to determine relevancy to the specified scope of this Project and review the Offeror's performance on the submitted projects.

a. Offeror must provide evidence of a minimum of three (3) successfully completed water or wastewater treatment plant installation projects of comparable size (minimum value of $10 million), complexity, and scope (at least two projects must be at operational wastewater treatment plants) within the United States successfully completed by the Offeror within the past Ten (10) years.

i. The Owner may contact the past project references, as may be necessary to verify the qualifications, experience, and reputation of the Offeror. This requirement can be met through the employment of a qualified subcontractor.

b. The Owner will also evaluate:

i. The Proposer's Information as presented in Attachment A.

ii. The list of equipment available to the Contractor and specifically intended to be used on the Work as presented in Attachment E.

iii. The list of the available workforce for the various disciplines and crafts as presented in Attachment F.

iv. The list of all current projects of the Contractor as presented in Attachment G.

v. The Contractor's list of all completed projects as presented in Attachment H.

E. CONTRACTOR'S KEY PERSONNEL **10 points total**

i. Offeror will be awarded points based on the experience of the proposed key personnel, with a maximum score of ten (10) points for a team that demonstrates all desirable characteristics.

a. Per Exhibit 00400 Part 3 – EXPERIENCE REQUIREMENTS, key personnel will be evaluated for experience with the type and scope of work required for this Project,

previous work history as a team, definition of roles in previous experience, length of time with the company, and the percent of time allocated to the project as presented in Attachment C – Statement of Experience for Proposer's Key Personnel."

SECTION 00300 – PROPOSAL FORM

a) All twelve (12) pages of the new proposal form are being re-issued in this addendum for convenience. The bullets below provide a summary of the changes:

- Page 00300-3, Proposal Item No. 3 and No. 4 have been added to include Trench Excavation Safety System and Structure Excavation Safety Systems, respectively.

- Page 00300-3, Proposal Item No. 3 has updated to No. 5 and has been revised to provide a firm price allowance for purchase of the Stacked Tray Grit Removal equipment. Proposal Item No. 4 has been deleted and the remaining Proposal Items renumbered.

- Page 00300-10, the list of named manufacturer/suppliers for the Lift Station Submersible Pumps has been revised to the following to clarify that Hydromatic and Myers pumps in the size specified are the same pump manufactured by Pentair.

SECTION W1 – DUCTILE IRON PIPE AND FITTINGS

a) Page W1-2, paragraph W1.04 A, REMOVE "All ductile-iron pipe and fittings shall be from a single Manufacturer" and REPLACE with "All pipe shall be from one single source and all fittings shall be from one single source."

b) Page W1-2, paragraph W1.05 E, REMOVE "Lok-Fast by American Cast Iron Pipe Company" and REPLACE with "Flex-Ring."

SECTION 015000 – TEMPORARY FACILITIES AND CONTROLS

a) Page 015000-4, paragraph 2.2.A TEMPORARY FACILITIES, replace Paragraph A with the following "Field Offices: Field engineer's office is not required."

SECTION 018819 – TIGHTNESS TESTING PERFORMANCE REQUIREMENTS

a) Page 018819-4, paragraph 3.7 SCHEDULE, replace Paragraph A as follows:

"A. Test following structures for tightness:

1. Tank types include:
    a. Sodium Bisulfite Facility – new containment area detailed on SG-SF-1.
2. Wet well types include:
    a. Influent Channel upstream of wet well detailed on SG-SA sheets."

SECTION 030130 – MAINTENANCE OF CAST IN PLACE CONCRETE

a) DELETE this specification in its entirety.

SECTION 400551 – TABLE: VALVE SCHEDULE

a) Refer to the revised Valve Schedule attached. The prior valve schedule was missing some valves at the Treatment Units. This schedule is provided for Contractor's convenience and does not relieve them of requirements to install all valves shown on the Drawings.

SECTION 400557 – ACTUATORS FOR PROCESS VALVES AND GATES

a) Page 400557-1, paragraph 1.2.B, ADD the following as Item 2 and renumber the remaining two items:

"2. Section 099679 "Atmospheric Protection and Plant Service Areas Coatings" for non-submerged actuators as required."

disregard lighlight

SECTOIN 400562 – PLUG VALVES

a) Page 400562-2, paragraph 2.1.A, ADD "4. Henry Pratt" to the list of approved manufacturers.

SECTION 400582 – SOLENOID VALVES FOR PROCESS SERVICE

a) Page 400582-2, paragraph 2.1A REMOVE items 1 and 2 and REVISE as follows:

"1. Type L by Magnatrol Valve Corp. Hawthorne, NJ 07507
2. Atkomatic 14500 Series by Circle Valve. Harleysville, PA 19438
3. Or Engineer approved equal as suitable for service required."

b) Page 400582-2, paragraph 2.1.B.7 REMOVE "As indicated on drawings" and REVISE as "120VAC"

c) Page 400582-2, paragraph 2.1.B.4 replace with "Coil: Class H".

d) Page 400582-2, paragraph 2.1.C.4 REMOVE "PTFE" and REVISE as "Viton or PTFE"

SECTION 40700 – INSTRUMENTATION FOR PROCESS SYSTEMS

a) Appendix A, Instrument Device Schedule page 1, REVISE the PI/PSH – 2130-1 and PI/PSH - 2130-2 to be provided by Division 43.

SECTION 432335 – RECESSED IMPELLER PUMPS

a) Page 432335-6, paragraph 2.2.C, REVISE to read as:

"All flow path clearances within pump equal to or greater than 3 inches, so that all solids that pass-through discharge will pass through pump."

SECTION 431118 – VERTICALLY SPLIT MULTISTAGE BLOWERS

a) Page 431118-4, paragraph 1.3.D.3 REMOVE "and overspeed."

b) Page 431118-14, paragraph 2.3.M.1.c REMOVE Paragraph c "Overspeed tested to at least 115 percent speed" and re-number Paragraphs d and e accordingly.

c) Page 431118-12, paragraph 2.3.H.3.d.2 and 3, REVISE as follows:

"2) Minimum design pressure of 20 psig.
3) If the housing is not rated for 20 psig, then the manufacturer will hydrostatically test the blower casing at 20 psig before shipment and furnish test results."

d) Page 431118-19, REMOVE Paragraph 2.8.B and replace with the following:

"B. Vibration Monitoring System:

1. Each blower shall be provided with vibration transmitter on the inlet and outlet bearings to detect and monitor vibration level. Exceeding the vibration warning set point will initiate a vibration warning alarm. Exceeding the vibration shutdown set point will shut off the blower.

2. The LCS will receive and display the vibration probe signals. Include an adjustable alarm feature such that when bearings reach the selected vibration, an alarm light illuminates until reset and the unit shuts down."

SECTION 431133 – ROTARY LOBE BLOWERS

a) Page 431133-3, paragraph 1.4.G.1, REVISE "Annex C" to "Annex B".

b) Page 431133-8, paragraph 2.2.F.2, REVISE Item 2 as:

"2. Hydrostatic Pressure Rating: 1.5 maximum continuous design pressure rating at operating temperatures."

c) Page 431133-14, paragraph 2.7.D.4 REMOVE Item 4 and REPLACE with "ASHRAE 52.2 MERV 7"

SECTION 432113 – MULTI-RAKE BAR SCREENS

a) Page 462113-3, paragraph 1.7.C, DELETE in its entirety.

b) Page 462113-12, paragraph 2.3.K.7, REVISE the formatting and language to reads as:

"L. Anchorage: Manufacturer to perform the anchor and mounting bolt design calculations, signed by a Professional Engineer, and provide them in the submittal.
1. Anchor Bolts: Approved by the Manufacturer
   a. Type 316 stainless steel unless otherwise specified.
   b. Ample size and strength for purpose intended."

c) Page 462113-14, paragraph 2.5.C.2, UPDATE the rating from "NEMA 1" to "NEMA 12 suitable rating for indoor conditions."

SECTION 432513 – SUBMERSIBLE SOLIDS HANDLING PUMPS

a) Page 432513-7, paragraph 2.2.A.1, REVISE to read as:

"a. Wilo
b. Pentair (Hydromatic / Myers)"

b) Page 432513-7, paragraph 2.2.C, Conditions of Operation Table, REVISE "Design Point Flow Rate – (gpm)" to read as "Design Point Flow Rate – 2 Pumps Running (gpm).

c) Page 432513-7, paragraph 2.2.C, Conditions of Operation Table, REVISE "Flow Rate at Secondary Operation Point – (gpm)" to read as "Flow Rate at Secondary Operation Point – 1 Pump Running (gpm).

d) Page 432513-7, paragraph 2.2.C, Conditions of Operation Table, REVISE the Minimum Overall W/W Efficiency at Design Point (percent) from "77" to "72".

e) Page 432513-7, paragraph 2.2.C, Conditions of Operation Table, REVISE the Minimum Overall W/W Efficiency at Secondary Operation Point (percent) from "77" to "72".

f) Page 432513-8, paragraph 2.3.C.2.a.1, REVISE "1) Semi-open, solids handling type" to read as:

"1) Semi-open or enclosed, solids handling type".

g) Page 432513-8, paragraph 2.3.D, after Paragraph 1 add the following in Paragraph 2 to read as follows and renumber the following to paragraph 3 accordingly:

"2. Enclosed Impeller Designs: Stationary wear ring or wear plate to have minimum 50 points Brinnell hardness greater than rotating wear ring or semi-open impeller vane tip hardness."

h) Page 432513-10, paragraph 2.4.A, REVISE to read as "Pump Motors: Inverter duty rated, housed in an air filled or oil filled, water tight casing."

i) Page 432513-10, REMOVE paragraph 2.4.A.2 which disallowed oil-filled motor housings. Renumber the following items as appropriate.

j) Page 432513-13, REMOVE paragraph 2.8.A.7 requiring flood-tight hatches. Renumber the following items as appropriate.

SECTION 462363 – STACKED TRAY VORTEX GRIT SEPARATOR EQUIPMENT

a) Append to the end of Section 462323 as Attachment 462323-A the attached Hydro International firm price proposal for the equipment specified in this section.

SECTION 462363 – GRIT CLASSIFYING AND WASHING EQUIPMENT

a) Page 462363-3, paragraph 1.6.B.2, ADD the following spare parts after item c:

" d. One of each size and type of fuse used in the control panel.
e. One of each type of indicator light used in each control panel.
f. One of each type of relay used in each control panels.
g. One of each type of I/O card used for the PLC in the control panels.
h. One spare PLC power supply used for the PLC in the control panels."

b) Page 462363-8, paragraph 2.4.B.5, REVISE the material from "Stainless Steel Type 316" to "Stainless Steel".

c) Page 462363-10, paragraph 2.4.C.4, REVISE the Enclosure rating from "NEMA 4X" to "NEMA 7".

REVISIONS TO DRAWINGS

SHEET G-2 – DRAWING INDEX

a) ADD in sheet title "SG-DF-3 SAN GABRIEL WWTP HYDROPNEUMATIC TANK DEMOLITION PHOTOS".

SHEET SG-G-1 – PROCESS FLOW DIAGRAM

a) ADD the following note: "1. DESIGN INTENT IS TO PROVIDE THE CAPABILITY TO CONVEY INFLUENT FLOW DOWNSTREAM OF THE GRIT BASIN IN A STEP FEED CONFIGURATION. DURING NORMAL OPERATIONS, 75% OF INFLUENT FLOW WILL BE CONVEYED THROUGH THE 20"-ABI-DI UPSTREAM OF DROP LEG "A" IN THE AERATION BASINS. THE REMAINING 25% INFLUENT FLOW IS CONVEYED BY STEP FEED THROUGH THE EXISTING 24" INFLUENT PIPE TO THE STEP FEED INLET MIXING BOX. FLOW IS SPLIT VIA TWO WEIRS, AS SHOWN ON SG-MB-1. THE PROCESS CAN BE OPERATED WITH 100 PERCENT PLUG FLOW THROUGH THE 20"-ABI-DI PIPE DURING DRY WEATHER FLOW, BUT OVERFLOWS WILL OCCUR IF THIS CONFIGURATION IS USED DURING PEAK FLOW."

SHEET SG-DD-1 – BLOWER AREA DEMOLITION PLAN AND SECTIONS

a) ADD the following note:

"2. SEE SG-MC SHEETS FOR DETAILS ON NEW ABOVE GRADE 8"-LPA-SS TO EXISTING 8"-LPA- DI CONNECTION TO SERVICE WAS AIRLIFTS. EXISTING 90 DEG BEND TO BE REMOVED AND REPLACED WITH A 90 DEG STAINLESS STEEL BEND AS DETAILED ON PROCESS MECHANICAL SHEETS."

SHEET SG-DF-3 – ABANDONDED HYDROPNEUMATIC TANK DEMOLITION PHOTOS

a) See new sheet adding to contractor's scope the demolition of the hydropneumatic tank.

SHEET SG-C-6 – YARD PIPING PLAN SOUTH

a) ADD a leader note next to the 8"-DR-SDR26 PVC line to indicate to concrete encase the line. ADD detail callout B/CZ-3.

SHEET SG-SA-3 – INFLUENT LIFT STATION MODIFICATIONS TOP PLAN

a) Refer to REVISED Sheet SG-SA-3 attached to this addendum which shows the following:

    a. Add a 2'-0 x 0'-6" containment curb around the influent lift station.
    b. Revise pump access hatches from flood tight hatches to angle frame hatches with updated dimensions of 3'-6" x 4'-6".

SHEET SG-SA-4 – INFLUENT LIFT STATION MODIFICATIONS SECTIONS

a) Refer to REVISED Sheet SG-SA-4 attached to this addendum which shows the following:
    a. Addition of a 2'-0" x 0'-6" containment curb around the influent lift station.

SHEET SG-SB-2 – GRIT CHAMBER MODIFICATIONS UPPER PLAN AND SECTIONS

a) Plan View, UPDATE the distance of the "punch out" wall east of the 8'-1" FRP weir from 10" to 1'-0" to provide a clearance of 3'-2" as shown on SG-SB-1.

SHEET SC-SC-1 – AERATION BASIN MODIFICATIONS PLAN AND SECTIONS

a) ADD Section 6 as shown in REVISED sheet SG-SC-1 attached to this addendum.

SHEET SG-SC-2 – RAS METER VAULTS PLAN AND SECTION

a) Top Plan View and Section 1, REVISE hatch size to show 3'-0" x 5'-0" as depicted on the call out.

SHEET SG-MA-2 – INFLUENT LIFT STATION PLAN

a) REVISE the pump access hatches opening to angle frame type and the width from 3'-1" to 3'-6" as shown in Sheet SG-MA-2 attached to this addendum.

SHEET SG-MC-1 – PROCESS AREA ENLARGED PLAN

a) UPDATE 8" – LPA – SS piping configuration and pipe support as shown in REVISED sheet SG-MC-1 attached to this addendum.

SHEET SG-MC-2 – ENLARGED PROCESS AREA SECTION 1

a) UPDATE 8" – LPA – SS piping configuration and pipe support as shown in REVISED sheet SG-MC-2 attached to this addendum.

SHEET SG-MC-4 – TREATMENT STRUCTURE UNIT SECTIONS II

a) UPDATE 8" – LPA – SS piping configuration and pipe support as shown in REVISED sheet SG-MC-4 attached to this addendum.

SHEET SG-MC-5 – RAS METER VAULTS PLAN AND SECTION

a) Top Plan View and Section 1, REVISE hatch size to accurately show 3'-0" x 5'-0" as depicted on the call out on SG-SC-2.

b) Bottom Plan View, REVISE leader note from "SNAP ON" to "STRAP ON".

SHEET SG-MF-2 – SODIUM BISULFITE STORAGE AND FEED AREA – SECTION

a) ADD the following note:

"4. THE BOTTOM OF THE SODIUM BISULFITE PUMP SKID MUST BE MOUNTED AT A MINIMUM DISTANCE OF 2'-6" ABOVE THE FINISHED FLOOR ELEVATION".

SHEET SG-ME-1 – AERATED SLUDGE HOLDING TANK MODIFICATIONS - PLAN

a) Plan View, REVISE increaser size on blower discharge pipe from 10" x 12" as currently shown to 8" x 10" increaser. Revise butterfly valve size from 10" to 8" typical of each blower discharge.

SHEET SG-EB-1 – GRIT CHAMBER LOWER LEVEL POWER PLAN

a) REVISE the LCS tag from "LCS-1200-1" and "LCS-1200-2" to read as "LCS-2130-1" and "LCS-2130-2", respectively.

SHEET SG-IE-1 – AERATED SLUDGE HOLDING TANK BLOWER AND MISCELLANEOUS P&ID

a) UPDATE signals from LCP-2401-1 to include readouts for Power, Power Factor, Phase Current, and Phase Voltage. See REVISED sheet SG-IE-1 attached to this addendum.

SHEET SG-IG-1 – WW BLOWER AND PECAN BRANCH TRANSFER PUMP STATION P&ID

a) UPDATE signals from LCP-2600-1 to include readouts for Power, Power Factor, Phase Current, and Phase Voltage. See REVISED sheet SG-IG-1 attached to this addendum.

END OF ADDENDUM NO. 3

SECTION 00300
PROPOSAL FORM

PROPOSER'S NAME: _____

PROJECT IDENTIFICATION:

City of Georgetown
Project Name: San Gabriel WWTP Rehabilitation
Project Address: 1107 N College St, Georgetown, TX

SAN GABRIEL WWTP PROJECT NUMBER: PRJ000165
PROPOSAL NUMBER: 202305
CONTRACT NUMBER: 23-0041CIP

THIS PROPOSAL IS SUBMITTED TO:

City of Georgetown
Georgetown Municipal Complex, Purchasing Department
300-1 Industrial Avenue
Georgetown, Texas 78626

1.01 The undersigned Proposer proposes and agrees, if this Proposal is accepted, to enter into an Agreement with OWNER in the form included in the Request for Proposal (RFP) Documents to perform all Work as specified or indicated in the RFP Documents for the prices and within the times indicated in this Proposal and in accordance with the other terms and conditions of the RFP Documents.

2.02 PROPOSER understands and agrees that the OWNER has the right to reject any or all Proposals and to waive any minor technicalities.

2.01 Proposer accepts all of the terms and conditions of Section 100, including without limitation those dealing with the disposition of Security. The Proposal will remain subject to acceptance for 120 days after the Proposal opening, or for such longer period of time that Proposer may agree to in writing upon request of OWNER.

3.01 In submitting this Proposal, Proposer represents, as set forth in the Agreement, that:

A. Proposer has examined and carefully studied the RFP Documents, the other related data identified in the RFP Documents, and the following Addenda, receipt of all which is hereby acknowledged.

Addendum No.	Addendum Date
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

B. Proposer 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. Proposer is familiar with and is satisfied as to all federal, state and local laws and regulations that may affect cost, progress and performance of the Work.

D. Proposer has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions, and (2) reports and drawings of a Hazardous Environmental Condition, if any, which has been identified in the Supplementary Conditions as provided in paragraph 4.06 of the General Conditions.

E. Proposer has obtained and carefully studied (or assumes responsibility for having done so) all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (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 Proposer, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the RFP Documents to be employed by Proposer, and safety precautions and programs incident thereto.

F. Proposer does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Proposal for performance of the Work at the price(s) Proposal and within the times and in accordance with the other terms and conditions of the RFP Documents.

G. Proposer is aware of the general nature of work to be performed by OWNER and others at the Sites that relates to the Work as indicated in the RFP Documents.

H. Proposer has correlated the information known to Proposer, information and observations obtained from visits to the Sites, reports and drawings identified in the RFP Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the RFP Documents.

I. Proposer has given ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that Proposer has discovered in the RFP Documents, and the written resolution thereof by ENGINEER is acceptable to Proposer.

J. The RFP Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Proposal is submitted.

4.01 Proposer further represents that this Proposal 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; Proposer has not directly or indirectly induced or solicited any other Proposer to submit a false or sham Proposal; Proposer has not solicited or induced any individual or entity to refrain from proposing; and Proposer has not sought by collusion to obtain for itself any advantage over any other Proposer or over OWNER.

5.01 Proposer will complete the Work in accordance with the Contract Documents for the following price(s):

SCHEDULE OF PRICES FOR

CITY OF GEORGETOWN
San Gabriel WWTP Rehabilitation

PROPOSAL ITEM NO. 1: Insurance, Bonds and **Mobilization/Demobilization** Related Expenses not to exceed 5% of Total Proposal Price.

Lump Sum $_____
(FIGURES)

_____
(WRITTEN)

PROPOSAL ITEM NO. 2: Furnish all necessary labor, materials, equipment and incidentals necessary to construct the **San Gabriel WWTP Rehabilitation** for improvements to the 2.5 million gallons per day San Gabriel Wastewater Treatment Plant, as more fully described in the Drawings and the Summary of Work contained in Section CIP3. This item shall include all work as specified and shown on the Drawings including all ancillary equipment, complete in place including incidental work obviously needed for the complete project, except those costs specifically included in the other items in this Schedule of Prices.

Lump Sum $_____
(FIGURES)

_____
(WRITTEN)

BASE BID ITEM NO. 3: Design, furnish, install, maintain and remove Trench Excavation Safety Systems as required in all trenches deeper than five feet deep, complete in place as detailed and specified, including overhead and profit associated therewith.

*_____L.F. @ $_____/L.F. $_____
(FIGURES)

_____
(WRITTEN)

* Maximum linear feet to be determined by Proposer and entered here. Linear footage shall not be less than 100 L.F.

BASE BID ITEM NO. 4: Design, furnish, install, maintain and remove Structure Excavation Safety Systems as required in all structure special shoring excavation systems, greater than five feet deep, complete in place as detailed and specified, including overhead and profit associated therewith.

**_____S.F. @ $_____/S.F. $_____
(FIGURES)

_____
(WRITTEN)

** Maximum square feet to be determined by Proposer and entered here. Square footage shall be not less than 100 S.F.

PROPOSAL ITEM NO. 5: An allowance for purchasing the equipment and materials associated with the **Stacked Tray Grit Removal Equipment and Appurtenances** in accordance with Section 462323. Proposer shall include in Proposal Item No. 2 the installation cost, materials, overhead, and profit for

installing, field testing, and making ready for operation the equipment and materials furnished under Section 462323.

Lump Sum $ 274,050
(FIGURES)

Two Hundred and Seventy-Four Thousand and Fifty Dollars and No Cents
(WRITTEN)

PROPOSAL ITEM NO. 6: Furnish all necessary labor, materials, equipment and incidentals necessary to perform **Removal, Loading, Transport, and Disposal** of wastewater solids, grit, rags, and debris from the facilities to be modified including the Aeration Basins, Influent Lift Station Wet Well, Irrigation Water Clearwell, Aerated Sludge Holding Tank, and Grit Chamber and all other related work complete in place as detailed on the Drawings and as specified in Section 460200 "Tank and Structure Cleaning" except those costs specifically included in other items in this Schedule of Prices.

Estimated Quantity: 600 WET TONS

Unit Price per $/WET TON: $
(FIGURES)

Total Amount: $
(FIGURES)

(WRITTEN)

PROPOSAL ITEM NO. 7: Furnish all necessary labor, materials, equipment and incidentals necessary to construct the new **Electrical Improvements**, including all site electrical work including electrical demolition, electrical service, motor control centers (MCC), switchgear, panelboards, new Coordinated E-houses, emergency power supply generator, generator access platform, circuit breakers, transformer, and all electrical power distribution and control system conduit, duct banks, miscellaneous wiring, terminations, lighting fixtures, and electrical components, coordination with electric service provider, and all required appurtenances required for a complete and operational system, and all other related work complete in place as detailed on the drawings and/or as specified, except those costs specifically included in other items in this Schedule of Prices.

Lump Sum $
(FIGURES)

(WRITTEN)

PROPOSAL ITEM NO. 8: Furnish all necessary labor, materials, equipment and incidentals necessary to construct the new **SCADA/Instrumentation and Control Improvements**, including modification of the existing SCADA system, furnishing and installing of all materials, equipment, software, labor and services required to install and configure all instrumentation and field wiring for all proposed work included in this contract. Design, coordinate, program, and modify the existing process control system for proper operation with equipment and materials furnished under this contract including PLC programming, HMI configuration, graphics development, historical logging software application and report generation, network configuration and programming, and all other related work complete in place as detailed on the drawings and/or as specified, except those costs specifically included in other items in this Schedule of Prices.

Lump Sum $_____

(FIGURES)

_____

(WRITTEN)

PROPOSAL ITEM NO. 9: Allowance for fence relocation at San Gabriel WWTP, as needed.

Lump Sum $10,000.00

(FIGURES)

Ten Thousand Dollars and No Cents

(WRITTEN)

PROPOSAL ITEM NO. 10: Allowance to be used for paying fees and charges for permanent electrical service from Georgetown Utility Systems. Refer to Drawing E-3 (Electrical General Notes), Service and Metering notes. The cost for the work to be performed shall be negotiated and Contractor shall be paid for the work out of this allowance:

Lump Sum $150,000.00

(FIGURES)

One Hundred and Fifty Thousand Dollars and No Cents

(WRITTEN)

PROPOSAL ITEM NO. 11: Owner-directed improvements are considered provisional amounts to be used only if directed and are exclusive of work indicated in the Contract Documents for which payment is included in other items in the Schedule of Prices. Contractor's cost for bonds, insurance, overhead, profits, etc. associated with this allowance shall be included in the lump sum Proposal items above; no mark-up shall be allowed for these funds.

Lump Sum $100,000.00

(FIGURES)

One Hundred Thousand Dollars and No Cents

(WRITTEN)

TOTAL PROPOSAL (TOTAL OF ITEMS 1-11) $_____

(FIGURES)

_____

(WRITTEN)

_____

(WRITTEN)

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The above Prices shall include all labor, materials, bailing, shoring, removal, overhead, profit, insurance, etc., to cover the finished work of the several kinds called for. The Proposer understands that the Owner reserves the right to reject any or all Proposals and to waive any informalities in the RFP Documents.

Unit Prices have been computed in accordance with paragraph 11.03.B of the General Conditions.

Proposer acknowledges that estimated quantities are not guaranteed, are solely for the purpose of comparison of Proposals, and final payment for all Unit Price Proposal items will be based on actual quantities provided, determined as provided in the Contract Documents.

