

**Bidding Requirements, Contract Forms and Conditions of the Contract**  
**ADDENDUM**  
**Section 00900**

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**ADDENDUM No. 1**

Date: August 24, 2016

City of Austin

Project Name: South Austin Regional WWTP – Thickeners Improvements Project

C.I.P. No. 3333.016 IFB No.: 6100 CLMC558

This Addendum forms a part of the Contract and corrects or modifies original Bid Documents, dated **July 25, 2016**. Acknowledge receipt of this addendum in space provided on bid form. Failure to do so may subject bidder to disqualification.

**A. Project Manual Revisions:**

Note: Revisions per this Addendum No. 1 in the specifications have been **bolded and underlined**.

Volume 1:

Section 01010: Remove section in its entirety, and replace with the attached Section 01010.

Volume 2:

Section 11258: Remove section in its entirety, and replace with the attached Section 11258.

Section 11318: Remove section in its entirety, and replace with the attached Section 11318.

Section 11364: Remove section in its entirety, and replace with the attached Section 11364.

Section 15120: Remove section in its entirety, and replace with the attached Section 15120.

Section 16450 Remove section in its entirety, and replace with the attached Section 16450.

**B. Drawing Revisions:**

Sheet M-5: Remove sheet M-5, and replace with the attached sheet M-5. Notes were added to provide clarity on sequence of construction.

Sheets M-7, M-8, M-9: Remove sheets, and replace with the attached sheets. Header pipes and pipe supports were adjusted to better reflect field conditions.

Sheet M-12: Remove sheet M-12, and replace with the attached sheet M-12. The "3-6" DIA. CENTER COLUMN" callout was deleted, and Note 1 was modified.

- Sheet M-21: Remove sheet M-21, and replace with the attached sheet M-21. Tapping sleeve valve orientation was modified.
- Sheet M-27: Remove sheet M-27, and replace with the attached sheet M-27. Detail G was modified to provide clarity on pipe support and Detail E was modified.
- Sheet E-35: Remove sheet E-35, and replace with the attached sheet E-35. Light Fixture Schedule has been updated.

This addendum consists of 96 pages/sheets (including these 2 pages).

  
8-24-16  
Approved by OWNER

  
  
08/24/16

Approved by ENGINEER/ARCHITECT

END

The Work of this Contract includes sustainability requirements as shown in the Division 1 Sections 01505 and all other applicable specification sections. It is the intent of the OWNER to work in partnership with the CONTRACTOR in implementing sustainable construction practices to the greatest extent possible.

## **PART 1 - GENERAL**

### **1.1 Related Documents:**

Drawings and general provisions of Contract, including General Conditions, Section 00700, and Supplemental General Conditions, Section 00810, and Division 1 requirements.

### **1.2 DESCRIPTION OF WORK**

#### **1.21 Scope of Work**

- A. This section describes the Project in general and provides an overview of the extent of the Work to be performed by the CONTRACTOR. Detailed requirements and extent of Work is stated in the applicable Specification Sections and shown on the Drawings. CONTRACTOR shall, except as otherwise specifically stated herein or in any applicable part of these Contract Documents, provide and pay for all labor, materials, equipment, tools, construction equipment, and other facilities and services necessary for proper execution, testing, and completion of the Work.
- B. Any part or item of the Work which is reasonably implied or normally required to make the installation satisfactorily operable shall be performed by the CONTRACTOR and the expense thereof shall be included in the applicable unit prices or lump sum prices bid for the Work. It is the intent of these Specifications to provide the OWNER with the complete system. All miscellaneous appurtenances and other items of Work that are incidental to meeting the intent of the Specifications shall be considered as having been included in the applicable unit prices or lump sum prices bid for the Work even though these appurtenances and items may not be specifically called for in the Bid Documents.
- C. The Work shall include furnishing all tools, labor, materials, equipment, and miscellaneous items necessary for the complete construction of the "South Austin Regional Wastewater Treatment Plant Thickener Improvements Project", City of Austin Capital Improvement Project No. 3333-016, in its entirety as shown on the Drawings and as specified herein. The work includes, but is not necessarily limited to the following:
  - 1. Erosion and sedimentation controls and tree protection
  - 2. Site Preparation
  - 3. Gravity Thickeners
    - a. Replace mechanisms and scum collection systems for each existing thickener
    - b. Reconstruct effluent boxes
    - c. Replace concrete stairs with aluminum stairs
    - d. Replace existing door
    - e. Construct new concrete scum wetwells
    - f. Recoat interior of thickener launder troughs
    - g. Install associated controls
  - 4. Thickened Sludge Pumps

- a. Replace and improve suction and discharge headers and piping for six existing thickened sludge pumps
  - b. Install associated piping accessories, valving, and controls
- 5. Thickener Scum Pumps
  - a. Install one submersible, chopper scum pump at each thickener scum wet well
  - b. Install scum piping, as well as associated piping accessories, valving, and controls
- 6. Electrical Room
  - a. Provide new roofing and doors for existing electrical room
  - b. Install new electrical equipment and accessories
  - c. Install new HVAC system
- 7. Sludge Holding Tank
  - a. Replace existing roof hatch and install **new** roof **hatches** to existing tank cover
- 8. Sludge Blending Tanks
  - a. Replace roof hatches, railings and access stairs.
- 9. Odor Control System
  - a. Install two bioscrubber systems with access ladders and guardrails.
  - b. Connect existing ductwork to new odor control systems, and install new ductwork as required
  - c. Connect NPW supply lines to existing piping
  - d. Connect bioscrubber drains to existing thickener supernatant line
  - e. Install appropriate pipe and duct accessories, valving, and controls
- 10. Yard Piping and Valves
  - a. Install scum yard piping either by sliplining existing scum lines or replacing existing scum lines in place,
- 11. Electrical
  - a. Route new ductbanks and abandon existing ductbanks in place
- 12. Instrumentation and SCADA
- 13. Site work
  - a. Perform revegetation
- 14. Roads
  - a. Repave plant roads as required
- 15. Site Lighting
  - a. Install new site lighting
- 16. Furnish trailer-mounted valve operator system

### 1.22 Location of Project

- A. The Project is located at the South Austin Regional Wastewater Treatment Plant: 1017 Fallwell Lane in Del Valle, Texas. The project location/route is shown on the Drawings.

### 1.23 Work Sequence

- A. Perform Work in sequence listed below to ensure completion of the Work in the Contract Time. Completion dates if the various stages shall be in accordance with the approved construction schedule submitted by the CONTRACTOR. To maintain plant operations, work on the gravity thickeners must be split in two phases, with Phase 1 including the work associated with the North thickeners (2A and 2B) and corresponding three thickened sludge pumps, and Phase 2 including work associated with the South thickeners (1A and 1B) and corresponding three thickened sludge pumps. **Odor Control System No. 1 and No. 2 shall both be made operational in conjunction with the North Thickeners to provide ventilation once thickeners are in operation. Items No. 7 and No. 8, below may be performed independently from the work associated with the gravity thickeners.**

- 1. Site Preparation
  - a. Install erosion and sedimentation controls.

- b. Implement tree protection plan.
  - c. Prepare site for construction, including site access ways.
2. North Gravity Thickener Systems (Phase 1)
- a. The North Gravity Thickener System consists of GT 2A, GT 2B, Thickened Sludge Pumps No. 4, 5 and 6, and associated components.
  - b. GT 2A and GT 2B
    - i. Coordinate with OWNER to take offline and drain GT 2B. **OWNER will drain contents of each thickener.**
    - ii. Remove top hexagon of thickener domes by removing six center struts, as shown on the Drawings. Do not, under any circumstance remove the center hexagonal ring.
    - iii. **Remove existing concrete stairs and effluent boxes.**
    - iv. Remove existing mechanism, walkway, and scum collection system either through existing entry way or through hexagonal opening.
    - v. **Install new stairs, effluent boxes and scum wells.**
    - vi. Install new mechanism, walkway, and scum collection system either through entry way or through top hexagonal opening. Assemble parts beneath thickener dome structure as required.
    - vii. Coordinate with manufacturer for thickener, walkway, and scum collection system installation.
    - viii. Perform remaining improvements to thickener as shown on the Drawings and specified herein, including reconstruction of effluent box, construction of scum wet well, and stair and door replacement.
    - ix. Test thickeners and make ready for operation. GT 2A and GT 2B will be put into operation before GT 1A and 1B are taken offline.
  - c. Scum Pump Stations and Piping
    - i. Install scum pumps, discharge piping, valves, and controls associated with GT 2A and GT 2B.
    - ii. Install scum pipe lines to Sludge Transfer Building either by sliplining existing scum lines or by replacing existing scum lines in place.
    - iii. Test and make ready for operation scum pumps and piping.
  - d. Thickened Sludge Pumps
    - i. Work associated with Thickened Sludge Pump No. 4, 5 and 6 will be performed in conjunction with the replacement of GT 2A and GT 2B. **Refer to Drawing M-5 for more detail on sequence of construction. Contractor shall provide work plan to Engineer two weeks prior to commencing work.**
    - ii. **Use existing valves to isolate Pump No. 4, 5 and 6.**
    - iii. **Contractor shall be responsible for flushing and disposing of residual contents in piping.**
    - iv. Demolish piping for Thickened Sludge Pump No. 4, 5, and 6
    - v. Install new suction and discharge piping, piping accessories, valves, and controls for Thickened Sludge Pump 4, 5, and 6.
    - vi. **Core drill new pipe penetration in sludge holding tank wall.**
    - vii. **Prepare to install new hanging pipe supports and new 8" sludge discharge pipes.**
    - viii. **Connect existing 8" sludge discharge to new wall penetration in sludge holding tank using temporary bypass piping. Temporary bypass shall occur for no more than 10 working days.**
    - ix. **Within 10 days, complete piping associated with Thickened Sludge Pumps No. 4, 5 and 6 for permanent operation.**
3. South Gravity Thickener Systems (Phase 2)
- a. The South Gravity Thickener System consists of GT 1A, GT 1B, Thickened Sludge Pumps No. 1, 2 and 3, and associated components.
  - b. GT 1A and GT 1B

- i. Coordinate with OWNER to take offline and drain GT 1B and 1A. **OWNER will drain contents of each thickener.**
    - ii. Remove top hexagon of thickener domes by removing six center struts, as shown on the Drawings. Do not, under any circumstance remove the center hexagonal ring.
    - iii. **Remove existing concrete stairs and effluent boxes.**
    - iv. Remove existing mechanism, walkway, and scum collection system either through existing entry way or through hexagonal opening.
    - v. **Install new stairs, effluent boxes and scum wells.**
    - vi. Install new mechanism, walkway, and scum collection system either through entry way or through top hexagonal opening. Assemble parts beneath thickener dome structure as required.
    - vii. Coordinate with manufacturer for thickener, walkway, and scum collection system installation.
    - viii. Perform remaining improvements to thickener as shown on the Drawings and specified herein, including reconstruction of effluent box, construction of scum wet well, and stair replacement.
    - ix. Test thickeners and make ready for operation.
  - c. Scum Pump Stations and Piping
    - i. Install scum pumps, discharge piping, valves, and controls associated with GT 1A and GT 1B.
    - ii. Install scum pipe lines to Sludge Transfer Building either by sliplining existing scum lines or by replacing existing scum lines in place.
    - iii. Test and make ready for operation scum pumps and piping.
  - d. Thickened Sludge Pumps
    - i. Work associated with Thickened Sludge Pump No. 1, 2 and 3 will be performed in conjunction with the replacement of GT 2A and GT 2B.
    - ii. Demolish piping for Thickened Sludge Pump No. 1, 2, and 3
    - iii. Install new suction and discharge piping, piping accessories, valves, and controls for Thickened Sludge Pump 1, 2, and 3.
- 4. Odor Control Systems
  - a. **Odor Control System No. 1 and No.2 shall both be made operational in conjunction with the North Thickeners to provide ventilation once thickeners are in operation. Refer to Section 11258.**
  - b. Odor Control System No. 1
    - i. Remove existing odor control system
    - ii. Install Odor Control System No. 1 as shown on the Drawings and as specified herein, **except for the connection to Thickener No. 1A.**
    - iii. **Perform start-up and place in operation Odor Control System No. 1**
    - iv. **After installation of GT 1A, connect GT 1A and put odor control system in operation to develop microbial populations.**
    - v. **Conduct performance testing on system for final acceptance**
  - c. Odor Control System No. 2
    - i. Remove existing odor control system
    - ii. Install Odor Control System No. 2 as shown on the Drawings and as specified herein, **except for the connection to Thickener No. 1B.**
    - iii. **Perform start-up and place in operation Odor Control System No. 2**
    - iv. **After installation of GT 1B, connect GT 1B and put odor control system in operation to develop microbial populations.**
    - v. **Conduct performance testing on system for final acceptance**
- 5. Yard Piping
  - a. Yard piping associated with GT 2A and GT 2B shall be completed in **order to facilitate the sequence of construction specified herein.**
  - b. Yard piping associated with GT 1A and GT 1B shall be completed in **order to facilitate the sequence of construction specified herein.**

6. Electrical
  - a. All Electrical and I&C improvements shall be completed in **order to facilitate the sequence of construction specified herein.**
  - b. Perform Electrical Room improvements while still maintaining existing controls for existing and operating equipment.
7. Sludge Holding Tank
  - a. Replace existing hatch and add new hatches to top of holding tank.
8. Blending Tank No. 1 and No. 2
  - a. Replace existing stairs and guardrail

#### **1.24 Contractor's Responsibilities**

- A. Execute all Work, including but not limited to installation of erosion and sedimentation controls, site preparation, gravity thickener rehabilitation and associated solids thickening improvements, as shown on the Drawings and specified herein. The Work of this Contract is specified in the City of Austin Standard Specifications, Special Provisions and Special Specifications listed in the Table of Contents.
- B. Secure all construction-related permits, other than those provided by OWNER as described in paragraph 6.6 of Section 00810, Supplemental General Conditions, and pay for the same.
- C. Arrange for the necessary temporary water and electric service and pay for these services and all water and electricity consumed during the construction Work.
- D. Provide adequate temporary sanitary facilities.

#### **1.25 Operation of Existing Facilities**

- A. Existing water and wastewater facilities shall be kept in continuous operation throughout the construction period. No interruption will be permitted which adversely affects the degree of service provided. Provided permission is obtained from OWNER in advance, portions of the existing facilities may be taken out of service for short periods corresponding with periods of minimum service demands.
- B. CONTRACTOR shall provide temporary facilities and make temporary modifications as necessary to keep the existing facilities in operation during the construction period.

#### **1.26 Connections to Existing Facilities**

- A. Unless otherwise specified or indicated, CONTRACTOR shall make all necessary connections to existing facilities including structures, drain lines, and utilities. In each case, CONTRACTOR shall receive permission from OWNER or the owning utility prior to undertaking connections. CONTRACTOR shall protect facilities against deleterious substances and damage.
- B. Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials and labor shall be on hand at the time of undertaking the connection. Work shall proceed continuously (around the clock) if necessary to complete connections in the minimum time. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

#### **1.27 Unfavorable Construction Conditions**

- A. No portion of the Work shall be constructed under conditions which adversely affect the quality or efficiency thereof, unless special means or precautions are taken by CONTRACTOR to perform the Work in a proper and satisfactory manner.

**End**

SECTION 11258  
ODOR CONTROL BIOSCRUBBER SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required for the installation, start-up, warranty, and testing of two complete, bioscrubber systems as shown on the Drawings and specified herein. Each system shall include: two fiberglass reinforced plastic (FRP) bioscrubber vessels, (each equipped with vessel roof access, guardrails, ladders, and personal fall prevention system as shown on the Drawings and specified herein), exhaust stacks, media, wiring and electrical components, a local control panel, automatic irrigation systems, supplemental nutrient supply equipment, and one 55 FRP gallon nutrient tank. If the manufacturer utilizes recirculation systems, the manufacturer shall provide all components for the recirculation systems, including the recirculation pumps, as necessary for fully functional systems. Additionally, for each system, the manufacturer shall be responsible for the fan, ductwork between the fan and bioscrubber vessels (which includes isolation dampers, flexible flange connectors, and other fittings), and the pipe supports for the non-potable water/recirculation pipeline(s) and for a 3/4-inch PVC pipeline, with a minimum 1/4-in PE exhaust sample tubing line inside it, along the bioscrubber vessels. The location of the 3/4-inch PVC pipeline shall be coordinated with the Engineer. This Section gives a general description of system requirements, but does not cover all details, which will vary in accordance with the manufacturer and requirements of the application. It does, however, cover the furnishing, delivery, installation supervision, start-up, warranty, and field testing of all materials, equipment and appurtenances for the complete bioscrubber systems as specified, whether specifically mentioned in this Section or not.
- B. The bioscrubber system manufacturer shall have complete system responsibility for the bioscrubber systems. The manufacturer shall furnish and be responsible for proper functioning of all internal piping and appurtenances. The Contractor shall provide and install water, drain and interconnect piping, water and drain piping insulation, ductwork and power and control wiring to the bioscrubber system. The system manufacturer shall supply the Engineer and Contractor with all necessary wiring diagrams and shall furnish and be responsible for all integral electrical components (transformers, control panels and circuits, interlocks, instrumentation, etc.) required for proper functioning of the systems.
- C. The term "manufacturer" as used in this specification will refer to the manufacturer of the bioscrubber system or the manufacturer's authorized representative.
- D. **The installation of the gravity thickeners and associated components will occur in two phases. Odor Control System No. 1 and 2 shall both be made operational during Phase 1 in conjunction with the North thickeners (2A and 2B) to provide ventilation once thickeners are in operation. Until Phase 2 is complete, each Odor Control System will ventilate one of the North thickeners. Refer to Section 01010 – Summary of Work. Contractor shall coordinate lead times and schedule with manufacturer.**

1.02 RELATED WORK

- A. **Section 01010 – Summary of Work**

- B. Section 01170 – Special Provisions.
- C. Motors are specified in Section 01171.
- D. **Section 01740 – Warranties and Bonds**
- E. Metal Fabrications are specified in Section 05500.
- F. Control Panels are specified in Section 13390.
- G. Testing, Adjusting, and Balancing is specified in Section 15950.
- H. Fiberglass Ductwork and Accessories are specified in Section 15891.
- I. Instrumentation and controls are included in Division 13 and Division 17.
- J. Piping, duct valves, pipe hangers, and appurtenances are included in Division 15.
- K. Electrical is included in Division 16.

#### 1.03 SUBMITTALS

- A. Submit to the Engineer, in accordance with this Section 01300, all materials and equipment required to establish compliance with this Section. Partial submittals will not be accepted. Submittals shall include the following at a minimum:
  - 1. Descriptive literature, bulletins, and/or catalogs of the equipment.
  - 2. Complete, detailed instructions on the installation of the bioscrubber systems.
  - 3. A statement from the manufacturer that the fabrication is in accordance with this Section.
  - 4. Design structural calculations for vessel construction of each system and for the hold down lug, stamped and sealed by a professional structural engineer registered in Texas.
    - a. Provide detailed drawing showing anchor requirements and locations where anchor bolts must be in place when the support pad is poured.
    - b. Provide signed and sealed (State of Texas PE) calculations that the bioscrubber systems, including vessels, roof access areas, ladders, and safety rails can withstand the wind load and live load design criteria specified in Paragraph 1.07, as well as meet all applicable OSHA requirements.
    - c. Current design does not include wiring restraints. If wiring restraints are required based on the calculations, modifications to the bioscrubber system design, including pad size to allow appropriate access space, shall be performed at no additional cost to the Owner.
  - 5. Certified shop and erection drawings showing all important details of construction and dimensions.
    - a. Dimensions shall include anchor bolt layout and locations, and diameters of air duct, water supply and drainage piping at the limit of work.

6. Drawings and descriptive information on the roof access areas, platforms, personal fall prevention system (including safety rails), and ladders, including the material of construction.
7. Wiring diagram and electrical requirements, including logic diagrams and wiring schematics.
8. Materials of construction, including resin and material used, as well as a statement from the manufacturer that the materials and resin used are suitable for this installation.
9. Submit fan data sheets for each system with a description of the proposed fan, fan size, type, arrangement, materials of construction, weight, motor horsepower, motor type, power supply, frame size, sheave sizes, belts size, number and length. Each submittal shall include pertinent equipment dimensional data, and a performance curve showing the fan operating point and range. Minimum curve size shall be 8-in by 6-in. Faxed copies of curves are not acceptable. A list of accessories to be furnished shall be included. Copies of operating and maintenance manuals shall be submitted. Refer to Section 01171 for motor requirements.
10. Descriptive information of media including but not limited to pressure drop through media, liquid hold-up data, and media physical characteristics.
  - a. Complete data on the head loss for the air flow through the media at design air flow rate.
  - b. Details of filter media supports.
11. Drawings and descriptive information of nozzles and liquid distribution system to include spray pattern, pressure drop, liquid flow rate, support system details and materials of construction.
12. Acclimation procedure and any required temporary piping during the acclimation period.
13. The total weight of the equipment of each system including the weight distribution at the points of supports.
14. A complete bill of materials for all equipment.
15. A list of the manufacturer's recommended spare parts.
16. A list of special tools.
17. Testing procedures and test equipment.
18. Complete description of surface preparation and shop painting of painted surfaces.
19. Complete Control Panel layout, including size, wiring, schematics internal and external equipment and device arrangement, nameplates and parts catalog cuts as specified in Section 13390.
20. If permanent recirculation systems are provided, submittals for the recirculation pumps shall include as a minimum the following:

- a. A certified statement from the bioscrubber manufacturer that the recirculation pump is suitable for the bioscrubber system and pumping low pH streams.
- b. Manufacturer's certified rating data.
- c. Certified shop drawings showing all important details of construction, dimensions and anchor bolt locations.
- d. Descriptive literature, bulletins and/or catalogs of the equipment.
- e. A list of the manufacturer's recommended spare parts. Include gaskets, packing, etc., on the list.
- f. Data regarding pump and motor characteristics and performance:
  - 1) Prior to fabrication and testing, provide guaranteed performance curves based on shop tests of mechanically duplicate pumping units, showing they meet specified requirements for head, capacity, horsepower and efficiency.
  - 2) For units of same size and type, provide curves for a single unit only.
  - 3) Submit curves for guaranteed performance and certified tests as specified on 8-1/2 in by 11-in sheets, one curve per sheet.
  - 4) Provide motor information as specified in Section 01171.