SCHEDULE OF MATERIALS AND SUPPLIERS

The Contract Documents are based upon the equipment or products available from the manufacturers/ suppliers denoted within the specifications. The Proposal must be based on the manufacturers or suppliers included in the specifications. Proposers shall circle the manufacturers included in the Proposal as shown on the Proposal Equipment table. If nothing is circled, then it shall be the first manufacturer listed that is expected to be provided.

Provision is made in the Contract Documents for alternate manufacturers and suppliers whose equipment or product may be deemed equivalent in quality. If the Proposer desires to propose one or more alternate manufacturers/suppliers, the Proposer may write in the name of such alternates in the spaces provided on the attached schedule. Wherever an alternate manufacturer/supplier is proposed, the Proposer must insert the amount to be deducted from the Contract Price (either lump sum or unit price) if the alternate manufacturer/supplier is eventually approved.

If the Owner determines that it is in the best interest of the project to review the alternate manufacturer, then the Owner will request that the Proposer supply complete information on proposed alternates for review prior to the Notice of Award. If the proposed alternate manufacturer/supplier is not determined to be in the best interest for this project or is not acceptable to the Owner or Engineer, the Proposer shall use their circled specified manufacturers or suppliers.

The deductive amount specified for alternate manufacturers/suppliers will not be used in determining the successful Proposer. Alternates will be considered only after award of the Contract.

For any alternate manufacturer or supplier accepted by the Owner, the Contract Price will be reduced by the deductive amount stated in the Proposal. However, because the Contract Price is based on specified manufacturers/suppliers it will not be adjusted for any alternate supplier rejected.

The Contractor shall reimburse the Owner for any costs directly attributable to the change in manufacturer or supplier, such as additional field trips for the Engineer, additional redesign costs, additional review and inspection costs, etc.

PROPOSAL EQUIPMENT

Equipment Item or Material	Spec Section	Manufacturer/Supplier
Multi-Rake Bar Screen	462113	a. Kusters Water b. Huber c. Headworks d. Vulcan
Lift Station Submersible Pumps	432513	a. Wilo b. Pentair (Hydromatic/ Myers)
Stacked Vortex Tray Grit Equipment	462323.11	a. Hydro International
Grit Classifying and Washing Equipment	462363	a. Hydro International b. Huber
Recessed Impeller Grit Handling Pumps	432335	a. Wemco b. Egger
Multistage Centrifugal Blowers	431118	a. Lone Star Blower b. Continental c. Hoffman Lamson Gardner Denver
Rotary Lobe Positive Displacement Blowers	431133	a. Aerzen b. Universal Blower PAC c. Hoffman Lamson Gardner Denver d. Kaeser
Ceramic Disc Fine Bubble Diffusers	465136	a. ITT-Sanitaire Xylem b. Aquarius Technologies c. EDI
Coarse Bubble Diffusers	465121	a. ITT-Sanitaire Xylem b. Aquarius Technologies c. EDI
Peristaltic Metering Pumps	432880	a. Watson Marlow b. Blue-White
Stainless Steel Slide Gates	400559.23	a. Whipps b. RW Gate
Programmable Logic Controllers		a. Allen-Bradley

ALTERNATE MANUFACTURERS/SUPPLIERS

Proposer proposes the following alternate manufacturers and suppliers for the equipment or material categories identified:

Equipment Item or Material	Drawing No.	Spec. Section	Alternative Manufacturer/Supplier (List One Only)	Deductible Amount (Indicate whether lump sum or unit price)
1.				
2.				
3.				
4.				
5.				

SCHEDULE OF SUBCONTRACTORS

Proposer proposes the following subcontractors to be used for the Project. All subcontractor specialties indicated below and any subcontractors that, due to the nature of the construction work, comprise a critical or essential element of the construction such that the amount of the subcontract is equal to or greater than 10% of the construction budget or $50,000, whichever is greater must be listed and submitted with the Proposal. Proposers shall provide the address and phone number for each subcontractor listed and three (3) references for similar size and type of project (Attachment D of Section 00400) with the Proposal in accordance with Section 00100. The references shall include name of project, and contact information, including name, phone number and address, for the Owner, Engineer and General Contractor for each project. Failure to provide this information by the specified date and time will disqualify the Proposal from consideration.

Proposer may change subcontractors after Proposal submittal only as approved in writing by the Engineer. The information provided will be used in the evaluation of the Proposer.

SUBCONTRACTOR	SPECIALTY
1.	Electrical
2.	Instrumentation
3.	
4.	
5.	

6.01 Proposer agrees that the Work will be substantially complete and fully complete project and ready for final payment as noted in Section 00500.

6.02 Proposer accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the times specified above, which shall be stated in the Agreement.

7.01 The following documents are attached to and made a condition of this Proposal:

A. Required Proposal security in the form of _____.

B. Section 00400, Statement of Proposer's Experience, including Attachments A – I.

8.01 The terms used in this Proposal with initial capital letters have the meanings indicated in the Instructions to Proposers, the General Conditions, and the Supplementary Conditions.

SUBMITTED on _____, 20____.

If Proposer is:
An Individual

Name (typed or printed): _____

By: _____ (SEAL)
(Individual's signature)
Doing business as: _____
Business address: _____
_____
Phone No.: _____ FAX No.: _____

A Partnership

Partnership Name: _____ (SEAL)

By: _____
(Signature of general partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Business address: _____
_____

Phone No.: _____ FAX No.: _____

A Corporation

Corporation Name: _____ (SEAL)
State of Incorporation: _____
Type (General Business, Professional, Service, Limited Liability):_____

By: _____
(Signature -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____
(CORPORATE SEAL)
Attest _____
(Signature of Corporate Secretary)

Business address: _____
_____

Phone No.: _____ FAX No.: _____
Date of Qualification to do business is _____.

A Joint Venture

Joint Venturer Name: _____ (SEAL)

By: _____
(Signature of joint venture partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Business address: _____
_____

Phone No.: _____ FAX No.: _____

Joint Venturer Name: _____ (SEAL)

By: _____
(Signature -- attach evidence of authority to sign)

Name (typed or printed): _____
Title: _____
Business address: _____
_____

Phone No.: _____ FAX No.: _____
Phone and FAX Number, and Address for receipt of official communications:
_____
_____

(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.)

Attachment 462323-A, Stacked Tray Vortex Grit Separator Equipment

Hydro International Firm Price Proposal

April 6, 2023

To: **All Bidding Contractors**

RE: Stacked Tray Grit Separation - Spec Section 462323
San Gabriel WWTP
San Gabriel, TX
File #20_11_0567

Hydro International is pleased to present our quote for a HeadCell® Grit Removal Unit. The unit will meet the requirements described in Section 462323 with comments noted below.

Comments

1. Hydro's requested Payment Terms are as follows and are prefaced on the following timeline:
   Receipt of a purchase order by August 18, 2023, release to fabrication by January 5, 2024, and shipment of the equipment prior to May 24, 2024.

Milestone	Incremental Payment	Cumulative Payment
Upon Fully Executed PO	10%	10%
Upon Approval of Shop Drawings	10%	20%
Upon Release to Fabrication	10%	30%
Upon Delivery of Equipment to Site	65%	95%
Upon Final Acceptance or 45 days following completion of equipment start up	5%	100%

2. Velocity at the mouth of the HeadCell® unit at peak flow must be ≤3 ft/s.
3. All piping connected to Hydro equipment must be supported by other means than the Hydro equipment.
4. Please see the exclusions detailed in the proposal below.

Equipment Summary

1. One (1) 9' 7 tray HeadCell® Grit Concentrator unit shall be supplied. The HeadCell® shall consist of a stack of nested trays. The trays shall be fabricated from UV stabilized LDPE and shall be supported by a 316L SS frame integral to the unit. All flow passages shall be self-cleaning and free of sharp projections or fittings that may snag stringy or fibrous materials. The HeadCell® trays shall be constructed with a minimum ¼ inch material pans and sidewalls. The Tray Supports shall be fabricated to provide a means to independently support each tray and transfer the weight of each tray to the support structure frame. The HeadCell® will securely fit into a support structure frame containing the screened raw wastewater inlet connection, necessary hardware, and connections. The HeadCell® Concentrator shall be equipped with a 316L SS fluidizing ring with1.5" NPT NPW connection for collection and removal of settled solids. The settled solids are pumped to the Grit Washing / Dewatering unit by others from the HeadCell® unit.

   The unit shall remove 95% of all grit (S.G. 2.65) 106 micron and larger at a peak flow of 7.5 mgd. The unit shall have 12 inches of headloss at the peak flow.

Appurtenances Per Unit

HeadCell® Grit Concentrator

DESCRIPTION	QTY
Fluidizing Water Throttling Globe Valve 1.5" Crane Globe Valve, Bronze	1

Hydro International
2925 NE Aloclek Suite 140 · Hillsboro, OR 97124
Tel: (866) 615-8130 Fax: (503) 615-2906 Web: hydro-int.com

Fluidizing Water Shut-off Valve 1.5” Apollo Ball Valve, Bronze	1
Motorized Ball Valve 1.5” Flow-Tek Ball Valve, Stainless Steel with RCS Actuator (120VAC, NEMA 7)	1
Fluidizing Water Flow Meter 1.5” Blue White Flow Meter, 10-50 gpm, Acrylic	1
Anchor Bolts –Frames Hilti 316SS 3/8” x 5 1/8” HAS Anchor Rods for use with HIT HY 200 Anchor System	4
Anchor Bolts –Fluidizing Ring Hilti 316SS 3/8” x 5 1/8” HAS Anchor Rods for use with HIT HY 200 Anchor System	5
Anchor Bolts – For Fastening Inlet Duct to Channel Hilti 3/8” HDI 3/8 SS Drop-in anchors	set

Utility Requirements

Clarified NPW or Reuse Water:

The HeadCell® unit requires intermittent 32 gpm @ 50 +/- 10 psig of clarified water for “fluidizing” to function properly.

Start-up

One (1) factory trained representative, three (3) trips, for start-up and instruction services as required totaling seven (7) days.

Performance Test

Testing in accordance with specification section 462323-3.2.

Exclusions

Any item(s) not specifically described above are excluded and are not to be supplied by Hydro International including but not limited to the following:

- Field assembly, erection, and installation
- Interconnecting piping and valving not expressly stated above
- Pipe connections and fittings not expressly stated above including bell-mouth grit slurry suction line
- All pipe supports, hangers, and braces
- Controls, switches, control panels and instrumentation of any kind not expressly stated above
- Wiring and conduit
- Grit pump(s) and associated piping, valving, gauges, sensors
- Field or touch-up paint, painting, blasting and touch-up of surface finish
- Spare parts not specifically stated above
- Unloading, hauling and storage charge
- Lubricating oil and greases
- Grit study and associated sampling and reports
- All concrete and grouting work
- Insulation and heat tracing of any kind
- Structural / Seismic analysis
- Bonds of any kind (Performance, Payment, Warranty, Efficacy and/or Supply Bond)
- Grit dumpsters
- Translation Services
- Extended Discharge chutes (flexible or rigid)
- Access platforms, ladders, stairs, walkways, railing, hatches
- Equipment covers/grating
- Washing and dewatering equipment

Insurance Limitations

- Commercial General Liability is limited to $1,000,000 each occurrence
- Automobile combined single limit of $1,000,000 each occurrence
- Worker's Compensation is limited to $1,000,000 each accident
- Excess Liability $4,000,000 on each of the above

Warranty

Hydro International's two (2) year warranty from substantial completion shall apply per the Terms and Conditions of Sale (estimated start date 8/17/2025).

Delivery

Please allow 14-16 weeks after receipt of purchase order for approval drawings. Shipment is typically 18-20 weeks after receipt of "Approved" or "Approved As Noted, Resubmittal Not Required" submittal package. In current market conditions, these times may require adjustment. Price includes truck freight to jobsite but does not include any state or local taxes if required. Timelines are based on typical workloads and with current market conditions they are taking longer. The grit removal unit shall be delivered to site fully fabricated, subject to size, packaging and transportation constraints. The General Contractor must inspect equipment prior to unloading and notify Hydro International of any damage to equipment within 5 days to effect proper remedial action. Failure to notify Hydro International of damage to equipment prior to unloading will void all warranties pertaining to subject equipment.

Terms & Conditions

Hydro International payment terms are detailed in the attached terms and conditions. Price includes truck freight to jobsite and does not include any state or local taxes if required. The prices quoted are firm based on a receipt of a purchase order by August 18, 2023, release to fabrication by January 5, 2024, and shipment of the equipment prior to May 24, 2024. For any delays in delivery which are beyond Hydro International's responsibility, a finance charge of 1.5% of the contract value per month will be due and payable to Hydro.

Pricing $ 274,050.00

Purchase Order

Please make purchase orders to:
Hydro International
2925 NE Aloclek Drive, Suite 140
Hillsboro, OR 97124

Local Representative

Plant Representative:
Mr. Miguel Vera
HRM Environmental
3118 Media Drive
Cedar Park, TX 78641
Ph: (512) 565-1681
Fax: (512) 337-7824
mvera@hrmenv.com

If you have any questions or concerns, please do not hesitate to contact me.

Regards,

Hydro International

Sam Randall
Applications Engineer

Standard Terms and Conditions of Sale

1. **DEFINITIONS.** "Hydro" is Hydro International with an address of 2925 NE Aloclek Drive #140 in Hillsboro, Oregon. "Buyer" is the party purchasing the goods from Hydro.

2. **ENTIRE AGREEMENT**. Hydro's agreement is based on these terms and conditions of sale. This document, together with any additional writings signed by Hydro, represents a final, complete, and exclusive statement of the agreement between the parties and may not be modified, supplemented, explained, or waived by parol evidence, Buyer's purchase order, any course of dealing, Buyer's payment or acceptance, or in any other way except in writing signed by Hydro through its authorized representative. These terms and conditions are intended to cover all activity of Hydro and Buyer hereunder, including sales and use of products, parts, and work, and all related matters (references to products include parts and references to work include construction and installation). Hydro's obligations hereunder are expressly conditioned on Buyer's assent to these terms and conditions. Hydro objects to any terms that are different from, or additional to, these terms and conditions. Any applicable detail drawings and specifications are hereby incorporated and made a part of these Terms and Conditions of Sale insofar as they apply to the material supplied hereunder.

3. **SPECIFICATIONS.** Products are supplied in accordance with information received by Hydro, or its duly authorized agent, from Buyer. Hydro shall have no responsibility for products created or sold based upon inaccurate and/or incomplete information supplied to it. Buyer shall ensure that Hydro receives all relevant information in time to enable it to supply the appropriate products.

4. **INSTALLATION AND APPLICATION OF PRODUCTS.** Products supplied hereunder shall be installed and used only in the application for which they were specifically designed. Buyer should not presume that any products supplied by Hydro may be utilized for any applications other than those specified; nor shall Hydro's obligations, including, without limitation, any warranty obligations, survive Buyer's transfer of products supplied hereunder to third parties unless the products are transferred with Hydro's consent. In addition, Buyer shall not use any product supplied hereunder at any location other than at the location for which Hydro has previously received notice from Buyer. Any breach of any of the foregoing restrictions may amount to an infringement of the patent for the products in question and will in any event void all express or implied warranties relating to the products supplied hereunder.

5. **PURCHASE PRICE AND PAYMENT TERMS.** All prices are in U.S. dollars and all payments shall be made in U.S. dollars. Payment terms are as follows:

	Incremental Payment	Cumulative Payment
Upon Fully Executed PO	10%	10%
Upon Approval of Shop Drawings	10%	20%
Upon Release to Fabrication	10%	30%
Upon Delivery of Equipment to Site	65%	95%
Upon Final Acceptance or 45 days following completion of equipment start up	5%	100%

If payments are not made in conformance with the terms stated herein, any unpaid balance shall be subject to interest at a rate 1½% per month, but not to exceed the maximum amount permitted by law. If shipment is delayed by Buyer, the previously agreed date of readiness for shipment shall be deemed to be the date of shipment for payment purposes. If manufacture is delayed by Buyer, a payment shall be made based on purchase price and percentage of completion, with the balance payable in accordance with the terms as stated. If at any time in Hydro's judgment Buyer may be or may become unable or unwilling to meet the terms specified, Hydro may require satisfactory assurance or full or partial payment as a condition to commencing, or continuing manufacture, or in advance of shipment.

Until payment in full has been received by Hydro, this Standard Terms and Conditions of Sale shall constitute a security agreement and Buyer hereby grants Hydro a purchase money security interest in and to the products produced by Hydro hereunder, and any products or proceeds thereof. In particular:

a. Hydro will retain an express purchase money security interest in and to the products and all proceeds thereof.

b. Until full payment for the products is received by Hydro, Hydro reserves the right to retake possession of the products at any time and for this purpose Buyer authorizes Hydro or its duly authorized agent to enter upon land or premises where it believes the product may be.

c. Proceeds of any disposal of the products shall be held in trust for Hydro pursuant to the terms of the Maine Uniform Commercial Code.

d. Buyer grants Hydro a power of attorney for the purpose of filing a UCC-1 financing statement in the name of Buyer to evidence Hydro's security interest in the products.

6. **BACKCHARGES.** In the event that Buyer is required to make repairs, corrections or modifications to the goods supplied by Hydro, it shall only do so upon written approval from Hydro. Backcharges shall be limited to the costs directly associated in making the repairs, corrections or modifications to the goods supplied by Hydro. The costs of such backcharges shall be subject to approval by Hydro and shall be limited to: (1) directly related labor and material costs, (2) directly related equipment and tool rental at prevailing rates in the project location and (3) Buyer's overhead & supervision costs to make repairs, corrections or modifications to the goods supplied by Hydro. Buyer shall submit complete documentation to Hydro's satisfaction including but not limited to labor time sheets, material lists, and rental fees detailing the nature of the back charges. Backcharges shall be in the form of an adjustment to the contract price or reduction in retained payments and not a direct payment. No incidental or consequential backcharges shall be allowed.

7. **DELIVERY.** The goods are sold DDP (Incoterms 2010) jobsite, freight prepaid to Buyer at job site. Except as outlined in Paragraph 8 below, the risk of loss passes to Buyer after Hydro delivers the goods to the jobsite. Hydro reserves the right to select the method of shipment and carrier. Delivery dates are approximate only and are not a guarantee of delivery on a particular day. Hydro is not liable for failure or delays in deliveries of any cause whatsoever beyond the control of Hydro.

8. **TITLE & INSURANCE:** Title to the product(s) and risk of loss or damage shall pass to Buyer upon delivery to a carrier as outlined in Paragraph 7 above, or, in the event Buyer delays shipment, by the previously agreed date of readiness for shipment, except that a security interest in the product(s) or any replacement shall remain in Hydro's name, regardless of the mode of attachment to realty or other property, until the full price has been paid in cash. Buyer agrees to protect Hydro's interest by adequately insuring the product(s) against loss or damage from any external cause with Hydro named as insured or co-insured.

9. **ERECTION:** Unless otherwise stated in writing, the goods provided hereunder shall be assembled and erected by and at the expense of Buyer.

10. **CANCELLATION & BREACH:** Orders placed cannot be canceled, nor shipments of goods made up, or in process, be deferred beyond the original shipment dates specified, except with Hydro's written consent and upon terms which shall indemnify Hydro against all loss. In the event of cancellation or the substantial breach of Buyer's obligations, as by failing to make any of the payments when due, the parties agree that Hydro will suffer a serious and substantial damage that will be difficult, if not impossible, to measure, both as of the time of entering into this purchase agreement and as of the time of such cancellation or breach. Therefore, the parties agree that, upon such cancellation or breach, Buyer shall pay to Hydro the sums set forth herein below, which sums the parties do hereby agree shall constitute agreed and liquidated damages in such event:

    a. If cancellation or breach shall occur after the acceptance of the purchase order but prior to mailing of submittal documents by Hydro to Buyer, liquidated damages shall be 10% of the selling price.

    b. If cancellation or breach shall occur within thirty (30) days from the mailing of submittal documents by Hydro to Buyer, the liquidated damages shall be 20% of the selling price.

    c. If the cancellation or breach occurs after thirty (30) days from the mailing of submittal documents by Hydro to Buyer, but prior to notification that the order is ready for shipment, the liquidated damages shall be the total of 30% of the selling price plus the expenses incurred, cost of material, and reasonable value of the work expended to fill the order involved herein by Hydro's engineers and other employees, agents and representatives after the mailing of general arrangement drawings by Hydro to Buyer, said sums to be determined at the sole reasonable discretion of Hydro; provided, however, that the total liquidated damages under this provision shall not exceed the total selling price.

    d. If cancellation or breach shall occur after Hydro has notified Buyer that the order is ready for shipment, then the liquidated damages shall be the total selling price, less costs associated with startup or field testing.

11. **MATERIALS OF CONSTRUCTION, PAINTS AND COATINGS**: Buyer is responsible for determining the suitability of, and for giving final approval of, the materials of construction, paints, coatings, etc. to be used by Hydro.

12. **WARRANTY:** Any product that proves defective in material, workmanship or design within two (2) years after substantial completion (estimated start date 8/17/2025) will be, at the discretion of HYDRO, modified, repaired or replaced, or Buyer's payment for the products will be refunded. This shall be Buyer's sole remedy. HYDRO EXPRESSLY EXCLUDES AND DISCLAIMS ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHER WARRANTIES, EXPRESS OR IMPLIED.

    This warranty does not cover any defects or costs caused by: (1) normal wear and tear of equipment from designed operation. (2) modification, alteration, repair or service of the goods by anyone other than Hydro; (3) physical abuse to, or misuse of, the goods, or operation thereof in a manner contrary to Hydro's instructions; (4) any use of the goods other than that for which they were intended; (5) chemicals or components which were not disclosed to Hydro; (6) storage contrary to Hydro's instructions; or (7) failure to maintain the goods in accordance with Hydro's instructions.

This warranty does not apply to component parts of the goods that were not both originally designed and manufactured by Hydro, including, but not limited to, valves and controls. These component parts do not carry any warranties by Hydro, and only carry the warranties, if any, of their manufacturers.

In order for Buyer to make a claim under this warranty, Buyer must promptly, and within the warranty period, notify Hydro in writing of any defect(s) in the goods covered by this warranty. If any defect(s) in the goods covered by this warranty are visible at the time of delivery, Buyer must notify Hydro of the defect(s) in writing within five working days. To make any claim under this warranty, Buyer must also fully comply with written authorization and return instructions from Hydro.

13. **FIELD SERVICE:** Startup/Field Service will only be scheduled upon written request. Buyer shall notify Hydro of schedule requirements at least ten (10) working days in advance, or additional charges may be added to cover late-scheduled travel costs. Additional costs will be limited to those arising out of late-scheduled costs. Should Buyer have outstanding balances due Hydro, no startup / field service will be scheduled until such payments are received by Hydro. Hydro will send documents to Buyer defining the service or startup requirements. Buyer assumes all responsibility for the readiness of the system when it requests startup service. Should Hydro's Field Service Engineer arrive at the jobsite and determine that the system cannot be started up within a reasonable time, Hydro shall have the option to bring the Field Service Engineer home and bill Buyer for time, travel and living expenses. Additional field service is available from Hydro at the prevailing per-diem rate at the time of the request for service plus all travel and living expenses, portal-to-portal. A purchase order or change order will be required prior to scheduling this additional service.

14. **LIMITATION OF HYDRO'S LIABILITY.** Hydro assumes no liability or responsibility for the misuse of its products by Buyer, Buyer's employees, agents or assigns, or other use inconsistent with the use appropriate to the performance specification requirements submitted to Hydro, and Buyer agrees to indemnify and hold harmless Hydro for any loss, costs, expense or liability that it may incur or be put to as a result of misuse or inconsistent use of the products. In addition, Hydro shall have no liability to Buyer for any consequential or incidental damages incurred by Buyer in connection with the contract documents or the products purchased by Buyer. Hydro shall not be liable for any loss which results from delay in delivery caused by any reason beyond its control, including, but not limited to, acts of God, casualty, civil disturbance, labor disputes, strikes, transportation or inability to obtain materials or services, any interruption of its facilities, or act of any governmental authority. The total liability of Hydro to Buyer in the form of liquidated damages for any loss, indemnity, damage or delay of any kind will not under any circumstances exceed 25% of the Contract Sum.

15. **DELAYS AND EXTENSIONS OF TIME**. In the event of any delay in delivery caused by any reason beyond Hydro's control, including, but not limited to, acts of God, casualty, civil disturbance, labor disputes, strikes, pandemics, transportation or inability to obtain materials or services, including related to supply chain disruptions, any interruption of its facilities, or act of any governmental authority, the time for delivery shall be automatically extended during the continuance of such conditions.

16. **INTELLECTUAL PROPERTY**. Hydro shall retain sole ownership of all of its intellectual property used or produced in connection with the Project, including but not limited to all drawings, specifications, software, written materials, manuals, marks, business methods, and all other property that is capable of protection by a patent, copyright or trademark (whether or not such protection has actually been sought). Buyer shall not use such intellectual property except for the purpose of confirming the quality of design and/or manufacturing of the products and services set forth in the Proposal. Buyer shall not photocopy, duplicate or in any way copy such intellectual property except for the Buyer's internal purposes only (but not for rendering services or selling products to third persons). Buyer shall not sell, license, assign or transfer the intellectual property protected by this paragraph to anyone. Buyer shall ensure that Owner is in possession of valid licenses for all third-party software (not provided by Hydro) used for the Project, and shall indemnify and hold harmless Hydro against all claims by licensors of such software. Hydro makes no warranty regarding the effect of such third-party software on the performance of the software to be developed by Hydro for the Project and Hydro shall be released from any warranties given to Buyer to the extent that such software causes or contributes to problems. Following acceptance and final payment to Hydro, Hydro will grant to the Owner a non-transferable, non-exclusive license to use the software for the Owner's internal purposes only in the form of the license agreement attached as Exhibit A.

17. **TAXES.** Prices stated herein do not include any tax, excise, duty or levy now or hereafter enacted or imposed, by any governmental authority on the manufacture, sale, delivery and/or use of any item delivered. An additional charge will be made therefore and paid by Buyer unless Hydro is furnished with a proper exemption certificate relieving Hydro of paying or collecting the tax, excise, duty or levy in question.

18. **INTERPRETATION OF CONTRACT.** This contract shall be construed according to the laws of the State of Maine.