B. Submit shop inspection and test certificates.

1. The Engineer retains the right to have a 1-inch diameter core sample extracted from each vessel after delivery for analysis of the resin. The location of the test sample(s) shall be submitted by the manufacturer for the Engineer's review and approval. The hole(s) shall be repaired by the manufacturer, and the analysis shall be paid for by the manufacturer. The Engineer may reject any bioscrubber vessel if it does not meet the standard of the representative samples. Costs for extraction, repair and laboratory analysis shall be by the Contractor.
2. Certificates from the manufacturer shall be submitted stating that the installation of the equipment is satisfactory, the systems have been satisfactorily tested, is ready for operation and the operating personnel have been suitably instructed in the operation and care of the systems.

C. Operation and Maintenance Data.

1. Operations and maintenance instructions shall be furnished to the Engineer as specified herein and in accordance with Section 01730. These instructions shall consist of clean, legible, reproducible manufacturers' manuals prepared by the manufacturer exclusively for the equipment furnished for this installation. Operations and maintenance instructions shall be written in a clear, concise and easily understandable manner to serve in training personnel at this facility. The instruction manual shall include schematic and detailed drawings and diagrams as necessary to accompany the written instructions. A complete set of equipment shop drawings. All component parts shall be clearly identified by name and part numbers cross-referenced. A complete listing of nameplate data for each piece of equipment shall be attached to these instructions. In addition, the instructions shall include troubleshooting data and full preventive maintenance schedules.

1.04 SERVICES OF A MANUFACTURER'S REPRESENTATIVE

- A. A factory representative who has a complete knowledge of the proper operation and maintenance shall be provided as specified herein. Qualifications of the representative shall be submitted for approval. Workday requirements listed are exclusive of travel time and do not

relieve the Contractor of obligation to provide sufficient service to place equipment in satisfactory operation. The factory representative shall provide a minimum of two (2) training sessions (typically early morning and late evening) to accommodate plant staff. Owner and Engineer shall be notified in writing a minimum of fourteen (14) calendar days prior to the scheduled training.

Services Provided by Factory Representative	Minimum <sup>(a)</sup> No. of Trips	Minimum Time On Site Per Trip (hours)
1. Supervise installation	1	8
<b><u>2. Inspect and approve installation</u></b> <b><u>(b)(c)</u></b>	<b><u>2</u></b>	4
<b><u>3. Supervise initial adjustment</u></b> <sup>(c)(d)</sup>	<b><u>2</u></b>	4
<b><u>4. Instruct Owner and Engineer in proper start-up and O&amp;M</u></b> <sup>(d)(e)(f)</sup>	<b><u>2</u></b>	4
<b><u>5. Conduct acceptance testing</u></b> <sup>(g)</sup>	<b><u>1</u></b>	8
<p>(a) The manufacturer's factory representative shall be present at frequent enough intervals to ensure proper installation, testing, and initial operation of the equipment.</p> <p>(b) The manufacturer's factory representative shall provide to the Engineer a written certification that the system has been installed in accordance with the manufacturer's recommendations.</p> <p><b><u>(c) These services shall be provided at two separate times; once in conjunction with the start-up of the North thickeners and once in conjunction with the start-up of the fully-installed thickener system.</u></b></p> <p>(d) May be done on the same trip upon completion of prior item if acceptable to the Engineer.</p> <p><b><u>(e) The manufacturer's factory representative shall provide start-up services and instruction to Contractor and Owner prior to start-up after Phase 1, in addition to services for Owner after thickener system is fully installed.</u></b></p> <p>(f) Instruction may be given upon completion <b><u>of Item 3, provided that the O&amp;M manuals</u></b> have been submitted to and accepted by the Engineer.</p> <p><b><u>(g) Performance Testing shall occur after all four thickeners are online and operating with new mechanisms.</u></b></p>		

1.05 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM).

1. ASTM D638 – Standard Test Method for Tensile Properties of Plastics.
2. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
3. ASTM D883 - Definition of terms relating to plastics.

4. ASTM D1505 – Standard Test Method for Density of Plastics by the Density Gradient Technique.
  5. ASTM D1525 - Standard Test Method for Vicat Softening Temperature of Plastics.
  6. ASTM D1693 – Standard Test Method for Environmental Stress – Cracking of Ethylene Plastics.
  7. ASTM D1998 – Standard Specification for Polyethylene Upright Storage Tanks.
  8. ASTM D2563 - Recommended Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts.
  9. ASTM D2583 - Test for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
  10. ASTM D3299 - “Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion Resistant Tanks.
  11. ASTM D3982 – Standard Specification for Contact Molded “Fiberglass” (Glass Fiber Reinforced Thermosetting Resin) Ducts.
  12. ASTM D4097-82 - Standard Specifications for Contact Molded Glass Fiber Reinforced Thermoset Resin Corrosion Resistant Tanks.
- B. European Standards (EN).
1. EN 13725 – Air Quality: Determination of Odour Concentration by Dynamic Olfactometry.
- C. American National Standard Institute (ANSI).
- D. Instrument Society of America (ISA).
- E. Anti-Friction Bearing Manufacturers Association (AFBMA).
- F. SPI Proposed Product Standard - Corrosion Resistant Structures - Reinforced Plastics/Composites Division Section, September 1970.
- G. National Electrical Manufacturers Association (NEMA).
- H. Underwriters Laboratories (UL).
- I. National Fire Protection Association (NFPA).
- J. National Electrical Code (NEC).
- K. International Building Code (IBC).
- L. Occupational Safety and Health Administration (OSHA).

- M. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.06 QUALITY ASSURANCE

- A. To assure compatibility of all system components and complete system responsibility, ensure that the bioscrubber systems and all accessories and controls specified herein are furnished by a single manufacturer. The manufacturer shall be fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The equipment shall be manufactured and installed in accordance with the best practices and methods, and shall operate satisfactorily. The bioscrubber systems shall be EcoFilter Reactor by BioAir Solutions, LLC; Biotrickling Filter by Biorem Technologies Inc.; Biotrickling Filter by ECS.
- B. The odor control systems have been designed around the EcoFilter system by BioAir. The selection of an alternate manufacturer's equipment may require additional equipment and a revised layout. The Contractor shall coordinate with potential manufacturers prior to bidding and incorporate costs into the bid price.

1.07 SYSTEM DESCRIPTION

- A. Bioscrubber systems shall continuously and automatically treat and effectively remove hydrogen sulfide and eliminate odors from foul air exhausted from the solids thickening facilities. Exhaust rate capacities shall be 13,000 scfm for Odor Control System (OCS) No. 1 and 9,000 for OCS No. 2. Hydrogen sulfide and other odorants shall be removed by microbial action within synthetic media furnished in the bioscrubbers.
- B. For purposes of testing bioscrubber odor control system performance, inlet concentrations of odorous pollutants will be as summarized in Table 1.

Table 1  
Inlet Pollutant Concentrations

Odor Control System	Pollutant	Inlet Concentration (ppmv)
1	Hydrogen sulfide - average concentration	40
	Hydrogen sulfide - peak concentration	220
2	Hydrogen sulfide - average concentration	20
	Hydrogen sulfide - peak concentration	150

- 1. The pollutant removal performance of bioscrubber systems shall be as indicated in Table 2.

Table 2  
Required Odor Removal Performance

Criterion	A Required Performance After Bioscrubber
1	Average hydrogen sulfide removal efficiency shall be equal to or greater than 99.0 % under both average and peak conditions or 0.5 ppmv, whichever is less stringent.
2	Outlet odor concentration shall not exceed 1,000 dilutions-to-threshold (D/T) under both peak and average hydrogen sulfide loading conditions OR odor concentration removal shall be 90%, whichever is less stringent. Odor concentration shall be measured and analyzed in accordance with EN 13725-2003.

- C. Performance testing procedures and terms of the performance guarantee are described in Subsection 3.04 of this Specification.
- D. Each bioscrubber system will consist of two vessels with durable inorganic media, two stacks, one fan, one water distribution system, one nutrient addition system (if necessary) and controls.
- E. The bioscrubber system, including vessels, nutrient tanks, roof access areas, ladders, and fall prevention system (including safety rails) shall be able to withstand 90 mph winds and shall be in accordance with the wind loading requirements and structural design criteria requirements described in the 2012 International Building Code. The bioscrubber vessel shall be able to withstand a minimum of 300 lb. live load for roof access. The roof access area shall include a ladder, personal fall prevention system, guardrails, and either a platform or non-slip surface; all roof access components shall comply with all applicable OSHA requirements.
- F. The manufacturer shall provide two 55 gallon FRP nutrient tanks (one for each system) suitable for outdoor condition outdoor conditions and filled with nutrient.

1.08 WARRANTY

- A. The manufacturer shall warrant that bioscrubber systems be supplied in accordance with these specifications and shall perform as described herein. The manufacturer shall warrant that the systems will be free from defects in materials and workmanship for a period of one (1) year after **Phase 2** startup and final acceptance of the equipment at the Owner's facility. At the manufacturer's discretion, the manufacturer shall repair or provide replacement for any defective components under this warranty provided that any such defect was not the result of misuse of the component by the Owner or the Owner's Agent. **Refer to Section 01740 for warranty requirements.**
- B. The manufacturer shall warrant the suitability of the biological reactor media and vessel for a period of ten (10) years from the date of final start-up and final acceptance, provided that the Systems are operated in accordance with the manufacturer's Operation and Maintenance Manual provided hereunder. In the event of a failure of the media within the ten (10) year warranty period, the manufacturer shall replace the media at no expense to the Owner or Contractor. In the event of the vessel failure the vessel shall be repaired or replaced with mutual agreement between the owner and manufacturer.
- C. **Final acceptance shall occur after Performance Testing, which shall occur after all four thickeners are online and operating with new mechanisms; however, odor control systems**

**shall begin operating in conjunction with the start-up of the North thickeners (2A and 2B). Refer to Section 01010 Summary of Work. Contractor shall coordinate Phase 1 and 2 construction schedules with bioscrubber manufacturer.**

1.09 ENVIRONMENTAL CONDITIONS

- A. Ambient Environment. The ambient temperatures are expected to range between 15 degrees F and 110 degrees F with a relative humidity that will vary from 10 to 100%. The site elevation is approximately 430 feet above mean sea level.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in coordination with installation of the pads, wiring, and piping by others. If equipment is delivered before the pad is ready, the manufacturer shall be responsible for both off-loading and placement of the equipment on the pad.
- B. Exercise care during loading, transporting, unloading, and handling to prevent damage of any nature to interior and exterior surfaces of pipe and fittings.
- C. Do not drop pipe and fittings.
- D. Store materials on the project site in enclosures or under protective coverings in accordance with manufacturer's recommendations and as required by the Engineer.
- E. Assure that materials are kept clean, and all electrical components shall be stored inside.
- F. All equipment and materials shall be properly protected and maintained such that no damage will occur from the time of shipment until the completion of the installation.
- G. The Engineer and Contractor shall inspect all equipment upon delivery. Contractor shall notify manufacturer within 24 hours if damage occurred as a result of shipping.
- H. Vessels shall be shipped in either the vertical or horizontal position. Multiple shipments are acceptable. If shipped in the horizontal position, manufacturer is responsible for any damage to the shape of the units and must orient the vessels vertically upon offloading the vessels.
- I. Flange faces shall be protected from damage by covering with suitable plywood or hardboard, securely fastened.
- J. Pipe and tubing, fittings and miscellaneous small parts shall be crated or boxed.
- K. The equipment shall be inspected by contractor before unloading at the installation site.

1.11 SUBSTITUTION

- A. Any substitutions or deviations in equipment or arrangement, from that specified herein, shall be the responsibility of the Contractor. Any deviation must be accompanied by detailed structural, mechanical, and electrical drawings and additional supporting data for review by the Owner or the Owner's Engineer, and must be stamped and certified by a registered Professional Engineer (PE) in Texas.

- B. All costs associated with the review of substitutions or deviations, and costs to the Engineer, Contractor or Owner associated with project drawing changes as a result of approval of such, shall be borne by the Contractor. There shall be no additional costs to the Owner due to substitutions or deviations.

#### 1.12 TOOLS AND SPARE PARTS

- A. At a minimum, manufacturer shall provide an adequate supply of consumables including nutrient and calibration materials necessary to operate and maintain the equipment specified herein for one-year period after Owner's acceptance.
- B. Manufacturer shall provide the following spare parts:
  - 1. One (1) mesh strainer for water panel.
  - 2. One (1) set of fan bearings.
  - 3. One (1) set of V-belts for fans.
  - 4. If a permanent recirculation system is provided, one (1) spare recirculation pump.
  - 5. Refer to Sections 01171 and 13390 for additional requirements.
  - 6. One nutrient pump repair kit per system.

### PART 2 PRODUCTS

#### 2.01 GENERAL

- A. General Description.
  - 1. As shown on the Drawings, each bioscrubber system shall consist of two self-contained totally enclosed vessels (four vessels total), constructed of fiberglass-reinforced resin. The vessels shall contain a durable inorganic media that serves as a support structure for a microbial population without being consumed as a source of nutrients or alkalinity. Non-potable water shall be distributed uniformly over the surface of the media to supply moisture and nutrients to the microbial population and remove process waste. The manufacturer may recirculate water and/or supply a nutrient to the irrigation water dosing system, these systems shall be completely integrated into the irrigation and electrical system. Portable totes or drums shall not be allowed.
  - 2. Each bioscrubber system shall include a fan and control panel to control flow of water and nutrients. As shown on the Drawings and as specified herein, the bioscrubber vessel unit shall include a stack, gauges to monitor pressure drop, manway, roof access area, guardrails, ladder with fall prevention system (including safety rail), manway, sampling port for drainage water, and freeze protection provisions. Freeze protection provisions shall include, yet not limited to, the installation of heater(s) and insulation for the water panels.
  - 3. All equipment shall be new and unused and suitable for the conditions of service to which they will be subjected. Workmanship shall be of the highest quality and shall be carried out by competent and experience workmen.

2.02 DESIGN REQUIREMENTS

- A. All components of the System shall be compatible with the conditions and constituents to which they will be subjected to during normal operation. Compounds with which the materials of construction must be compatible with include, but are not limited to:
1. Hydrogen Sulfide.
  2. Sulfuric Acid.
  3. Ammonia.
  4. Dimethyl Sulfide.
  5. Methyl Mercaptan and other Mercaptans.
  6. Other Reduced Sulfur Compounds (RSC's).
- B. The Systems shall be furnished to meet the following criteria:

Parameter	OCS No. 1 Value	OCS No. 2 Value	Systems
Capacity	13,000	9,000	scfm
Number of trains	1	1	train
Capacity per train	13,000	9,000	scfm
Number of vessels in parallel per train	2	2	vessels
H2S loading (average/peak)	40/220	20/150	ppmv
Bioscrubber diameter (max)	12	12	ft.
Bioscrubber overall height, including stack (max)	30	24	ft.
Maximum allowable pressure drop for the bioscrubber system. Includes bioscrubber media, fan (suction and discharge sides), isolation damper, and associated ductwork connections. Ductwork headloss upstream of the fan inlet is not included. Refer to Paragraph 2.02 for fan sizing, which describes ductwork headloss upstream of the fan inlet.	5	5	inch water column
Pressure drop across bioscrubber media (max)	2	2	inch water column
System water flow rate (instantaneous) (max)	50	50	gallons/minute
System water pressure (max)	65	65	psi
System water consumption (approx., max)	20,000	20,000	gallons/day
System Nutrient Consumption (approx.) (average)	0*	0*	gallons/month
Empty bed residence time (EBRT) (min)	15	15	seconds

*\* Note: When the Total N is 3 – 20 mg/L and Total P is 1 – 5 mg/L, the system will not require any supplemental nutrients.*

C. Fiberglass Reinforced Plastic Vessel.

1. All parts of the vessels shall be proportioned to have liberal strength and stiffness and to be especially adapted for the work to be done. Ample room and facilities shall be provided for access.
2. Each bioscrubber vessel shall be a free-standing tower including media and media bed irrigation system. Each reactor vessel shall be constructed of corrosion resistant FRP. The vessel shall be designed to support the required number of media layers and treatment stages. All materials of construction shall be corrosion resistant. The interior of the vessel shall be treated with vinyl ester corrosion barrier for maximum corrosion resistance. The exterior of the vessel shall incorporate a surface veil for superior durability.
3. Equipment built to these specifications shall meet the requirements of ASTM D3299 for filament wound tanks, ASTM D4097 for contact molded tanks and ASTM 3982 for contact molded duct.
4. Vessels built to these specifications shall have the following information printed on nameplates of appropriate size for the equipment involved.
  - a. Name of Manufacturer
  - b. Capacity in Cubic Feet.
  - c. Chemical Environment.
  - d. Manufacturer Serial Number.
  - e. Year Built.
  - f. Name and Equipment Number.
  - g. Purchase Order Number.
  - h. Design Pressure and Temperature.
  - i. Resin.
5. Resins.
  - a. The resin used shall be resistant to corrosion by wet hydrogen sulfide and other corrosive gases present in wastewater treatment plants. A single, fire retardant resin shall be used throughout. Flame spread ratio shall not exceed 25 when tested in a Steiner Test Tunnel in accordance with ASTM E84.
  - b. Antimony or NYACOL additives shall not be used to achieve flame spread index.
  - c. Acceptable products:
    - 1) Derakane 510-B-400.
    - 2) Cor VE 8401.
    - 3) AOC Vipel K022.
    - 4) Reichold's Dion Impact 9303-54.
    - 5) Or Engineer approved equal.
  - d. Each bioscrubber vessel shall be constructed of factory fabricated fiberglass reinforced fire retardant vinyl ester resin as follows:
    - 1) The shell shall consist of an interior layer, a corrosion barrier, a structural layer and an exterior layer.
    - 2) No thixotropic agents may be used in the corrosion barrier.
    - 3) Reinforcing material shall be commercial grade glass fiber containing a coupling agent to produce a suitable bond with the resin used.

- 4) Interior layer shall be a minimum of 20 mils thick single layer Nexus or C glass surface veiling in a resin rich surface. Resin content shall be approximately 90 percent.
  - 5) Corrosion barrier shall be a minimum of 100 mils thick of Type E glass strand mat, applied in two layers of equal thickeners. Resin content shall be approximately 70 percent.
  - 6) Structural layer shall be alternating layers of Type E glass, reinforced by interweaving of chopped strand mat and woven roving continuous helically filament winding glass. Resin content shall be approximately 60 percent.
  - 7) Exterior layer shall be a parafinized gel coat with UV inhibitors.
- e. All surfaces shall be finished so as to obtain complete cure of the resin without air inhibition. The finished laminate shall be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, air bubbles, pinholes and pimples. Each vessel shall be post cured per the resin manufacturer's recommendations and shall conform to the resin manufacturer's minimum standard for Barcol hardness.
  - f. The inner surface shall and interior layer shall meet the visual acceptance criteria in Table 5 ASTM C 582 process side. Exterior shall meet the referenced criteria for the non-process side.
  - g. The structural layer or body of the laminate shall be of chemically resistant construction suitable for the service, providing the additional strength necessary to meet the tensile and flexural requirements. Where separate layers such as matt, cloth, or woven roving are used, all layers shall be lapped a minimum of 1 in. Laps shall be staggered as much as possible. If woven roving or cloth is used, the layer of chopped strand glass shall be placed as alternate layers. All filament wound structural layers shall be per ASTM D 2996. The exterior surface shall be relatively smooth with no exposed fibers or sharp projections. Handwork is acceptable, but enough resin shall be present to prevent fiber show.
  - h. Any grinding, repair, or sanding of interior surfaces shall be covered with a laminate duplicating the inner corrosion liner and parafinized top coat. All exposed edges shall be sealed with the same resin as used on each vessels and shall be fully post cured.
  - i. There shall be no longitudinal joints in the axial direction of the cylindrical shell. The entire shell thickness shall be built up prior to removal of the shell from the mandrel.
  - j. The minimum wall thickness shall be per structural calculations but no less than 3/8 in for all vessels. Each vessel shall have external circumferential reinforcing ribs and bottom knuckle reinforcement as dictated by the design and the referenced ASTM standards. The flat bottom of both rectangular and cylindrical vessels shall be constructed integral to the straight sides off of a singular mold with no seams. Laminating flat bottom to vertical sides will not be accepted. Knuckle shall be seamless having a minimum radius of 1 ½-inch.

#### D. Equipment & Tank Connections.

1. Lifting lugs (minimum of three) shall be provided for use in transporting and placing the vessel.
2. Hold downs (minimum of four) each consisting of a fiberglass reinforced polyester gusseted hold down lug laminated to the vessel sidewall and a Type 316L stainless steel anchor clip. The anchor clip shall be used for anchor bolting to the concrete foundation and clamping to the hold down lug. The hold down systems shall be of sufficient strength to hold the vessel and any exhaust duct the vessel supports against all loads.

3. Vessel manufacturer shall provide anchor requirements and locations to the Contractor where anchor bolts must be in place when the support pad is poured.
4. Anchor bolts shall be provided by the Contractor.
5. Vessel connection flanges shall be compatible with connecting piping and duct work and shall conform to the following:
  - a. Vessel nozzles shall be 150 psi rated flanged nozzles. Press molded or compression molded flanged nozzles will not be accepted.
  - b. All nozzles 6 in diameter and smaller shall be of the blade gusseted configuration meeting strength requirements of 1500 ft. lbs. of bending and 2000 ft. lbs. torque.
  - c. Nozzles overlays shall be as specified in ASTM D 3299 or ASTM D 4097.
  - d. The area on the back of all flanges around each bolt hole shall be the diameter of a standard washer and shall be flat and parallel to the flange face. This area shall be spot faced, if necessary, to meet this requirement. Flanges shall be manufactured by the hand layup method and shall conform to ANSI 150 lb. standard dimensions for bolting.
  - e. Blind flanges and access doors shall be the same thickness and material as the flanges to which they are attached. Tolerance as flatness shall be the same as for flanges.
  - f. Manways on bioscrubber vessel and equipment shall be a minimum of 24" I.D.
  - g. All access doors and bolted attachments shall be provided with 1/8-in thick EPDM gaskets and 316 stainless steel nuts, bolts and washers.
  - h. Access doors shall be constructed of industrial grade, clear polycarbonate that will not undergo structural deterioration or clouding and shall be of a minimum thickness of 1/2-inch.
  - i. Supports shall be suitably attached to the outer vessel walls as necessary to support vessel piping and interconnecting FRP ductwork and shall meet loading criteria specified in Paragraph 1.07.
6. Threaded couplings shall not be allowed below the liquid level.