19. **CHOICE OF FORUM**. Buyer and Hydro hereby consent and agree that the United States District Court for the District of Maine or the District Court or Superior Court located in the City of Portland, County of Cumberland, Maine will have exclusive jurisdiction over any legal action or proceeding arising out of or relating to the contract documents, and each party consents to the personal jurisdiction of such Courts for the purpose of any such action or proceeding. Buyer and Hydro further hereby consent and agree that the exclusive venue for any legal action or proceeding arising out of or relating to the contract documents will be in the County of Cumberland, Maine. Each party hereby waives all rights it has or which may hereafter arise to contest such exclusive jurisdiction and venue.

20. **ATTORNEYS' FEES.** If any judicial or non-judicial proceeding is initiated for the purpose of enforcing a provision of this contract, the prevailing party shall be awarded reasonable attorneys' fees in addition to all other costs associated with the proceeding, whether or not the proceeding advances to judgment.

21. **SEVERABILITY.** If any provisions of this contract are held invalid by a court of competent jurisdiction, the remainder of this contract shall not be rendered invalid, and such invalid provisions shall be modified, in keeping with the letter and spirit of this contract, to the extent permitted by applicable law so as to be rendered valid.

22. **ANTI-BRIBERY.** Hydro International will not engage in any form of bribery or corruption. The offering, giving or receiving of bribes is contrary to Hydro International's values and can play no part in the way in which it carries out its business. Hydro requires you to support our approach and implement provisions consistent with our policy through your own organization and your supply chain. Please find a copy of our Anti-Bribery and Corruption Policy on our website at: https://www.hydro-int.com/sites/default/files/hydro_international_anti-bribery_and_corruption_policy_-_july_2018.pdf

SECTION 400551-A
TABLE 1
PROCESS MECHANICAL VALVE SCHEDULE

3

Tag Number	*Tag Typ*	*Valve Size (Inches)*	*End Connection*	*Working Pressure (psi)*[4]	*Service Fluid* [2]	*Actuator Type* [3]	*Notes*	*Drawing Number*	*Spec Section*
CV-2010-1	SCV1	12”	FLANGED	35	INF	MANUAL		SG-IA-1	400565.23
GV-2010-1	GV1	12”	FLANGED	35	INF	MANUAL		SG-IA-1	400561
CV-2010-2	SCV1	12”	FLANGED	35	INF	MANUAL		SG-IA-1	400565.23
GV-2010-2	GV1	12”	FLANGED	35	INF	MANUAL		SG-IA-1	400561
CV-2010-3	SCV1	12”	FLANGED	35	INF	MANUAL		SG-IA-1	400565.23
GV-2010-3	GV1	12”	FLANGED	35	INF	MANUAL		SG-IA-1	400561
PV-2130-1A	PV1	4”	FLANGED	10	GR	MANUAL	OPEN/CLOSE GLASS LINED ECCENTRIC	SG-IB-1	400562
PV-2130-2A	PV1	4”	FLANGED	10	GR	MANUAL	OPEN/CLOSE GLASS LINED ECCENTRIC	SG-IB-1	400562
PV-2130-1B	PV1	4”	FLANGED	10	GR	MANUAL	OPEN/CLOSE GLASS LINED ECCENTRIC	SG-IB-1	400562
PV-2130-2B	PV1	4”	FLANGED	10	GR	MANUAL	OPEN/CLOSE GLASS LINED ECCENTRIC	SG-IB-1	400562
CV-2130-1A	SCV1	4”	FLANGED	10	GR	MANUAL	GLASS LINED	SG-IB-1	400565.23
CV-2130-2A	SCV1	4”	FLANGED	10	GR	MANUAL	GLASS LINED	SG-IB-1	400565.23
PV-2110-1	PV	4”	FLANGED	10	ORGANICS	MOTOR	VENDOR PROVIDED	SG-IB-2	400562
PV-2700-1A	PV1	18”	FLANGED	10	ABI	MANUAL		SG-IC-1	400562
PV-2700-1B	PV1	18”	FLANGED	10	ABI	MANUAL		SG-IC-1	400562
BFV-2305-1	BFV2	8”	FLANGED	20	LPA	MANUAL	VENDOR PROVIDED	SG-ID-1	400564
BFV-2305-2	BFV2	8”	FLANGED	20	LPA	MANUAL	VENDOR PROVIDED	SG-ID-1	400564
BFV-2305-3	BFV2	8”	FLANGED	20	LPA	MANUAL	VENDOR PROVIDED	SG-ID-1	400564
BFV-2305-4	BFV2	8”	FLANGED	20	LPA	MANUAL	VENDOR PROVIDED	SG-ID-1	400564
CV-2310-1	DDCV1	12”	FLANGED	20	LPA	MANUAL		SG-ID-1	400565.29
CV-2310-2	DDCV1	12”	FLANGED	20	LPA	MANUAL		SG-ID-1	400565.29

Tag Number	*Tag Typ*	*Valve Size (Inches)*	*End Connection*	*Working Pressure (psi)*[4]	*Service Fluid* [2]	*Actuator Type* [3]	*Notes*	*Drawing Number*	*Spec Section*
CV-2310-3	DDCV1	12”	FLANGED	20	LPA	MANUAL		SG-ID-1	400565.29
CV-2310-4	DDCV1	12”	FLANGED	20	LPA	MANUAL		SG-ID-1	400565.29
BFV-2310-1	BFV2	12”	FLANGED	20	LPA	MANUAL		SG-ID-1	400564
BFV-2310-2	BFV2	12”	FLANGED	20	LPA	MANUAL		SG-ID-1	400564
BFV-2310-3	BFV2	12”	FLANGED	20	LPA	MANUAL		SG-ID-1	400564
BFV-2310-4	BFV2	12”	FLANGED	20	LPA	MANUAL		SG-ID-1	400564
BFV-2315-1A	BFV2	18”	FLANGED	20	LPA	MANUAL		SG-ID-1	400564
BFV-2315-1B	BFV2	18”	FLANGED	20	LPA	MANUAL		SG-ID-1	400564
BFV-2315-2	BFV2	18”	FLANGED	20	LPA	MANUAL		SG-ID-1	400564
BFV-2316-1	BFV2	8”	FLANGED	20	LPA	MANUAL		SG-MC-2	4000564
CV-2410-1	DDCV1	8”	FLANGED	20	LPA	MANUAL	VENDOR PROVIDED	SG-IE-1	400565.29
BFV-2410-1	BFV2	8”	FLANGED	20	LPA	MANUAL		SG-IE-1	400564
CV-2410-2	DDCV1	8”	FLANGED	20	LPA	MANUAL	VENDOR PROVIDED	SG-IE-1	400565.29
BFV-2410-2	BFV2	8”	FLANGED	20	LPA	MANUAL		SG-IE-1	400564
BFV-2410-3	BFV2	6”	FLANGED	10	LPA	MANUAL		N/A	400564
CV-2610-1	DDCV1	12”	FLANGED	10	LPA	MANUAL	VENDOR PROVIDED	SG-IG-1	400565.29
BFV-2610-1	BFV2	12”	FLANGED	10	LPA	MANUAL		SG-IG-1	400564
-	BFV2	6”	FLANGED	20	LPA	MANUAL	Basin 1, Grid A	SG-MC-1	400564
-	BFV2	8”	FLANGED	20	LPA	MANUAL	Basin 1, Grid B	SG-MC-1	400564
-	BFV2	8”	FLANGED	20	LPA	MANUAL	Basin 1, Grid C	SG-MC-1	400564
-	BFV2	8”	FLANGED	20	LPA	MANUAL	Basin 1, Grid D	SG-MC-1	400564
-	BFV2	6”	FLANGED	20	LPA	MANUAL	Basin 1, Grid E	SG-MC-1	400564
-	BFV2	6”	FLANGED	20	LPA	MANUAL	Basin 2, Grid A	SG-MC-1	400564
-	BFV2	8”	FLANGED	20	LPA	MANUAL	Basin 2, Grid B	SG-MC-1	400564
	BFV2	8”	FLANGED	20	LPA	MANUAL	Basin 2, Grid C	SG-MC-1	400564
-	BFV2	8”	FLANGED	20	LPA	MANUAL	Basin 2, Grid D	SG-MC-1	400564
-	BFV2	6”	FLANGED	20	LPA	MANUAL	Basin 2, Grid E	SG-MC-1	400564

NOTES:

(1) Scheduled valves are limited to only process mechanical valves which are manually operated valves 4-inches and larger, and all process mechanical valves that have electric motor, solenoid or pneumatic operators. No fire protection or plumbing valves are included. For Plumbing, Building Mechanical, and Fire Protection valves see Divisions 21, 22, and 23.

(2) Process Fluid Abbreviations: INF= Raw Influent; GR=Grit; LPA=Low Pressure Air, ABI = Aeration Basin Influent

(3) See Section 400557 for Operator requirements.

(4) See pipe schedule for line test pressures and specifications for valve design pressure requirements. For valves at pump stations, confirm with pump manufacturer for flow and pressure requirements.

(5) This schedule is provided for Contractor's convenience and does not relieve them of requirements to install all valves shown on the Drawings.

Valve Type Summary	
Valve Type	Description
ARV1	Air Release Valves for Water Service
ARV2	Thermoplastic Air Release Valves
AVRV	Air/Vacuum relief Valves for Water Service
ASR	Air Release Valves for Wastewater Service
ASC	Combination Air Valves for Wastewater Service
BFV1	AWWA Butterfly Valves
BFV2	Cartridge Seat Process Duty Butterfly Valves
BFV3	High Performance Butterfly Valves
BFV4	Butterfly Valves for Low Pressure Air Service (Metal Body)
BFV5	Cartridge Seat Thermoplastic Butterfly Valves
BFV6	Boot Seat Thermoplastic Butterfly Valves
CAV1	Combination Air Valves for Water Service
CAV2	Combination Air Valves for Water Service with Anti Surge Mechanism
BPREG	Backpressure Regulating/Inline Pressure-relief Valves
DV2	Plastic Diaphragm Valves
SRV	Surge Relief Valve
VPBV	Vee Port Ball Control Valves
BV3	Two Piece Brass Body Ball Valves, 3-Inch and Smaller
BV8	Thermoplastic Ball Valves
VPBV	Vee-Port Ball Valve
RFCV	Rubber Flapper Check Valves 3-inch and Larger
RPZBP	Reduced Pressure Zone Backflow Preventers
DDCV1	Double Disk Check Valve -Blower Discharge Service
TDCV	Tilting Disk Check Valves
SCV1	Iron Body Swing Check Valves 4-inch and larger
SCV2	Alloy Body Swing Check Valves for Saline Service
GV1	Double Disc Gate Valves
GV2	Double Revolving Disc Gate Valves
GV3	Solid Wedge, Metal-Seated Gate Valves
GV4	Solid Wedge, Resilient-Seated Gate Valves
GV5	General-Duty Gate Valves-Smaller than 3 inches
GV6	Plastic Gate Valves
PRV1	Pressure Reducing Valves
PRV2	Thermoplastic Pressure Reducing Valves
PV1	Eccentric Plug Valves
PV3	Eccentric Plug Valves with Modulating Actuator for flow control
SV1	Solenoid Valves 2” and Larger
SV2	Solenoid Valves Smaller than 2”

END OF SECTION 400551A

PHOTO
NTS

NOTE:

1. ABANDONED TANK AND ASSOCIATED TANK PAD TO BE DEMOLISHED AND REMOVED. CONTRACTOR TO COORDINATE WITH OWNER TO ENSURE TANK IS FULLY EMPTY PRIOR TO DEMOLITION.

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	4/4/23	SKM	ATD	REVISION FOR ADDENDUM NO.3

DESIGNED BY: J. MAYER
DRAWN BY: S. RAJI
SHEET CHK'D BY: A. DOODY
CROSS CHK'D BY: A. WOELKE
APPROVED BY: A. DOODY
DATE: JANUARY 2023

CDM Smith
9430 Research Blvd., Suite 1-200
Austin, TX 78759
Tel: (512) 346-1100
TBPE Firm Registration No. F-3043

CITY OF GEORGETOWN, TEXAS

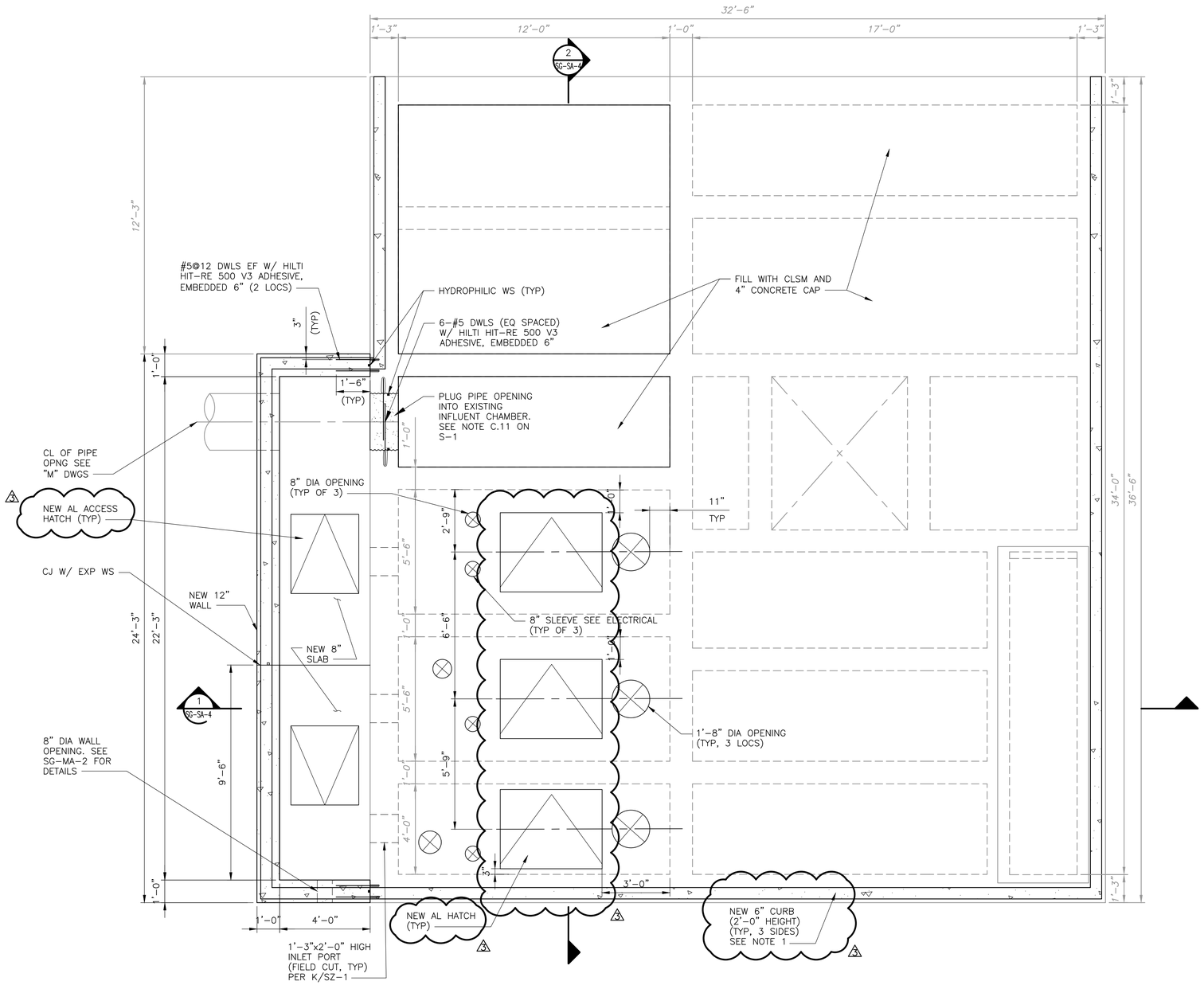
DOVE SPRINGS WWTP AND SAN GABRIEL WWTP REHABILITATION

SAN GABRIEL WWTP
ABANDONDED HYDROPNEUMATIC TANK DEMOLITON PHOTOS

ALEXANDRA T. DOODY
112812
LICENSED
PROFESSIONAL ENGINEER
April 4, 2023

PROJECT NO. 2048-264953
FILE NAME: SGDF3.DWG

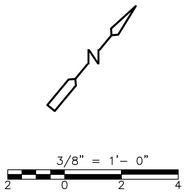
SHEET NO.
SG-DF-3



TOP

PLAN

3/8" = 1'-0"



3

NOTES:

1. LOCATIONS OF CURB CONSTRUCTION JOINTS TO BE LOCATED BY CONTRACTOR. PROVIDE A WATERSTOP AT ALL CONSTRUCTION JOINTS.

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	3/31/23	JNE	CFW	REVISED FOR ADDENDUM NO. 3

DESIGNED BY: J. EULL
DRAWN BY: M. SIDDIQ
SHEET CHK'D BY: W. YANG
CROSS CHK'D BY: J. EULL
APPROVED BY: C. WONG
DATE: JANUARY 2023

CDM Smith
9430 Research Blvd., Suite 1-200
Austin, TX 78759
Tel: (512) 346-1100
TBPE Firm Registration No. F-3043

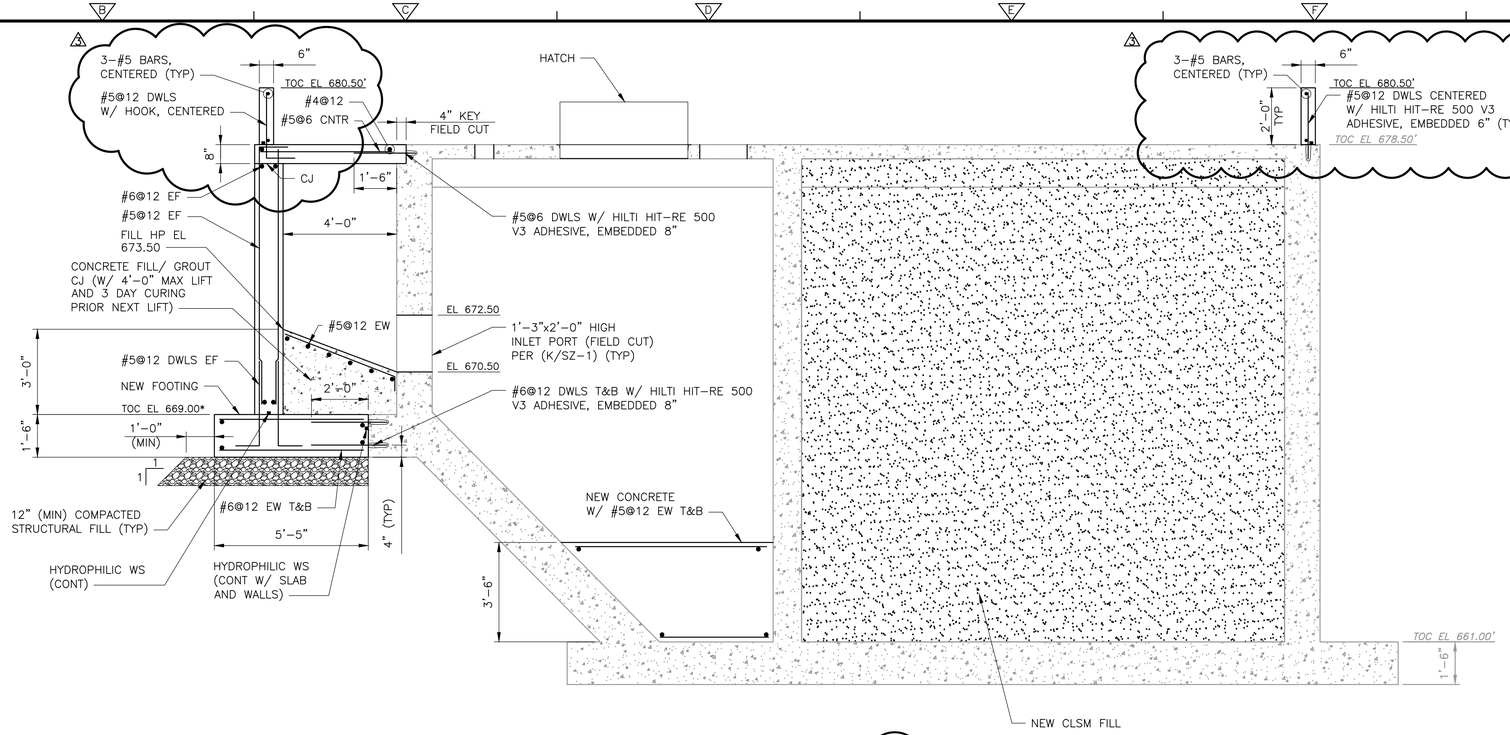
CITY OF GEORGETOWN, TEXAS

SAN GABRIEL WWTP
REHABILITATION

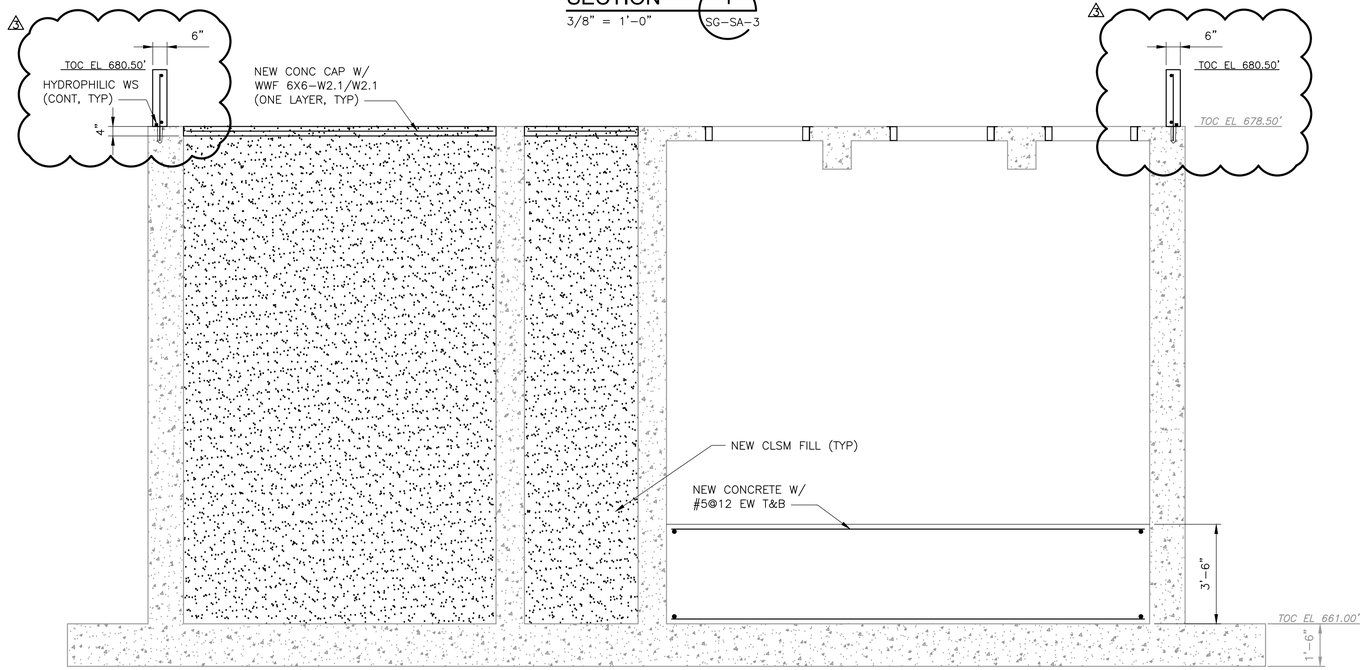
SAN GABRIEL WWTP
INFLUENT LIFT STATION MODIFICATIONS
TOP PLAN

PROJECT NO. 2048-264953
FILE NAME: S002LSPL.DWG

SHEET NO.
SG-SA-3



SECTION 1
3/8" = 1'-0"
SG-SA-3



SECTION 2
3/8" = 1'-0"
SG-SA-3

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	3/31/23	JNE	CJW	REVISED FOR ADDENDUM NO. 3

DESIGNED BY: J. EULL
DRAWN BY: M. SIDDIQ
SHEET CHK'D BY: W. YANG
CROSS CHK'D BY: J. EULL
APPROVED BY: C. WONG
DATE: JANUARY 2023

CDM Smith
9430 Research Blvd., Suite 1-200
Austin, TX 78759
Tel: (512) 346-1100
TBPE Firm Registration No. F-3043

CITY OF GEORGETOWN, TEXAS

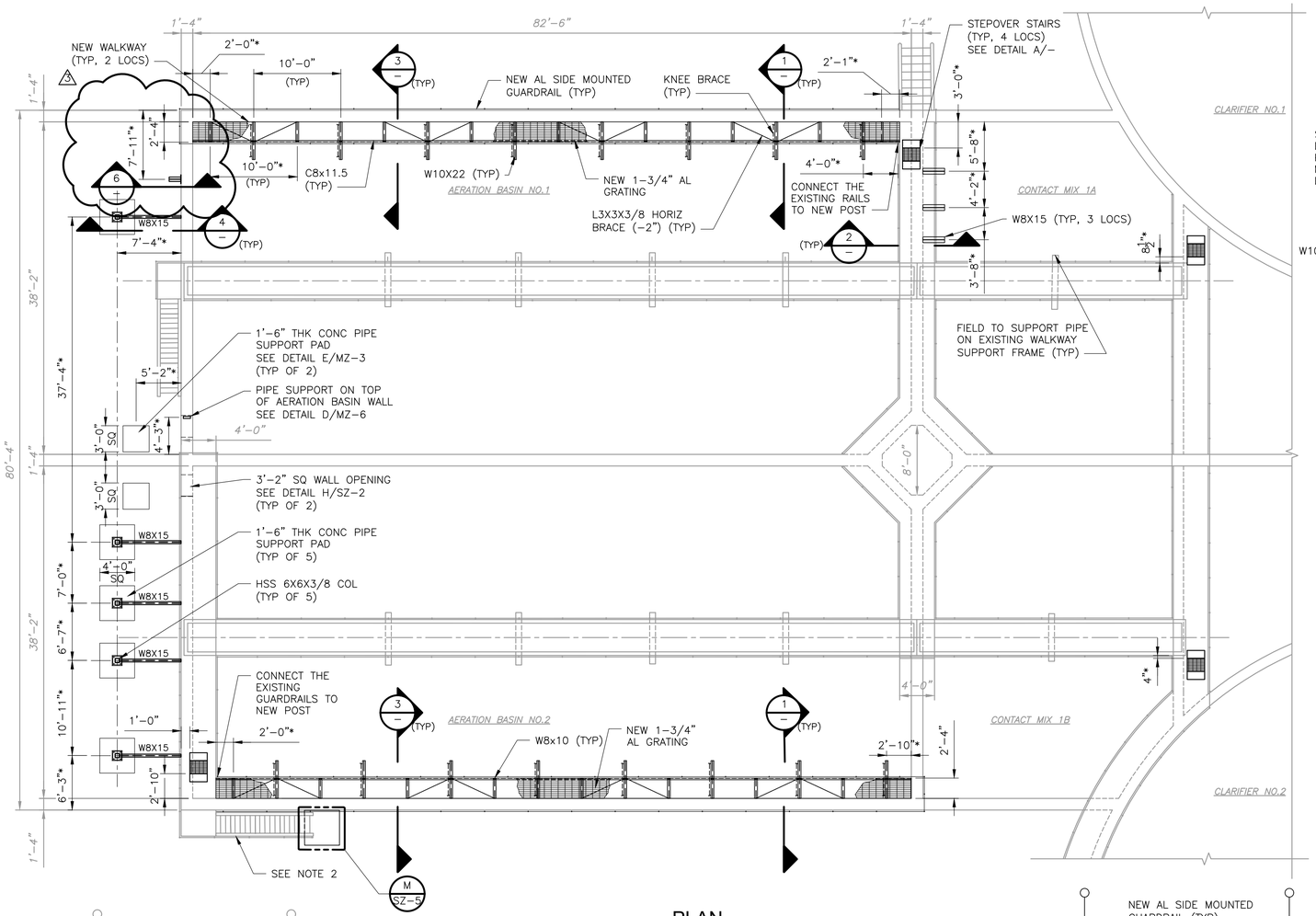
SAN GABRIEL WWTP
REHABILITATION

SAN GABRIEL WWTP
INFLUENT LIFT STATION MODIFICATIONS
SECTIONS

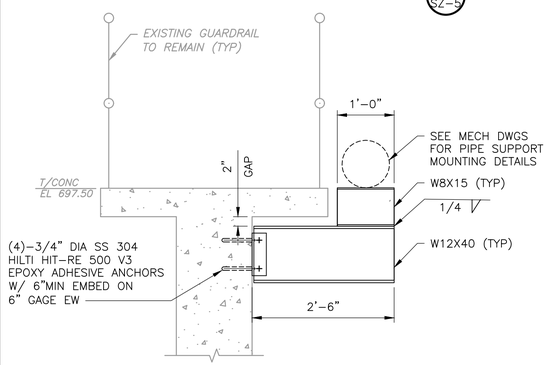
PROJECT NO. 2048-264953
FILE NAME: S003LSSC.DWG

SHEET NO.
SG-SA-4

STATE OF TEXAS
CHUN FOR WONG
92069
LICENSED
PROFESSIONAL ENGINEER
Chun For Wong
04-04-2023

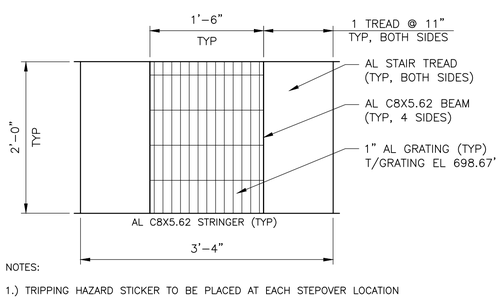


PLAN
1/8" = 1'–0"



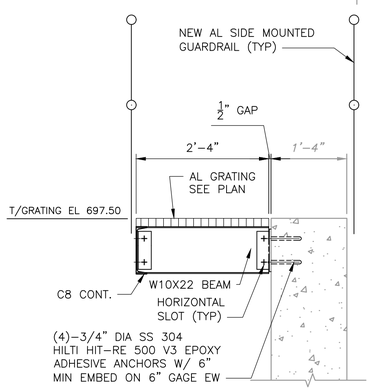
NOTE: 2" GAP TO BE ADJUSTED AS REQUIRED TO MATCH BOTTOM OF PIPE ELEVATION

SECTION 2
3/4" = 1'–0"

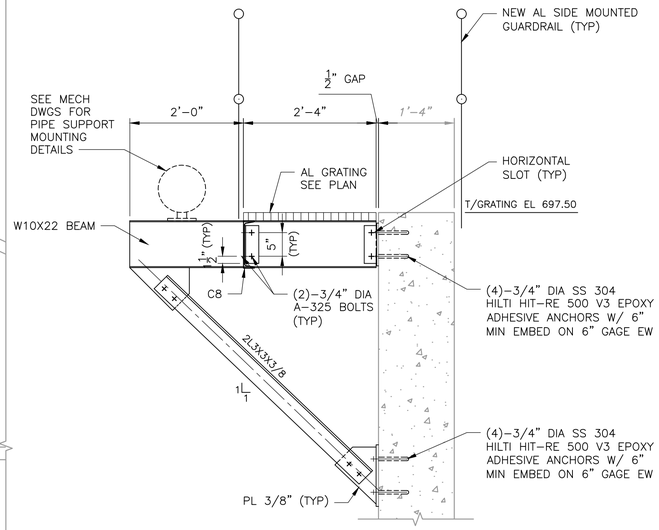


NOTES:
1.) TRIPPING HAZARD STICKER TO BE PLACED AT EACH STEPOVER LOCATION
2.) SEE DETAILS F AND G ON DRAWING SZ–5 FOR STRINGER CONNECTION DETAILS

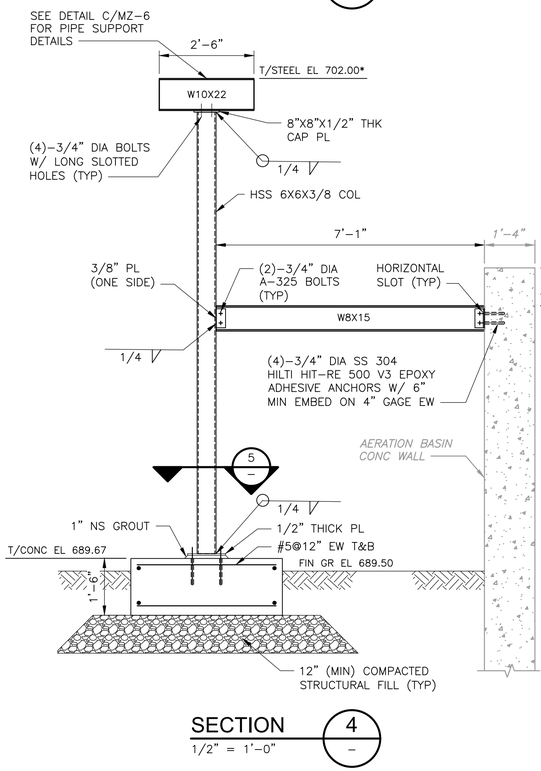
DETAIL A
1" = 1'–0"



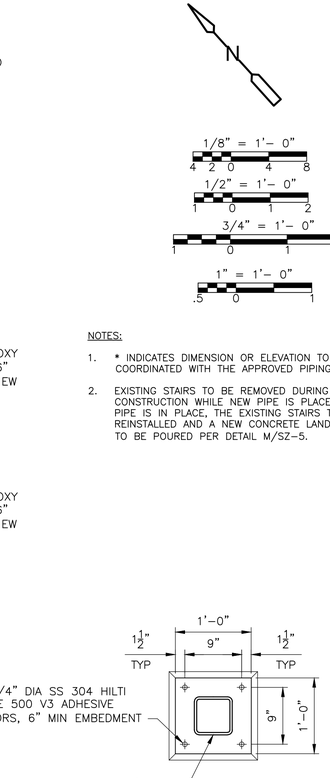
SECTION 3
3/4" = 1'–0"



SECTION 1
3/4" = 1'–0"

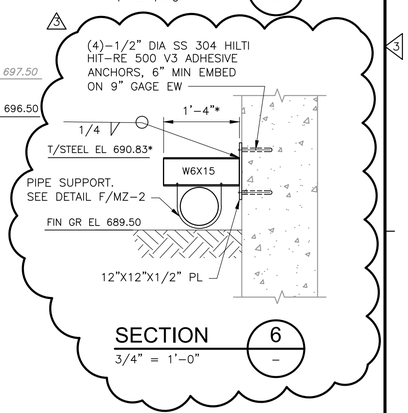


SECTION 4
1/2" = 1'–0"



NOTES:
1. * INDICATES DIMENSION OR ELEVATION TO BE COORDINATED WITH THE APPROVED PIPING PLAN.
2. EXISTING STAIRS TO BE REMOVED DURING CONSTRUCTION WHILE NEW PIPE IS PLACED. ONCE PIPE IS IN PLACE, THE EXISTING STAIRS TO BE REINSTALLED AND A NEW CONCRETE LANDING PAD TO BE POURED PER DETAIL M/SZ–5.

SECTION 5
1" = 1'–0"



SECTION 6
3/4" = 1'–0"

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	3/20/23	JNE	CFW	REVISED FOR ADDENDUM NO. 3

DESIGNED BY: J. EULL
DRAWN BY: M. SIDDIQ
SHEET CHK'D BY: W. YANG
CROSS CHK'D BY: J. EULL
APPROVED BY: C. WONG
DATE: JANUARY 2023

CDM Smith
9430 Research Blvd., Suite 1-200
Austin, TX 78759
Tel: (512) 346-1100
TBPE Firm Registration No. F-3043

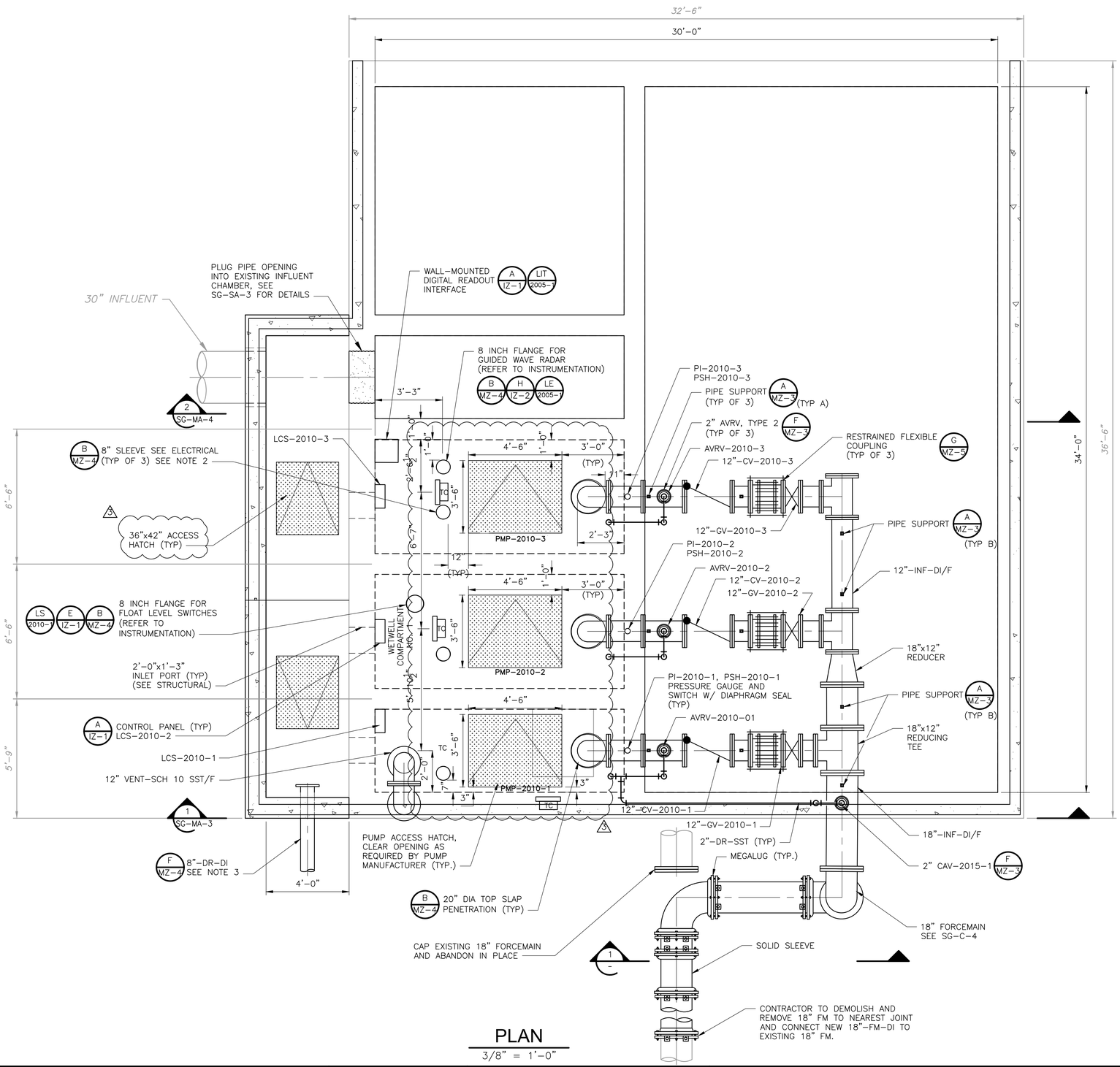
CITY OF GEORGETOWN, TEXAS

SAN GABRIEL WWTP
REHABILITATION

SAN GABRIEL WWTP
AERATION BASIN MODIFICATIONS
PLAN AND SECTIONS

PROJECT NO. 2048–264953
FILE NAME: S001SCPL.DWG
SHEET NO.
SG-SC-1

STATE OF TEXAS
CHUN FOR WONG
92059
LICENSED
PROFESSIONAL ENGINEER
Chun For Wong
03-20-2023



PLAN

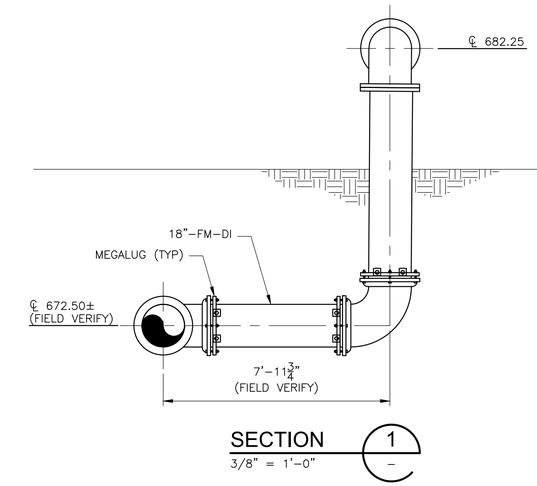
3/8" = 1'-0"

3/8" = 1'- 0"

2 0 2 4

NOTES:

1. CONTRACTOR TO COORDINATE ACCESS HATCH WITH HATCH MANUFACTURER REGARDING INSTALLATION IN EXISTING CONCRETE. THE DIMENSION OF THE ACCESS HATCHES AS WELL AS THE LOCATION OF THESE HATCHES MAY VARY BASED ON THE SELECTED PUMP MANUFACTURER. CONTRACTOR SHALL INSTALL THESE HATCHES BASED ON THE PUMP MANUFACTURER'S RECOMMENDATIONS AND MODIFY THE STRUCTURAL DESIGN AS NECESSARY AT NO ADDITIONAL COST TO THE OWNER. COORDINATE HATCH OPENING POSITION WITH OWNER AND PUMP MANUFACTURER. HATCH DIMENSIONS SHOWN ON PLAN VIEW IS THE FULL OUTER EDGE OF HATCH INCLUDING HATCH FRAME.
2. COORDINATE THE LOCATION OF THE PIPE PENETRATIONS PRIOR TO INSTALLATION TO CONFIRM THAT THEY WILL BE ACCESSIBLE AND HAVE SUFFICIENT CLEARANCE FROM THE CABINETS PER NFPA REQUIREMENTS.
3. CONTRACTOR TO FIELD VERIFY LOCATION AND DEPTH OF 8" DR LINE FROM BELT FILTER PRESS PRIOR TO CONSTRUCTION OF INFLUENT CHANNEL. CONTRACTOR IS TO CUT EXISTING 8" LINE TO NEAREST JOINT AND ROUTE NEW 8"-DR-DI TO INFLUENT CHANNEL.
4. CONTRACTOR TO FIELD VERIFY LOCATION OF REBAR AND BEAMS PRIOR TO PLACEMENT OF FLANGED PENETRATION.
5. DISTANCES, DIMENSIONS, AND ELEVATIONS MAY VARY WITH MANUFACTURER. ANY CHANGES BASED ON MANUFACTURER SELECTION SHALL BE APPROVED BY THE ENGINEER AND AT NO COST TO THE OWNER. DIMENSIONS, SIZES, ETC., SHALL BE IN COMPLIANCE WITH THE CURRENT HYDRAULIC INSTITUTE STANDARDS.



SECTION 1

3/8" = 1'-0"

ALEXANDRA T. DOODY 112812 LICENSED PROFESSIONAL ENGINEER
April 4, 2023

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	4/4/23	SKM	ATD	REVISION FOR ADDENDUM NO.3

DESIGNED BY: J. MAYER
DRAWN BY: S. RAJI
SHEET CHK'D BY: A. DOODY
CROSS CHK'D BY: A. WOELKE
APPROVED BY: A. DOODY
DATE: JANUARY 2023

CDM Smith
9430 Research Blvd., Suite 1-200
Austin, TX 78759
Tel: (512) 346-1100
TBPE Firm Registration No. F-3043

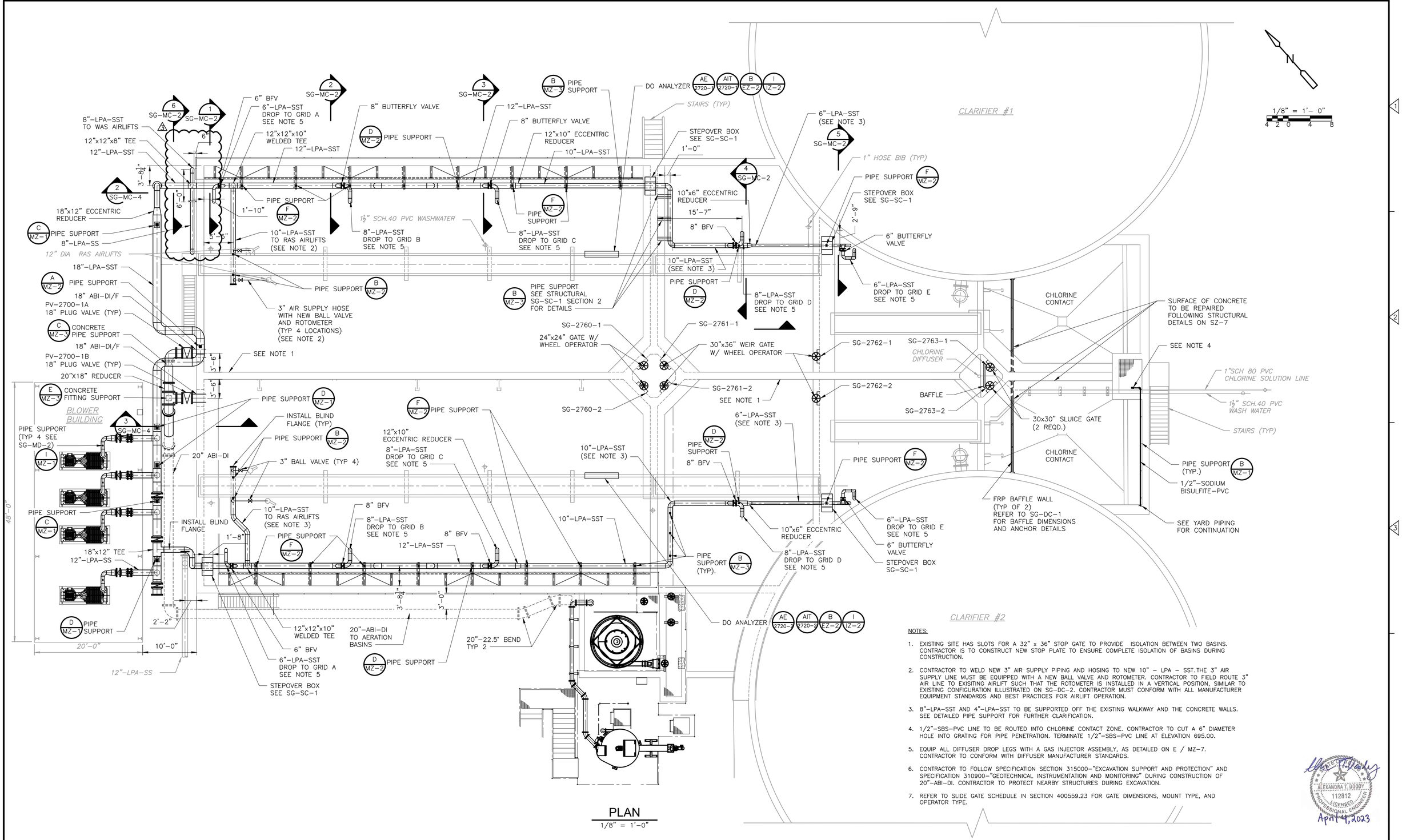
CITY OF GEORGETOWN, TEXAS

SAN GABRIEL WWTP REHABILITATION

SAN GABRIEL WWTP
INFLUENT LIFT STATION
PLAN

PROJECT NO. 2048-264953
FILE NAME: SGMA2_V2.DWG

SHEET NO.
SG-MA-2



PLAN
1/8" = 1'-0"

NOTES:

1. EXISTING SITE HAS SLOTS FOR A 32" x 36" STOP GATE TO PROVIDE ISOLATION BETWEEN TWO BASINS. CONTRACTOR IS TO CONSTRUCT NEW STOP PLATE TO ENSURE COMPLETE ISOLATION OF BASINS DURING CONSTRUCTION.
2. CONTRACTOR TO WELD NEW 3" AIR SUPPLY PIPING AND HOSING TO NEW 10" – LPA – SST. THE 3" AIR SUPPLY LINE MUST BE EQUIPPED WITH A NEW BALL VALVE AND ROTOMETER. CONTRACTOR TO FIELD ROUTE 3" AIR LINE TO EXISTING AIRLIFT SUCH THAT THE ROTOMETER IS INSTALLED IN A VERTICAL POSITION, SIMILAR TO EXISTING CONFIGURATION ILLUSTRATED ON SG-DC-2. CONTRACTOR MUST CONFORM WITH ALL MANUFACTURER EQUIPMENT STANDARDS AND BEST PRACTICES FOR AIRLIFT OPERATION.
3. 8"-LPA-SST AND 4"-LPA-SST TO BE SUPPORTED OFF THE EXISTING WALKWAY AND THE CONCRETE WALLS. SEE DETAILED PIPE SUPPORT FOR FURTHER CLARIFICATION.
4. 1/2"-SBS-PVC LINE TO BE ROUTED INTO CHLORINE CONTACT ZONE. CONTRACTOR TO CUT A 6" DIAMETER HOLE INTO GRATING FOR PIPE PENETRATION. TERMINATE 1/2"-SBS-PVC LINE AT ELEVATION 695.00.
5. EQUIP ALL DIFFUSER DROP LEGS WITH A GAS INJECTOR ASSEMBLY, AS DETAILED ON E / MZ-7. CONTRACTOR TO CONFORM WITH DIFFUSER MANUFACTURER STANDARDS.
6. CONTRACTOR TO FOLLOW SPECIFICATION SECTION 315000-"EXCAVATION SUPPORT AND PROTECTION" AND SPECIFICATION 310900-"GEOTECHNICAL INSTRUMENTATION AND MONITORING" DURING CONSTRUCTION OF 20"-ABI-DI. CONTRACTOR TO PROTECT NEARBY STRUCTURES DURING EXCAVATION.
7. REFER TO SLIDE GATE SCHEDULE IN SECTION 400559.23 FOR GATE DIMENSIONS, MOUNT TYPE, AND OPERATOR TYPE.