E. Ladders and Personal Fall Prevention System.

1. Provide a ladder and personal fall prevention system for each bioscrubber tank as shown on the Drawings and specified herein. The complete system shall meet all applicable OSHA requirements. The personal fall prevention system shall be designed, engineered, and manufactured, and shall include the following:
  - a. A rigid notched carrier rail.
  - b. A means of attaching the carriers easily to ladder.
  - c. A means of dismounting at the top of ladders.
  - d. Two-locking mechanisms which travel on the carrier.
  - e. Two-full body harnesses with double (split) shock absorbing lanyards to connect the workman to locking mechanism.
2. The complete personal system shall allow the worker to operate freely in a normal climbing position. The device is to be installed in accordance with the manufacturer's instructions in such a manner to enable the worker to be attached to the device at all times during the climb without having to remove his or her hands from the ladder to operate the system effectively. This shall also enable the worker to be attached safely to the system before rotating onto the ladder.

3. The ladder and carrier rail shall be made of aluminum. All ladder and fall prevention system components shall be durable, be corrosion resistant. Unless otherwise specified in this section ladders shall meet requirements specified in Section 05500.
4. Ladder and personal fall prevention system shall adhere to structural requirements outlined in Paragraph 1.07-E.
5. The locking sleeve and safety-locking mechanism shall consist of the following:
  - a. Sleeve: Cast manganese bronze tensile strength of 110,000 P.S.I.
  - b. Locking Pawl: Tensile strength of 110,000 P.S.I.
  - c. Sleeve Springs: Dual stainless steel springs.
  - d. Roller Bearings: Six steel roller bearings.
  - e. Snaps and Links: The snap shall be drop forged steel with a proof test of 5,000 pounds.
6. The full body harness with integrated belt shall consist of the following:
  - a. Harness shall be designed to perform optimally with all other components of fall prevention system.
  - b. Harness shall meet ANSI A10.14 1991 and CSA Z259.10.
  - c. Harness shall be composed of premium 1-3/4" Nylon webbing.
  - d. Strength of webbing shall be 6,500 lbs.
  - e. All load bearing components shall be rated to 5,000 lbs. and made of drop forged plated steel.
  - f. Sliding back "D" ring on full body harness shall be used for fall arrest.
  - g. Belt shall be manufactured of two layers of one and three quarter (1-3/4) inch webbing with a two (2) inch back support pad.
  - h. Front "D" ring on belt shall be used for climbing with fall prevention system.
  - i. Harness shall have double (split) bungee cord type shock absorbing lanyard. Lanyard shall be four foot-six inches (4'-6") long un-deployed, with two and one quarter inch (2'-1/4") throat large rebar locking snap hooks on each lanyard.
7. The personal fall prevention system shall be by: Miller, North Safety Products, or approved equal.
8. The bioscrubber manufacturer shall coordinate with the fall prevention system manufacturer and the Contractor for recommended installation of the ladder and fall prevention system.
9. A lockable, mountable, weatherproof storage box shall be provided to store safety harness and accessories. A caution sign shall be provided at the lowest point of access to the ladder. The sign shall read "CAUTION – Safety Equipment Required When Climbing Ladder". The sign shall be secured to the wall.
10. Contractor shall provide fall prevention training to plant staff personnel as part of the fall prevention system and devices for this project. This training shall be provided by a firm certified in fall prevention training. Contractor shall submit information on the training firm and training agenda for approval by the Owner prior to scheduling the training. The information shall be submitted after the pre-construction conference, and before substantial completion of the project. Training shall be as scheduled by the Owner. This training shall be subsidiary to other bid items in this section.

F. Fiberglass Reinforced Plastic Fan.

1. The fans shall be sized as follows:
  - a. OCS No. 1: 13,000 scfm, adjusted to 11,000 scfm for current **operation**.
  - b. OCS No. 2: 9,000 scfm.
2. The fans shall be single-width single-inlet as designed and manufactured by The New York Fan Company, Hartzell Fan Co., Verantis, or approved equal.
3. The fans shall be constructed such that all surfaces in contact with the corrosive gas stream are to be made of corrosion-resistant FRP.
4. All nuts, bolts and fasteners in contact with the gas stream shall type 316 stainless steel.
5. Fans shall be AMCA Arrangement 1, 8, 9, 9F or 10. AMCA Arrangement 4, which places the motor shaft in the corrosive air stream is unacceptable.
6. Fan ratings shall be based on tests made in accordance with AMCA Standard 210 and licensed to bear the AMCA Certified Ratings Seal for Air Performance. Fans not licensed to bear the AMCA Seal for performance shall be tested, at contractor's expense, in an AMCA Registered Laboratory.
7. Fan brake horsepower's shall be less than or equal to 20 HP for OCS No. 1 and 20 HP for OCS No. 2, each at 10 inches static pressure. This static pressure accounts for the pressure drop in the bioscrubber system including the scrubber, media, damper, fan plus an additional 5 inches for exhaust system ductwork and for specified flow rates at site elevation of approximately 430 feet above sea level. If the manufacturer's system has less headloss through their system, they may reduce the horsepower requirements as necessary for their system.
8. Fan motors shall be selected to be non-overloading for the entire fan curve range and for the temperature and humidity range in Paragraph 1.09-A.
9. Fans shall be assembled with OSHA compliant shaft and motor guards.
10. Fan inlet and outlet connections shall be flanged type.
11. Fans shall be constructed in accordance with ASTM D-4167 standard specification for fiber-reinforced plastic fans and blowers to ensure structural integrity.
12. All parts exposed to the gas stream shall be constructed of, or encapsulated in, an FRP laminate capable of resisting continuous airstream temperatures of up to 250 degree F. All resins shall be clear to allow detection of subsurface imperfections. Use of pigments, gel coats, inhibitors and additives which may disguise flaws in the laminate are prohibited.
13. Fan housing shall be constructed of a fire-retardant polyester or vinyl ester resin with an ASTM E84 Class I rating. Housing laminate construction shall conform to ASTM Standard C-582.

14. Wheel shall be of backwardly-inclined, non-overloading design for increased efficiency. Wheel shall be fabricated of a fire-retardant vinyl ester resin with an ASTM E84 Class I Rating.
15. Wheel hub shall be permanently bonded to the shaft and completely encapsulated in FRP to ensure corrosion-resistant integrity. Steel wheels coated with FRP, or wheels with taper-lock hubs are not acceptable.
16. Shafts shall be 316 stainless steel.
17. The fan motors shall be horizontal, TEFC, severe duty, squirrel caged induction type, 460 Volt, 3 Phase, 60 Hz with Class F insulation and a minimum 1.15 service factor, suitable for full voltage starting and continuous operation at 50 degrees C ambient temperature at the specified loads. Provide motor with heater as specified in Section 01171. The fan motor shall be suitable for operation in a Class 1 Division 2 environment.
18. Bearings shall have heavy-duty grease lubricated ball or roller bearings with a minimum ABMA L-10 life of 40,000 hours minimum for both fan and motor. Bearings shall have ample thrust provision to prevent end play during the normal life of the bearing.

G. Fan Schedule.

1. 13,000 scfm for OCS No. 1 (adjusted to 11,000 scfm for current **operation**) and 9,000 scfm for OCS No. 2.
2. Ambient temperature range of 15 to 110 deg. F.
3. Suction pressure at connection to bioscrubber system will be minus 5.0 inches w.c.
4. Size, speed, and horsepower shall be determined by the bioscrubber system manufacturer. The horsepower shall not exceed 20 HP.
5. Sound power level shall not exceed 90 DBA at 5 feet.
6. Flanged connections, flexible connections, FRP transition pieces, and FRP dampers: Refer to Section 15891 (Fiberglass Reinforced Plastic Ductwork and Accessories).

H. Control Panels.

1. General.
  - a. Each bioscrubber system shall have the control logic circuits mounted in a single Master Control Panel (MCP) enclosure provided by the manufacturer and located outdoors near the bioscrubber fan, and specified herein. The MCP enclosures shall be NEMA 4X 316 stainless steel, constructed by a UL certified control panel build facility and supported by the appropriate UL labeling.
  - b. The bioscrubber MCPs shall contain all controls, timers, relays, PLC, main circuit breaker, and motor starters for manual and automatic starting, stopping, and sequencing of the bioscrubber systems. The MCPs shall have all controls to provide the control sequences specified herein. The bioscrubber MCPs shall include switches, pushbuttons, and indicator lamps and specified herein. The bioscrubber MCP shall be provided with a single 3-phase 480 volt source of power and shall include all power

- transformers, if required. Systems requiring more than one electrical connection shall not be allowed.
- c. Controls shall be tested by the panel builder and by the bioscrubber manufacturer prior to shipment to owner.
  - d. All signal interface wiring between MCPs and the existing SCADA PLC shall be provided by the electrical contractor.
  - e. The bioscrubber control system shall be a Type A packaged control system type as specified in Section 13390.
2. Panel and Enclosure Construction.
- a. The MCPs shall meet the requirements of Section 13390.
  - b. MCPs shall include a main circuit breaker as specified in Section 13390.
  - c. A six-digit, non-resettable elapsed run-time meter shall be installed on the front of each MCP for each fan and pump drive motor. Elapsed run-time meters shall be ENM, or equal.
  - d. The MCPs shall house motor starters for drive motors. Starters shall be as specified in Section 13390.
  - e. Each MCP shall be provided with a surge protection unit on the load side of 120VAC /1Ø/60 Hz control power transformer. Control power transformer shall have both primary and secondary overcurrent protection and shall be sized by the bioscrubber supplier.
  - f. All necessary power conditioning and DC power supplies shall be furnished inside each MCP for proper operation of the equipment.
  - g. The MCPs shall include intrinsically safe barriers for termination of any signals to/from hazardous Class 1, Div. 1 and Class 1, Div. 2 areas. Provide 2-in separation or barriers between the conductors of intrinsically safe circuits and non-intrinsically safe circuits meeting the requirements of NEC 504.30.A.2.
  - h. PLC shall be required. PLC signals associated with the equipment to be controlled shall be wired directly to the PLC.
    - 1) PLC shall be a Type 2 Programmable Logic Controller as specified in 13390 and 17600.
    - 2) PLC discrete outputs shall drive a relay to provide a dry contact to interface with motor starters located in the MCP or in control panels furnished by others. Relay contacts shall be rated 10 amp at 120VAC. PLC input cards shall have optical isolation on individual channels.
    - 3) The manufacturer shall supply all necessary ventilation and cooling to accommodate a PLC in the ambient conditions.
  - i. The system supplier shall provide display and interface functionality at the LCP using knobs, buttons, switches, and indicator lamps. Digital touch screens or Operator Interface Units shall not be used as a primary form of control. Digital touch screens shall not be located on the exterior of the control panel.
  - j. Provide sun shield as specified in Section 13390.
  - k. Provide environmental controls as specified in section 13390.
  - l. Provide all other appurtenances required for a complete and fully operational control panel.
3. Each MCP shall include the following functions:
- a. Control of fan motor starter.
  - b. Control of water flow to the units with PLC and manual override, if required.
  - c. Control of nutrient flow.
  - d. If a recirculation pump is provided, control of the recirculation pump starter.

- e. Dry contacts for plant SCADA system for common alarm, fan run status for the odor control inlet fan. If a recirculation pump is provided, also provide a dry contact for pump run status.
  - f. Provide a totalizing meter to track the consumed irrigation water on the control panel. The totalizing meter shall be a resettable meter that displays the total water consumed.
  - g. Ventilation and/or cooling as required to protect the PLC.
4. Instrumentation Specifications shall include but not be limited to, the following:
- a. Flow rate shall be measured by a turbine flow meter, Signet Rotor-X Paddlewheel or approved equal.
  - b. Flow Switch shall be vane or disc actuated with Form C snap action, hermetically seal switch rated for 10A, 125/250 VAC. Switches for pipe sizes 3/4 to 1-1/2 shall be provided with a flow body. Switches great than 1-1/2 shall be installed directly into field piping. Flow body and all wetted parts shall be 316 stainless steel. Switch housing shall be NEMA 4X and manufactured by Magnetrol F50 and F10 or approved equal.
  - c. Differential Pressure Transmitters shall provide accuracy of 0.075% of span or better, NEMA 4X (IP66), and shall be Rosemount 3051CD or approved equal.
  - d. Pressure Switches shall be diaphragm actuated and provide repeatability or better than 1% of full scale. Set point shall be field adjustable with fixed dead band and automatic reset. Housing shall be NEMA 4X (IP65) with hermetically sealed switches, single pole double throw (SPDT) and rated for 10A at 230VAC. Switches shall be manufactured by Ashcroft or approved equal.
  - e. Pressure Gauges shall be bourdon tube actuated dial face and provide accuracy of 1% of span or better, Case shall be phenolic shock resistant or type 316 stainless steel. Gauge shall be manufactured by Ashcroft or approved equal.
  - f. Temperature Transmitters shall be three wire platinum RTD and provide accuracy of plus or minus 0.2 deg. C, NEMA 4X (IP66) and shall be Rosemount 3144P or approved equal.
  - g. High Level Float Switch shall be a hermetically seal reed switch rated for 120/240 VAC. Level Switch shall be Series F6 & F7 Horizontal Level Switch or approved equal.
  - h. All instruments shall be listed for use in Class I Division II environments.
5. The display on the control panel shall include the following items, at a minimum:
- a. Odor Control Fan failure
  - b. Odor Control Fan run status
  - c. High water level.
  - d. Irrigation water flow
  - e. Irrigation water and nutrient water totalization
  - f. If a recirculation pump is provided, pump run status and pump failure
  - g. Irrigation water
  - h. Alarms as shown on the Drawings

I. Synthetic Media.

- 1. The media shall be either structured media as supplied by BioAir or random media as supplied by Biorem, or ECS. Regardless of whether the media is structured or random, the material shall be synthetic, chemically resistant polyurethane, polyethylene, or polyvinyl chloride.

2. The media shall resist shrinking or swelling with varying moisture content.
3. Media layers shall be removable single media blocks or randomly dumped.
4. The treatment layers shall be designed not to short circuit or be subject to channeling under operating conditions.
5. The manufacturer is responsible for providing the proper media content to ensure system meets specified performance.
6. Organic media shall not be allowed.
7. Non-synthetic inorganic media shall not be allowed.
8. Manufacturer shall warranty the media for a minimum of 10 years. Warranty shall be a full replacement warranty and non-pro-rated.

J. Irrigation System.

1. Each reactor shall be configured with sufficient fluid spray nozzles to provide sufficient irrigation.
2. Each spray nozzle shall be inspected and tested by the manufacturer to ensure even dispersion of irrigation water, and certified to be operating properly prior to shipment.
3. When required, a nutrient addition system shall be provided to allow the Owner to supplement the nutrients in the non-potable irrigation water supply, or to use potable water for irrigation.

K. Water Panel.

1. The water panels shall be constructed of 316 stainless steel and shall be of a modified NEMA 4X design. NEMA 4, 12, and 3R ratings shall not be allowed. Materials of construction other than 316 stainless steel shall not be allowed.
2. The water panels shall contain all necessary piping, valves and instruments for proper operation of the system. Provide and install a schedule 80 inline, wye strainer for the non-potable water line. A single water panel shall be provided for each bioscrubber vessel.
3. Provide panel heater as specified in section 13390.

L. Nutrient Tank.

1. The nutrient tank shall be constructed of the same material as the vessel.
2. The tank shall have a low level switch.
3. The tank shall have a water connection with ball valve.
4. A 12" diameter flanged opening shall be provided on the top of the tank with 316 SS quick-connections, bolts are not allowed.

5. The tank shall have a 2" flanged drain fitting.
6. The tank shall be fastened to the concrete sufficient to withstand the specified wind loads.
7. The tank shall have a means to release vacuum while the tank is draining during operation.

M. Recirculation System.

1. Temporary: If a temporary recirculation system is necessary for start-up, the manufacturer shall provide a fully functional temporary recirculation system.
  - a. The temporary recirculation system shall be utilized as required for the full acclimation and start-up of the bioscrubber and shall remain in the property of the manufacturer at all times.
  - b. Contractor shall disconnect the temporary recirculation system once start up is complete and connect the system for normal operating mode per manufacturer's instruction.
2. Permanent: If a permanent recirculation system is required for the bioscrubber operation, the manufacturer shall provide a fully function permanent system, including a recirculation pump as specified herein.

N. Recirculation Pump (if necessary based on the manufacturer's recommendation and proposed system).

1. Each recirculation pump shall pump the low pH liquid from the vessel's sump to the spray headers.
2. Each pump shall have a capacity adequate to meet necessary irrigation pressure and flow requirements for a fully functioning recirculation system. The pump capacity and head shall be based on the selected manufacturer's system and may be revised as necessary in order to provide a functional system. All deviations shall be submitted to the Engineer for review and approval.
3. Pump motor horsepower shall be a 7.5 HP (maximum).
4. The number of recirculation pumps is one (1) per bioscrubber system. One (1) shelf spare pump shall be provided for use at both systems.
5. Pump shall be seal less, magnetically driven, horizontal, single stage, base mounted, end suction centrifugal configuration manufactured in accordance with ANSI Horizontal End Suction Pumps for Chemical Process.
6. The pump casings have a top discharge. Suction and discharge connections shall be 150 lb. standard ANSI flanges.
7. The pump casings shall be constructed of polypropylene and shall be designed to be suitable for pressures of at least 1.5 times the shut off head of the pump.
8. Magnets shall be rare earth, high performance.

9. The impellers shall be constructed of the same material as the casing and shall be fully open with contoured passages. The impellers shall be balanced for high efficiency.
  10. The pump shafts shall be of Type 316 stainless steel and shall be manufactured such that deflection is minimal. Where the shaft is directly exposed to the liquid being pumped, the shaft shall be protected by polypropylene shaft sleeves.
  11. The shaft shall be guided by low PV stationary bearings and rotary sleeve/thrust bearings that are resistant to corrosion from the process fluid.
  12. Each pump shall have an electrically non-conductive containment shell that is resistant to corrosion from the low pH process liquid.
  13. The bearing frames and bearing housing adapters shall be of cast iron construction with chemically resistant two-part epoxy resin coating and shall have a registered fit with the pump casings.
  14. The recirculation pump shall be able to operate outdoors and be exposed to sunlight and hot temperatures, specified in Paragraph 1.09-A, without pump material degradation.
  15. The recirculation pump motors shall be horizontal, TEFC, severe duty, squirrel caged induction type, 460 Volt, 3 Phase, 60 Hz with Class F insulation and a minimum 1.15 service factor, suitable for full voltage starting and continuous operation at 50 degrees C ambient temperature at the specified loads. The pump motors shall be suitable for operation in a Class 1 Division 2 environment. Provide motor with thermal protection and heater as specified in Section 01171.
  16. If required, fiberglass base plates shall support the pumps and motors. The base plates shall have holes mounting to a concrete equipment pad. The pumps and motors shall be assembled on the base plates in the manufacturer's shop.
  17. Brass or stainless steel nameplates giving the name of the manufacturer, model number, the rated capacity, head, speed and any other pertinent data shall be permanently attached to each pump.
  18. Brass or stainless steel nameplates giving the name of the manufacturer, serial number, model number, horsepower, speed, voltage, amperes and other pertinent data shall be attached permanently to each motor.
  19. The pump manufacturer shall supply all drive units and factory mount them on a common baseplate with the pumps. Acceptable vendors:
    - a. Vanton Pump and Equipment Corp
    - b. ANSI Mag
    - c. Goulds Pumps
    - d. Or Engineer approved equal
- O. Exhaust Stack.
1. Provide a connection location (flange outlet or NPT) and necessary fitting(s) such that the 1/4-in exhaust sample PE tubing inside the 3/4-inch PVC pipeline can be connected to each exhaust stack. The location of the 3/4-inch NTP shall be coordinated with the location of

the 3-inch pipe supports along the vessel. The sample connection and piping described above shall also be provided for the inlet side of the system. The manufacturer shall coordinate the inlet sample location with the Engineer.

P. Test ports

1. Provide test ports as shown on the Drawings, at minimum. Additional test ports shall be provided per the manufacturer's recommendation at no additional cost to the Owner

PART 3 EXECUTION

3.01 INSTALLATION OF BIOSCRUBBER SYSTEM

- A. The manufacturer/supplier shall be responsible for shipping the equipment and shall coordinate with the Contractor for proper off loading at the job site. The Contractor shall provide rigging services to place the equipment on the concrete pad. Anchor bolt holes shall be provided in accordance with the manufacturers shop drawing submittal. Any changes in bolt placement due to errors in the shop drawing shall be the responsibility of the manufacturer. The manufacturer or authorized representative shall have a technical representative, who is experienced in installing the equipment, on-site at the time of installation.
- B. The exhaust duct, power and control wiring, water supply, and drain line will be brought to the concrete pad by others. The Contractor will be responsible for connecting the exhaust duct, power and control wiring.
- C. Installation of the systems shall be completed by Contractor in accordance with the manufacturer's written instructions. At the discretion of the manufacturer, a manufacturer's technical representative may be present during the installation.

3.02 UTILITIES

A. Electrical:

1. A single 480V / 3-phase / 60 Hz electrical connection shall be made by the Contractor to the control panel. Systems requiring separate 110V and 480V power supplies shall not be allowed.

B. Water:

1. Water supply lines shall be provided by the Contractor as shown on the Drawings. The water supply shall be provided at a sufficient pressure and flow as required for system irrigation.

C. Connection of the water supply to the water panel shall be completed by the installing Contractor.

D. Heat tracing and aluminum jacketed insulation, in accordance with Section 15250, shall be provided by the Contractor.

3.03 START-UP

- A. **Start-up shall occur in conjunction with start-up of the North two thickeners (2A and 2B, Phase 1 construction) to provide ventilation during thickener operation. Bioscrubbers shall be utilized to treat odors from the North thickeners while Phase 2 construction is completed, however the specified performance is not required until the complete thickener system is substantially complete. Phase 1 start-up shall follow manufacturer recommended procedures.**
- B. **The Contractor shall coordinate testing, adjusting and balancing per Section 15950. Testing, adjusting and balancing shall be provided at two separate times; once in conjunction with the start-up of the North thickeners and once in conjunction with the start-up of the fully-installed thickener system.**
- C. A representative of the manufacturer who is experienced in the start-up of bioscrubber systems shall provide the services during start-up.
  - 1. Check all fan and water flow functions.
  - 2. Measure air flows after the odorous air collection system is adjusted to the specified flow rates.
  - 3. Make all provisions required to minimize acclimation time of the bioscrubber systems.
  - 4. Install all sampling taps in the bioscrubber required for acceptance testing.
- D. **Once all thickeners are online, operating, and connected to the odor control systems, an acclimation** period of up to 28 days after initial startup shall be allowed. Once the acclimation period is completed, the manufacturer shall commence Performance Testing as outlined in the following section.
- E. Start-up of the systems shall be the responsibility of the manufacturer, who shall furnish factory-trained personnel to complete this activity. Start-up will commence following a visual inspection and check out of the systems by the manufacturer's technical representative.

3.04 ACCEPTANCE TESTING

- A. **Performance Testing shall not commence until the Testing and Balancing Report for the entire ductwork system is submitted and approved by the Engineer.**
- B. **The Owner shall schedule acceptance testing within 90 days of connecting Thickeners No. 1A and 1B to OCS No. 1 and 2.** The total acclimation period shall not exceed 28 days.
- C. The fan speeds or inlet dampers shall be adjusted so that 5,500 scfm (current **operation**) goes to each vessel of OCS No. 1 and 4,500 scfm goes to each vessel of OCS No. 2, with the media microbial population fully developed.
- D. Sample collection equipment and hydrogen sulfide monitoring instruments will be provided by the manufacturer but must be approved by the Engineer.

- E. Inlet and outlet hydrogen sulfide concentrations will be monitored and logged continuously over a period of 24 hours. Inlet measurements shall be collected from the main duct upstream of the bioscrubber system inlet. Outlet conditions will be monitored at the discharge stack for each bioscrubber vessel.
- F. For each bioscrubber system, two inlet odor sample and four outlet odor samples (two per vessel) will be taken concurrently under average conditions, as shown on hydrogen sulfide monitors.
- G. Thus, there will be a total of twelve (12) odor samples. The samples shall be sent to St. Croix Sensory, Inc. of Stillwater, MN by overnight delivery for odor analyses. Odor concentrations will be measured and analyzed in accordance with EN 13725.
- H. To pass the acceptance test, the bioscrubber systems shall meet both hydrogen sulfide and odor reduction criteria set forth in Table 2, shown in Paragraph 1.07.
- I. If either system fails the acceptance test, the manufacturer shall conduct up two additional rounds of testing at no expense to the Owner. If the system does not pass after the additional testing, the manufacturer shall make whatever provisions are required to meet the criteria as defined in Paragraph 1.07 at no expense to the Owner. Failure to pass the acceptance test within 3 months of the initial acceptance test may result in forfeiture of the final payment, at the sole discretion of the Owner.

END OF SECTION

SECTION 11318  
SUBMERSIBLE CHOPPER PUMPS (SCUM/FOAM PUMPS)

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required, and install, complete and ready for operation, four submersible wet pit centrifugal chopper pumps as shown on the Drawings and as specified herein to pump scum from the four gravity thickeners to the sludge holding tank in the Sludge Transfer Building.
- B. Electric motors shall be furnished as part of the work of this section and shall conform to the requirements of Section 01171.
- C. **The installation of the gravity thickeners and chopper pumps will occur in two phases. Gravity Thickeners No. 2A and No. 2B and their associated chopper pumps shall be made operational during Phase 1 and Thickeners No. 1A and No. 1B and associated chopper pumps shall be made operational during Phase 2. Refer to Section 01010 – Summary of Work. Contractor shall coordinate lead time and schedule with manufacturer.**

1.02 RELATED WORK

- A. **Sequence of construction is provided in Section 01010.**
- B. Concrete work and installation of anchor bolts is included in Series 400, but anchor bolts for these units shall be furnished under this Section.
- C. Electric motors shall be furnished as part of the work of this section and shall conform to all applicable portions of Section 01171.
- D. Field painting is included in Section 09902.
- E. Control panels shall be furnished as part of the work of this section and shall conform to all applicable portions of Section 13390.
- F. Instrumentation is included in Division 13 and Division 17.
- G. Mechanical piping, valves, pipe hangers and supports are included Division 15.
- H. Electrical work is included under Division 16.
- I. Pump temperature and leak detection units (as specified in this Section) shall be furnished under this Section for installation in the motor control centers provided under Division 16. Coordinate the installation with the electrical contractor and the MCC supplier.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, copies of all materials required to establish compliance with the specifications. Submittals shall include the following:

1. Certified shop and erection drawings showing all important details of construction, dimensions and anchor bolt locations.
  2. Descriptive literature, bulletins and/or catalogs of the equipment.
  3. Data on the characteristics and performance of the pumps. Data shall include guaranteed performance curves, based on actual shop tests of duplicate units, which show that they meet the specified requirements for head, capacity, efficiency, allowable NPSH, allowable suction lift and horsepower. Curves shall be submitted on 8-1/2-in by 11-in sheets.
  4. The total weight of the equipment including individual weights of the pump and motor.
  5. A complete total bill of materials for all equipment.
  6. All information required by Section 01170.
  7. A statement indicating and documenting the life of all bearings.
  8. Complete data on motors and in accordance with Section 01171.
  9. Complete description of surface preparation, shop prime and finished painting.
  10. Factory performance test data as specified in Paragraph 1.06.
  11. Complete master wiring diagrams, elementary or control schematics, physical dimensional or elevation drawings and system single line drawings specific to this Contract. Standard preprinted sheets or drawings simply marked to indicate applicability to this Contract will not be acceptable.
  12. Submittal information shall include detailed information indicating wiring connection points for all external devices and controls as specified herein.
  13. Complete description of the control panel's required components in accordance with Section 13390.
  14. Detailed point-to-point wiring diagrams that show all terminal blocks and internal wire tag numbers and block wiring diagram that show number, type and size of all conductors connected externally to the control panel(s).
  15. Field test procedures and results as specified in PART 3.
  16. Manufacturer's warranty.
  17. Electrical accessory information, including the moisture and temperature sensors and association relays including schematic wiring diagram and description of all components.
- B. In the event that it is impossible to conform to certain details of the specifications because of different manufacturing techniques, describe completely all nonconforming aspects.
- C. Operation and Maintenance Data.

1. Operating and maintenance instructions shall be furnished to the Engineer as provided for in Section 01730. The instructions shall be prepared specifically for this installation and shall include all cuts, drawings, equipment lists and descriptions that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

#### 1.04 REFERENCE STANDARDS

- A. American National Standards Institute (ANSI)
- B. American Bearing Manufacturers Association (ABMA)
- C. National Electrical Manufacturers Association (NEMA)
- D. American Gear Manufacturers Association (AGMA)
- E. Occupational Safety and Health Administration (OSHA)
- F. National Electric Code (NEC)
- G. National Electrical Manufacturers Association (NEMA)
- H. Underwriters Laboratories (UL)
- I. Where reference is made is one of the above standards, the revision in effect at the time of bid opening shall apply.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications and Requirements.
  1. The equipment shall be manufactured by Vaughan Company, Inc., Hayward Gordon, Wemco Inc., or Landia, Inc. The design ash shown on the Drawings is based around Vaughan Company Pump Model SE3G.
  2. Pumps shall be manufactured in accordance with all applicable standards of the Hydraulic Institute.
  3. Pump manufacturer shall furnish pumps, motors, and accessories as complete package to insure proper coordination and compatibility of equipment.
  4. The equipment shall be manufactured in accordance with the best practices and methods, and shall operate satisfactorily when installed as shown on the Drawings.
  5. The Contract Drawings are based on the mechanical equipment manufactured by Vaughan. Selection of a different manufacturer may require a revised layout. Any revision in the design and/or construction of the structures, piping, appurtenant equipment, electrical work, etc. required to accommodate such a different manufacturer shall be made at no additional cost to the Owner and be as approved by the Engineer.
  6. The manufacturer supplying this equipment must have at least five installations of the same design, each with a minimum of three years successful operating experience.

1.06 SYSTEM DESCRIPTION

A. All of the equipment included herein is intended to be standard for pumping thickened sludge surface scum and/or foam. The pumps shall operate properly (on system curves) at all hydraulic conditions indicated.

B. The chopper pumps shall be as follows:

1. Name: Thickener Scum Pump No. 1 - 4
2. Location: Gravity Thickeners 1A, 1B, 2A, and 2B
3. Number of Units: 4
4. Configuration: Submersible
5. Capacity and Head: 200 gpm at 27 feet TDH
6. Minimum Efficiency at Design Capacity: 45 percent
7. Secondary Capacity and Head: 250 gpm at approximately 24 feet TDH
8. Pump Speed at Design Capacity: 1750 rpm (maximum)
9. Minimum Solids Size: 3-in
10. Minimum Shut-off Head: 34 feet
11. Motor Type: Submersible Electric
12. Motor Enclosure: Submersible, Explosion Proof
13. Motor Hp: 5
14. **Minimum** Pump Discharge Size: 3-in
15. Pump shall be capable of successful operation without motor overload, and without vibration at run-out.
16. Each pump will be operated at constant speed with start and stop control provided at the local control station and scum pump control panel furnished under this Section.

1.07 SERVICES OF MANUFACTURER'S SERVICE ENGINEER

A. Provide the services of factory-trained service engineer, specifically trained on the type of equipment specified. The man-day requirements listed 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.

1. **Start-up and testing: Complete review of installation, Provide written certification that the installation is complete and operable in all respects, and that no conditions exist which may affect the warranty:**

**Two 8-hour days split between two trips for each phase of thickener installation.**

2. **O&M instruction: Provide instruction on operation and maintenance of the equipment, including start-up, shut-down, troubleshooting, lubrication, maintenance and safety after O&M manuals are furnished and approved:**

**One 8-hour day upon completion of chopper pumps associated with Thickeners No. 2A and 2B.**

1.08 DELIVERY, STORAGE AND HANDLING

- A. All equipment shall be crated and delivered to protect against damage during shipment.
- B. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
- C. All equipment and parts shall be properly protected against damage during a prolonged period at the site.
- D. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.
- E. The finished surfaces of all exposed flanges shall be protected by wooden blank flanges, strongly built and securely bolted thereto.
- F. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
- G. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment and proper care shall be taken to protect parts from the entrance of water during shipment, storage and handling.
- H. No shipment shall be made until approved by the Engineer.

1.09 MAINTENANCE

- A. One set of all special tools required for the maintenance, adjustments, and repair of the equipment shall be provided for each pump model.
- B. As a minimum, the following spare parts shall be provided:
  - 1. One set of mechanical seals.
  - 2. One complete set of gaskets and O-rings.
- C. All tools and spare parts shall be furnished in accordance with Section 01170.

1.10 **WARRANTY**

- A. **The manufacturer shall warrant that the systems be supplied in accordance with these specifications and shall perform as described herein. The manufacturer shall warrant**

**that the systems will be free from defects in materials and workmanship for a period of one (1) year after substantial completion of Thickeners No. 1A and No. 1B and associated chopper pumps. At the manufacturer's discretion, the manufacturer shall repair or provide replacement for any defective components under this warranty provided that any such defect was not the result of misuse of the component by the Owner or the Owner's Agent. Refer to Section 01740 for warranty requirements.**

- B. **As noted in Paragraph 1.01, the chopper pumps associated with Thickeners No. 2A and 2B shall be placed in operation and utilized prior to installation of Thickeners No. 1A and 1B. The warranty period for all four pumps systems shall commence after substantial completion of Thickeners No. 1A and No. 1B and associated chopper pumps. Contractor shall coordinate construction schedule with chopper pump manufacturer.**

## PART 2 PRODUCTS

### 2.01 MATERIALS AND EQUIPMENT

#### A. General.

1. The equipment covered by these Specifications is intended to be standard submersible, explosion-proof pumping equipment of proven ability as manufactured by reputable concerns having long experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods, and shall operate satisfactorily when installed as shown on the Drawings.
2. All parts shall be so designed and proportioned as to have liberal strength and stiffness and to be especially adapted for the work to be done. Ample room and facilities shall be provided for inspection, repairs, and adjustment.
3. Pumps shall be installed on two-inch diameter stainless steel guide rails. Two guide rails shall be provided for each pump. Guide rail system shall be non-sparking and shall include a cast bronze pump guide bracket, cast ductile iron discharge elbow with mounting feet and 125-lb flanges, upper guide rail mounting bracket, and intermediate guide brackets every 5 feet. System design shall prevent spark ignition of explosive gases during pump installation and removal. Under the work of this Section, the contractor shall be specifically responsible for providing and installing the guide rails and mounting the pumps and rails to the concrete vault with stainless steel expansion bolts. A stainless steel lifting cable shall be attached to the top of the pump vault and to the top of each pump assembly. The pumps shall be completely removable and able to be reinstalled without the need for personnel to enter the wet well.
4. Brass or stainless steel nameplates giving the name of the manufacturer, the rated capacity, head, speed, and any other pertinent data shall be attached to each pump.
5. Brass or stainless steel nameplates giving the name of manufacturer, serial number, model number, horsepower, speed, voltage, amperes, service factor, insulation, and all other pertinent information shall be attached to each motor. The nameplate rating for the motor shall not be exceeded, nor shall the design service factor be reduced when its pump is operating at any point on its characteristic curve.

6. The pumps and motors shall be designed and constructed to avoid the generation of objectionable noise or vibration.
7. The pumps shall be identical in every respect with all parts interchangeable and designed for the service conditions specified in PART 1.
8. The nameplate rating of the motors and drives shall not be exceeded, nor shall the motor design service factor be reduced when its pump is operating at any point on its characteristic curve.

B. Chopper Pump.

1. The pumps for the scum/foam wells shall be submersible, heavy duty, solids handling, non-clogging, chopper type pump. The pump shall be located as shown on the Drawings and as specified herein.
2. The pump casing shall be of semi-concentric design and shall be constructed of ASTM A536 ductile cast iron or ASTM A48 cast iron with 125 or 150 lb. ANSI Standard flanged suction and discharge connections. All internal case clearances shall be equal to the discharge diameter so that all material which will pass through the discharge will pass through the pump. All cast parts shall be furnished in accordance with ASTM Standards. The casing shall be provided with all necessary cleanout, vent and drain connections.
3. The impeller shall be semi-open type with pump out vanes or a partial rear shroud to reduce seal area pressure, and to draw lubricant down from the reservoir should seal leakage occur. Chopping/maceration of materials shall be accomplished by the action of the cupped and sharpened leading edges of the impeller blades moving across the cutter bar at the intake openings, with a set clearance between the impeller and cutter bar of 0.010 to 0.015-in. Impeller shall be cast from ASTM A148 Grade 90-60 alloy, heat treated to minimum 60 Rockwell C hardness and dynamically balanced. The impeller shall be keyed to the shaft with a hardened steel bolt with washer, and shall have no axial adjustments or set screws. Fabricated impellers shall not be acceptable.
4. The cutter bar shall be recessed into the pump bowl, with a funnel shaped inlet opening, and shall contain at least 2 shear bars extending diametrically across the entire pump suction opening for the purpose of preventing intake opening blockage and wrapping of debris at the shaft area. The cutter bar shall be T1 plate steel and heat treated to minimum 60 Rockwell C hardness. Fabricated cutter bars or individually mounted shear bars shall not be acceptable.
5. The upper cutter assembly shall consist of a specially modified impeller working against a stationary cutting ring mounted into the back side of the casing in order to eliminate any buildup of rags, hair, or other stringy material, or the area behind the impeller shall be protected from fouling by the cutting and expulsion action of the serrated and sharpened teeth in the rear impeller shroud sweeping across spiral grooves in the casing backplane. The upper cutter shall be ASTM A148 cast alloy steel and heat treated to a minimum 60 Rockwell C Hardness.
6. Each motor shall be equipped with tandem mechanical seals in oil bath and dual moisture sensing probes.

7. Shaft shall be AISI 4140 heat treated steel or equal. Shaft diameter will be a minimum of 1.5-inches. Each pump shaft shall directly couple to the motor shaft with a bolt and keyway.

C. Motors.

1. Submersible motors shall be U.L. Listed, Explosion Proof for Class 1, Division 1, Group D hazardous locations, with a 1.15 service factor and Class F insulation system. Motor horsepower and synchronous speed shall be as specified herein. The motor shall be rated for 15 minutes of in-air operation at full load.
2. Motors shall not be required to deliver more than its rated nameplate horsepower, at unity (1.0) service factor, under any condition of mechanical or hydraulic loading throughout the entire pump performance curve.
3. Power cabling length shall be suitable for the pump station arrangements shown on the Drawings. Power cable shall be provided by the pump manufacturer.
4. Each pump shall be equipped with moisture leak detectors and motor thermal overload switch.

D. Pump Control Panel and Accessories.

1. The scum pump control system shall be a Type B packaged control system type as specified in Section 13390.
2. Each pump shall be provided with a Control Panel and Field Control Station, as shown on Drawings. Refer to Electrical Drawings for scum pump control panel field interconnect wiring schematic. Refer to Section 13390 for Package Control System requirements.
3. Each pump shall be provided with a submersible level transmitter meeting the requirements of Section 17380 and as shown on the Contract Drawings. Control panel shall allow operator-adjustable set point for automatic pump start, pump stop, high level alarm and low level alarm. Initial set point elevations shall be as listed in Paragraph 2.01-D.13.
4. Each pump shall be provided with an automatic recirculation valve assembly, controlled through the scum pump control panel, as specified herein.
5. The pump shall be provided with a discharge pressure gauge and annular flange mounted diaphragm seal. Refer to section 15120 for gauge and diaphragm seal requirements. Gauge range shall be 0 to 30 psi.
6. The controls for the scum pump system shall be mounted in a NEMA 4X Type 316 stainless steel enclosure provided by the pump manufacturer. Panels shall be located as shown on the Drawings. Panel construction shall meet the herein specified requirements and the general requirements of Section 13390.
  - a. Provide sun shield as specified in Section 13390.
7. The control panel shall have a hinged front door with neoprene gasket. Provide appropriate electric shock warning label on the outer door of the panel. A nameplate shall

- be permanently affixed to the panel and include model number, voltage, phase, hertz, ampere rating and horsepower rating of the pump.
8. Each control panel shall house the motor starter and the control relays and other devices necessary to provide the correct operation sequence.
  9. At a minimum, the following controls shall be provided for each scum pump control panel system, as shown on Drawings:
    - a. Local/Manual/Off/Auto Switch
    - b. Pump Start Pushbutton
    - c. Pump Stop Pushbutton
    - d. Recirculation Assembly Recirculate/Discharge Switch
    - e. Reset
  10. Complete pump control panels shall be provided for mounting and shall be completely wired and ready for field connection of power, control/sensory, and alarm wiring. The control panels shall be located at each gravity thickener as shown on the Drawings. The entire control panel assemblies shall be UL labeled for industrial control panels in accordance with UL-508.
  11. Power supply to the pump control panels will be 480 Volt, 3 phase. Provide individual thermal magnetic circuit breakers/disconnect switches interlocked with the door handle. 120 and/or 24 volt control circuit transformers with fuse protection shall be included.
    - a. Control leads to and from the wet well or sump shall be low voltage, microwatt type designed such that if system components fail, voltage and current will not exceed their normal values. All of the low voltage intrinsically safe components shall be isolated by and mounted through a grounded metal barrier. All field connections shall be by means of terminals.
    - b. Panels shall have lamacoid nameplates, Hand/Off/Automatic selector switches, pump run lights, pump running elapsed time meters, a thermostatically (adjustable) controlled condensate heater, and lightning protection.
  12. A local field control station shall be provided as shown on the Drawings for manual control at the pumps. The local control station shall comply with NEC requirements for a Class 1 Division 2 area. The Local switch position at the scum pump control panel shall enable control at the local field control station when the Local/Remote switch at the field control station is in the Local position. The Remote switch position at the field control station will enable operation from the scum pump control panel. The following controls at the field control station shall be:
    - a. Local/Remote Switch
    - b. Pump Start Pushbutton
    - c. Pump Stop Pushbutton
  13. Scum Pump Control.
    - a. The pumps shall be started and stopped automatically by submersible level transducer located in the scum well or manually from the scum pump control panel or local field control station.
    - b. Transducer set points shall be field adjustable and initially set, as listed below, or as acceptable to the Engineer. Refer to Contract Drawings for installation requirements.
      - 1) Low Level Alarm: 428.0' or equal to minimum submergence elevation per manufacturer.