ALEXANDRA T. DOODY 112812 LICENSED PROFESSIONAL ENGINEER
April 4, 2023

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	3/20/23	JAM	ATD	REVISED FOR ADDENDUM NO. 3

DESIGNED BY: J. MAYER
DRAWN BY: S. RAJI
SHEET CHK'D BY: A. DOODY
CROSS CHK'D BY: A. WOELKE
APPROVED BY: A. DOODY
DATE: JANUARY 2023

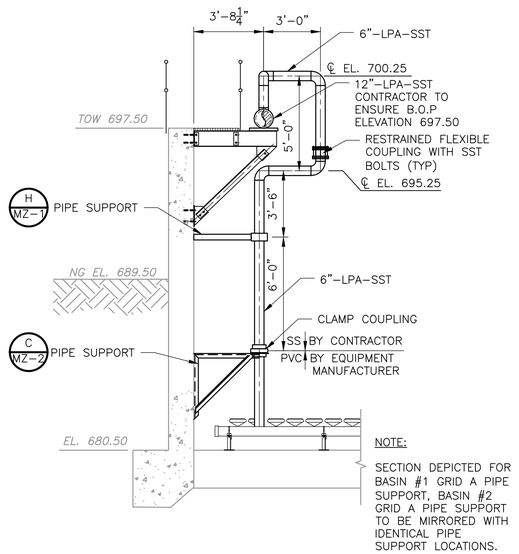
CDM Smith
9430 Research Blvd., Suite 1-200
Austin, TX 78759
Tel: (512) 346-1100
TBPE Firm Registration No. F-3043

CITY OF GEORGETOWN, TEXAS

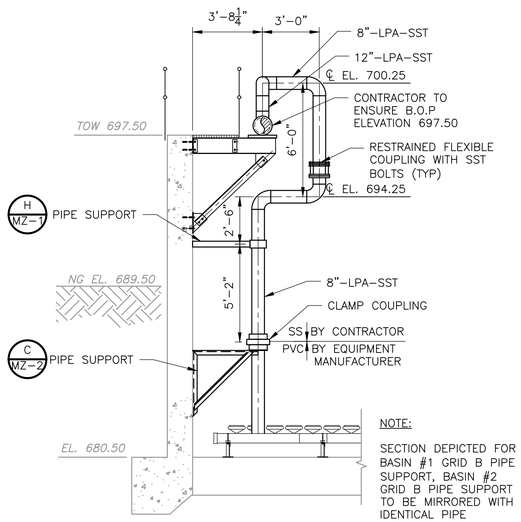
SAN GABRIEL WWTP REHABILITATION

SAN GABRIEL WWTP
PROCESS AREA ENLARGED PLAN

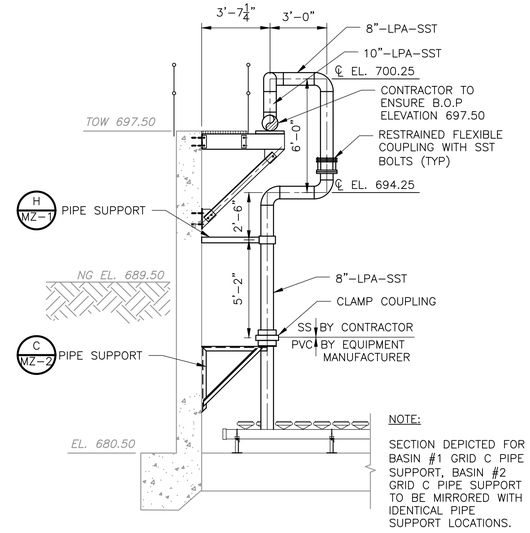
PROJECT NO. 2048-264953
FILE NAME: SGMC1.DWG
SHEET NO.
SG-MC-1



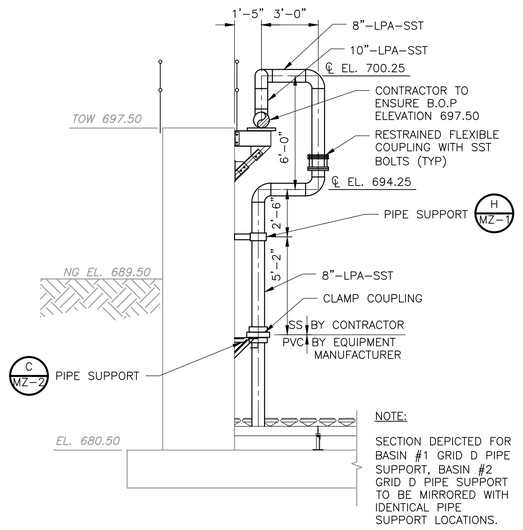
SECTION 1 — 1/4" = 1'-0" — SG-MC-1



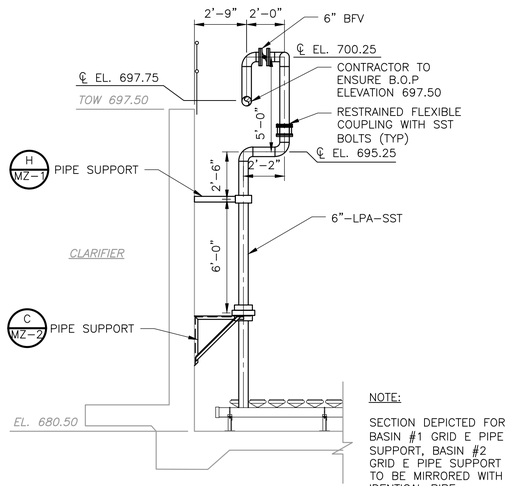
SECTION 2 — 1/4" = 1'-0" — SG-MC-1



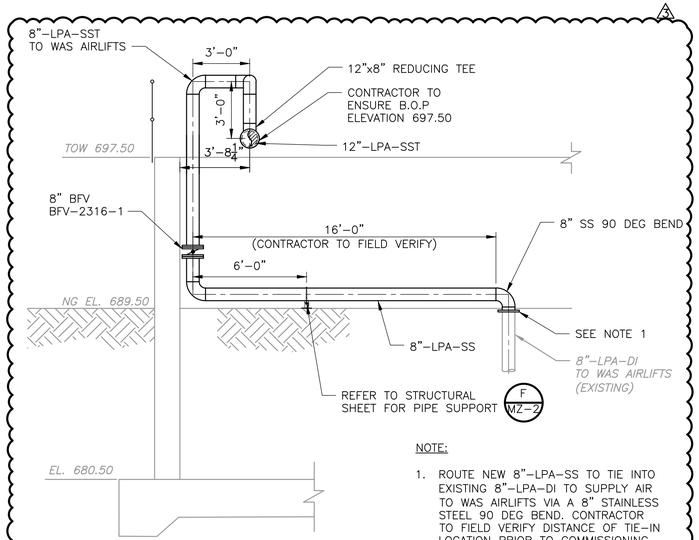
SECTION 3 — 1/4" = 1'-0" — SG-MC-1



SECTION 4 — 1/4" = 1'-0" — SG-MC-1



SECTION 5 — 1/4" = 1'-0" — SG-MC-1



SECTION 6 — 1/4" = 1'-0" — SG-MC-1

1/4" = 1'- 0"
2 1 0 2 4

ALEXANDRA T. DOODY 112812 LICENSED PROFESSIONAL ENGINEER
April 4, 2023

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	3/20/23	JAM	ATD	REVISED FOR ADDENDUM NO. 3

DESIGNED BY: J. MAYER
DRAWN BY: S. RAJI
SHEET CHK'D BY: A. DOODY
CROSS CHK'D BY: A. WOELKE
APPROVED BY: A. DOODY
DATE: JANUARY 2023

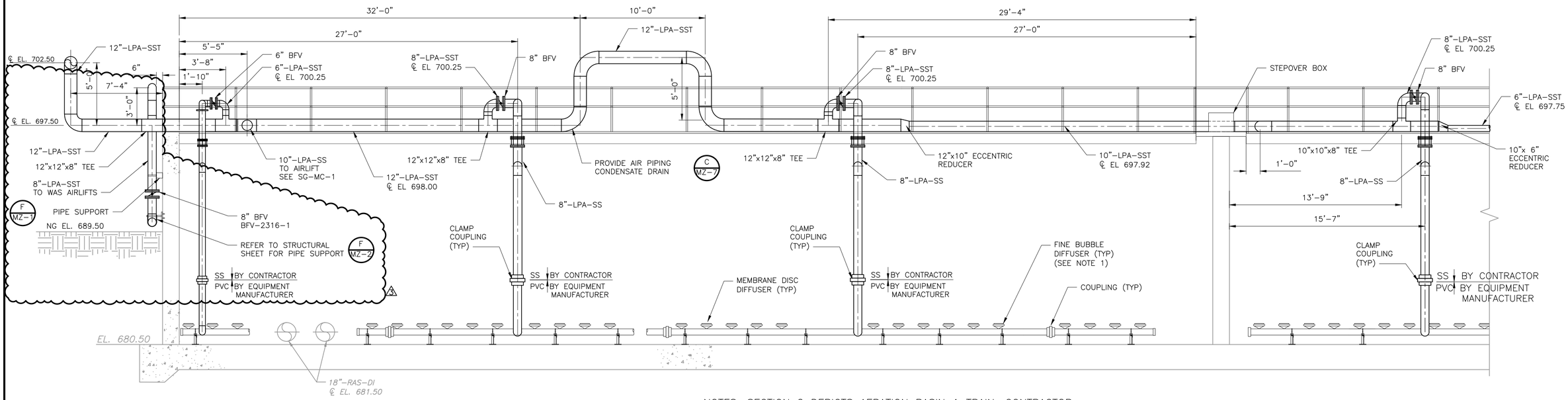
CDM Smith
9430 Research Blvd., Suite 1-200
Austin, TX 78759
Tel: (512) 346-1100
TBPE Firm Registration No. F-3043

CITY OF GEORGETOWN, TEXAS

SAN GABRIEL WWTP
REHABILITATION

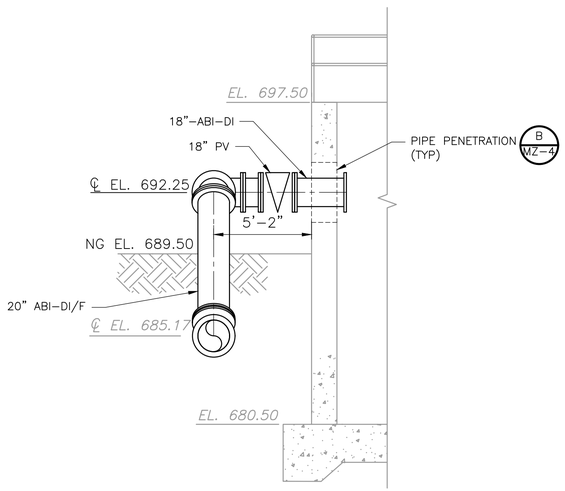
SAN GABRIEL WWTP
ENLARGED PROCESS AREA SECTION I

PROJECT NO. 2048-264953
FILE NAME SGMC2_50 ADD.DWG
SHEET NO.
SG-MC-2



NOTES: SECTION 2 DEPICTS AERATION BASIN 1 TRAIN. CONTRACTOR TO CONSTRUCT AERATION BASIN 2 TRAIN AS A MIRROR TO SECTION VIEW ABOVE.

SECTION 2
1/4" = 1'-0" SG-MC-1 & SG-MC-3



SECTION 3
1/4" = 1'-0" SG-MC-1 & SG-MC-3

NOTES:

1. DIFFUSER LAYOUT PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY. DIFFUSER SUPPLIER SHALL BE RESPONSIBLE FOR LAYOUT OF DIFFUSERS INCLUDING DETERMINATION OF NUMBER OF REQUIRED DIFFUSERS AND ARRANGEMENTS TO AVOID CONFLICTS WITH IN-BASIN OBSTRUCTIONS SUCH AS AERATION BRIDGE SUPPORTS AND 18" RAS PIPELINE, AND MEETING ALL REQUIREMENTS OF SPECIFICATION SECTION 465136.
2. CONTRACTOR TO FIELD VERIFY LOCATION OF ALL AERATION BRIDGE SUPPORTS PRIOR TO DIFFUSER INSTALLATION.

ALEXANDRA T. DOODY
112812
LICENSED
PROFESSIONAL ENGINEER
April 4, 2023

1/4" = 1'- 0"
2 1 0 2 4

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	3/20/23	JAM	ATD	REVISED FOR ADDENDUM NO. 3

DESIGNED BY: J. MAYER
DRAWN BY: S. RAJI
SHEET CHK'D BY: A. DOODY
CROSS CHK'D BY: A. WOELKE
APPROVED BY: A. DOODY
DATE: JANUARY 2023

CDM Smith
9430 Research Blvd., Suite 1-200
Austin, TX 78759
Tel: (512) 346-1100
TBPE Firm Registration No. F-3043

CITY OF GEORGETOWN, TEXAS

SAN GABRIEL WWTP
REHABILITATION

SAN GABRIEL WWTP
TREATMENT UNIT SECTIONS II

PROJECT NO. 2048-264953
FILE NAME: SGMC4.DWG

SHEET NO.
SG-MC-4

TYP. OF LOOP NOS.
2401-1 & 2401-2

SG-PLC

READY
RUNNING
FAULT
FUEL LOW LEVEL

GEN-2000-1
GENERATOR CONTROL PANEL
(DIV. 26)

LOSS OF INCOMING POWER
ON BYPASS
LOW BATTERY

UPS-2000-2
CONTROL ROOM UPS
(DIV. 40)

IN AUTO
RUNNING
FAULT
MOTOR STARTER IN REMOTE
START/STOP
HIGH PRESSURE
HIGH TEMPERATURE
POWER
POWER FACTOR
PHASE CURRENT
PHASE VOLTAGE
3

MS-2401-1
MS (IN MCC-2)
LOR HS 2401-1E
START HS 2401-1F
STOP HS 2401-1G
RUNNING YRL 2401-1B
FAULT XL 2401-1B
(TYP. OF 2) (DIV. 26)

LCP-2401-1
OIT
PLC
HOA HS 2401-1A
E-STOP HS 2401-1B
RUNNING YRL 2401-1A
AUTO YCL 2401-1A
START HS 2401-1C
STOP HS 2401-1D
FAULT XL 2401-1A
REMOTE YCL 2401-1B
(DIV. 43) (TYP. OF 2)

HIGH TEMPERATURE
TSH 2000-1 23
ELECTRICAL HOUSE-I TEMPERATURE

HIGH TEMPERATURE
TSH 2000-2 23
ELECTRICAL HOUSE-II TEMPERATURE

HIGH TEMPERATURE
TSH 2000-3 23
ELECTRICAL HOUSE-III TEMPERATURE

GENERAL NOTES:

1. REFER TO SPECIFICATION SECTION 431133 FOR ADDITIONAL INSTRUMENTATION AND CONTROL REQUIREMENTS.

B/L
INLET AIR
VIA BLOWER
ENCLOSURE LOUVER

PDI 2401-1 4.3
BV-2401-1A
BV-2401-1B
PI 2402-1 4.3
BV-2401-2A
8"-AR-SS

S-2401-1
INLET AIR SILENCER NO. 1

BLR-2401-1
AEROATED SLUDGE HOLDING TANK BLOWER NO. 1

PI 2401-1 4.3
PSH 2401-1 4.3
BV-2401-1C
PRV-2400-1A
TI 2401-1 4.3
TSH 2401-1 4.3
PRV-2401-1B

S-2401-1
DISCHARGE SILENCER NO. 1

CV-2410-1
BFV-2410-1
8"-LPA-SS

VENDOR PROVIDED ENCLOSURE (DIV. 43)

B/L
INLET AIR
VIA BLOWER
ENCLOSURE LOUVER

PDI 2401-2 4.3
BV-2401-2A
BV-2401-2B
PI 2402-2 4.3
BV-2401-2B
8"-AR-SS

S-2401-2
INLET AIR SILENCER NO. 2

BLR-2401-2
AEROATED SLUDGE HOLDING TANK BLOWER NO. 2

PI 2401-2 4.3
PSH 2401-2 4.3
BV-2401-2C
PRV-2401-2A
TI 2401-2 4.3
TSH 2401-2 4.3
PRV-2401-2B

S-2401-2
DISCHARGE SILENCER NO. 2

CV-2410-2
BFV-2410-2
8"-LPA-SS

VENDOR PROVIDED ENCLOSURE (DIV. 43)

10"-LPA-SS
B/L
TO AERATED SLUDGE HOLDING TANK

STATE OF TEXAS
MICHAEL CLARK
140086
LICENSED PROFESSIONAL ENGINEER

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	4/7/23	SS	MC	REVISION FOR ADDENDUM NO. 3

DESIGNED BY: M. CLARK
DRAWN BY: B. SRISYLESH
SHEET CHK'D BY: S. RAJESH
CROSS CHK'D BY: A. DOODY
APPROVED BY: M. CLARK
DATE: JANUARY 2023

CDM Smith
9430 Research Blvd., Suite 1-200
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Tel: (512) 346-1100
TBPE Firm Registration No. F-3043

CITY OF GEORGETOWN, TEXAS

SAN GABRIEL WWTP
REHABILITATION

SAN GABRIEL WWTP
AERATED SLUDGE HOLDING TANK
BLOWER AND MISCELLANEOUS P&ID

PROJECT NO. 2048-264953
FILE NAME: SG-IE-1.DWG

SHEET NO.
SG-IE-1

XREFs: [CDMS_2234_REVW_M_CLARK-SEAL] Images: []
Last saved by: VARSHAN Time: 12/19/2022 5:22:12 PM
F:\INST\Projects\2022\Dallas\San Gabriel & Dove Springs\CAD\PW\SG-IG-1.dwg

SG-PLC

IN AUTO · RUNNING · FAULT · MOTOR STARTER IN REMOTE · START/STOP · HIGH PRESSURE · HIGH TEMPERATURE · POWER · POWER FACTOR · PHASE CURRENT · PHASE VOLTAGE (3)

TYP. OF LOOP NOS. 2700-1 & 2700-2

IN AUTO · RUNNING · FAULT · START/STOP · SPEED · SPEED SETPOINT

MS-2600-1
MS · LOR HS 2600-1E · START HS 2600-1F · STOP HS 2600-1G · RUNNING YRL 2600-1B · FAULT XL 2600-1B
(IN MCC-1) (DIV. 26)

VFD-2700-1
VFD · HOA HS 2700-1A · START HS 2700-1B · STOP HS 2700-1C · AUTO YCL 2700-1A · SPEED SI 2700-1
RUNNING YRL 2700-1 · FAULT XL 2700-1 · SPEED SP SC 2700-1 · HIM
(DIV. 26) (TYP. OF 2)

LCP-2600-1
OIT · PLC
HOA HS 2600-1A · E-STOP HS 2600-1B · RUNNING YRL 2600-1A · AUTO YCL 2600-1A
START HS 2600-1C · STOP HS 2600-1D · FAULT XL 2600-1A · REMOTE YCL 2600-1B
(DIV. 43)

NOTES:
1. REFER TO SPECIFICATION SECTION 431133 FOR ADDITIONAL INSTRUMENTATION AND CONTROL REQUIREMENTS.

B/L INLET AIR — 12"-AR-SS — BV-2600-1A — PDI 2600-1 43 — BV-2600-1B

S-2600-1
INLET AIR SILENCER NO. 1

12"-AR-SS — M — **BLR-2600-1**
WET WEATHER STORAGE TANK BLOWER NO. 1

BV-2600-1C — PI 2600-1 43 — PSH 2600-1 43 — PRV-2600-1A — TI 2600-1 43 — TSH 2600-1 43 — PRV-2600-1B

S-2600-1
DISCHARGE SILENCER NO. 1

CV-2610-1 — BFV-2610-1 — 12"-LPA-SS — B/L TO WET WEATHER STOARGE TANK

(1) VENDOR PROVIDED SKID (DIV. 43)

B/L FROM WET WEATHER STORAGE BASIN — 12"-WWEFF-DI

PV-2700-1A — PV-2700-2A

ARV-2700-1A — PI 2700-1 — BV-2700-1 — ARV-2700-1B — CV-2700-1 — PV-2700-1B — 10"-WWEFF-DI — 10"-WWEFF-DI — PV-2700-3 — B/L TO PECAN BRANCH WWTP

PMP-2700-1
PECAN BRANCH TRANSFER PUMP NO. 1

ARV-2700-2A — PI 2700-2 — BV-2700-2 — ARV-2700-2B — CV-2650-2 — PV-2650-2B — 10"-WWEFF-DI

PMP-2700-2
PECAN BRANCH TRANSFER PUMP NO. 2

STATE OF TEXAS · MICHAEL CLARK · 140086 · LICENSED PROFESSIONAL ENGINEER

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	4/7/23	SS	MC	REVISION FOR ADDENDUM NO. 3

DESIGNED BY: M. CLARK
DRAWN BY: B. SRISYLESH
SHEET CHK'D BY: S. RAJESH
CROSS CHK'D BY: A. DOODY
APPROVED BY: M. CLARK
DATE: JANUARY 2023

CDM Smith
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Austin, TX 78759
Tel: (512) 346-1100
TBPE Firm Registration No. F-3043

CITY OF GEORGETOWN, TEXAS

SAN GABRIEL WWTP REHABILITATION

SAN GABRIEL WWTP WW BLOWER AND PECAN BRANCH TRANSFER PUMP STATION P&ID

PROJECT NO. 2048-264953
FILE NAME: SG-IG-1.DWG
SHEET NO. SG-IG-1

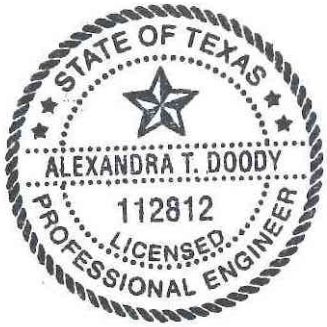
CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

CITY OF GEORGETOWN

SAN GABRIEL WASTEWATER TREATMENT PLANT REHABILITATION

ADDENDUM NO. 4

Date Issued: April 17, 2023



Prepared by Alexandra T. Doody, PE 112812
CDM Smith, Inc Texas Registration No. F-3043

Proposers on this project are hereby notified that this addendum shall be attached to and made a part of the above named Contract Documents and Technical Specifications, dated January 2023.

The following items are issued to add to, modify, and clarify the Contract Documents and Technical Specifications and Drawings. These items shall have full force and effect as the Contract Documents and Technical Specifications, and cost involved shall be included in proposal prices. Proposals to be submitted on the specific proposal date shall conform to the additions and revisions listed herein.

Acknowledge receipt of this addendum by designating receipt of the addendum on the first page of the Proposal. Failure to do so may subject proposer to disqualification.

ADDITIONAL INFORMATION

1. All Proposals are due on or before 2:00 PM CDT on April 20, 2023. The public opening will be held virtually through Microsoft Teams. This is accessible using the link and call-in information provided below:

Microsoft Teams meeting

Join on your computer, mobile app or room device

Click here to join the meeting

Or call in (audio only)

+1 512-672-8405,,664784646# United States, Austin

Phone Conference ID: 664 784 646#

QUESTIONS AND ANSWERS

Below are questions received and their associated responses:

1. **Question:** SG-MA-3 has a 12" Vent Penetration called out as a 12" Wall Pipe w/ collar (TYP). I only see one of these vents. Is the TYP regarding another vent or is this describing the similar penetration for the INF-DI?

   Answer: *There is only one vent.*

2. **Question:** The B/MZ-4 detail callout on SG-MA-3 represents a core drilled hole, with a link seal type seal. This differs from what is shown on SG-MA-3. Should SG-MA-3 be followed or the detail?

   Answer: *Use detail B/MZ-4 for the wall penetrations on SG-MA-3.*

3. **Question:** On SG-MC-1, both trains are drawn ending with an elbow down. This elbow down is not shown in the section view provided. Also, looking at the basin floor drawing, there doesn't appear to be a diffuser to connect to. Are the elbows drawn on the end of these runs a mistake? Do I assume these are supposed to be end caps?

   Answer: *The design intent is for the 6"-LPA-SST header to be equipped with a 90 degree bend up (rather than a tee) to the 6-inch butterfly valve. Refer to REVISIONS TO DRAWINGS.*

4. **Question:** On SG-MC-2, please provide the section views of the four 3" LPA drop legs.

   Answer: *The 3" - lines are not drop legs for diffuser manifolds, rather they are the air supply lines for the existing RAS Airlifts. The 3" – LPA - SST air supply lines are to be tapped and welded into the 10" – LPA – SST line and field routed to the air lift connection point, as indicated on Note 2 on SG-MC-1. A photograph of this existing system is shown on SG-DC-2 for clarity; provide a similar layout to that shown on SG-DC-2.*

5. **Question**: Would it be acceptable to provide a standard drive and upsize the Active Filter to address the VFD harmonics and the motor power factor correction for MCC 3?

   Answer: Free-standing 18-pulse VFDs are acceptable for the 150HP motor loads fed from Motor Control Center MCC-3.

6. **Question**: Can you clarify if a full blown MPR is required for these 150HP motors or if you only need the RTD protection and a ML RRTD relay (attached) is all that is needed?

   Answer: RTD protection is required where shown on the Drawings. The use of the Multilin RRTD Remote RTD Module, or equal, compatible with the solid-state reduced voltage starter and installed integral to the motor control center is acceptable in lieu of motor protection relay.

7. **Question:** Can the drying beds be utilized when the cleaning is taking place? If yes, who will be responsible for the end disposal of the dry solids?

   Answer: *Contractor may not assume the drying beds can be used for drying as the City needs them for handling debris collected by the City's line maintenance crews. Contractor is responsible for handling the material from the basins and hauling it to an approved off-site waste disposal facility.*

8. **Question:** How were 600 wet tons calculated?

   Answer: *Based on feedback with the Owner from a recent similar Georgetown project, it is assumed that the Owner will pump the liquid in the basins down to approximately 3-ft of depth prior to the Contractor being responsible for the cleaning of the tanks. A specific gravity similar to water was used to convert volume into wet tons.*

9. **Question:** If the quantity exceeds 600 wet tons will this item be paid based on unit pricing for any amount over?

   Answer: *Contractor will be paid for quantities removed at the unit price indicated on Proposal Form. Any quantity over 600 wet tons will be paid on a unit price basis. If the quantity exceeds 600 wet tons, the funding for this overage can be applied against the Proposal Item for Owner-directed improvements.*

10. **Question:** How will the owner determine if the material in tank is unsuitable for introduction into the liquid treatment process when draining the tanks?

    Answer: *The Owner will determine if the material in the tank is unsuitable via a visual inspection for large debris or substantial quantities of heavy grit and sand. Contractor to coordinate these inspections by the Owner during drainage process.*

11. **Question:** How much volume of solids/liquid is estimated in each tank?

    Answer: *The majority of the volume is expected to be wastewater sludge with some grit. For bidding purposes, Contractor should assume an average solids content of approximately 3 percent solids.*

12. **Question:** Due to the size of some of the tanks a vactor will be required to complete the clean out. Will the vactor(s) be able to dump on site or will this material need to be disposed of offsite?

    Answer: *The vactor trucks must haul away all liquid and sludge to be disposed of off-site.*

13. **Question:** If dewatering equipment is needed is there 3 phase, 480V power available on site? Will the contractor be responsible for the cost of using this power?

    Answer: *Some spare buckets are available on site to power temporary dewatering equipment if Contractor deems dewatering to be the most cost-effective approach. The outdoor switchgear SWGR-1 located northeast of the administration building has available breakers that could power up to 100 HP. The contractor is responsible for providing their own reduced voltage motor starters and temporary power cable. If dewatering is proposed for cost savings, submit a plan for Owner and Engineer review detailing proposed temporary piping, electrical connections, and containment methods proposed to contain spills.*

14. **Question:** Is there a water source available that can supply at least 60 psi to a 2-3 inch water line? Will the contractor be responsible for the cost of using the water?

    Answer: *The Owner's treated plant effluent water loop will not be available for construction activities due to the existing demand from plant operations and external users. However, there are potable water hydrants located along College Street that are accessible for use, if needed. The Contractor is required to pay for the potable water permit, installation of the water meter, and all temporary piping. The Contractor will not be required to pay the water bill as the water meter usage will be billed directly to the City.*

15. **Question:** Are there any manholes available to return filtrate water from dewatering to the head of the plant?