- 2) Pump Off Elevation: 428.5' or 6" above minimum submergence elevation per manufacturer.
  - 3) Pump On Elevation: 432.0' or equal to field verified thickener scum pipe invert elevation.
  - 4) High Level Alarm: 433.0' or 12" above field verified thickener scum pipe invert elevation.
- c. Local and Remote Manual Control: When the pump Local/Manual/Off/Auto switch is in the Manual position, the pump shall be started and stopped from the pushbuttons on the scum pump control panel. When the pump Local/Manual/Off/Auto switch is in the Local position, the pump shall be started and stopped from the pushbuttons on the field control station. An Amber indicating light shall be provided on the scum pump control panel to indicate when the field control station is in the Local position.
  - d. Local Automatic Control at Control Panel: When the pump Local/Manual/Off/Auto switch is in the Auto position, the pump shall be automatically started and stopped by the control panel using the level transducer located in the basin. The pump shall be called to start when the level in the wet well rises above the "Pump Start" level and shall stop when the wet well falls below the "Pump Stop" level.
  - e. A Red run indication light shall be provided on the scum pump control panel to indicate when the motor is running.
14. A Pump Temperature and Leak Detection.
- a. Provide a leak and temperature detection device for each new pump.
  - b. The device shall accept the following field wiring:
    - 1) The thermal detection/alarm portion of the device shall be wired to the thermal sensor in the submersible pump motor.
    - 2) The leak detection/alarm portion of the device shall be wired to the leakage sensor in the submersible pump motor.
  - c. The device shall provide dry output contacts rated 120 VAC, 10 Amps for alarm of high temperature or leak detection to be used in the pump control panel circuit to shut down the motor.
  - d. The device shall have indicating lights for moisture and temperature detection.
  - e. An alarm reset shall be provided.

## 2.02 RECIRCULATION SYSTEM

- A. The scum pumps shall be fitted with an adjustable recirculation nozzle assembly to permit recirculation of the pit contents prior to discharge. The recirculation nozzle shall be adjustable minimum 180 degrees horizontally and 45 degrees vertically. A valve assembly shall be connected to the pump discharge to adjust pump flow either to the nozzle or the pump discharge flange. Valve shall be ASTM A536 ductile cast iron or ASTM A48 cast iron, with 316 SS valve disk and 150 lb. flanged recirculation and discharge flange. Automatic operation of the recirculation assembly shall be achieved through an electronic valve actuator. Manual operation shall also be permitted. The operating levers shall be located above at a mounting plate for easy access.
- B. Automatic Valve Actuator: An electrically operated valve actuator shall position the valve for pumpout or mixed operation. A ball screw linear actuator shall be used to provide valve positioning. Unit shall operate on 120V AC, single-phase power with 25% duty cycle, and shall be capable of producing 500lb. of actuation force, with a freewheeling feature to prevent over travel at the end of stroke. Unit shall be powered from scum pump control panel. External timers are required to determine valve position. A capacitor for single phase-motor starting

shall be included in the design. All components shall be housed in the scum pump control panel.

## 2.03 ACCESSORIES

- A. Submersible level transmitter shall be as specified in Section 17380.
- B. Portable Davit Crane.
  - 1. A portable davit crane system shall be supplied to remove the pumps from the wet wells. One davit crane shall be provided and each scum pump shall be provided with a pedestal mount base so that the davit crane can be moved to any of the scum wells.
  - 2. Davit crane shall be Series 5PT10-15 as manufactured by Thern, Inc. Alternative manufacturers may be approved if requirements specified herein are met. The crane manufacturer shall have a minimum of five years of experience in providing this type of equipment.
  - 3. Davit crane shall have a pedestal base and manual operating winch. Crane shall have a design factor of greater than 3:1 for all components including the lifting winch and base.
  - 4. Crane boom reach shall telescope up to four different lengths and shall have a boom that is adjustable position between horizontal and 45 degrees from horizontal. The minimum height of the boom shall be 51 inches between mounting surface and the underside of the boom in all base configurations. Mast and boom shall be able to rotate 360 degrees with a rotational handle to facilitate rotation. Contractor and pump supplier shall field verify all dimensions and ensure that the crane can reach, lift, and move pump from wet well to ground surface (adjacent to wet well) without damaging pump.
  - 5. The crane system shall be located as shown on the Drawings and verified in the field. The crane system shall avoid conflict with pump accessories and control panel, as well as provide a clear walking area. Location shall be submitted to Engineer for approval.
  - 6. Crane shall be made of galvanized steel and meet all applicable ASTM standards. Crane boom, mast, and base shall have a corrosion resistant finish. Hook and wire rope shall be type 304 stainless.
  - 7. Crane shall have a minimum capacity of 550 pounds when fully extended. Contractor shall coordinate with pump supplier to confirm that pump weight does not exceed capacity of crane system.
  - 8. Crane shall have the ability to break down into portable carrying components with no single component weighing more than 50 pounds.
  - 9. Provide a nametag made of a non-corrosive metal that includes the manufacturer's name, model number, serial number, capacity rating, and any other necessary information.

## 2.04 SURFACE PREPARATION AND SHOP PRIME PAINTING

- A. All surfaces shall be prepared, shop primed and finish painted in the manufacturer's shop as part of the work of this Section. Surface preparation and shop priming shall be as specified in

Section 09901. Finish paint shall be manufacturer's standard high solids epoxy. Touch-up paint shall be provided.

## 2.05 FACTORY TESTING

- A. Factory performance tests shall be conducted and the results submitted to and approved by the Engineer prior to shipment of the equipment.
  - 1. Each pump shall be tested at the factory to show satisfactory mechanical operation of the unit and hydraulic performance in strict accordance with these Specifications. Tests shall be performed in accordance with the latest edition of the Hydraulic Institute Standards. A complete test report for each pump, including characteristic curves of the pump, consisting of at least head, capacity, efficiency, and horsepower, and copies of the hydrostatic test report shall be submitted with O&M manuals.
  - 2. Each drive motor shall be factory tested as specified in Section 01171.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations. Anchor bolts and guide rails shall be set in accordance with the manufacturer's recommendations.
- B. Submit manufacturer's certification of installation.

### 3.02 INSPECTION AND TESTING

- A. After all pumps have been completely installed and made ready for operation, the pumps shall be started and run and demonstrate the ability to operate without overheating of bearings and motor, and without excessive vibration.
- B. If the pump does not perform properly, corrective measures shall be taken, or pump shall be removed and replaced with a pump that satisfies the conditions specified. Each pump shall operate for a total of 24 hours before acceptance and shall operate without excessive noise, vibration or overheating.

END OF SECTION

SECTION 11364  
GRAVITY THICKENER EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to install complete and ready for operation, and field test, sludge collection, scum removal, and appurtenant gravity thickener equipment in each of the four (4) existing 50-ft diameter gravity thickeners as shown on the Drawings and as specified herein.
- B. Electric motors and power factor correction capacitors (if required) shall be furnished as part of the work of this Section and shall be in accordance with Section 01171.
- C. **The installation of the gravity thickeners and associated components will occur in two phases. Gravity Thickeners No. 2A and No. 2B shall be made operational during Phase 1 and Thickeners No. 1A and No. 1B shall be made operational during Phase 2. Refer to Section 01010 – Summary of Work. Contractor shall coordinate lead time and schedule with manufacturer.**

1.02 RELATED WORK

- A. **Section 01010 – Summary of Work**
- B. Concrete work is included in Series 400.
- C. Yard piping is included in Division 2 and Division 15.
- D. Metals are included in Division 5.
- E. Surface preparation and shop prime painting is included in Section 09901.
- F. Field painting is included in Section 09902.
- G. Control panels shall be furnished as part of the work of this section and shall conform to all applicable portions of Section 13390.
- H. Instrumentation and control work, except as specified herein, is included in Division 13 and Division 17. Instrumentation and controls provided in this section shall adhere to Instrumentation and Control Specifications Sections in Division 13.
- I. Mechanical piping, valves, pipe hangers and supports are included in Division 15.
- J. Electrical work, except as otherwise specified herein, is included in Division 16.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, copies of all materials required to establish compliance with this section. Submittals shall include the following:

1. A listing of magnitudes, directions and locations of reactions applied by the equipment to the structure.
2. Certified shop and erection drawings showing all important details of construction, dimensions, weld requirements and anchor bolt locations and sizes. The equipment manufacturer shall provide installation templates for anchor bolts.
3. Descriptive literature, bulletins and/or catalogs of the equipment.
4. The total weight of the equipment including the weight of the single largest item or component.
5. A complete bill of materials for all equipment.
6. A list of the manufacturer's recommended spare parts. Include gaskets, packing, etc., on the list.
7. The recommended summer and winter grades of lubricants along with alternative references to equal products of other manufacturers.
8. Documentation of the AGMA rating of the drive assembly.
9. Complete data on motors and power factor correction capacitors (if required) as specified in Section 01171.
10. Complete description, control diagrams and schematics of torque overload and other instrumentation devices.
11. Submittal information shall include detailed information indicating wiring connection points for all external devices and controls as specified herein.
12. Complete description of the control panel's required components in accordance with Section 13390.
13. Detailed point-to-point wiring diagrams that show all terminal blocks and internal wire tag numbers and block wiring diagram that show number, type and size of all conductors connected externally to the control panel(s).
14. Documentation of the design torque rating of all components of the thickener mechanism.
15. Evidence of manufacturer experience as specified in paragraph 1.05.
16. A copy of the written warranty in accordance with Section 01740.
17. Submittal requirements for anchor bolts shall conform to the requirements as specified herein.
18. Submittal requirements for the preparation of concrete surfaces shall conform to the requirements of Series 400 and as specified herein.
19. Welding data including the following:

- a. Welding procedure specification for all procedures used during fabrication.
  - b. Welding procedure qualification record.
  - c. Welder's certification for the qualified procedures.
  - d. Post-weld de-scaling and cleaning procedures.
20. ABMA Calculations: Include the following, performed and certified by a registered professional engineer. B-10 / L-10 calculations should be provided by the clarifier supplier substantiating the life rating of the main bearing. The calculations shall include:
- a. No. of balls (Z)
  - b. Total hanging weight of equipment (Ft)
  - c. Rotational speed (rpm)
  - d. Raceway hardness factor (fh)
  - e. Weibull exponent (e)
  - f. Nominal contact angle (a)
  - g. Thrust and radial raceway material factor (fcm)
  - h. Pitch diameter (dpw)
  - i. Ball diameter (dw)
- B. In the event that it is impossible to conform to certain details of this section, describe completely all non-conforming aspects.
- C. Submit certified copies of field test report as specified in PART 3.
- 1.04 REFERENCE STANDARDS
- A. Hydraulic Institute (HI)
- B. American Society for Testing and Materials (ASTM)
1. ASTM A36 - Standard Specification for Carbon Structural Steel.
  2. ASTM A48 - Standard Specification for Gray Iron Castings.
  3. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  4. ASTM A148 - Standard Specification for Steel Castings, High Strength, for Structural Purposes.
  5. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  6. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
  7. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
  8. ASTM A536 - Standard Specification for Ductile Iron Castings.
  9. ASTM A992 - Standard Specification for Structural Steel Shapes.

- C. American National Standards Institute (ANSI)
  - 1. ANSI B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form).
  - 2. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
  - 3. ANSI 9 - Load Ratings and Fatigue Life for Ball Bearings.
  - 4. ANSI 11 - Load Ratings and Fatigue Life for Roller Bearings.
- D. American Gear Manufacturers Association (AGMA)
  - 1. AGMA 250.04 - Lubrication of Industrial Enclosed Gear Drives.
  - 2. AGMA 908-B - Geometry Factors for Determining the Pitting Resistance and Bending Strength of Spur, Helical and Herringbone Gear Teeth.
  - 3. AGMA 1012 - Gear Nomenclature, Definitions of Terms with Symbols.
  - 4. AGMA 2001-D04 - Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth.
  - 5. AGMA 2004-B - Gear Materials and Heat Treatment Manual.
  - 6. AGMA 6001-C - Design and Selection of Components for Enclosed Gear Drives.
  - 7. AGMA 6010-E - Standard for Spur, Helical, Herringbone and Bevel Enclosed Drives.
  - 8. AGMA 6019-E - Gearmotors Using Spur, Helical, Herringbone, Straight Bevel or Spiral Bevel Gears.
  - 9. AGMA 6034-B92 - Practice for Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors.
- E. American Institute of Steel Construction (AISC)
  - 1. Specifications for Design, Fabrication and Erection of Structural Steel for Buildings.
- F. American Iron and Steel Institute (AISI)
- G. American Welding Society (AWS)
- H. American Bearing Manufacturers Association (ABMA)
- I. National Electrical Manufacturers Association (NEMA)
- J. Factory Mutual (FM)
- K. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

## 1.05 QUALITY ASSURANCE

### A. Qualifications.

1. The Contractor shall assume responsibility for the satisfactory installation and operation of the entire system of thickener mechanisms as specified.
2. The gravity thickener equipment is intended to be standard equipment of proven ability as manufactured by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The manufacturer shall have furnished equipment, similar to that to be provided under this Section, for at least ten separate wastewater facilities, each with gravity thickener(s) of the same size or larger than the gravity thickeners on this project and the equipment shall have been in continuous and successful service for not less than ten years.
3. The equipment shall be manufactured, fabricated and installed in accordance with the best practices and methods and to operate satisfactorily when installed as shown on the Drawings.
4. The equipment shall be by Walker Process; Ovivo/Eimco Water Technologies; Hi-Tech; or WesTech Engineering.
5. Should equipment which differs from this section be offered and determined to be equal to that specified, such equipment shall be acceptable only on the basis that any revisions in the design and/or construction of the structure, piping, appurtenant equipment, electrical work, and associate items required to accommodate such a substitution shall be made at no additional cost to the Owner and be as approved by the Engineer.

### B. Services of Manufacturer's Representative.

1. The manufacturer shall furnish an engineer experienced in the erection, alignment and operation of the equipment furnished under this section for a minimum of two days per mechanism to supervise the erection and adjustment of the equipment, certify its readiness for operation and assist with start-up and testing. Each day shall include a full eight hour working day on the project site; travel time shall be additional to these requirements.
2. A factory representative who has complete knowledge of the proper operation and maintenance of the equipment furnished shall be provided for one day as defined above and in addition to the days required above, to instruct representatives of the Owner and the Engineer on proper operation and maintenance of the equipment. An additional trip is not necessarily required, if the training can be satisfactorily scheduled as an extension of the installation and inspection trips, as provided above; and provided that the final operational test is successful and the operation and maintenance manuals and instructions have been furnished and approved. **Training shall occur in conjunction with the start-up of Thickeners No. 2A and No. 2B.**

### C. Operating and Maintenance Instructions.

1. Submit a Draft and Final Operations and Maintenance Manual to the Owner and Engineer in accordance with Section 01730. The manual shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, and descriptions

necessary to instruct operating and maintenance personnel unfamiliar with such equipment. Furnish for review by the Owner and Engineer a draft version of the O&M Manual. Respond to Owner and Engineer comments and furnish four copies of final O&M Manual to Owner and Engineer in 3 ring binder along with digital copy in PDF format.

#### 1.06 SYSTEM DESCRIPTION

- A. All of the equipment specified herein is intended to be standard equipment for use with either primary sludge, secondary sludge, or a combination of both. Supplemental water may be added to increase overflow rates to industry and TCEQ standards.
- B. Each gravity thickener shall be a complete assembly and shall include: center drive assembly; access bridges and walkways; center column; influent well; center drive cage; sludge collection equipment; scum collection equipment; anchors and hardware; and related equipment.
- C. The thickener units shall be installed in existing circular concrete tanks with an inside diameter of 50-ft, approximately 14 degree floor slope, and a side water depth and freeboard as shown on the Drawings. Contractor is responsible for field verifying dimensions.
- D. Each gravity thickener mechanism shall be designed to receive primary sludge, waste activated sludge, and a combination of both types of sludge, as well as supplemental water.
- E. Each gravity thickener mechanism shall be designed to receive the following hydraulic flow rates and solids loading rates:
  - 1. 1,100 gpm of sludge or a combination of sludge and supplementary water (maximum).
  - 2. 60,000 lb/day of solids.
- F. Each gravity thickener shall be able to thicken settled sludge to a solids concentration of up to 3.0 percent.
- G. Each thickener unit shall be of the under-floor, center-column feed type with peripheral weir to a peripheral weir overflow to an annular discharge launder. The center column shall support the entire mechanical drive and collection equipment and the inboard end of the access walkways which spans from the outside wall of the tank.
- H. The central driving mechanisms shall support and rotate two attached rake arms. Rake collector blades attached to the arms shall be arranged to move the settled sludge on the tank bottom to a sludge concentrator. Scrapers attached to the arms shall move the sludge to the point of withdrawal. The rake arms and collector scraper blades shall be designed to operate at a peripheral speed not to exceed 10 fpm. A scum collector shall be attached to each of the sludge rake arms to remove floating material (skimmings) from the liquid surface, for discharge into a scum box supported off of the tank effluent launder and/or tank wall as shown in the Drawings.
- I. Influent sludge shall enter through the influent pipe and discharge through openings near the water surface directly into the influent chamber at a maximum flow rate of 1,100 gpm. Flow shall then pass under the lower rim of the influent baffle (influent well) into the clarification zone and eventually discharge over the peripheral overflow weir and trough.

- J. The Contractor shall adjust the rake collector blades, squeegees, and other equipment provided to the finished contours of the gravity thickeners tank floors.
- K. Underwater bearings to carry any part of the vertical thrust load will not be acceptable. All gearing shall be completely enclosed and oil lubricated.

#### 1.07 PROJECT/SITE REQUIREMENTS

- A. The equipment required under this Section shall be provided in accordance with the sequencing requirements specified in Section 01010. As a result, the services of the Manufacturer's Representative as specified in Paragraph 1.05B cannot occur in one continuous site visit. The specified services, including alignment, final testing and startup shall be provided for each thickener unit at the time required by the construction sequence. Additional days required to meet requirements of these specifications shall be at no additional cost to the Owner.
- B. All of the equipment provided shall be identical and interchangeable for each gravity thickener.

#### 1.08 MAINTENANCE

- A. Spare Parts.
  - 1. Spare parts shall be furnished with the equipment by the manufacturer in accordance with Section 01170.
  - 2. As a minimum, the following spare parts shall be furnished for each size unit provided under this section:
    - a. One set of rake blade squeegees (for all scrapers in the tank).
    - b. One set of all gaskets, seals, sealing strips, etc., (including but not limited to neoprene lip seals or felt seals for the spur gear.).
    - c. One set of scum collector (skimmer) wiping edges.
    - d. One drive chain (if used).
    - e. One set of heat treated bearing strip liner inserts (main turntable assembly) (if used).
    - f. Twelve shear pins (if used).
    - g. All other spare parts recommended by the manufacturer as needed to replace equipment items failing due to normal wear and tear during a one-year period of operation following Substantial Completion.
- B. Special Tools.
  - 1. Provide all special tools required for normal maintenance. Tools shall be packaged in a steel case, clearly and indelibly marked on the exterior to indicate equipment for which tools are intended. Include any special equipment required to facilitate drainage or refill of lubricating oils.

#### 1.09 WARRANTY

- A. **The manufacturer shall warrant that the systems be supplied in accordance with these specifications and shall perform as described herein. The manufacturer shall warrant that the systems will be free from defects in materials and workmanship for a period of one (1) year after substantial completion of the project. At the manufacturer's discretion, the manufacturer shall repair or provide replacement for any defective components under**

**this warranty provided that any such defect was not the result of misuse of the component by the Owner or the Owner's Agent. Refer to Section 01740 for warranty requirements.**

- B. **As noted in Paragraph 1.01, Thickeners No. 2A and 2B shall be placed in operation and utilized prior to installation of Thickeners No. 1A and 1B. The warranty period for all four thickeners shall be for one (1) year after substantial completion of the project. Contractor shall coordinate construction schedule with gravity thickener manufacturer.**

## PART 2 PRODUCTS

### 2.01 MATERIALS AND EQUIPMENT

- A. This section calls attention to certain features, but does not purport to cover all details of construction of the units.
- B. All equipment shall be assembled in the manufacturer's shop as far as practical to ensure proper fitting of parts, then match-marked for erection and disassembled for shipment. All field connections shall be bolted connections, sized and arranged to resist all static, live and erection loads. Field welded assembly shall be minimized. Photographs of test assembly shall be made available to the Engineer upon written request.
- C. The equipment shall be constructed so that there will be no chains, sprockets, bearings or operating mechanism below the liquid surface or in contact with the liquid.
- D. All structural steel used in the fabrication of the mechanisms shall be Type 304 stainless steel and shall conform to the applicable requirements of ASTM. Selection and fabrication of structural steel members shall be in accordance with the latest edition of the AISC "Specifications for Design, Fabrication and Erection of Structural Steel for Buildings". All welding shall be continuous and conform to the latest standards of AWS. All structural steel shall have a minimum thickness of 1/4-in, except as otherwise noted.

### 2.02 CENTER DRIVE ASSEMBLY

- A. Provide the center drive assembly completely factory assembled and shipped as a complete unit. The basic acceptable drive types are: helical and worm gear, hydraulic gear and cycloidal reducer.
- B. The drive assembly shall consist of an electric motor connected to a primary helical or cycloidal reducer; drive and driven sprockets with drive chain (if used); an intermediate worm gear reducer (if used); pinion gear; turntable base and main spur gear; and complete automatic overload actuating system. Drive assemblies shall be completely factory assembled and shipped as complete units.
- C. The requirements for the center drive assembly construction are further described in the following.
1. Design the entire drive assembly on the basis of a maximum continuous working output torque of not less than 29,000 ft.-lbs. at this maximum continuous working output torque, all gearing in the drive train shall be rated on the latest AGMA standards with a service factor of 1.0. Provide the complete drive assembly with an AGMA torque rating that includes a service factor of 1.25. This shall apply to both strength and durability with the

minimum value used as the controlling limit. The main gear shall have a minimum diameter of 40 inches. With respect to the main spur gear and companion pinion, the AGMA rating shall be based on a life of 20 years continuous duty for both strength and durability. The drive assembly is to be capable of withstanding a stalled torque of twice the maximum continuous working output torque. At the stalled torque, no components of the drive train or drive platform shall be stressed to a level greater than 90 percent of yield. In addition, the unit shall be of sufficient strength to screed the 2-in of grout in the tank bottom without damage to any of its components.