    Answer: *There are manholes available on site that return water to the coarse bar screen; refer to the manholes indicated on the WW pipelines shown on Drawing SG-C-5.*

16. **Question:** Are there existing T-Clips (TCLP Analysis) of the material that is proposed to be cleaned out?

    Answer: *No, there are no TCLP analyses available of the material. It is expected to be primarily compose of sludge, grit, and rags at the bottom of the basins.*

REVISIONS TO CONTRACT DOCUMENTS AND SPECIFICATIONS

SECTION 262300 – LOW – VOLTAGE SWITCHGEAR

a) Page 262300-5, paragraph 2.4.D.5.c, REVISE "Silver plated" to "Tin-plated".

b) Page 262300-5, paragraph 2.4.D.5.d, REVISE "Silver-plated" to "Tin-plated".

SECTION 262419 – MOTOR-CONTROL CENTERS

a) Page 262419-11, ADD paragraph 2.8.N.4 as follows:

"2. Output Ethernet Interface: Provide EtherNet/IP communication module integral to MCC where indicated on the Drawings. Output monitoring functions including power, power factor, phase current and phase voltage."

b) Page 262419-14, DELETE paragraph 2.11.D in its entirety and replace with the following:

"D. RTD Module:

1. Programmable RTD module: Module capable of monitoring up to 12 three wire shielded RTDs, Multilin RRTD, or equal installed integral to MCC.

2. Over-temperature protection: provide configurable RTD inputs, including alarm and trip settings, and associated TRIP or ALARM outputs. Provide the following functionality:

a. PTC or NTC Thermistor input.

b. Assign RTD inputs as "Off", "Stator" or "Bearing" type.

c. Four different RTD types: 100 Ohm Platinum, 120 Ohm Nickel, 100 Ohm Nickel, or 10 Ohm Copper.

d. RTD sensor fail alarm.

3. Provide monitoring functions:

a. Temperature of each RTD input.

b. Latest trip report containing RTD temperatures.

4. User interface

a. Accept AC control power as determined by MCC manufacturer.

b. Form C contacts that change state when an over-temperature condition occurs."

disregard highlight

SECTION 460200 – TANK AND STRUCTURE CLEANING

a) Page 460200-2, paragraph 3.3.A, ADD the following as Item 5 and 6:

"5. Submit a plan for Owner and Engineer review detailing proposed temporary piping, electrical connections, and containment methods proposed to contain spills if dewatering is required.

6. Water: potable water hydrants available if needed.

a. Contractor is responsible to pay for water permit, meter installation, and all temporary piping."

REVISIONS TO DRAWINGS

SHEET SG-C-5 – YARD PIPING PLAN NORTH

a) UPDATE electrical conduit ductbank routing and 8" – LPA – SST. Refer to REVISED Sheet SG-C-5 attached to this addendum.

SHEET SG-MC-1 – PROCESS AREA ENLARGED PLAN

a) REVISE Note 3 to read as "10" – LPA – SST AND 6" – LPA – SST TO BE SUPPORTED OFF THE EXISTING WALKWAY AND THE CONCRETE WALLS. SEE DETAILED PIPE SUPPORTS SECTION VIEWS FOR FURTHER CLARIFICATION.

b) UPDATE the callout on Aeration Basin 2 RAS Airlift from "10" – LPA – SST TO RAS AIRLIFTS (SEE NOTE 3)" to read as "10" – LPA – SST TO RAS AIRLIFTS (SEE NOTE 2)".

c) UPDATE the dropleg configuration of the 6" – LPA – SST air header for Grid E in both Aeration Basin 1 and Aeration Basin 2 to show a 90 degree bend up rather than a tee and a second dropleg.

SHEET E-3 – ELECTRICAL NOTES

a) REVISE Scope of Work Note No.1 as follows: "PROVIDE ALL LABOR, MATERIALS AND EQUIPMENT REQUIRED TO INSTALL, COMPLETE AND MAKE OPERATIONAL, ELECTRICAL IMPROVEMENTS SUCH AS BUT NOT LIMITED TO REPLACING THE EXISTING SWITCHBOARD AND MOTOR CONTROL CENTER(S) (MCC) WITH NEW SWITCHGEAR AND MCCS WHILE MAINTAINING OPERATIONS AT THE SAN GABRIEL WWTP."

b) REVISE NEC Classified Hazardous Areas Note No.2 as follows: "REFER TO SHEET SG-G-5 FOR ADDITIONAL INFORMATION ON CLASSIFICATION BOUNDARIES."

SHEET SG-E-1 – OVERALL SITE ELECTRICAL NEW WORK PLAN

a) Refer to REVISED Sheet SG-E-1 attached to this addendum.

SHEET SG-E-2 – SWITCHGEAR SWGR-1 ONE-LINE DIAGRAM

a) Refer to REVISED Sheet SG-E-2 attached to this addendum.

SHEET SG-E-15 – ELECTRICAL DUCTBANK SCHEDULE IV

a) Refer to REVISED Sheet SG-E-15 attached to this addendum.

SHEET SG-E-16 – ELECTRICAL DUCTBANK SCHEDULE V

a) Refer to REVISED Sheet SG-E-16 attached to this addendum.

SHEET SG-ED-1 – BLOWER AREA POWER PLAN

a) Refer to REVISED Sheet SG-ED-1 attached to this addendum.

SHEET SG-EE-1 – AERATED SLUDGE HOLDING TANK PD BLOWER PLAN

a) REVISE tag LCS24011-1 home run from “TO SG-PLC” to “TO RTU-SGWWTP”.

b) REVISE tag LCS24012-1 home run from “TO SG-PLC” to “TO RTU-SGWWTP”.

SHEET SG-EG-1 – WET WEATHER STORAGE TANK PLAN

a) REVISE tag LCS26001-1 from “CAT6 CABLE, 3/4"C” to “2-CAT6 CABLE, 3/4"C.”

SHEET EY-2 – ELECTRICAL SCHEMATIC II

a) Refer to REVISED Sheet EY-2 attached to this addendum.

SHEET SG-I-1 – CONTROL SYSTEM ARCHITECTURE

a) Refer to REVISED Sheet SG-I-1 attached to this addendum.

SHEET SG-IE-1 – AERATED SLUDGE HOLDING TANK BLOWER AND MISCELLANEOUS P&ID

a) Refer to REVISED Sheet SG-IE-1 attached to this addendum.

SHEET SG-IG-1 – WW BLOWER AND PECAN BRANCH TRANSFER PUMP STATION P&ID

a) Refer to REVISED Sheet SG-IG-1 attached to this addendum.

END OF ADDENDUM NO. 4

NOTES

1. FIELD VERIFY LOCATION, DEPTH, JOINT LOCATIONS AND TYPE, PIPE MATERIAL, AND SIZE OF ALL KNOW PIPES TO BE CONNECTED TO, CROSSED, ETC., PRIOR TO ORDERING MATERIAL AND AND PERFORMING THE WORK.
2. ALL YARD PIPING SHALL HAVE A MINIMUM COVER OF 42" UNLESS NOTED OTHERWISE.
3. WHEN MAKING CONNECTIONS TO NEW OR EXISTING PIPING, CONTRACTOR SHALL PROVIDE ALL FITTINGS, ADAPTERS, CONNECTING PIECES, ETC., NECESSARY TO MAKE THE CONNECTIONS IN A MANNER SATISFACTORY TO THE ENGINEER.
4. REFERENCE MECHANICAL SHEETS FOR YARD PIPING IN THE VICINITY OF PROPOSED STRUCTURES OR EQUIPMENT.
5. 3"–NPW–PVC TO BE CONCRETE ENCASED UNDERNEATH THE ACCESS ROAD.
6. CONTRACTOR TO POTHOLE 18" – RAS – DI TO FIELD VERIFY PROPOSED LOCATIONS OF PRECAST FLOW METER VAULTS WILL NOT CONFLICT WITH EXISTING UTILITIES. RELOCATE THE 1 1/2" WATER LINE AS REQUIRED IF A CONFLICT OCCURS.
7. NEW DUCTBANK ROUTE IS SHOWN ON THIS SHEET FOR COORDINATION PURPOSES. REFER TO ELECTRICAL SITE PLAN AND DETAILS.
8. MODIFICATIONS TO COARSE BAR SCREEN AND INFLUENT PUMP STATION MAY REQUIRE TEMPORARY BYPASS PUMPING TO ELEVATED HEADWORKS. FURNISH TEMPORARY PUMPS AND TEMPORARY BURIED PIPING UNDERNEATH ROAD PER SECTION 331210
9. ALL ABOVE GRADE PIPING 4–INCHES AND SMALLER MUST BE INSULATED AND HEAT TRACED PER SPECIFICATIONS 404113.13 AND 404213.
10. CONTRACTOR TO ROUTE 8"–LPA–SST DOWN TO FINISHED GRADE TO TIE INTO EXISTING 8"–LPA–SST AT ABOVE GRADE LOCATION AS DETAILED ON SG–MC SHEETS

N

1" = 20'
10 0 20

DEWATERING BUILDING
24" EFF
8" IRR
10" DR–PVC
EX. 18" OUTFALL LINE (ABANDONED)
8" DR–PVC
6" SL–DI
ASPHALT
EXISTING 8" AIR LINE (ABANDONED)
EXISTING 10" FORCE MAIN (ABANDONED)
BUILDING
EX 18" ABANDONED
8" WW
2 1/4" WD
BFP FEED PUMP STATION
1 1/2" PW–PVC
CONNECT 1"–NPW–PVC TO EXISTING 3"–NPW LINE
1"–NPW–PVC
3" NPW
8" LPA–SS/W (ABOVE GROUND RE: SG–ME–1)
AERATED SLUDGE HOLDING TANK BLOWERS
AERATED SLUDGE HOLDING TANK
1 NPW
1 1/2" W
GENERATOR PAD
2 1/4" W
INSTALL CAP ON 2"–NPW–PVC LINE.
ABANDON 2" – NPW ROUTED BETWEEN BLOWER BUILDING AND AERATION BUILDING
NEW GUS TRANSFORMER
NEW NEMA 3R SWITCH GEAR
6" WAS–DI
SEE NOTE 6
18" RAS–DI
CLARIFIER NO. 1
RAS FLOWMETER VAULT NO.1
ADMINISTRATION BUILDING
18" LPA–SST
8" LPA–SS
8" LPA–SST (SEE NOTE 10)
18" LPA–SST (ABOVE GROUND RE: SG–MC–1 AND SG–MC–2)
18" ABI–DI
18" ABI–DI
TREATMENT UNIT
STAIRS
2" W
2" NPW
2"–NPW–PVC
NPW BLD.
IRRIGATION FLOW METER
IRRIGATION TRANSFER PUMP STATION
12" WW
30"
FLUME
12" IRR–PVC
8" WW
SODIUM BISULFITE FACILITY
BLOWER PAD
INSTALL CAP ON EXISTING 2"–NPW–PVC. 2" GATE VALVE (FIELD VERIFY LOCATION) IS TO REMAIN.
TIE NEW 18" INF–DI INTO EXISTING 18" INF–DI. SEE SG–MA–2
12" LPA–SS
BLIND FLANGE
12" LPA–SS
20" ABI–DI
1/2"–SBS–PVC
1"–NPW–PVC
INFLUENT LIFT STATION SEE NOTE 8
RAS FLOW METER VAULT NO. 2
GRIT CHAMBER
CLARIFIER NO. 2
CONNECT 1" – NPW – PVC TO EXISTING 2" – NPW – PVC TO SERVICE WASHWATER STATION IN SBS FACILITY VIA TAPPING SADDLE
CONNECT 3" – NPW – PVC TO EXISTING 12"–IRR–PVC TO SERVICE GRIT REMOVAL EQUIPMENT VIA TAPPING SADDLE
18" INF
18" INF–DI
18" RAS–DI
2" NPW
HEADWORKS
SIDEWALK
CONC.
WW (FM) (ABANDONED)
8" DFI
ELECTRICAL PANEL
12" WW (FM)
IRRIGATION HIGH SERVICE PUMP
COARSE BAR SCREEN SEE NOTE 8
10" WW (FM)
18" WW
20" WW (FM)
4" MH
1 1/2" NPW
15" WW
ASPHALT
ABANDON 2" NPW LINE IN PLACE
B C2–3 3"–NPW–PVC SEE NOTE 5

MATCH LINE - SEE SHEET SG-C-6

STATE OF TEXAS
ALEXANDRA T. DOODY
112812
LICENSED PROFESSIONAL ENGINEER
4/14/2023

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	4/14/23	RSM	ATD	REVISIONS FOR ADDENDUM NO. 4

DESIGNED BY: J. MAYER
DRAWN BY: S. MALPASS
SHEET CHK'D BY: A. DOODY
CROSS CHK'D BY: A. WOELKE
APPROVED BY: A. DOODY
DATE: JANUARY 2023

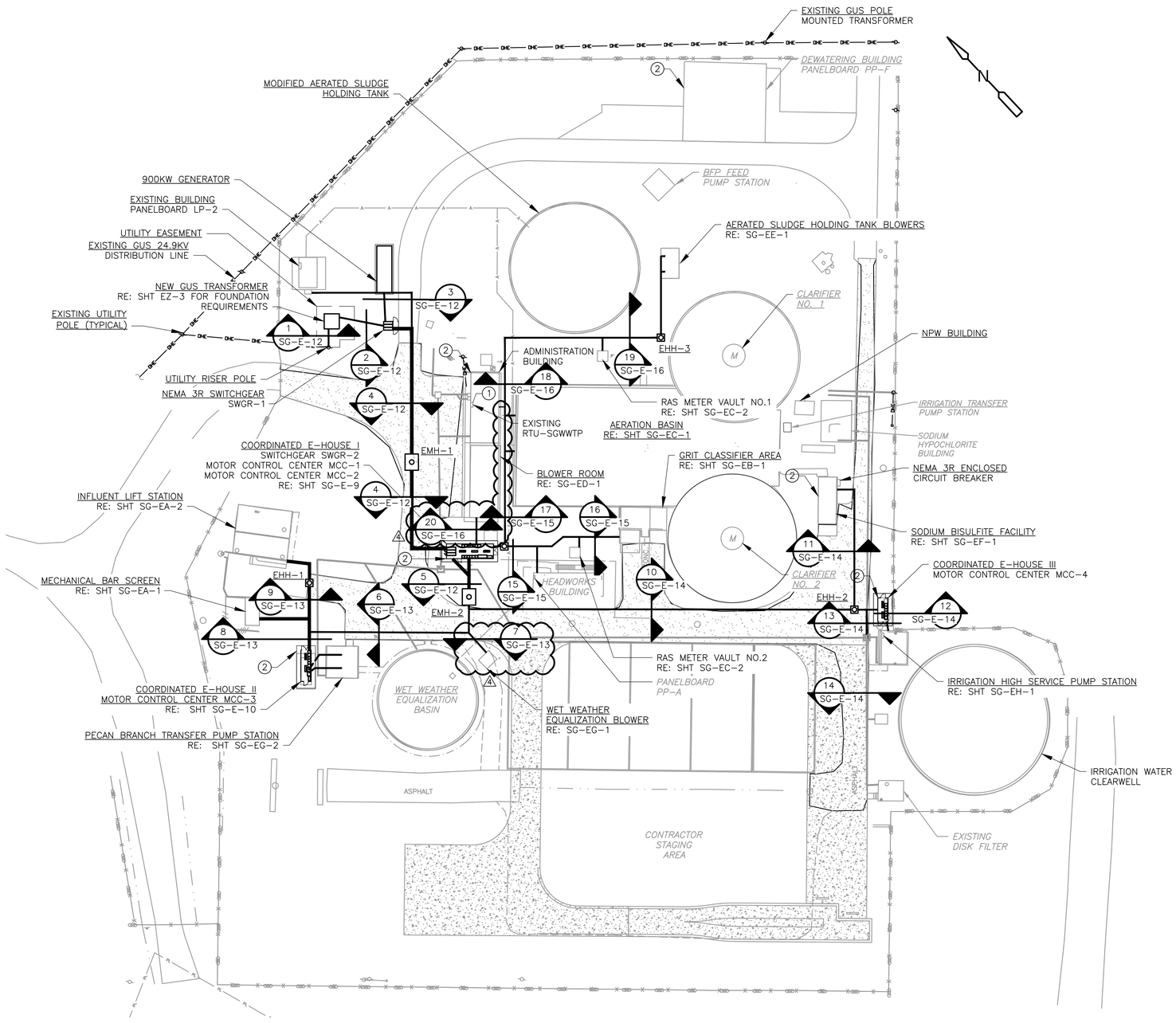
CDM Smith
9430 Research Blvd., Suite 1-200
Austin, TX 78759
Tel: (512) 346-1100
TBPE Firm Registration No. F-3043

CITY OF GEORGETOWN, TEXAS

SAN GABRIEL WWTP
REHABILITATION

SAN GABRIEL WWTP
YARD PIPING PLAN NORTH

PROJECT NO. 2048–264953
FILE NAME: C204YPPL.DWG
SHEET NO.
SG-C-5



SAN GABRIEL PROPOSED ELECTRICAL SITE

PLAN

1" = 40'

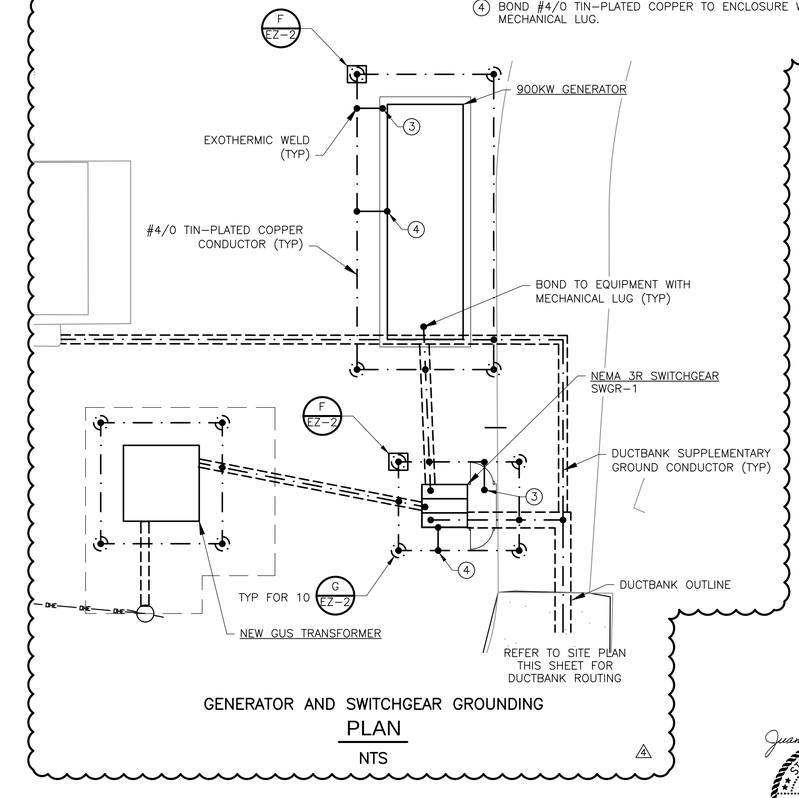
20 0 40

GENERAL ELECTRICAL NOTES:

1. ELECTRICAL DRAWINGS ARE INTENDED TO SHOW THE GENERAL LAYOUT OF WORK TO BE INSTALLED UNDER THIS CONTRACT WITHOUT ATTEMPTING TO SHOW ALL DETAILS. FURNISH LABOR, MATERIALS, EQUIPMENT AND INCIDENTALS REQUIRED FOR A COMPLETE AND OPERATIONAL ELECTRICAL SYSTEM AS SHOWN ON THE CONTRACT DOCUMENTS.
2. COORDINATE WORK WITH OTHER TRADES AND THE OWNER.
3. FIELD VERIFY EXISTING UNDERGROUND ELECTRICAL CONDUIT, CONCRETE DUCT BANKS, MANHOLES, PULL BOXES, ETC. AND MECHANICAL PIPING. CONTRACTOR SHALL INCLUDE IN BID COSTS ASSOCIATED WITH RELOCATION OR REMOVAL OF UNDERGROUND EQUIPMENT AS REQUIRED BY THIS CONTRACT. USE DUE CARE IN CONGESTED AREAS TO AVOID DAMAGE TO EXISTING UNDERGROUND UTILITIES.
4. REPAIR, IN ACCORDANCE WITH SPECIFICATIONS, SIDEWALKS, WALLS, ROADWAYS, ETC. DISTURBED BY CONSTRUCTION ACTIVITIES WHETHER OR NOT SHOWN FOR REPAIR/REPAVING ON CIVIL DRAWINGS.
5. CONCEL CONDUITS TO GREATEST EXTENT PRACTICABLE. CONDUITS RUN AT EXISTING STRUCTURES SHALL BE RUN EXPOSED.
6. COORDINATE ROUTING OF PROPOSED DUCTBANKS WITH PROCESS PIPING. REFER TO CIVIL AND MECHANICAL SHEETS FOR PROCESS PIPING NEAR PROPOSED DUCTBANKS.
7. LOCATION OF GROUNDING LOOP SHALL BE AT A MINIMUM OF 30" FROM ANY FOUNDATION WALLS AND COLUMNS. GROUNDING LOOP SHALL BE BURIED 30" BELOW GRADE LEVEL.

KEY NOTES:

1. APPROXIMATE LOCATION OF EXISTING SAN GABRIEL RTU-SGWWTP. FIELD VERIFY EXACT LOCATION.
2. PROVIDE A LIGHTNING PROTECTION SYSTEM FOR THE STRUCTURE IN ACCORDANCE WITH NFPA 780.
3. BOND #4/0 TIN-PLATED COPPER TO STRUCTURAL STEEL.
4. BOND #4/0 TIN-PLATED COPPER TO ENCLOSURE WITH MECHANICAL LUG.



GENERATOR AND SWITCHGEAR GROUNDING

PLAN

NTS

Juan Carlos Saenz
STATE OF TEXAS
JUAN CARLOS SAENZ
138331
LICENSED PROFESSIONAL ENGINEER
04/14/2023

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	04/13/23	JCS	JCS	REVISION FOR ADDENDUM NO. 4

DESIGNED BY: J. SAENZ
DRAWN BY: V. MANJU
SHEET CHK'D BY: M. CZACH
CROSS CHK'D BY: G. PRABHU
APPROVED BY: J. SAENZ
DATE: JANUARY 2023

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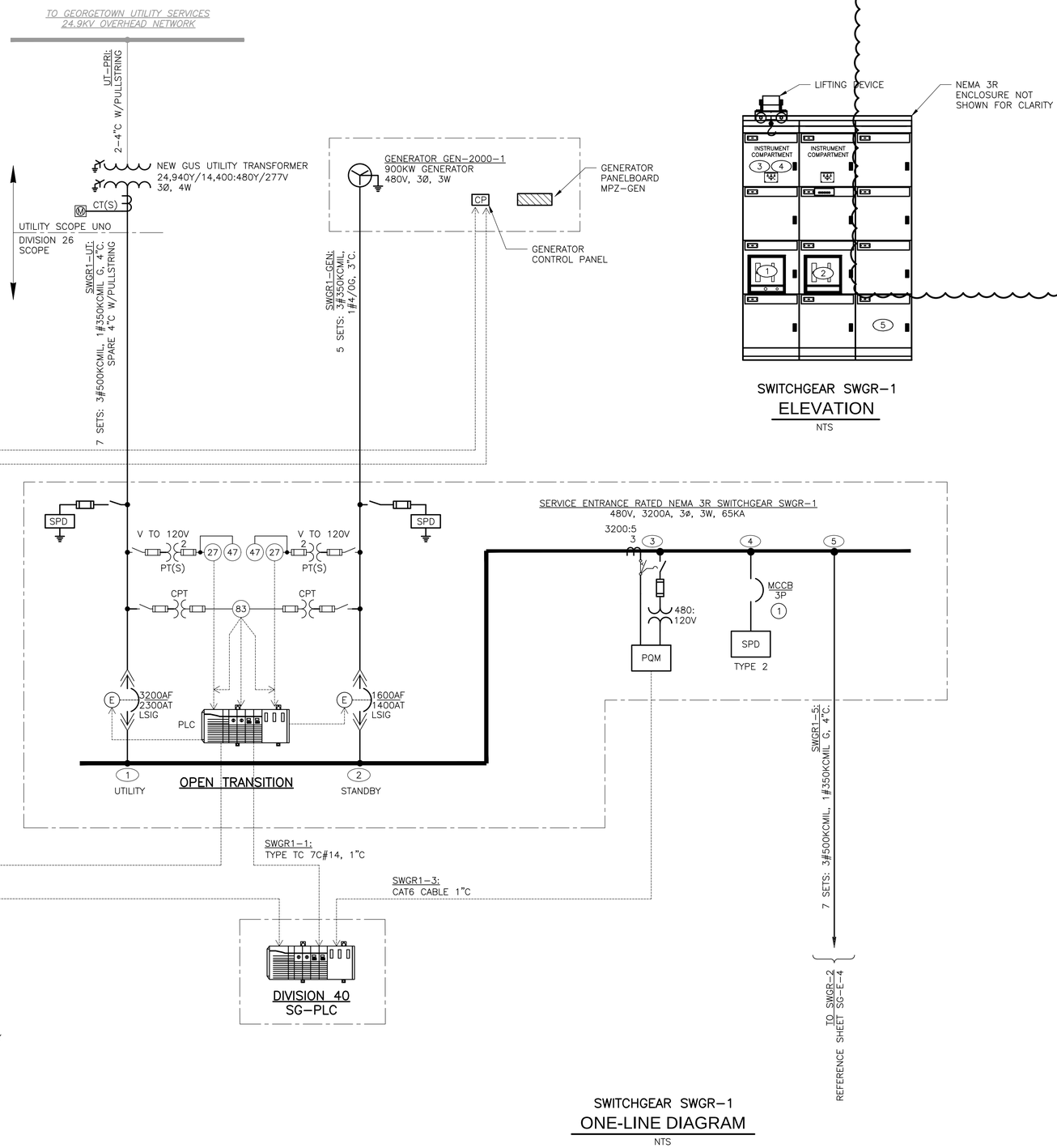
CITY OF GEORGETOWN, TEXAS

SAN GABRIEL WWTP
REHABILITATION

SAN GABRIEL WWTP
OVERALL SITE
ELECTRICAL NEW WORK PLAN

PROJECT NO. 2048-264953
FILE NAME: SGE1STPL.DWG

SHEET NO.
SG-E-1



ANSI STANDARD DEVICE DESIGNATION:

27-UNDERVOLTAGE RELAY
47-PHASE-SEQUENCE RELAY
83-AUTOMATIC SELECTIVE CONTROL OR TRANSFER RELAY

LEGEND:

---------- COMMUNICATIONS OR CONTROL

(E) ELECTRICALLY OPERATED CIRCUIT BREAKER

SWITCHGEAR SWGR-1
ONE-LINE DIAGRAM
NTS

SWITCHGEAR SWGR-1
ELEVATION
NTS

GENERAL ELECTRICAL NOTES:

1. ELECTRICAL DRAWINGS ARE INTENDED TO SHOW THE GENERAL LAYOUT OF WORK TO BE INSTALLED UNDER THIS CONTRACT WITHOUT ATTEMPTING TO SHOW ALL DETAILS. FURNISH LABOR, MATERIALS, EQUIPMENT AND INCIDENTALS REQUIRED FOR A COMPLETE AND OPERATIONAL ELECTRICAL SYSTEM AS SHOWN ON THE CONTRACT DOCUMENTS.
2. CONTRACTOR'S WORK SHALL INCLUDE COMPLETE TESTING OF EQUIPMENT AND WIRING INCLUDING MAKING MINOR CORRECTIONS, CHANGES OR ADJUSTMENTS NECESSARY FOR THE PROPER FUNCTIONING OF THE SYSTEM AND EQUIPMENT.