2. Provide drive motor of either 1,200 or 1,800 rpm, totally enclosed, **rated for a Class 1 Division 1 environment** and in conformance to the motor standards in Section 01171. The motor shall be rated for a minimum of 0.75 Hp and sized such that the nameplate horsepower rating will not be exceeded if the mechanism operates at the stalled torque.
3. The primary cycloidal, planetary or helical gear reducer shall be either of the directly connected geared motor type or be separately connected to the electric motor by a flexible coupling. Gear assemblies used in the primary gear reducers shall conform to AGMA Service Classification II and have a service factor of not less than 1.4. Gears are to be supported on anti-friction bearings or directly mounted to the pinion and be oil or grease lubricated. Oil fill, drain, vent and level indicator devices or grease zerks shall be provided. Provide oil (if used) level monitoring, drainage, condensate draining and oil refill to be easily accomplished from a safe working position on the operating platform and all fittings with clear accessibility and work room. Provide oil (if used) drain extension tube as required to allow collection of drained oil and condensate into a container. Arrangements requiring auxiliary oil pumps or recirculating systems are not acceptable.
4. Provide chain drive (if used) with a minimum factor of safety of 4 as applied to the ultimate breaking or transmission strength of the chain with respect to loads transmitted at twice the maximum continuous output torque rating of the mechanism. Provide chains of the steel roller type. Fabricate sprockets from either steel or high test cast-iron. Provide chain and sprockets enclosed in a weatherproof fabricated stainless steel guard provided with service openings or equal configuration of corrosion resistant materials.
5. Provide intermediate gear reducer (if used) secured to the turntable base. The intermediate gear set shall be a cylindrical or double-enveloping worm and worm gear. The worm gearing assembly shall be supported on anti-friction roller bearings and operate in an oil bath. Provide worm gears of cast bronze or high-test cast iron either manufactured in one or two parts. If the worm gear consists of two parts, namely a rim and a spider, it is to be shouldered, bolted and doweled for concentricity. The worm shall be hardened ground alloy steel or high test heat treated cast iron. Provide the worm gearing enclosed in at least ASTM A48, Class 40 high grade cast iron housing with a removable cover over the worm. Drive configurations that utilize cycloidal or planetary reduction directly coupled to the pinion shaft do not require intermediate reduction. The output pinion shaft shall be of one or two piece construction with no over-hung loading conditions. The shaft shall be precision aligned and supported by upper and lower bearing assemblies. Suitable oil fill, drain and oil level indicator devices shall be provided. Oil level monitoring, drainage and refill is to be easily accomplished from a safe working position on the operating platform and all fittings shall be provided with clear accessibility and work room. Provide the oil drain with an extension tube as required to permit collection of drained oil into a container.

6. The turntable base shall be bolted to the center column and constructed of high test cast iron conforming to ASTM A48, Class 30A or 40, **or Type 304 stainless steel**. The turntable base shall support the main spur gear; the entire rotating mechanism; and one end of the Access Bridge and walkway. The top of the turntable base shall provide or support a convenient access platform for the drive mechanism. Turntable base shall have an annular raceway for a ball race upon which the main spur gear rotates. The turntable base shall incorporate a deep oil reservoir to allow sediment to settle away from the ball race.
7. The ball race which supports the rotating mechanism shall have a diameter to assure stability (minimum 45 inches), without the need of guide shoes and shall be designed for both radial and thrust loads. The ball race shall use alloy steel balls which shall rotate on renewable hardened steel strip liners inserted in the turntable base and main spur gear or rotate locked in place by a full-contour deep groove raceway. Units utilizing full-contour deep groove raceways in the gear shall provide for replacement of the balls without removing the gear. The balls shall run in an oil bath and shall be protected by a felt or neoprene seal and a steel dust shield. Suitable oil fill, drain and level indicator devices, which can be easily read from the operating platform shall be provided. Provide oil level monitoring, drainage and refill that can be easily accomplished from a safe working position on the operating platform and all fittings with clear accessibility and work room. Provide oil drain with an extension tube as required to allow collection of drained oil into a container.
8. Provide the main spur gear of high test nodular cast iron in accordance with ASTM A536 with a minimum tensile strength of 80,000 psi or Alloy Steel AISI 4140 with a minimum ultimate strength of 120,000 psi or cast steel conforming to ASTM A148. The gear shall be driven by either a heat treated high test cast iron or heat treated alloy steel pinion gear keyed to the output shaft of the intermediate worm gear reducer or directly connected to the output shaft of the primary cycloidal or planetary reducer. The main spur gear/bearing shall support the entire load of the rotating collector assembly from the mounting lugs.
9. Provide gear assemblies used in speed reducers or geared motors conforming to AGMA Service Classification II. All gear assemblies including the main gear and pinion used in the drive assembly shall conform to the applicable requirements of the AGMA Standards specified in Part 1 and be especially selected for the actual operating speed range of the mechanism.
10. All bearings incorporated within the drive assembly shall be of the anti-friction type, oil or grease lubricated, and conform to the following schedule of minimum rated-life expectancy (B-10) based on the ABMA standards when operating at the maximum continuous working output torque rating of the mechanism.
  - a. Main turntable and pinion bearings B10 - 200,000 hours
  - b. Intermediate Worm (if used) and wheel gearbox bearings B10 - 200,000 hour
  - c. Cycloidal or Helical and spur speed reducer gearbox bearings B10 - 30,000 hours
  - d. Geared motor (direct drive) B10 - 30,000 hours

## 2.03 TORQUE LIMITING DEVICES

- A. A high-torque warning, and high-high torque shut-off device shall be incorporated into the drive assembly and shall be rated for Class 1, Division 1. The device is to be actuated by the thrust from the worm shaft or rotation from the primary or intermediate gear reducer and have an indicating meter so that the load on the mechanism can be visually monitored from the platform

at all times during operation. Provide assembly enclosure that is completely weatherproof and provided with access panels for field adjustment or removal of parts when necessary and 120 Volt heaters to prevent condensation. The enclosure for electrical components is to be rated for Class 1, Division 1 environment. Exposed linkage bars and moving gear housings are not acceptable.

1. Provide the overload warning device pre-set at the factory to allow the transmission of a remote signal in case of impending excessive load. The device shall be set to energize an alarm in the case of impending excessive load of to 100 percent of the maximum continuous working output torque and motor cutout at 120 percent of the maximum continuous torque.
  2. The electrical supply to the overload device shall be 120 Volts, single phase, 60 Hz. Provide dry contacts rated 10 Amps at 120 V AC for remote control of alarms. Provide one pair of contacts for overload warning and one pair of contacts for motor shutdown, each with one normally open and one normally closed contact.
  3. Alternate means of accomplishing overload warning (such as current sensing devices) will be considered for approval providing that any revisions in electrical and instrumentation work required to accommodate such an alternate can be made at no additional cost to the Owner and be as approved by the Engineer.
- B. Shear pin device, or an additional mechanical or electronic over load device, set for 130 percent of the maximum continuous working output torque shall be furnished. Ball detent type overloads are not acceptable.

#### 2.04 DRIVE MECHANISM CONTROL PANEL AND ACCESSORIES

- A. The gravity thickener drive control system shall be a Type B packaged control system type as specified in Section 13390.
- B. Each thickener drive shall be provided with a Control Panel as shown on the Drawings. Refer to Electrical Drawings for drive mechanism control panel interconnect wiring schematic. Refer to Section 13390 for Package Control System requirements.
  1. Provide sun shield as specified in Section 13390.
- C. The controls for each thickener drive system shall be mounted in a NEMA 4X Type 316 stainless steel enclosure provided by the thickener manufacturer. Panels shall be located as shown on the Drawings. Panel construction shall meet the herein specified requirements and the general requirements of Section 13390.
- D. The control panel shall have a hinged front door with neoprene gasket. Provide appropriate electric shock warning label on the outdoor of the panel. A nameplate shall be permanently affixed to the panel and include the model number, voltage, phase, hertz, ampere rating, and horsepower rating of the drive mechanism.
- E. Each control panel shall house the motor starter, control 2 relays, and other devices necessary to provide the correct operation sequence.

1. At a minimum, the following controls shall be provided for each drive mechanism control panel system:
  - a. Drive Start Pushbutton.
  - b. Drive Stop Pushbutton.
  - c. Reset.
  - d. Run Indicating Light (Red).
- F. Complete drive mechanism control panels shall be provided for mounting and shall be completely wired and ready for field connection of power, control/sensory, and alarm wiring. The control panels shall be located at each gravity thickener as shown on the Drawings. The entire control panel assemblies shall be UL labeled for industrial control panels in accordance with UL-508.
- G. Power supply to the thickener drive mechanism control panels will be 480 Volt, 3 phase. Provide individual thermal magnetic circuit breakers/disconnect switches interlocked with the door handle. 120 and/or 24-volt control circuit transformers with fuse protection shall be included.
  1. Control leads to and from the thickener drive shall be low voltage, microwatt type designed such that if system components fail, voltage and current will not exceed their normal values. All of the low voltage intrinsically safe components shall be isolated by and mounted through a grounded metal barrier. All field connections shall be by means of terminals.
  2. Panels shall have lamacoid nameplates, drive run lights, alarm lights (including torque alarm), a thermostatically (adjustable) controlled condensate heater, and lightning protection.

## 2.05 ACCESS BRIDGES AND WALKWAYS

- A. For each thickener, an access bridge and walkway shall extend from the tank sidewall to the operating platform support on the stationary turntable base as shown on the Drawings. One end bearing member of the bridges shall slide. Each bridge shall be oriented as shown on the Drawings.
- B. The bridges and supports shall consist of structural trusses, beams or channels. Structural members shall be of Type 304 stainless steel and at least 3/16-inch thick. The walkways shall be aluminum grating at least 36-in wide inside the guardrails. Provide aluminum grating treads with integral slip resistant nosing's where steps are required. Walkways and bridges shall be designed for a super-imposed minimum loading of 100 lbs. /sq. ft. Deflection of the access bridges under this load shall not exceed 1/360 of span. The walkways surface shall be the same elevation as the operating platform to provide a uniform walkway surface.
- C. Aluminum guard railing with a 4-in toe board shall be attached to both sides of the bridges and extend around the operating platform. If a truss bridge is used, the truss sides may be designed to serve as the guard railing if equal to or greater than 3-ft 6-in high. The guard railing shall conform to OSHA requirements, to the standard details shown on the Structural Drawings for a 1-1/2-in diameter 2-rail system, and to Section 05520 with respect to materials and type of construction, line and post dimensions and spacing and strength requirements.

- D. The operating platform at the turntable base shall be of skid proof 3/8-in thick aluminum or 1/4-in Type 304 stainless steel checkered plate and shall provide a walkway space at least 2-ft-0-in wide on all sides of the drive.
- E. An electrical fixture mounting platform shall be provided on each access bridge, in accordance with the Catwalk Pole Mounting Detail included on the electrical Drawings. The mechanism manufacturer shall consider this fixture and detail in the overall bridge design and coordinate this detail design with the actual fixture furnished by Division 16.

## 2.06 CENTER COLUMN

- A. The center column (pier) shall be structurally sized to completely support the entire sludge collector mechanism including the inboard end of the access bridges. The center column shall be constructed from 1/4-in thick (minimum) Type 304 stainless steel plate reinforced and constructed such that no portion of the center column or top and bottom attachment flanges will be stressed beyond the allowable limits set forth in the AISC standards when the full stalled torque of the drive assembly is applied. The center columns shall have a **diameter of 18-in.**
- B. The center column shall be mounted over the concrete influent port at the center of the tank. The bottom of the center column shall have a bolting flange for anchorage to the new concrete tank. The equipment manufacturer shall furnish a template to locate the anchor bolts for the center column. Anchor bolts shall be provided to ensure complete rigidity of the sludge collector equipment to the concrete. Two 12-in square or circular bolted inspection and access hatches shall be provided at the base of the center column. The anchor bolts shall be of Type 316 stainless steel.
- C. The center column shall have outlet ports to disperse the influent into the tanks near the water surface. The number and size of the outlet ports shall be such that the velocity of the flow in the outlet ports shall not exceed 1.6 fps at the maximum influent flows specified in paragraph 1.06D. The top of the center column shall be provided with a mounting plate to provide an accurate fit of the drive assembly and allow the drive assembly to be accurately positioned, shimmed, leveled and grouted in place. The drive assembly shall be attached with Type 316 stainless steel bolts or machine screws.

## 2.07 CENTER FEED WELL

- A. The influent center feed well shall be designed to efficiently and evenly disperse the influent liquid into the tank without disturbance. The well shall be at least 10-foot diameter. The influent well shall extend at least 6-inches above the normal maximum water surface in the tank and at least 3-ft, 9-in below the water surface. The influent well shall be constructed of 3/16-in or thicker Type 304 stainless steel plate suitably reinforced with a top rim angle and vertical stiffening angles as required. The influent well shall be supported by and shall rotate with the center drive cage. Provisions shall be made for the continuous or periodic removal of scum and floating material from inside the influent well without allowing short circuiting. The above provision shall take the form of slots compatible with existing baffles.

## 2.08 CENTER DRIVE CAGE

- A. The center drive cage shall be of a box truss all-welded construction of structural Type 304 stainless steel having minimum plate thickness of 1/4-in. Center drive cage shall be fastened to the main spur gear assembly with Type 304 stainless steel machine screws or a high strength

bolted connection. The center drive cage shall support and rotate the two collector arm assemblies complete with the influent well and scum removal devices. The center drive cage assembly shall have sufficient strength and rigidity that no member will be stressed beyond the allowable limits set forth in the AISC standards when the full stalled torque load of the drive assembly is applied as a distributed load over the length of the rake collector arm, in the forward direction. The rake arms shall be designed to have sufficient strength and rigidity to handle momentary jogs in the reverse direction. The two rake collector arms shall be connected to the center drive cage by rigid bolted connections.

## 2.09 SLUDGE COLLECTION EQUIPMENT

- A. Each sludge collector mechanism shall have two structural Type 304 stainless steel rake collector arms, located 180 degrees apart, and rigidly connected to the center drive cage. The rake collector arms shall be of a rectangular truss construction conforming to the slope of the tank floor and shall extend from the center drive cage to the inside face of the outer wall of the tank. Triangular truss construction is not acceptable.
- B. Each rake collector arm shall be provided with inward scraping steel blades to scrape the thickened sludge along the tank bottom to the sludge hopper located at the center of the tank. The rake arms and scraper blades shall be arranged to scrape the entire tank bottom twice per revolution of the mechanism. The rake collector blades shall have a minimum depth of 9-1/2-in and shall be of stilted construction for maximum thickening.
- C. To ensure alignment and connection to the center drive cage, the width of the rake collector arms shall be approximately the same as the center drive cage. The rake arms shall be connected to the center drive cage in such a manner that each arm can be easily removed completely or adjusted to conform to the angle of the tank floor when the tank is partially or completely empty. Furnish shims as required to adjust rake arm angle. The arms shall not incorporate the use of tie rods or yoke connections.
- D. All blades shall be provided with adjustable Type 304 stainless steel squeegees projecting approximately 1-1/2-in below the bottom of the blade and secured by Type 304 stainless steel bolts and nuts. Each squeegee shall have a minimum thickness of 26 gauge and be designed for a 2-in minimum adjustment in the vertical plane.
- E. Components of the rake collector arms shall be constructed from 1/4-in thick (minimum) Type 304 stainless steel plate and angle, suitably reinforced such that no portion of the rake arm will be stressed beyond the allowable limits set forth in the AISC standards when the full stalled (motor cut-out) torque load of the drive assembly is applied as a distributed load on one of the rake arms.
- F. The rake collector arms shall be equipped with vertical stirring angles (pickets) attached with Type 304 stainless steel bolts to provide a sludge discharge of maximum density. The pickets shall be spaced at 2-ft on center.
- G. The sludge hopper shall be furnished with a four-blade scraper assembly as shown on the Drawings. The scraper shall be designed to continuously move accumulated sludge to the sludge withdrawal pipe. The blade settings shall be such that the concentric sludge hopper is scraped four times with each revolution of the mechanism. Each scraper blade shall be rigidly fixed to the center drive cage. Each scraper shall be constructed such that no portion of the

scraper will be stressed beyond the allowable limits set forth in the AISC standards when 25 percent of the stall torque load of the drive assembly is applied.

## 2.10 SCUM COLLECTION EQUIPMENT

- A. Each thickener mechanisms shall be provided with two scum skimming devices to move and remove any floating scum from the entire tank water surface to a single 4-ft x 4-ft scum box as shown on the Drawings. The scum removal system shall consist of a scum skimmer blade; cantilevered support boom; truss support system; and with neoprene strips on the bottom and inner edges to seal the entrapped scum and water when discharging into the scum box.
- B. The mechanisms shall be equipped with one scum box cantilevered from the tank wall extending inward to the influent well as shown on the Drawings.
- C. The scum removal system shall consist of structural stainless steel member cantilevered from the cage and feed well. The scum removal member shall be fitted with a neoprene skirt 12-in deep by 3/8-in and fastened with steel back-up bars and stainless steel fasteners.
- D. The approach ramp of the box shall have a tapered width and sloped. The scum box shall be fabricated from 3/16-in welded stainless steel.
- E. A 6-in or 8-in Schedule 40 stub pipe connector for field fitting of a flexible connector shall be located at the inner end of the box, depending on the thickener per the Drawings. Rigid pipe connection will not be allowed. The trough shall be fully adjustable by providing a mid-adjustment leveling support and adjustable supports at the tank wall.
- F. The scum removal system shall be equipped with a mechanical flushing assembly to flush the scum box with thickener supernatant. The system shall be designed so that the skimmer boom trips the flap gate/valve as it passes the scum box to allow water to enter. The quantity of flush water allowed, and the start of the flush cycle, shall be field adjustable using trip arms connected to the skimmer boom.

## 2.11 SPRAY NOZZLES SYSTEM

- A. A spray nozzles system shall be mounted to the bridge assembly as shown on the Drawings. A series of continuous spray nozzles shall be provided with a flat spray pattern.

## 2.12 BOLTS, NUTS, WASHERS, ANCHORS AND HARDWARE

- A. It shall be the responsibility of the equipment manufacturer to determine the number, size and location of all anchor bolts to be set in concrete. Anchor bolts, nuts and washers shall be ASTM A276, Type 316 stainless steel. Anchor bolts for field tests may be mild steel bolts. All anchor bolts shall be furnished by the equipment manufacturer.
- B. Except where specified otherwise, bolts for the equipment assembly shall be of the best-quality refined steel. Hexagonal nuts of the same quality of metal as the bolts shall be used. All threads shall be clean cut and shall conform to ANSI B1.1. Fasteners for high stressed conditions shall conform to ASTM A325.
- C. Mild steel bolts, nuts and washers shall be galvanized, or zinc-coated, after being threaded, by the hot-dip process in conformity with ASTM A123, or ASTM A153, as applicable.

- D. The equipment manufacturer shall furnish all templates for setting the anchorage.

## 2.13 SURFACE PREPARATION AND SHOP PRIME PAINTING

- A. Surface preparation and shop prime painting shall be part of the work of this section and shall be as specified in Section 09901. Galvanized, aluminum and stainless steel surfaces shall not require painting.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Installation of gravity thickener equipment into the existing thickener structures shall be in strict accordance with the Contract Documents and respective manufacturer's instructions and recommendations in the locations shown on the Drawings. For each thickener, the Contractor may remove the top hexagonal center of the existing domed cover and bring in gravity thickener mechanism and walkway components using the hexagonal opening, as shown on the Drawings. The Contractor may also bring in gravity thickener mechanism and walkway components through the door. The Contractor shall coordinate with manufacturer for installation.
- B. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations. Anchor bolts shall be furnished by the equipment manufacturer and set in accordance with the manufacturer's recommendations.
- C. Submit a certificate from the manufacturer stating that the installed equipment has been examined and found to be in complete accordance with the manufacturer's requirements and specifications, that the equipment is ready for operation and that the operating personnel have been suitably instructed in the operation, lubrication and care of the equipment.

### 3.02 FIELD TESTING

- A. Furnish the services of a factory representative as specified in PART 1 to inspect the final installation and supervise a test run of the equipment.
- B. Working under the direction of the manufacturer, perform field tests as follows:
  - 1. A torque test shall be conducted **for each thickener mechanism.**
  - 2. Anchor bolts furnished by the equipment manufacturer shall be embedded in the concrete floor at points near the outer portion of the rake arms. The anchor bolts shall be suitable for the loads applied and shall be cut off flush with the rough concrete surface after the tests are completed. The bolts shall be arranged so that a single cable shall be used at the apex of the cables connecting panel points of the rake arms. A hydraulic cylinder of sufficient capacity with a known piston diameter, complete with pressure gauge, shall be connected to the anchor bolts to determine the horizontal load developed. The required gauge reading shall be such that the gauge indicates a force at the anchor bolts, which, when multiplied by the distance from the center of the tank to the anchor bolts, will equal twice the specified maximum continuous working output torque. This force shall be maintained for a period of 15 seconds duration to assure that the equipment is capable of withstanding the required loading under static test conditions (i.e., without the drive motor

in operation) and to verify or correct the setting of the overload device prior to the actual testing of the equipment with the drive motor. Also adjust the over load warning torque setting specified in PART 2. Alternative methods of producing the required torque will be considered. Details of any alternative test procedures shall be submitted to the Engineer for approval. Test methods shall not apply impact loading or jerky loading conditions to the mechanism which may reduce the life of the equipment.

3. After the above test and adjustments and settings to the overload device have been made, the drive motor shall be switched on and the mechanism loaded to overload condition to ensure that the sludge collector mechanism will alarm, then stop when a predetermined overload condition occurs in the tank.
4. Upon completion of the static and operating torque tests, the mechanism shall be run dry for a period of eight hours and shall operate without vibration, noise, jamming, or overheating. Special attention shall be given during the dry test run of the equipment for the clearance of the rake scraper blades and for the operation of the scum removal device and the settings of the scum removal blade to the scum trough lip. The settings of the hinged blade to the scum box lip and the rubber wiping and sealing strips shall be such as to ensure an adequate volume of scum and effluent will be discharged once every complete revolution of the sludge collection mechanism under normal operating conditions.
5. The tests shall be conducted in the presence of the Engineer. The Contractor shall furnish all power, water, equipment and appurtenances required for testing.
6. In the event the mechanisms fail to meet the above test, the necessary changes shall be made and the mechanisms retested. If the mechanisms remain unable to meet the test requirements to the satisfaction of the Engineer, they shall be removed and replaced with satisfactory mechanisms at no additional cost to the Owner.

END OF SECTION

SECTION 15120  
PROCESS MECHANICAL PIPING SPECIALTIES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install complete test, and make ready for operation all piping specialties required by the work of this Contract. Specific piping materials, systems and related installation and testing requirements shall be coordinated with the related sections in Divisions 2, 13 and 15. The items shall include the following:

1. Unions
2. Flanged Joints
3. Dielectric Connectors
4. Plugs and Caps
5. Miscellaneous Adaptors
6. Vents and Drains
7. Shock Absorbers (Water Hammer Arrestor)
8. Line Strainers
9. Service Clamps
10. Cleanouts
11. Quick Connect Couplings
12. Mechanical Sleeve Seals
13. Flexible Connectors
  - a. Sleeve Couplings
  - b. Split or Grooved Couplings
  - c. Flange Adapters
  - d. Pump and Equipment Flexible Connectors
  - e. Flexible Connectors
  - f. Transition Couplings
14. Expansion Joints
  - a. Single- and Multiple-Arch Type
  - b. Bellows Style
  - c. Flexible Metal Hose
15. Harnessing and Restraints
16. Pressure Gauges

17. Diaphragm Seals for Gauges
18. Thermometers
19. Rotameters and Flow Indicators
20. Spray Nozzle
21. Wash Hose Stations
22. Appurtenances and Miscellaneous Items
23. Color Coding and Labeling

#### 1.02 RELATED WORK

- A. Pipeline color coding and labeling is included in Section 09902
- B. Piping materials and systems are included in other Sections of Division 15.
- C. Specialties and apparatus furnished with equipment and systems are included in individual Sections in Division 11.
- D. Valves are included in Section 15100.
- E. Pipe supports are included in Section 15140.
- F. Pipe insulation is included in Section 15250.

#### 1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, general submittals for piping, piping systems and pipeline appurtenances are listed below. It is not intended that all submittals listed below be provided for all piping materials and systems. Refer to individual System or Piping Sections for specific submittals.
- B. Shop Drawings and Product Data
  1. Piping layouts with specialties.
  2. Location of pipe hangers and supports.
  3. Location and type of backup block or device to prevent joint separation.
  4. Large scale details of wall penetrations and fabricated fittings.
  5. Catalog cuts of specialties, joints, couplings, harnesses, expansion joints, gaskets, fasteners and other accessories.
  6. Catalog cuts of all pipeline appurtenances specified herein.

7. Brochures and technical data on coatings and linings and proposed method for application and repair.

C. Samples

D. Design Data

E. Certificates

1. Copies of certification for all welders performing work in accordance with ANSI B31.1.

F. Manufacturers Installation (or application) instructions.

G. Statement of Qualifications

H. Manufacturers Field Report

I. Project Record Document

J. Operation and Maintenance Data in accordance with Section 01730.

K. Warranties

1.04 REFERENCE STANDARDS

A. ASTM International

1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A126 - Standard Specification for Gray Iron Casting for Valves, Flanges and Pipe Fittings.
3. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts.
4. ASTM A278 - Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 Degrees F.
5. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
6. ASTM A325 - Standard Specification for Strength Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
7. ASTM A536 - Standard Specification for Ductile Iron Castings
8. ASTM A575 - Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
9. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
10. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

- B. American National Standards Institute (ANSI)
  - 1. ANSI A13.1 - Scheme for the Identification of Piping Systems.
  - 2. ANSI B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form)
  - 3. ANSI B18.2 - Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws.
  - 4. ANSI B31 - Code for Pressure Piping.
  - 5. ANSI B31.1 - Power Piping
- C. American Society of Mechanical Engineers (ASME)
  - 1. ASME B2.1 - Specifications, Dimensions, Gauging for Taper and Straight Pipe Threads (except dry seals).
  - 2. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
  - 3. ASME B16.5 - Pipe Flanges and Flange Fittings
- D. American Welding Society (AWS)
  - 1. AWS B3.0 - Welding Procedure and Performance Qualifications
- E. American Water Works Association (AWWA)
  - 1. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3-in Through 48-in (75mm Through 1200mm), for Water and Other Liquids.
  - 2. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - 3. AWWA C219 - Bolted Sleeve-Type Couplings for Plain-End Pipe
  - 4. AWWA C606 - Grooved and Shouldered Joints.
  - 5. AWWA Manual M11 - Steel Pipe - A Guide for Design and Installation.
- F. Plumbing and Drainage Institute (PDI)
  - 1. WH 201 - Water Hammer Arrestors
- G. Underwriters Laboratories (UL)
- H. Factory Mutual (FM)
- I. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

## 1.05 QUALITY ASSURANCE

- A. All materials shall be new and unused.
- B. Install piping to meet requirements of local codes.
- C. Provide manufacturer's certification that materials meet or exceed minimum requirements as specified.
- D. Coordinate dimensions and drilling of flanges with flanges for valves, pumps and other equipment to be installed in piping systems. Bolt holes in flanges to straddle vertical centerline.
- E. Reject materials contaminated with gasoline, lubricating oil, liquid or gaseous fuel, aromatic compounds, paint solvent, paint thinner and acid solder.
- F. Pipe-joint compound, for pipe carrying flammable or toxic gas, must bear approval of UL or FM.
- G. Unless otherwise specified, pressures referred to in all Piping Sections are expressed in pounds per square inch, gauge above atmospheric pressure, psig and all temperature are expressed in degrees Fahrenheit (F).

## 1.06 DELIVERY, STORAGE AND HANDLING

- A. During loading, transportation and unloading, take care to prevent damage to pipes and coating. Carefully load and unload each pipe under control at all times. Place skids or blocks under each pipe in the shop and securely wedge pipe during transportation to ensure no injury to pipe and lining. Cover or cap all pipe ends while pipe is in storage, until it is made a part of the work.

## PART 2 PRODUCTS

### 2.01 MATERIALS AND EQUIPMENT

- A. Specific piping materials and appurtenances are specified in the respective Piping or System Sections. The use of a manufacturer's name and/or model number is for the purpose of establishing the standard of quality and general configuration desired.
- B. Equipment shall be of the size shown on the Drawings or as noted and as far as possible equipment of the same type shall be identical and from one manufacturer.
- C. Equipment shall have the name of the maker, nominal size, flow directional arrows (if applicable), working pressure for which they are designed and standard referenced specifications. Equipment titles shall be marked per Section 09902.
- D. Unless otherwise noted, items shall have a minimum working pressure of 150 psi or be of the same working pressure as the pipe they connect to, whichever is higher and suitable for the pressures noted where they are installed.

## 2.02 UNIONS

- A. Unions shall be brass or bronze unions for joining nonferrous pipe; malleable brass or bronze-seated iron or steel unions for joining ferrous pipe; PVC unions for joining PVC pipe; CPVC unions for joining CPVC pipe.

## 2.03 FLANGED JOINTS

- A. Flanged Joints. Bolt and nuts, Grade B, ASTM A307 or Type 304 stainless steel, bolt number and size same as flange standard; studs - same quality as machine bolts; 1/16-in thick rubber gaskets with cloth insertions; rust-resistant coatings.

## 2.04 DIELECTRIC CONNECTORS

- A. Dielectric pipe fittings/insulators and unions shall be used to prevent galvanic action wherever valves or piping of dissimilar metals connect. This shall be particularly the case for copper, brass and bronze piping connecting to cast iron or steel piping systems.
- B. Dielectric unions shall be used for 2-in and smaller connections. Steel union nuts shall meet ASTM A575 requirements. The steel or ductile iron connection end shall have a steel body and shall have accurately machined taper tapped pipe threads in accordance with ASME B2.1. The copper connection end shall be a copper solder joint that meets requirements of ASTM B88. Dielectric unions shall be rated for at least 250 psi at 210 degrees F.
- C. Dielectric flange unions shall be used for connections 2-1/2-in and larger. Cast iron flanges shall meet ASTM A126; the copper solder end shall meet ASTM B62 and the pipe thread shall meet ASME B2.1. Dielectric flange unions shall be rated for at least 175 psi at 210 degrees F.
- D. Dielectric unions and flange unions shall be as manufactured by Epco Inc., Cleveland, OH or equal.
- E. Flange insulating kits shall be as acceptable to the Engineer, as manufactured by PSI or equal.
- F. Insulated sleeve couplings and flange adaptors shall be similar to those units as specified elsewhere.

## 2.05 PLUGS AND CAPS

- A. Provide standard plug or cap as required for testing; plugs, caps suitable for permanent service.
- B. Plug or cap or otherwise cover all piping work in progress.

## 2.06 MISCELLANEOUS ADAPTORS

- A. Between different types of pipe and/or fittings special adapters may be required to provide proper connection. Some of these may be indicated on the Drawings or specified with individual types of pipe or equipment. However, it is the Contractor's responsibility to ensure proper connection between various types of pipe, to structures and between pipe and valves, gates, fittings and other appurtenances. Provide all adapters as required, whether specifically noted or not.

- B. As required, these adapters shall be suitable for direct bury, with proper dielectric insulation and as a minimum, if metallic (not stainless steel or galvanized), with two coats of Coal Tar Epoxy.

## 2.07 VENTS AND DRAINS

- A. 1/2-in vents shall be provided at the high point in each system. Vent connections may be tapped, provided the tap will accept three full threads on the bronze nipple.
- B. 1-1/2-in drains shall be provided to permit drainage of each system located on the invert of the blind flange; provide hose-end valve.

## 2.08 SHOCK ABSORBERS (WATER HAMMER ARRESTORS)

- A. Shock absorbers shall be supplied on the non-potable and potable water piping. The shock absorbers shall be Model 1485-1 as manufactured by Josam Manufacturing Company, Michigan City, IN; similar model by J.R. Smith or Zurn Industries; or equal.
- B. Arrestors shall be sized in accordance with PDI WH 201, for all hot and cold water systems.
- C. Placement shall be in accordance with PDI WH 201 with a minimum of one shock absorber at each quick acting valve, lever operated valve, self closing valve and self closing valve/faucet; or a minimum of one for each battery of these fixtures. The water hammer arrestors shall be accessible for maintenance.

## 2.09 LINE STRAINERS

### A. "Y" Type Strainers

1. Manual strainers furnished for pipe diameters smaller than 2-in shall be "Y" type, capable of removing solids 0.01-in in diameter and larger. The strainer body shall be of semi-steel construction for steel pipe and brass or bronze for copper pipe and shall conform to the latest revision of ASTM A278, Class 30. Strainer elements, including woven wire mesh, shall be constructed of stainless steel.
2. The design of the strainer body shall be such that the cleanout plug and screen may be easily removed to permit inspection and cleaning without disassembly of the inlet and outlet piping. End connections shall be ANSI screwed pipe threads.
3. Sufficient spare screen shall be furnished for replacement of all "Y" type units at least once. The strainers shall be designed for a maximum operating pressure of 150 psig. They shall be as manufactured by GA Industries Inc., Pittsburg, PA or equal.

### B. Manual Basket Strainer

1. Manual basket strainers shall be furnished for pipe diameters 2-in in diameter and larger as shown on the Drawings. The mesh size shall be 150 microns (100 mesh) unless otherwise specified herein or on the Drawings.
2. The strainer body shall be equivalent to Schedule 80 PVC pipe. The strainer elements, including woven wire screen, shall be constructed of Type 304 stainless steel. The bodies of the strainers shall be of heavy-duty construction, with an easily removable gasketed

cover. The body shall be supplied with female NPT threaded connections. The design of the basket strainer body shall be such that the bolted lid and basket may be easily removed for inspection and cleaning without disassembly of the inlet and outlet piping.

3. A trap with a blow-off port shall be provided for removing any material that may settle at the bottom. The strainers shall be designed for a maximum operating pressure of 150 psig. Strainer shall be a Simplex Basket Strainer as manufactured by Hayward, or equivalent design and materials by Spears Manufacturing Company or GA Industries Inc, or approved equal.
4. Proper blow-off piping with valve shall be supplied and run to nearest drain.

#### C. Rotating Screen Strainer

1. In-line rotating dual screen strainers shall be furnished for pipe diameters 2-in in diameter and larger, as shown on the Drawings. The strainer shall employ two handwheel-equipped rotating screens and rigid scraper bars to remove solids from the surface of the screens when the handwheels are rotated. The strainer shall be equipped with a solids-collecting sump. Cleaning of the strainer shall be accomplished by opening a valve on the sump flush connection (while operating under positive pressure) and rotating the handwheels several times.
2. The strainer body shall be of cast iron construction and be equipped with flanges to match process piping. The strainer elements, including the perforated metal screen, shall be constructed of Type 304 stainless steel. Screen perforations shall be 3/32-inch staggered, with 33% open area.
3. The strainer shall allow for external scraper adjustment. Strainers that require disassembly for cleaning are not acceptable.
4. The strainers shall be designed for a maximum operating pressure of 150 psig, and shall be Type DH as manufactured by Hellan® Strainer or approved equal.
5. Strainer shall be equipped with a solids flush outlet and ball valve. Solids flush shall be run to the nearest drain as shown on Drawings.

#### 2.10 SERVICE CLAMPS

- A. Service clamps for outlet sizes up to 2-in shall have malleable or ductile iron bodies which extend at least 160 degrees around the circumference of the pipe and shall have neoprene gaskets cemented to the saddle body. Bodies shall be tapped for IPS. Clamps shall be of the double strap design. Service clamps shall be Style 91 by Dresser Industries, Inc.; Smith Blair; Mueller or equal.
- B. Service clamps for outlet sizes 4-in through 12-in where the outlet size is not greater than half the size of the main pipe shall have ductile iron bodies and a neoprene circular cross section O-ring gasket confined within the body. Outlet shall be AWWA C110 flange or AWWA C111 mechanical joint as required for the application. Straps shall be alloy steel, minimum 1/4-in by 1-1/2-in in cross section and fabricated with 3/4-in threaded ends. Service clamps shall be Fig. A-10920 or A-30920 by American Cast Iron Pipe Company or equal.

## 2.11 CLEANOUTS

- A. Interior flush floor cleanouts shall consist of a coated cast iron ferrule, a tapered threaded bronze cleanout plug, adjustable housing and a scoriated round cast iron tractor cover with bronze top. Interior flush floor cleanouts shall be Type No. 56056 by Josam Manufacturing Co., Michigan City, IN, similar models by Tyler, or equal.
- B. Exterior cleanouts shall consist of a coated cast iron ferrule with cut-off sections, a tapered threaded bronze cleanout plug, Josam 58486 or equal, with a heavy round coated cast iron access frame with anchor flanges and a gasketed cover, Josam Type No. 58680, similar models by Tyler or equal. Exterior cleanouts shall be installed as noted on the Drawings.
- C. Cleanouts shall be located where shown on the Drawings.
- D. Cleanout connections to 6-in cast iron bell and spigot soil pipe and cleanout connections to 6-in ductile iron bell and spigot pipe shall be caulked.

## 2.12 QUICK CONNECT COUPLINGS

- A. Couplings shall be of the cam and groove type consisting of a male adapter conforming to MIL-C-27487. Male adapters shall be designed to receive a female coupler without requiring threading, bolting, or tools. Connections shall remain tight and leak proof under pressures up to 100 psig. Each adapter shall be furnished with a dust cap complete with a 18-in long security chain of corrosion resistant material. Couplings shall be by Civacon, a Division of Dover Corporation; Ever-tite or equal. Units shall be "drip proof", providing totally dry connections and dis-connections.
- B. Adapters shall be furnished in accordance with the Drawings, or as required by the installation.

## 2.13 MECHANICAL SLEEVE SEALS

- A. Mechanical sleeve seals shall be used to secure and seal the annular space around all new sleeved and core-drilled wall penetrations.
- B. A single seal shall be provided for all sleeve and cores in walls up to 14-in thick; dual sleeves shall be provided in larger walls.
- C. Galvanized steel wall sleeves and concrete core diameter shall be sized sufficiently larger to accommodate the modular elements, per the manufacturer's recommendations.
- D. Bolts and hardware shall be carbon steel, zinc-plated. Pressure plates shall be corrosion-resistant acetal resin.
- E. Mechanical sleeve seals shall consist of modular bolted, synthetic rubber sealing elements, Link Seal by Thunderline Corp. or equal.

## 2.14 FLEXIBLE CONNECTORS

### A. Sleeve Couplings

1. Provide plain end type ends to be joined by sleeve couplings as stipulated in AWWA C219.
  - a. Join welds on ends by couplings without pipe stops. Grind flush to permit slipping coupling in at least one direction to clear pipe joint.
  - b. Outside diameter and out-of-round tolerances shall be within limits specified by coupling manufacturer.
  - c. Provide lugs in accordance with ASTM A36.
  - d. Provide hardened steel washers in accordance with ASTM A325.
  - e. Plastic plugs shall be fitted in coupling to protect bolt holes.
  - f. Nuts and bolts
    - 1) Provide bolts and bolt-studs in accordance with ASTM A307 and ANSI B1.1 with hexagonal or square heads, coarse thread fit, threaded full length with ends chamfered or rounded.
    - 2) Project ends 1/4-in beyond surface of nuts.
    - 3) Hexagonal nuts with dimensions in accordance with ANSI B18.2 and coarse threads in accordance with ANSI B1.1.
2. Middle ring of each mechanical coupling shall have a thickness at least equal to that specified for size of pipe on which coupling is to be used and shall not be less than 10-in long for pipe 30-in and larger and not less than 7-in long for pipe under 30-in in diameter.
  - a. Omit pipe stop from inner surface of middle rings of couplings whenever necessary to permit removal of valves, flowmeters and other installed equipment.
  - b. Provide pipe stops in other couplings.
3. Clean and shop prime with manufacturer's standard rust inhibitive primer.
4. Furnish gaskets of a composition suitable for exposure to the fluid service.
5. Where shown on the Drawings, anchor sleeve-coupled joints with harness bolts. Weld harness lugs to steel pipe.
  - a. Joint harness bolts shall be of sufficient length, with harness lugs placed so that coupling can be slipped at least in one direction to clear joint. Provide harnesses of sufficient number and strength to withstand test pressure as recommended in AWWA M-11.
  - b. Each harness shall have a minimum of two 5/8-in diameter bolts.
6. Unless otherwise specified with the individual type of pipe, sleeve couplings (mechanical couplings) shall be Victaulic Depend-O-Lok E x E (unrestrained) or F x F ( self-restrained); Smith Blair (part of Sensus) Style 411; Dresser Style 38, similar models by Baker or equal, with the pipe stop removed.
7. Similar insulation type couplings shall be provided at the face of buildings, between different type metals or where otherwise noted.
8. In addition to those locations noted on the Drawings, sleeve couplings shall be provided on all piping where it connects with a structure or buried directly under a structure at the structure's expansion joints. Special treatment will be required where pipe is encased in

concrete, utilizing minimum 3-in thick styrofoam placed perpendicular to the horizontal centerline of the coupling.

B. Split or Grooved Couplings

1. Split couplings shall be cast in two or more parts. When secured together with ASTM A183 bolts and nuts, couplings shall engage grooved or shouldered pipe ends and encase an elastomeric gasket to create a pipe seal. Gasket material shall be as recommended by the manufacturer for the service required.
2. Split couplings shall be as manufactured by Victaulic Company of America or equal. Numbers below refer to Victaulic Co. items, for reference only.
3. Unless otherwise specified with the individual type of pipe:
  - a. Flexible split ring couplings shall be:
    - 1) grooved ends - Style 77 (for steel/stainless steel) or Style 31 (for grooved ductile iron)
    - 2) shouldered ends – Victaulic Style 44 or Fluid Master
    - 3) fixed ends – Victaulic Depend-O-Lok, F x F (fixed by fixed)
  - b. Rigid split ring couplings shall be:
    - 1) grooved ends - rigid groove with Style 31 couplings on ductile iron 36-in and smaller diameter with sufficient wall thickness per AWWA C606, or manufacturer's recommendation, or standard groove with Style 07 Zero-Flex coupling on manufactured steel or IPS pipe.
    - 2) shouldered ends – Style 44 coupling on ductile iron over 36-in diameter or without sufficient wall thickness per AWWA C606 or on manufactured steel pipe or thin wall stainless steel pipe. Field welding of shoulders of ductile iron pipe is specifically prohibited.
4. Ductile iron pipe for use with split-type coupling joints shall have radius grooved ends conforming to AWWA C606. Pipe shall have grooved ends to provide either a rigid joint or flexible joint as shown on the Drawings and as specified herein. Flexible joint grooving shall permit expansion and contraction, and angular deflection. Rigid joint grooving shall allow no angular or linear movement. Minimum pipe wall thickness for grooved pipe shall be the following class:

Size	Class
4 thru 16	53
18	54
20	55
24	56

5. Grooved couplings for steel and stainless steel piping shall have roll grooving, machine-grooving, or ring collars fully welded to the pipe or fitting.
6. Rigid split couplings may be substituted for flanges as noted on the Drawings and in the individual pipe requirements.
7. Certain minimum thickness of pipe walls are required by AWWA C606 and coupling manufacturers for use of various type split couplings with certain pipes. Utilize at least

those minimum wall thicknesses required (unless a greater thickness is specified or required in the individual pipe specifications) with split couplings.

8. If minimum thicknesses are not utilized with grooving, then a shouldered end treatment with couplings as noted shall be utilized.