KEY NOTES:

(1) MOLDED CASE CIRCUIT BREAKER (MCCB) FOR TYPE 2 SURGE PROTECTION DEVICE (SPD) SIZED BY SWITCHGEAR MANUFACTURER.

(2) SEPARATELY DERIVED SYSTEM SHALL BE BONDED TO THE NEAREST GROUNDING ELECTRODE PER NEC.

NO.	EQUIPMENT TAG	EQUIPMENT SERVED	LOAD SIZE	STARTER TYPE
1	GENERAL POWER	BUILDING MISC. LOADS	200 KVA	N/A
2	MISC. MOTORS	PROCESS MOTORS	10 HP	FVNR
3	SCR-2000-1	BAR SCREEN	2 HP	VFD
4	PMP-2010-1	INFLUENT PUMP NO.1	50 HP	FVNR
5	PMP-2010-2	INFLUENT PUMP NO.2	50 HP	FVNR
6	PMP-2130-1	GRIT PUMP NO.1	10 HP	FVNR
7	BLR-2310-1	AERATION BLOWER NO.1	150 HP	SSRVS
8	BLR-2310-2	AERATION BLOWER NO.2	150 HP	SSRVS
9	–	CLARIFIER NO.1	1 HP	FVNR
10	–	CLARIFIER NO.2	1 HP	FVNR
11	BLR-2401-1	SLUDGE HOLDING TANK BLOWER NO.1	150 HP	SSRVS
12	ITP-01	IRRIGATION TRANSFER PUMP NO.1	10 HP	FVNR
13	IWP-02	IRRIGATION WATER PUMP NO.2	50 HP	FVNR

GENERATOR LOAD LIST
NTS

4

Juan Carlos Saenz
STATE OF TEXAS
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PROFESSIONAL ENGINEER
04/14/2023

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	04/13/23	JCS	JCS	REVISION FOR ADDENDUM NO. 4

DESIGNED BY: S. KAMAL
DRAWN BY: S. KAMAL
SHEET CHK'D BY: M. CZACH
CROSS CHK'D BY: G. PRABHU
APPROVED BY: J. SAENZ
DATE: JANUARY 2023

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CITY OF GEORGETOWN, TEXAS

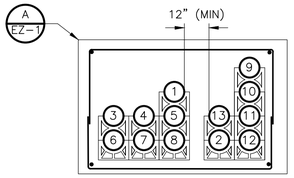
SAN GABRIEL WWTP
REHABILITATION

SAN GABRIEL WWTP
SWITCHGEAR SWGR-1
ONE-LINE DIAGRAM

PROJECT NO. 2048-264953
FILE NAME: SGE02NFOL.DWG
SHEET NO.
SG-E-2

GENERAL ELECTRICAL NOTES:

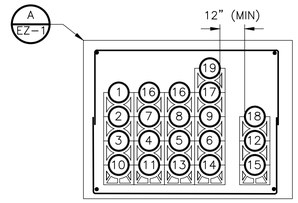
1. CONCRETE REINFORCED DUCTBANKS SHALL BE EXTENDED UNDERNEATH STRUCTURES OR ELECTRICAL EQUIPMENT AND ARE NOT SHOWN FOR CLARITY BUT THE RESPONSIBILITY OF ELECTRICAL CONTRACTOR.
2. PROVIDE PULLSTRING FOR SPARE CONDUITS.
3. DETAILS SHOWN ON THIS SHEET ARE FOR DIAGRAMMATICAL PURPOSES AND SHOW INTENT. DUCTBANK SECTIONS DO NOT NECESSARILY REFLECT ACTUAL CONDUIT PLACEMENT.



DUCTBANK SECTION 17 E-4
NTS

TABLE FOR SECTION 17		
CONDUIT NO.	CONDUIT TAG/ SIZE	DESCRIPTION
1	LP1-8/ 1"C.	FROM PANELBOARD LP-1 TO RAS FLOWMETER VAULT NO.1 FIT-2740-1
2	FIT27401-1/ 1"C.	FROM PLC-SGB TO RAS FLOWMETER VAULT NO.1 FIT-2740-1
3	MCC1-8/ 2"C.	FROM MOTOR CONTROL CENTER MCC-1 TO SLUDGE HOLDING TANK BLOWER NO.1 BLR-2401-1
4	MCC1-8A/ 1-1/2"C.	FROM MOTOR CONTROL CENTER MCC-1 TO SLUDGE HOLDING TANK BLOWER NO.1 BLR-2401-1
5	LP1-16/ 1"C.	FROM PANELBOARD LP-1 TO SLUDGE HOLDING TANK BLOWER NO.1 LCP-2401-1
6	MCC2-7/ 2"C.	FROM MOTOR CONTROL CENTER MCC-1 TO SLUDGE HOLDING TANK BLOWER NO.1 BLR-2401-2
7	MCC2-7A/ 1-1/2"C.	FROM MOTOR CONTROL CENTER MCC-1 TO SLUDGE HOLDING TANK BLOWER NO.1 BLR-2401-2
8	LP1-18/ 1"C.	FROM PANELBOARD LP-1 TO SLUDGE HOLDING TANK BLOWER NO.1 LCP-2401-2
9	BV2750-1/ 1"C.	FROM PLC-SGB TO BV-2750-1/-2
10	AIT2720-1/ 1"C.	FROM PLC-SGB TO AIT-2720-1
11	BV2750-2/ 1"C.	FROM PLC-SGB TO BV-2750-3/-4
12	AIT2720-2/ 1"C.	FROM PLC-SGB TO AIT-2720-2
13	PIT2311-1/ 1"C.	FROM PLC-SGB TO PIT-2311-1

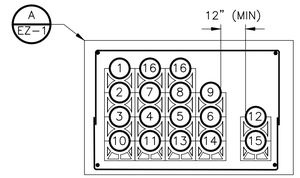
CONCRETE ENCASED DUCTBANK SCHEDULE
NTS



DUCTBANK SECTION 15 E-4
NTS

TABLE FOR SECTION 15		
CONDUIT NO.	CONDUIT TAG/ SIZE	DESCRIPTION
1	MCC1-9/ 1"C.	FROM MOTOR CONTROL CENTER MCC-1 TO EXISTING CLARIFIER NO.1
2	MCC2-8/ 1"C.	FROM MOTOR CONTROL CENTER MCC-2 TO EXISTING CLARIFIER NO.2
3	MCC1-10/ 1"C.	FROM MOTOR CONTROL CENTER MCC-1 TO GRIT PUMP NO.1 PMP-2130-1
4	MCC1-10A/ 1"C.	FROM MOTOR CONTROL CENTER MCC-1 TO GRIT PUMP NO.1 PMP-2130-1
5	MCC2-9/ 1"C.	FROM MOTOR CONTROL CENTER MCC-2 TO GRIT PUMP NO.2 PMP-2130-2
6	MCC2-9A/ 1"C.	FROM MOTOR CONTROL CENTER MCC-1 TO GRIT PUMP NO.2 PMP-2130-2
7	LP1-11/ 1"C.	FROM PANELBOARD LP-1 TO MOTORIZED VALVE BV-2131-1
8	BV2129-1B/ 1"C.	FROM GRIT BASIN MASTER CONTROL PANEL MCP-2110-1 TO MOTORIZED VALVE BV-2131-1
9	LP1-13/ 1"C.	FROM PANELBOARD LP-1 TO 1-1/2" NPW HEAT TRACE-1 THERMOSTAT
10	MCP21101-1/ 1"C.	FROM GRIT BASIN MASTER CONTROL PANEL MCP-2110-1 TO GRIT WASHER CLASSIFIER GC-2111-1
11	MCP21101-2/ 1"C.	FROM GRIT BASIN MASTER CONTROL PANEL MCP-2110-1 TO SCREW CONVEYOR CNV-2112-1
12	LCS2110-1/ 2"C.	FROM GRIT BASIN MASTER CONTROL PANEL MCP-2110-1 TO LOCAL CONTROL STATION LCS-2110-1
13	LP1-15/ 1"C.	FROM PANELBOARD LP-1 TO 1-1/2" NPW HEAT TRACE-2 THERMOSTAT
14	TCGC-1/ 3"C.	FROM GRIT BASIN MASTER CONTROL PANEL MCP-2110-1 TO TERMINATION CABINET TC-GC
15	TCGC-2/ 1"C.	FROM GRIT BASIN MASTER CONTROL PANEL MCP-2110-1 TO TERMINATION CABINET TC-GC
16	SPARE/ 1"C.	FROM GRIT BASIN MASTER CONTROL PANEL MCP-2110-1 TO GRIT CLASSIFIER AREA
17	LP1-9/ 1"C.	FROM PANELBOARD LP-1 TO RAS FLOWMETER VAULT NO.2 FIT-2740-2
18	FIT27402-1/ 1"C.	FROM PLC-SGB TO RAS FLOWMETER VAULT NO.2 FIT-2740-2
19	MCC2-16/ 2"C.	FROM MOTOR CONTROL CENTER MCC-2 TO EXISTING PANELBOARD PP-A

CONCRETE ENCASED DUCTBANK SCHEDULE
NTS



DUCTBANK SECTION 16 E-4
NTS

TABLE FOR SECTION 16		
CONDUIT NO.	CONDUIT TAG/ SIZE	DESCRIPTION
1	MCC1-9/ 1"C.	FROM MOTOR CONTROL CENTER MCC-1 TO EXISTING CLARIFIER NO.1
2	MCC2-8/ 1"C.	FROM MOTOR CONTROL CENTER MCC-2 TO EXISTING CLARIFIER NO.2
3	MCC1-10/ 1"C.	FROM MOTOR CONTROL CENTER MCC-1 TO GRIT PUMP NO.1 PMP-2130-1
4	MCC1-10A/ 1"C.	FROM MOTOR CONTROL CENTER MCC-1 TO GRIT PUMP NO.1 PMP-2130-1
5	MCC2-9/ 1"C.	FROM MOTOR CONTROL CENTER MCC-2 TO GRIT PUMP NO.2 PMP-2130-2
6	MCC2-9A/ 1"C.	FROM MOTOR CONTROL CENTER MCC-1 TO GRIT PUMP NO.2 PMP-2130-2
7	LP1-11/ 1"C.	FROM PANELBOARD LP-1 TO MOTORIZED VALVE BV-2131-1
8	BV2129-1B/ 1"C.	FROM GRIT BASIN MASTER CONTROL PANEL MCP-2110-1 TO MOTORIZED VALVE BV-2131-1
9	LP1-13/ 1"C.	FROM PANELBOARD LP-1 TO 1-1/2" NPW HEAT TRACE-1 THERMOSTAT
10	MCP21101-1/ 1"C.	FROM GRIT BASIN MASTER CONTROL PANEL MCP-2110-1 TO GRIT WASHER CLASSIFIER GC-2111-1
11	MCP21101-2/ 1"C.	FROM GRIT BASIN MASTER CONTROL PANEL MCP-2110-1 TO SCREW CONVEYOR CNV-2112-1
12	LCS2110-1/ 2"C.	FROM GRIT BASIN MASTER CONTROL PANEL MCP-2110-1 TO LOCAL CONTROL STATION LCS-2110-1
13	LP1-15/ 1"C.	FROM PANELBOARD LP-1 TO 1-1/2" NPW HEAT TRACE-2 THERMOSTAT
14	TCGC-1/ 3"C.	FROM GRIT BASIN MASTER CONTROL PANEL MCP-2110-1 TO TERMINATION CABINET TC-GC
15	TCGC-2/ 1"C.	FROM GRIT BASIN MASTER CONTROL PANEL MCP-2110-1 TO TERMINATION CABINET TC-GC
16	SPARE/ 1"C.	FROM GRIT BASIN MASTER CONTROL PANEL MCP-2110-1 TO GRIT CLASSIFIER AREA

CONCRETE ENCASED DUCTBANK SCHEDULE
NTS

Juan Carlos Saenz
STATE OF TEXAS
JUAN CARLOS SAENZ
138331
LICENSED PROFESSIONAL ENGINEER
04/14/2023

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	04/13/23	JCS	JCS	REVISION FOR ADDENDUM NO. 4

DESIGNED BY: S. KAMAL
DRAWN BY: S. KAMAL
SHEET CHK'D BY: M. CZACH
CROSS CHK'D BY: G. PRABHU
APPROVED BY: J. SAENZ
DATE: JANUARY 2023

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TBPE Firm Registration No. F-3043

CITY OF GEORGETOWN, TEXAS

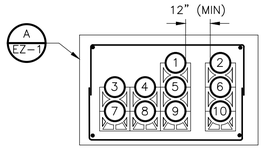
SAN GABRIEL WWTP
REHABILITATION

SAN GABRIEL WWTP
ELECTRICAL DUCTBANK SCHEDULE IV

PROJECT NO. 2048-264953
FILE NAME: SGE15NFSC.DWG
SHEET NO.
SG-E-15

GENERAL ELECTRICAL NOTES:

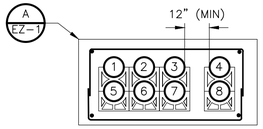
1. CONCRETE REINFORCED DUCTBANKS SHALL BE EXTENDED UNDERNEATH STRUCTURES OR ELECTRICAL EQUIPMENT AND ARE NOT SHOWN FOR CLARITY BUT THE RESPONSIBILITY OF ELECTRICAL CONTRACTOR.
2. PROVIDE PULLSTRING FOR SPARE CONDUITS.
3. DETAILS SHOWN ON THIS SHEET ARE FOR DIAGRAMMATICAL PURPOSES AND SHOW INTENT. DUCTBANK SECTIONS DO NOT NECESSARILY REFLECT ACTUAL CONDUIT PLACEMENT.



DUCTBANK SECTION 18 E-4
NTS

TABLE FOR SECTION 18		
CONDUIT NO.	CONDUIT TAG/ SIZE	DESCRIPTION
1	LP1-8/ 1"C.	FROM PANELBOARD LP-1 TO RAS FLOWMETER VAULT NO.1 FIT-2740-1
2	FIT27401-1/ 1"C.	FROM PLC-SGB TO RAS FLOWMETER VAULT NO.1 FIT-2740-1
3	MCC1-8/ 2"C.	FROM MOTOR CONTROL CENTER MCC-1 TO SLUDGE HOLDING TANK BLOWER NO.1 BLR-2401-1
4	MCC1-8A/ 1-1/2"C.	FROM MOTOR CONTROL CENTER MCC-1 TO SLUDGE HOLDING TANK BLOWER NO.1 BLR-2401-1
5	LP1-16/ 1"C.	FROM PANELBOARD LP-1 TO SLUDGE HOLDING TANK BLOWER NO.1 LCP-2401-1
6	LCS24011-1/ 1"C.	FROM RTU-SGWWTP TO LCS-2401-1 4
7	MCC2-7/ 2"C.	FROM MOTOR CONTROL CENTER MCC-1 TO SLUDGE HOLDING TANK BLOWER NO.1 BLR-2401-2
8	MCC2-7A/ 1-1/2"C.	FROM MOTOR CONTROL CENTER MCC-1 TO SLUDGE HOLDING TANK BLOWER NO.1 BLR-2401-2
9	LP1-18/ 1"C.	FROM PANELBOARD LP-1 TO SLUDGE HOLDING TANK BLOWER NO.1 LCP-2401-2
10	LCS24012-1/ 1"C.	FROM RTU-SGWWTP TO LCS-2401-2 4

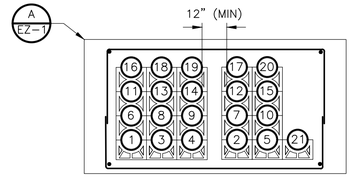
CONCRETE ENCASED DUCTBANK SCHEDULE
NTS



DUCTBANK SECTION 19 E-4
NTS

TABLE FOR SECTION 19		
CONDUIT NO.	CONDUIT TAG/ SIZE	DESCRIPTION
1	MCC1-8/ 2"C.	FROM MOTOR CONTROL CENTER MCC-1 TO SLUDGE HOLDING TANK BLOWER NO.1 BLR-2401-1
2	MCC1-8A/ 1-1/2"C.	FROM MOTOR CONTROL CENTER MCC-1 TO SLUDGE HOLDING TANK BLOWER NO.1 BLR-2401-1
3	LP1-16/ 1"C.	FROM PANELBOARD LP-1 TO SLUDGE HOLDING TANK BLOWER NO.1 LCP-2401-1
4	LCS24011-1/ 1"C.	FROM RTU-SGWWTP TO LCS-2401-1 4
5	MCC2-7/ 2"C.	FROM MOTOR CONTROL CENTER MCC-1 TO SLUDGE HOLDING TANK BLOWER NO.1 BLR-2401-2
6	MCC2-7A/ 1-1/2"C.	FROM MOTOR CONTROL CENTER MCC-1 TO SLUDGE HOLDING TANK BLOWER NO.1 BLR-2401-2
7	LP1-18/ 1"C.	FROM PANELBOARD LP-1 TO SLUDGE HOLDING TANK BLOWER NO.1 LCP-2401-2
8	LCS24012-1/ 1"C.	FROM RTU-SGWWTP TO LCS-2401-2 4

CONCRETE ENCASED DUCTBANK SCHEDULE
NTS



DUCTBANK SECTION 20 E-4
NTS

TABLE FOR SECTION 17		
CONDUIT NO.	CONDUIT TAG/ SIZE	DESCRIPTION
1	MCC2-6/ 2"C.	FROM MOTOR CONTROL CENTER MCC-2 TO AERATION BLOWER NO.4 BLR-2310-4
2	MCC2-6A/ 1"C.	FROM MOTOR CONTROL CENTER MCC-2 TO AERATION BLOWER NO.4 BLR-2310-4
3	MCC2-6B/ 1-1/2"C.	FROM MOTOR CONTROL CENTER MCC-2 TO AERATION BLOWER NO.4 LCP-2310-4
4	LP1-7/ 1"C.	FROM PANELBOARD LP-1 TO AERATION BLOWER NO.4 LCP-2310-4
5	LCP23104-1/ 1"C.	FROM PLC-SGB TO AERATION BLOWER NO.4 LCP-2310-4
6	MCC2-5/ 2"C.	FROM MOTOR CONTROL CENTER MCC-2 TO AERATION BLOWER NO.3 BLR-2310-3
7	MCC2-5A/ 1"C.	FROM MOTOR CONTROL CENTER MCC-2 TO AERATION BLOWER NO.3 BLR-2310-3
8	MCC2-5B/ 1-1/2"C.	FROM MOTOR CONTROL CENTER MCC-2 TO AERATION BLOWER NO.3 LCP-2310-3
9	LP1-5/ 1"C.	FROM PANELBOARD LP-1 TO AERATION BLOWER NO.3 LCP-2310-3
10	LCP23103-1/ 1"C.	FROM PLC-SGB TO AERATION BLOWER NO.3 LCP-2310-3
11	MCC1-6/ 2"C.	FROM MOTOR CONTROL CENTER MCC-1 TO AERATION BLOWER NO.2 BLR-2310-2
12	MCC1-6A/ 1"C.	FROM MOTOR CONTROL CENTER MCC-1 TO AERATION BLOWER NO.2 BLR-2310-2
13	MCC1-6B/ 1-1/2"C.	FROM MOTOR CONTROL CENTER MCC-1 TO AERATION BLOWER NO.2 LCP-2310-2
14	LP1-6/ 1"C.	FROM PANELBOARD LP-1 TO AERATION BLOWER NO.2 LCP-2310-2
15	LCP23102-1/ 1"C.	FROM PLC-SGB TO AERATION BLOWER NO.3 LCP-2310-2
16	MCC1-5/ 2"C.	FROM MOTOR CONTROL CENTER MCC-1 TO AERATION BLOWER NO.1 BLR-2310-1
17	MCC1-5A/ 1"C.	FROM MOTOR CONTROL CENTER MCC-1 TO AERATION BLOWER NO.1 BLR-2310-1
18	MCC1-5B/ 1-1/2"C.	FROM MOTOR CONTROL CENTER MCC-1 TO AERATION BLOWER NO.1 LCP-2310-1
19	LP1-4/ 1"C.	FROM PANELBOARD LP-1 TO AERATION BLOWER NO.1 LCP-2310-1
20	LCP23101-1/ 1"C.	FROM PLC-SGB TO AERATION BLOWER NO.1 LCP-2310-1
21	PLCSGB-1/ 2"C.	FROM PLC-SGB TO RTU-SGWWTP

CONCRETE ENCASED DUCTBANK SCHEDULE 4
NTS

Juan Carlos Saenz
STATE OF TEXAS
JUAN CARLOS SAENZ
138331
LICENSED PROFESSIONAL ENGINEER
04/14/2023

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	04/13/23	JCS	JCS	REVISION FOR ADDENDUM NO. 4

DESIGNED BY: S. KAMAL
DRAWN BY: S. KAMAL
SHEET CHK'D BY: M. CZACH
CROSS CHK'D BY: G. PRABHU
APPROVED BY: J. SAENZ
DATE: JANUARY 2023

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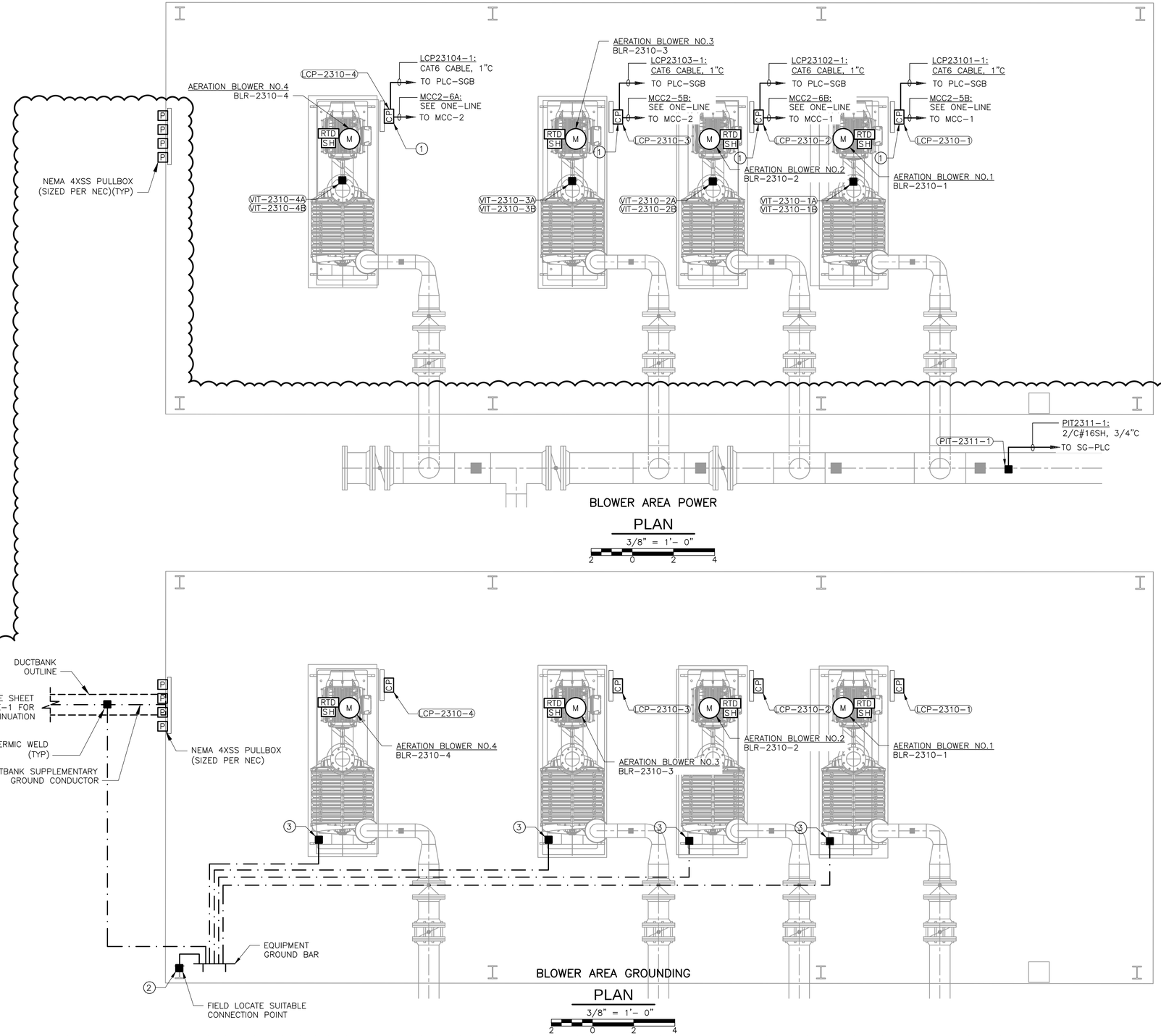
Tel: (512) 346-1100
TBPE Firm Registration No. F-3043

CITY OF GEORGETOWN, TEXAS

SAN GABRIEL WWTP
REHABILITATION

SAN GABRIEL WWTP
ELECTRICAL DUCTBANK SCHEDULE V

PROJECT NO. 2048-264953
FILE NAME: SGE16NFSC.DWG
SHEET NO.
SG-E-16



BLOWER AREA POWER

PLAN

3/8" = 1'- 0"

2 0 2 4

BLOWER AREA GROUNDING

PLAN

3/8" = 1'- 0"

2 0 2 4

GENERAL ELECTRICAL NOTES:

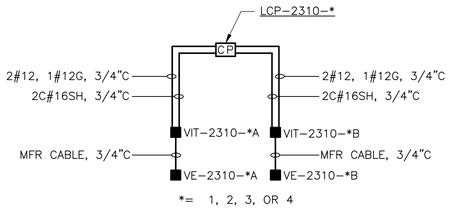
1. REFER TO SHEET SG-E-4 AND SG-E-5 FOR ONE-LINE DIAGRAM.
2. CONDUIT PENETRATIONS THROUGH EXISTING STRUCTURE ARE NOT SHOWN BUT SHALL BE THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR. A4

KEY NOTES:

(1) PROVIDED BY DIVISION 43 THIS CONTRACT.

(2) BOND #4/0 BARE COPPER CONDUCTOR TO STRUCTURAL STEEL.

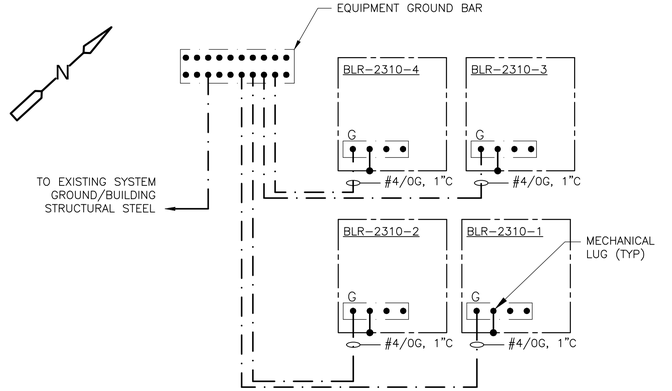
(3) EQUIPMENT GROUND BUS OR PADS. BOND GROUND CONDUCTOR TO EQUIPMENT STRUCTURE. COORDINATE LOCATIONS WITH SYSTEM SUPPLIER (TYP).



AERATION BLOWER SKID WIRING

DIAGRAM 1

TYP FOR 4



GROUNDING RISER

NTS A4

Juan Carlos Saenz
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04/14/2023

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	04/13/23	JCS	JCS	REVISION FOR ADDENDUM NO. 4

DESIGNED BY: S. KAMAL
DRAWN BY: S. KAMAL
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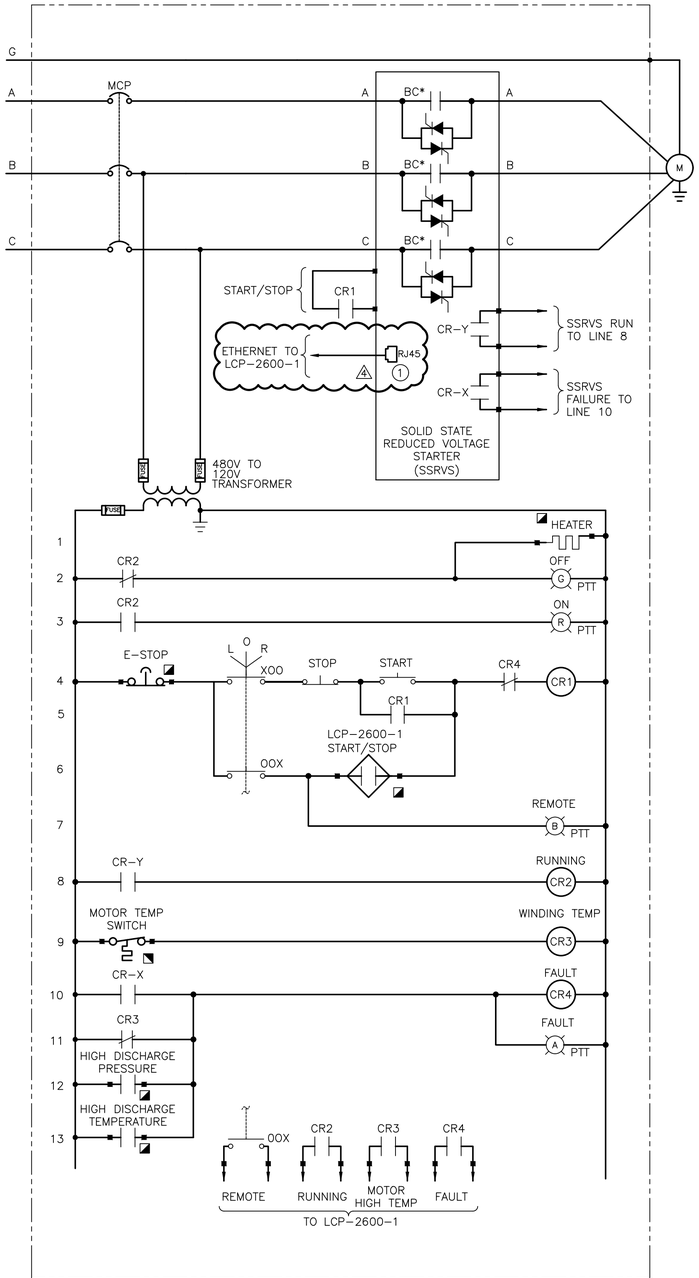
CITY OF GEORGETOWN, TEXAS

SAN GABRIEL WWTP
REHABILITATION

SAN GABRIEL WWTP
BLOWER AREA
POWER PLAN

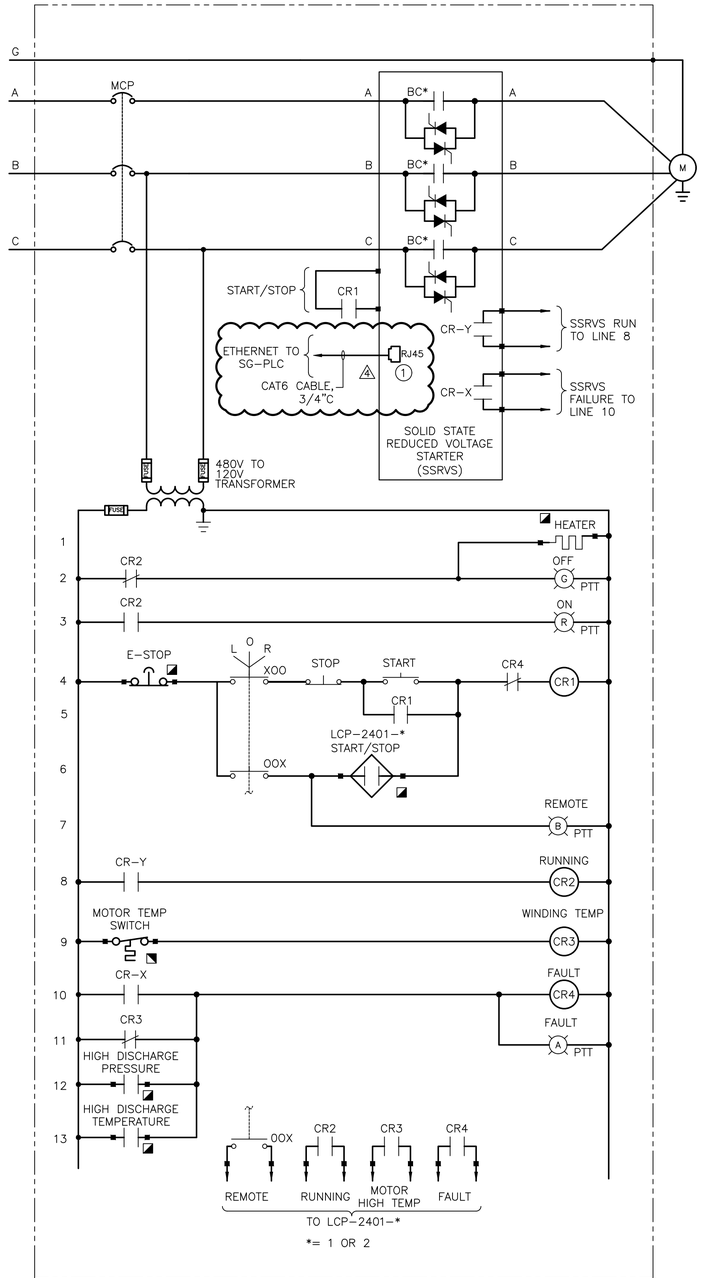
PROJECT NO. 2048-264953
FILE NAME: SGED1BBPL.DWG

SHEET NO.
SG-ED-1



WET WEATHER STORAGE TANK BLOWER

SCHEMATIC 1 / TYP FOR 1



AERATED SLUDGE HOLDING TANK BLOWER

SCHEMATIC 2 / TYP FOR 2

GENERAL ELECTRICAL NOTES:

1. THE CONTROL DIAGRAMS, ALONG WITH ANY WRITTEN OPERATIONAL DESCRIPTIONS IN THE SPECIFICATIONS AND/OR LOOP DIAGRAMS, SHOW THE INTENDED FUNCTIONS OF THE SYSTEMS AND CIRCUITS.
2. ALL MOTOR STARTER CONTROL TRANSFORMERS SHALL BE A MINIMUM OF 100VA AND, IF NECESSARY, BE INCREASED IN SIZE SO AS TO PROVIDE SUFFICIENT VOLT-AMPERE CAPACITY FOR OPERATING ALL ELECTRICAL DEVICES ASSOCIATED WITH THE CONTROL OF THE MOTOR. THIS SHALL INCLUDE STARTER COIL, RELAYS, TIMERS, MOTOR HEATERS, INDICATING LIGHTS, ETC.
3. REFERENCE PLANS FOR CONDUIT AND WIRE REQUIREMENTS.

SCHEMATIC LEGEND

- ■ EXTERNAL DEVICE TERMINAL CONNECTIONS
- ◪ DEVICE LOCATED IN FIELD
- ▲ DEVICE LOCATED IN FIELD LCS
- ON (R) PUSH-TO-TEST LED PILOT LIGHT PTT

KEY NOTES:

(1) PROVIDED ETHERNET COMMUNICATION MODULE. 4

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LICENSED PROFESSIONAL ENGINEER
04/14/2023

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	04/13/23	JCS	JCS	REVISION FOR ADDENDUM NO. 4

DESIGNED BY: S. KAMAL
DRAWN BY: S. KAMAL
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APPROVED BY: J. SAENZ
DATE: JANUARY 2023

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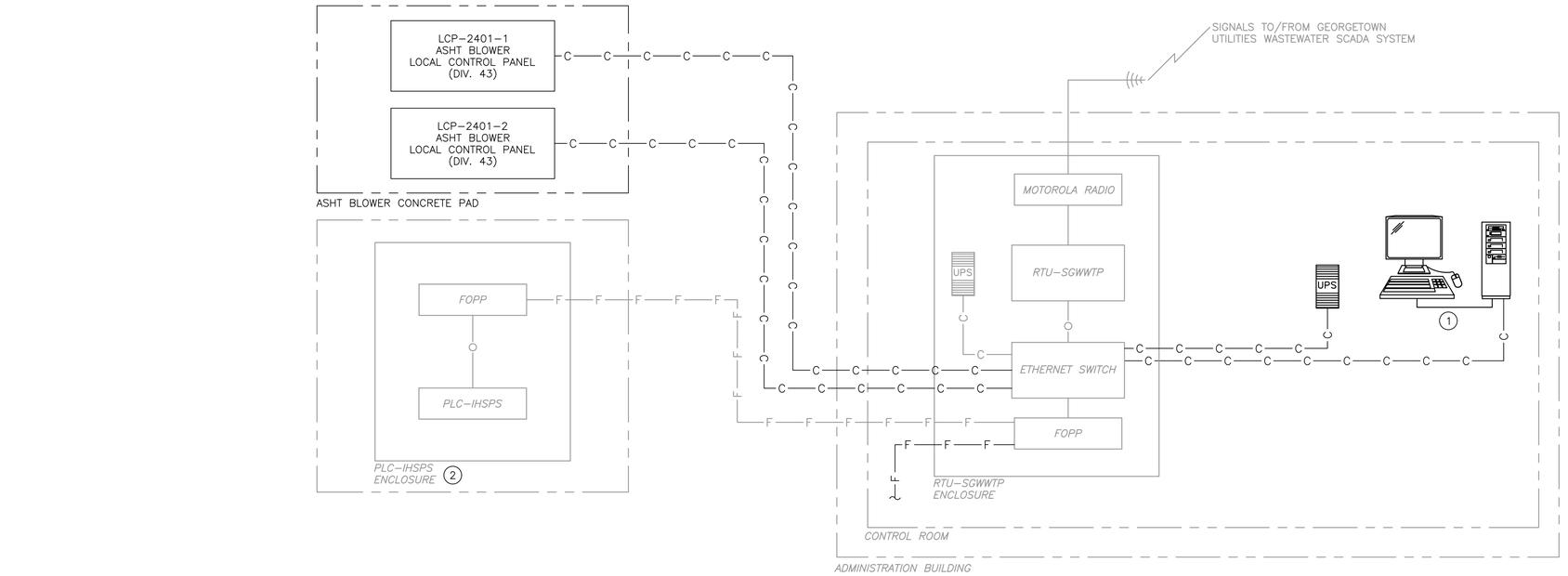
CITY OF GEORGETOWN, TEXAS

SAN GABRIEL WWTP REHABILITATION

SAN GABRIEL WWTP
ELECTRICAL SCHEMATIC II

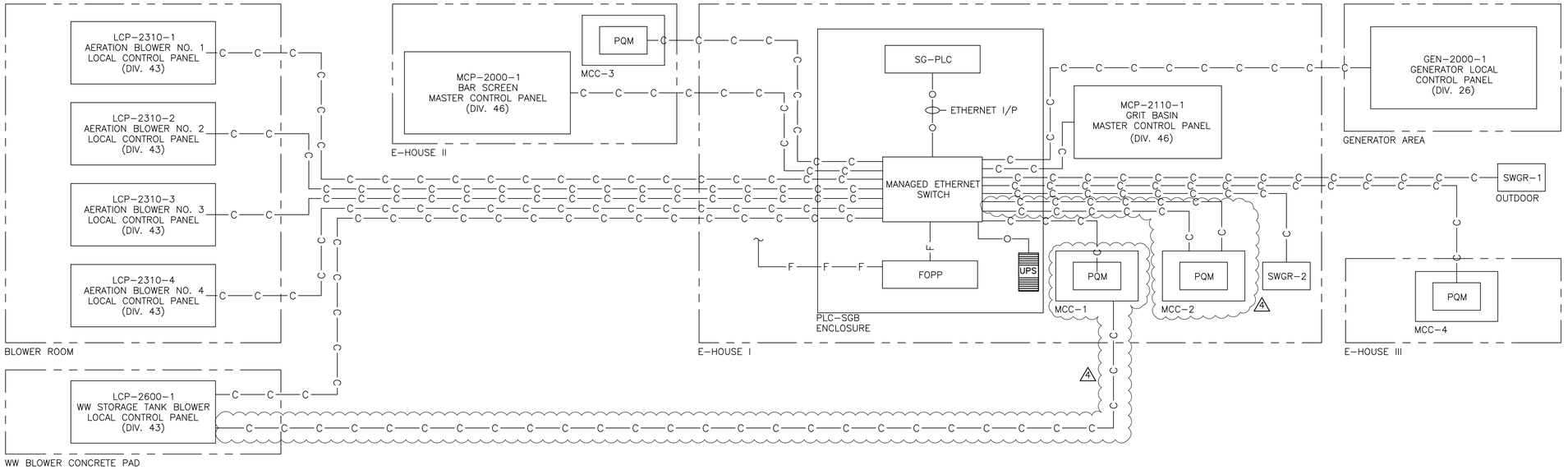
PROJECT NO. 2048-264953
FILE NAME: EY-2.DWG

SHEET NO.
EY-2



NOTES:

1. THE PCSS SHALL PROVIDE LICENSES TO INTEGRATE SAN GABRIEL WASTEWATER TREATMENT PLANT WITH CITY WIDE SCADA SYSTEM.
2. THE PCSS SHALL HAVE SCOPE IN THE EXISTING PLC-IHSPS TO MODIFY THE PLC CODE THAT IS CAPABLE TO RUN THE EXISTING IRRIGATION TRANSFER PUMPS TOGETHER AUTOMATICALLY BASED ON THE CLEARWELL LEVEL. REFER TO THE SHEET SG-IH-1 AND CONTROL DESCRIPTION FOR DETAILED CONTROLS.



REV. NO.	DATE	DRWN	CHKD	REMARKS
1	4/17/23	SSB	MC	REVISION FOR ADDENDUM NO. 4

DESIGNED BY: M. CLARK
DRAWN BY: A. MAXWELL
SHEET CHK'D BY: S. RAJESH
CROSS CHK'D BY: A. DOODY
APPROVED BY: M. CLARK
DATE: JANUARY 2023

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CITY OF GEORGETOWN, TEXAS

SAN GABRIEL WWTP
REHABILITATION

SAN GABRIEL WWTP
CONTROL SYSTEM ARCHITECTURE

PROJECT NO. 2048-264953
FILE NAME: SG-I-1.DWG

SHEET NO.
SG-I-1

STATE OF TEXAS
MICHAEL CLARK
140056
LICENSED
PROFESSIONAL ENGINEER

TYP. OF LOOP NOS.
2401-1 & 2401-2

SG-PLC

READY
RUNNING
FAULT
FUEL LOW LEVEL

GEN-2000-1
GENERATOR
CONTROL PANEL
(DIV. 26)

LOSS OF INCOMING POWER
ON BYPASS
LOW BATTERY

UPS-2000-2
CONTROL ROOM UPS
(DIV. 40)

4

POWER
POWER FACTOR
PHASE CURRENT
PHASE VOLTAGE

MS-2401-1
MS
LOR HS 2401-1E
START HS 2401-1F
STOP HS 2401-1G
RUNNING YRL 2401-1B
FAULT XL 2401-1B
(IN MCC-2)
(TYP. OF 2)
(DIV. 26)

IN AUTO
RUNNING
FAULT
MOTOR STARTER IN REMOTE
START/STOP
HIGH PRESSURE
HIGH TEMPERATURE

LCP-2401-1
OIT
PLC
HOA HS 2401-1A
E-STOP HS 2401-1B
RUNNING YRL 2401-1A
AUTO YCL 2401-1A
START HS 2401-1C
STOP HS 2401-1D
FAULT XL 2401-1A
REMOTE YCL 2401-1B
(DIV. 43)
(TYP. OF 2)

HIGH TEMPERATURE
TSH 2000-1 23
ELECTRICAL HOUSE-I TEMPERATURE

HIGH TEMPERATURE
TSH 2000-2 23
ELECTRICAL HOUSE-II TEMPERATURE

HIGH TEMPERATURE
TSH 2000-3 23
ELECTRICAL HOUSE-III TEMPERATURE

GENERAL NOTES:

1. REFER TO SPECIFICATION SECTION 431133 FOR ADDITIONAL INSTRUMENTATION AND CONTROL REQUIREMENTS.

B/L
INLET AIR
VIA BLOWER
ENCLOSURE LOUVER

PDI 2401-1 4.3
BV-2401-1A
BV-2401-1B
S-2401-1
INLET AIR SILENCER NO. 1

PI 2402-1 4.3
BV-2401-2A
8"-AR-SS

BLR-2401-1
AERATED SLUDGE HOLDING TANK
BLOWER NO. 1

PI 2401-1 4.3
PSH 2401-1 4.3
BV-2401-1C
PRV-2400-1A

TI 2401-1 4.3
TSH 2401-1 4.3

S-2401-1
DISCHARGE SILENCER NO. 1

PRV-2401-1B
CV-2410-1
BFV-2410-1
8"-LPA-SS

VENDOR PROVIDED ENCLOSURE (DIV. 43)

10"-LPA-SS

B/L
TO AERATED SLUDGE HOLDING TANK

B/L
INLET AIR
VIA BLOWER
ENCLOSURE LOUVER

PDI 2401-2 4.3
BV-2401-2A
BV-2401-2B
S-2401-2
INLET AIR SILENCER NO. 2

PI 2402-2 4.3
BV-2401-2B
8"-AR-SS

BLR-2401-2
AERATED SLUDGE HOLDING TANK
BLOWER NO. 2

PI 2401-2 4.3
PSH 2401-2 4.3
BV-2401-2C
PRV-2401-2A

TI 2401-2 4.3
TSH 2401-2 4.3

S-2401-2
DISCHARGE SILENCER NO. 2

PRV-2401-2B
CV-2410-2
BFV-2410-2
8"-LPA-SS

VENDOR PROVIDED ENCLOSURE (DIV. 43)

STATE OF TEXAS
MICHAEL CLARK
140056
LICENSED
PROFESSIONAL ENGINEER

REV. NO.	DATE	DRWN	CHKD	REMARKS
2	4/17/23	SSB	MC	REVISION FOR ADDENDUM NO. 4
1	4/7/23	SS	MC	REVISION FOR ADDENDUM NO. 3

DESIGNED BY: M. CLARK
DRAWN BY: B. SRISYLESH
SHEET CHK'D BY: S. RAJESH
CROSS CHK'D BY: A. DOODY
APPROVED BY: M. CLARK
DATE: JANUARY 2023

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TBPE Firm Registration No. F-3043

CITY OF GEORGETOWN, TEXAS

SAN GABRIEL WWTP
REHABILITATION

SAN GABRIEL WWTP
AERATED SLUDGE HOLDING TANK
BLOWER AND MISCELLANEOUS P&ID

PROJECT NO. 2048-264953
FILE NAME: SG-IE-1.DWG

SHEET NO.
SG-IE-1

XREFs: [CDMS_2234_REVW_M_CLARK-SEAL] Images: []
Last saved by: VARSHAN Time: 12/19/2022 5:22:12 PM
F:\INST\Projects\2022\Dallas\San Gabriel & Dove Springs\CAD\PW\SG-IG-1.dwg

SG-PLC

IN AUTO · RUNNING · FAULT · MOTOR STARTER IN REMOTE · START/STOP · HIGH PRESSURE · HIGH TEMPERATURE · POWER · POWER FACTOR · PHASE CURRENT · PHASE VOLTAGE

TYP. OF LOOP NOS. 2700-1 & 2700-2

IN AUTO · RUNNING · FAULT · START/STOP · SPEED · SPEED SETPOINT

MS-2600-1 (IN MCC-1) (DIV. 26)
MS · LOR HS 2600-1E · START HS 2600-1F · STOP HS 2600-1G · RUNNING YRL 2600-1B · FAULT XL 2600-1B

VFD-2700-1 (DIV. 26) (TYP. OF 2)
VFD · HOA HS 2700-1A · START HS 2700-1B · STOP HS 2700-1C · AUTO YCL 2700-1A · SPEED SI 2700-1 · HIM · RUNNING YRL 2700-1 · FAULT XL 2700-1 · SPEED SP SC 2700-1

LCP-2600-1 (DIV. 43)
OIT · PLC · HOA HS 2600-1A · E-STOP HS 2600-1B · RUNNING YRL 2600-1A · AUTO YCL 2600-1A · START HS 2600-1C · STOP HS 2600-1D · FAULT XL 2600-1A · REMOTE YCL 2600-1B

NOTES:
1. REFER TO SPECIFICATION SECTION 431133 FOR ADDITIONAL INSTRUMENTATION AND CONTROL REQUIREMENTS.

B/L INLET AIR — 12"-AR-SS — PDI 2600-1 43 — BV-2600-1A / BV-2600-1B

S-2600-1 INLET AIR SILENCER NO. 1

12"-AR-SS — PI 2600-1 43 — PSH 2600-1 43 — BV-2600-1C — PRV-2600-1A

BLR-2600-1 WET WEATHER STORAGE TANK BLOWER NO. 1

TI 2600-1 43 — TSH 2600-1 43 — PRV-2600-1B

S-2600-1 DISCHARGE SILENCER NO. 1

CV-2610-1 — BFV-2610-1 — 12"-LPA-SS — B/L TO WET WEATHER STOARGE TANK

(1) VENDOR PROVIDED SKID (DIV. 43)

B/L FROM WET WEATHER STORAGE BASIN — 12"-WWEFF-DI

PV-2700-1A — PV-2700-2A

PMP-2700-1 PECAN BRANCH TRANSFER PUMP NO. 1
PMP-2700-2 PECAN BRANCH TRANSFER PUMP NO. 2

ARV-2700-1A · *PI 2700-1* · *BV-2700-1* · *ARV-2700-1B* · *CV-2700-1* · *PV-2700-1B* · *10"-WWEFF-DI* · *PV-2700-3* · *B/L TO PECAN BRANCH WWTP*

ARV-2700-2A · *PI 2700-2* · *BV-2700-2* · *ARV-2700-2B* · *CV-2650-2* · *PV-2650-2B* · *10"-WWEFF-DI*

STATE OF TEXAS · MICHAEL CLARK · 140086 · LICENSED PROFESSIONAL ENGINEER

REV. NO.	DATE	DRWN	CHKD	REMARKS
2	4/17/23	SSB	MC	REVISION FOR ADDENDUM NO. 4
1	4/7/23	SS	MC	REVISION FOR ADDENDUM NO. 3

DESIGNED BY: M. CLARK
DRAWN BY: B. SRISYLESH
SHEET CHK'D BY: S. RAJESH
CROSS CHK'D BY: A. DOODY
APPROVED BY: M. CLARK
DATE: JANUARY 2023

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TBPE Firm Registration No. F-3043

CITY OF GEORGETOWN, TEXAS

SAN GABRIEL WWTP REHABILITATION

SAN GABRIEL WWTP WW BLOWER AND PECAN BRANCH TRANSFER PUMP STATION P&ID

PROJECT NO. 2048-264953
FILE NAME: SG-IG-1.DWG
SHEET NO. SG-IG-1