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 (ductile iron pipe and VIC-Flange Style 741/743 (for steel and stainless steel pipe) by the Victaulic Company of America, equal by Depend-O-Lok F x F FAC by Victaulic Depend-O-Lok Inc. or equal.
2. Flanged adaptor connections for plain end pipe at fittings, valves and equipment shall be Dresser Style 127 or 128, equal by Smith-Blair (part of Sensus); **equal by Romac Industries**, or equal.
3. **Restrained flanged coupling adaptors for plain end pipe at fittings, valves and equipment shall be Model 911 by Smith-Blair (part of Sensus), Series 2100 by EBAA, RFCA by Romac Industries, or equal.**

D. Pump and Equipment Flexible Connectors

1. The flexible connectors shall be expansion/vibration joints of the single arch type of butyl rubber construction with carcass of high grade woven cotton or suitable synthetic fiber and individual solid steel ring reinforcement. Soft rubber fillers shall be integrally cured into the arches to provide a smooth flow path to prevent settling of material into the arch. Joints shall be constructed to pipeline size and to meet working pressures and corrosive conditions similar to the line where installed. Joints shall have full faced fabric reinforced butyl flanges integral with the body.
2. Split steel or ductile iron back-up rings shall be provided to ensure a good joint. Rings shall be designed for mating with ANSI Standard minimum 150 lb. flanges. All joints shall be finish coated with Hypalon or equal paint.
3. Expansion/vibration joints shall be furnished with control (harness) units. Harness units shall consist of minimum two drilled plates, stretcher bolts, and rubber washers backed by metal washers. The stretcher bolts shall prevent over-elongation of the joint. Extra nuts shall be provided on the stretcher bolts on the inside of the plate to prevent overcompression. All nuts, bolts and plates shall be galvanized.
4. The manufacturer of the expansion joints shall be a member of the Rubber Expansion Joint Division of the Fluid Sealing Association. Expansion joints shall be Style 1025 filled arch by General Rubber Corp., Carlstadt NJ or similar products of Mercer Rubber; Goodall Rubber; Garlock; Red Valve Co., Inc.; Proco Products Inc., Stockton, CA or equal.
5. In addition to other locations shown on the Drawings, expansion joints shall be utilized in all exposed piping, within 1-ft of a building expansion joint, and on the suction and discharge side of all positive displacement pumps, compressors and rotating machinery, as close to the unit as possible.

E. Flexible Connectors

1. Provide one flexible connector for the seal water connection to each pump stuffing box. Connectors shall be of hose of Buna-N or similar resilient material, with fiber reinforcement, rated minimum 150 psi with bronze or Type 304 stainless steel NPT end fittings and shall be 12-in in length. Connectors shall be for the purpose of isolating pump vibration from the seal water piping.

F. Transition Couplings

1. Provide transition couplings as shown on the Drawings and for connecting pipes of same nominal size but with different outside diameters and materials. Transition couplings shall meet AWWA C219 and be coated inside and outside with fusion bonded epoxy in accordance with AWWA C213. Transition couplings shall be Smith-Blair, Inc.; Romac Industries, Inc.; JCM Industries, Inc.; Power Seal Corp.; Ford Meter Box Co.; Dresser Piping Specialties; or equal.

2.15 EXPANSION JOINTS

A. Expansion Couplings

1. Bolted split sleeve type couplings to allow for thermal expansion and contraction at the pipe joints shall consist of one piece housing, gasket assembly, bolts and nuts, and end rings to hold the coupling in the proper location.
2. Couplings shall be manufactured from ASTM A240 Type 304 or Type 316 stainless steel material for use on stainless steel pipe. Couplings for use on carbon steel or ductile iron pipe shall be manufactured from ASTM A36 material. Gaskets shall be of a composition suitable for exposure to the fluid or air service.
3. Carbon steel couplings shall be coated in accordance with liquid epoxy coating per AWWA C210 or fusion bonded epoxy coating per AWWA C213. Manufacturers standard shop primer will not be accepted as a coating system. Stainless steel couplings shall be passivated after all welding is completed.
4. End rings of the same material as the coupling housing shall be welded to the plain end of the pipe ends that form the joint per the coupling manufacturer's recommendations to hold the coupling in the proper location.
5. The expansion joints shall be designed for the axial movements shown on the Drawings along with the maximum axial force required to compress the joint. The joints shall prevent axial, lateral and rotational movement and vibration from being transmitted to the piping and equipment and shall be suitable for 50 psig operating pressure unless otherwise indicated.
6. Expansion couplings for expansion joints for plain end pipe shall be Depend-O-Lok F x E by Victaulic Depend-O-Lok, equal by Red Valve Company, or equal.

B. Single- and Multiple-Arch Type

1. The expansion joints shall be of the rubber spool type, soft rubber filled with single-, double-, or triple-arch steel reinforced expansion joint, as indicated on the Drawings, suitable for 120 degrees F service, unless otherwise indicated.
2. The rubber used shall be suited for service with wastewater and/or wastewater sludge, including three-ply abrasion resistant liner.
3. Provide galvanized retaining rings to mate with adjacent pipe flanges.
4. The joints shall prevent axial, lateral and rotational movement and vibration from being transmitted to the piping and equipment and shall be suitable for 50 psig operating pressure unless otherwise indicated.
5. Provide guides for each expansion joint.

C. Flexible Metal Hose

1. Flexible metal hose shall be constructed of corrugated inner tubing of tin-bronze or Type 321 stainless steel and shall have an outer shield of wire-braid of either tin-bronze or Type 321 stainless steel.
2. The flexible hose connectors shall have a length not less than five times the nominal pipe diameter.
3. The connectors shall have 150 psi flanged ends in all sizes and shall be suitable for pressure up to 150 psig and temperatures to 400 degrees F.
4. Flexible hose connectors shall be manufactured by Flexonics; Metraflex or equal.

2.16 HARNESSING AND RESTRAINT

- A. Where harnessed couplings or adapters are noted, they shall conform to AWWA Manual M11 except as modified by the Drawings or this Section.
- B. Unless otherwise noted, size and material for tie rods, clamps, plates and hex nuts shall be as shown on the Drawings, or, if not shown on the Drawings, shall be as required in AWWA Manual M11. Manufactured restraining clamp assemblies shall be as manufactured by Stellar Corporation, Columbus, OH, or equal.
- C. Restrained joints (such as welded, locking mechanical joints) shall be of the type specified with the individual type of pipe. If not specified, restrained (locking) mechanical joint pipe shall be of the manufacturer's standard design utilizing a locking device (ring or ears) integrally cast with the pipe.
- D. For up through 18-in diameter ductile iron pipe only, the following may be used as an alternative to other restraint system:
  1. The optional mechanical joint restraints shall be incorporated in the design of a follower gland. The gland shall be manufactured of ductile iron conforming to ASTM A536.

Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts as specified with the pipe.

2. The restraint mechanism shall consist of numerous individually activated gripping surfaces to maximize restraint capability. The gripping surfaces shall be wedges designed to spread the bearing surfaces on the pipe. Twist-off nuts, sized same as tee-head bolts, shall be used to ensure proper actuating of restraining devices. When the nut is sheared off, standard hex nut shall remain.
  3. The mechanical joint restraint device for ductile iron pipe shall have a working pressure of at least 250 psi with a minimum safety factor of 2:1.
  4. The mechanical joint restraint devices shall be of the type listed below or equal.
  5. For Ductile Iron Pipe: EBAA Iron, Inc. Megalug 1100 series for up to 12-in only.
- E. The Contractor shall be responsible for anchorage including restraint as noted elsewhere in Division 15.

#### 2.17 PRESSURE GAUGES

- A. Bosses, connections, or nipples for gauges shall be provided as acceptable to the Engineer. Unbossed tappings shall not be acceptable. Where gauge tappings are not available in the suction or discharge nozzle, the necessary tapping in the adjacent piping shall be made.
- B. In addition to the locations shown on the Drawings, pressure gauges shall be furnished and installed on the upstream and downstream sides of pressure reducing stations and in the suction and discharge nozzle of all pumps, compressors and similar equipment. Additional pressure gauges shall be furnished and installed as specified with individual equipment.
- C. Gauges shall be furnished as part of a complete factory assembly, including gauge, snubber, liquid fill, bar stock ball valve isolation valve and threaded red brass connecting piping.
- D. Unless otherwise noted, gauge rating shall be from 0 to at least 2.5 percent higher than the rating of the pipe it is connected to.
- E. For Liquid Service
  1. Pressure gauges shall have a ABS or FRP case and shall be 4-1/2-in nominal diameter with a full-sized Type 316 stainless steel Bourdon tube and a 300 series stainless steel movement. The gauges shall be liquid filled with glycerin and shall be provided with a filler/breather cap. The socket shall be 1/4-in NPT Type 316 stainless steel with a bottom connection and the dial shall be a white background with black markings. Gauges shall be ANSI Grade A plus or minus one percent of scale and shall have a blow-out back design.
  2. Gauges for the above services shall be liquid filled as manufactured by U.S. Gauge; Ashcroft; Terice; or approved equal.
- F. Gauges shall be furnished from standard ranges of the manufacturer, with dual range (ft. and psi) scales, per the following schedule.

## 2.18 DIAPHRAGM SEALS FOR GAUGES

- A. Diaphragm seals shall be installed for all pressure gauges and pressure switches not on clean water lines, to protect pressure gauges and pressure switches from contact with the fluid in the pipeline. Gauges shall be furnished as part of a complete factory assembly, including gauge, snubber, diaphragm seal, liquid fill, bar stock isolation valve and threaded red brass interconnecting piping. Furnish also a 1/4-in backflushing connection and ball valve.
- B. Diaphragm seals shall be minimum 2-1/2-in diameter, or as required for the connected pressure gauges. The diaphragm shall be "thread attached" to both piping and pressure switches or gauges. Furnish mineral oil fill between the diaphragm seal and the gauge.
  - 1. Diaphragm seals shall have an upper housing of cadmium plated carbon steel, with the lower housing of Type 316 stainless steel with Type 304 stainless steel bolts. Diaphragms shall be Teflon.
  - 2. Each diaphragm seal shall be connected to its respective piping or equipment with threaded red brass pipe and fittings. Pipe size and diaphragm tap size shall match the size of the gauge tap on the equipment, but shall not be less than 3/4-in, except for connections to plant water piping which shall be minimum 1/2-in. Furnish a ball valve shut-off valve between the pipeline or equipment and the diaphragm seal.
  - 3. Each diaphragm seal shall have a minimum 1/4-in NPT flush connection with ball valve and gauge tap to match the size of the gauge.
  - 4. Furnish pulsation dampeners adequate to prevent pulsation and/or vibration of the gauge indicator under all system operating conditions.
  - 5. Pump gauges shall connect to the diaphragm seal by a flexible Type 304 stainless steel capillary tube. Gauges shall be mounted on a support stand independent of the pump and piping, to minimize vibration of the gauges caused by vibration of the equipment or piping. Mount both the suction and discharge gauges at the same elevation. Furnish supports as specified in Section 15140, or attach gauges to the seal water assembly support (where applicable).
  - 6. Diaphragm seals shall be Type SG by Mansfield and Green; Ashcroft or equal.
- C. Where installed on chlorine lines, or lines leading to chlorine ejectors, seals shall be special chlorine-resistant type. All other materials shall be certified corrosion resistant for seal location and fluid.
- D. Diaphragm seals for chemical piping pressure gauges shall be equal to Series 30 threaded-end (1/2-in to 1-in diameter piping) or Series 40 flange (1-1/2-in to 2-in diameter piping) as manufactured by Red Valve. Body shall be PVC or Type 304 stainless steel with PVC end caps and diaphragms shall be Hypalon.

## 2.19 THERMOMETERS

- A. Thermometers shall be installed in the locations, and with the temperature ranges shown on the Drawings. Each thermometer shall be installed within a thermowell. The thermowell shall be designed to project sufficiently into the flow stream to assure an accurate thermometer reading.

Thermowells shall be of Type 304 stainless steel, and shall have a bore suitable for a 1/4-in thermometer stem diameter. The process piping connection shall be 1/2-in NPT, except where flanged connections are shown.

- B. Thermometers shall have a 3-in diameter dial case with bottom connection. The case, connection and stem shall be of Type 304 stainless steel and the lens shall be of tempered glass. Thermometers shall have an external calibration reset adjustment and shall be accurate to within one percent of scale.
- C. Thermometers shall be as manufactured by Helicoid, a Division of Bristol-Babcock; Ashcroft, or equal.

## 2.20 ROTAMETERS AND FLOW INDICATORS

- A. Rotameters for the systems listed below shall be of the glass tube type with Borosilicate glass tubes, Type 302 stainless steel frames with slip-on covers, 10-in detached type aluminum scales graduated in gallons per minute, 10:1 flow range, accuracy of two percent of full scale and vertical screwed end connections. Capacity, size and materials of construction shall be in accordance with the following table. Tube size shall be the same size as the end connections. Pressure drop at rated capacity shall not exceed 32-in of water.

Flow indicators for shaft seal/flushing water systems shall be brass body, glass or plastic tube, stainless steel float, 125 psi pressure rating.

## 2.21 SPRAY NOZZLES

- A. Nozzles shall be of the size, with feed rates as noted on the Drawings. Nozzles shall be attached to the distribution header, as indicated on the Drawings, via split-eyelet connections. Unless otherwise noted nozzles shall be brass.
- B. Each nozzle shall be furnished with a stainless steel adjustable ball fitting.
- C. The distribution piping to the nozzles shall be sloped for drainage and shall be adequately supported under the access bridge to prevent sagging, while facilitating access for nozzle replacement. Test the system to demonstrate to the Engineer that it is entirely self-draining prior to acceptance.
- D. 10 nozzles shall be provided as spares and shall be suitably boxed and marked for storage.
- E. All nozzles shall be the appropriate model, as manufactured by Spraying Systems Incorporated or equal.

## 2.22 WASH HOSE STATIONS

- A. Where indicated on the Drawings, stations shall be a 1 1/4 in, single supply, wall mounted hose station complete. Hose nozzles shall be Dixon Valve, Part No. BFN150NST, or equal. The 1-1/4-in hose shall be Hypalon Imperial, Figure No. 800 (yellow) double jacketed complete with expansion ring couplings at each end. The pipe hanger shall be copper plated malleable iron split ring type with malleable iron wall plate to receive 3/8-in diameter threaded rod. The wall anchors for hose rack shall be 5/16-in threaded stainless steel anchors with 5/16-in stainless steel hex bolts. The assembly shall be as provided by Leonard Valve Company, Model No. SW-

75-1572-HDHR-50HDH (1-1/4-IN)-FOG; or similar by F.W. Webb Company (formerly Joseph A. Pink & Son); or equal.

- B. Where indicated on the Drawings, stations shall be a 3/4 in, single supply, wall mounted hose station complete. Hose nozzles shall be Dixon Valve or equal. The 3/4-in hose shall be Hypalon Imperial, Figure No. 800 (yellow) double jacketed complete with expansion ring couplings at each end. The pipe hanger shall be copper plated malleable iron split ring type with malleable iron wall plate to receive 3/8-in diameter threaded rod. The wall anchors for hose rack shall be 5/16-in threaded stainless steel anchors with 5/16-in stainless steel hex bolts. The assembly shall be as provided by Leonard Valve Company; or F.W. Webb Company (formerly Joseph A. Pink & Son); or equal.
- C. Caution Sign for Plant Water Hose Stations
  - 1. Signs shall be aluminum backed and suitable for outdoor application. Signs shall be mounted to the yard hydrants using stainless steel No.16 single jack chain. Signs shall be manufactured by Emedco or equal, and shall say "DO NOT DRINK THE WATER – NO TOMAR EL AGUA", as shown on the Drawings.

## 2.23 APPURTENANCES AND MISCELLANEOUS ITEMS

- A. All gaskets, glands, bolts, nuts and other required hardware shall be provided for connection of piping and appurtenances. Bolts and nuts shall be high strength, Type 316 stainless steel if submerged, buried, or subject to splashing and cadmium plated otherwise, with tee-head and hexagon nut. All other hardware shall be of the size, type and number as required and recommended by the piping or appurtenance manufacturer and as specified herein.
- B. All gaskets for flanges shall be full face and suitable for 200 degrees F operating temperature, unless higher temperature required on individual systems and the fluids carried. See also Division 1.
- C. Plugs, caps and similar accessories shall be of the same material as the pipe and of the locking type, unless otherwise noted.
- D. Unions shall be of the same material as the pipe, except for dielectric connections.
- E. Special protective tape shall be fabric reinforced petroleum tape by Denso Inc., Houston, TX or equal.

## 2.24 COLOR CODING AND LABELING

- A. General
  - 1. Provide a complete color coding system consisting of preprinted labels and banding by Brady; Seton or equal. Field painting shall be specified in Section 09902. Painting and coding shall comply with the requirements of the PIPE COLOR SCHEDULE.

PIEP COLOR SCHEDULE

Abbr.	Service Fluid	Color	Pipe Marker Legend
TSC	Thickened Scum	Burnt Orange	SCUM
SL	Thickened Sludge	Brown	SLUDGE
DR	Drain	Black	DRAIN
NPW	Non-potable Water	Safety Purple	NPW

2. Piping system identification shall comply with the requirements of ANSI A13.1.
3. Colors listed are general. Actual colors will be selected based on a comparison to the existing plant color codes, except as otherwise indicated; samples shall be furnished for all pipe paint colors; with chips from existing piping where new service lines are connecting.
4. Banding
  - a. Bands shall be the same color as the pipe.
  - b. Unless special spacing is listed in schedule, apply banding to pipe at connections to equipment, valves, branch fittings, at wall, floor, or ceiling boundaries and at intervals not greater than 36-ft.
5. Labels and directional arrows shall be as specified in Section 09902.

PART 3 EXECUTION

3.01 GENERAL

- A. All dirt, scale, weld splatter, water and other foreign matter shall be removed from the inside and outside of all pipe and sub-assemblies prior to installing.
- B. All pipe joints and connections to equipment shall be made in such a manner as to produce a minimum of strain at the joint.
- C. Test Connections
  1. Provide 1/2-in female NPT test connection equipped with 1/2-in brass plug on all pump suction and discharge lines. Where indicated on the Drawings, test connections should be equipped with bar stock valve and gauge. Provide test connections at all steam traps. The connection shall be located on the discharge side of the trap between the trap and the first valve. It shall consist of a 1/2-in branch connection terminated with a gate valve.
- D. Installation of Expansion Joints and Flexible Connectors
  1. Piping systems shall be aligned prior to installation of expansion fittings. Alignment shall be provided by fitting a rigid pipe spool in place of the expansion joint. Prior to testing of the piping system, the pipe spool shall be replaced with the specified expansion or flexible fitting.
  2. In addition to the locations noted on the Drawings and in PART 2, expansion fittings and anchors shall be located and spaced as specified by the Expansion Joint Manufacturer's

Association. The expansion joints/flexible connectors shall not be installed during times of temperature extreme or in a fully compressed or fully expanded condition.

E. Installation of Sleeve Couplings

1. Unless otherwise required by the manufacturer's instructions, prior to installation of sleeve couplings, the pipe ends shall be cleaned thoroughly for a distance of at least 12-in. Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6-in from the end, the middle ring shall be placed on the already installed pipe and shall be inserted into the middle ring flair and brought to proper position in relation to the pipe already installed. The gaskets and followers shall then be pressed evenly and firmly into the middle ring flares.
2. After the bolts have been inserted and all nuts have been made up fingertight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint, preferably by use of a torque wrench of the appropriate size and torque for the bolts.
3. The correct torque as indicated by a torque wrench shall not exceed 75 ft-lb for 5/8-in bolts and 90 ft-lb for 3/4-in bolts.
4. If a wrench other than a torque wrench is used, it should be no longer than 12-in so that when used by the average person the above torque values shall not be exceeded.
5. To prevent sleeve couplings from pulling apart under pressure, a suitable harnessing or flange clamp assembly shall be provided and installed where shown on the Drawings, directed by the Engineer or required elsewhere under Division 15 concerning anchorage.
6. Note the additional locations required for sleeve couplings in PART 2. Also note Contractor's responsibility for locating, providing and installing restraints.

F. Installation of Split Couplings

1. Prior to assembly of split couplings, grooves or shoulders of the pipe as well as other parts shall be thoroughly cleaned. The ends of the pipes and outside of the gaskets shall be moderately coated with manufacturer's recommended lubricant, petroleum jelly, cup grease, soft soap, or graphite paste and the gasket shall be slipped over one pipe end. Lubricant shall be compatible with potable water application. After the other pipe has been brought to the correct position, the gasket shall be centered properly over the pipe ends with the lips against the pipes. The housing sections then shall be placed.
2. Ensure that the joints are fully extended after the rings are in place and prior to tightening the bolts. After the bolts have been inserted, the nuts shall be tightened until the housing sections are firmly in contact, as required by the manufacturer, without excessive bolt tension or strain on the pipe.

G. Installation of Pipeline Appurtenances

1. All pipeline appurtenances shall be installed as required and in accordance with the manufacturer's recommendations, as acceptable to the Engineer.

2. Gauges, meters and similar in-line items shall be isolated from testing pressures in excess of the rated pressure of the assembly.
3. Use Teflon tape on all screwed fittings.

H. Installation of Unions

1. Use unions to allow dismantling of pipe, valves, and equipment.

I. Welding

1. Welding shall be in accordance with ANSI B31 and AWS B3.0.
2. Install welding fittings on all welded lines. Make changes in direction and intersection of lines with welding fittings. Do not miter pipes to form elbows or notch straight runs to form tees, or any similar construction. Do not employ welder who has not been fully qualified in above specified procedure and so certified by approved welding bureau or similar locally recognized testing authority.

J. Installation of Flanged Joints

1. Make flanged joints with bolts; bolt studs with nut on each end; or studs with nuts where one flange is tapped. Use number and size of bolts conforming to same ANSI Standard as flanges. Before flanges pieces are assembled, remove rust resistant coating from machined surfaces, clean gaskets and smooth all burrs and other defects. Make up flanged joints tight, care being taken to prevent undue strain upon valves or other pieces of equipment.

3.02 TESTING

- A. Test all pipelines for water/gas tightness as specified in the Piping or System Sections. Furnish all labor, testing plugs or caps, pressure pumps, pipe connections, gauges and all other equipment required. Testing shall be performed in accordance with one or more of the testing procedures appended to this Section as specified in each Piping or System Section. All testing shall be performed in the presence of the Engineer.
- B. Repair faulty joints or remove defective pipe and fittings and replace as approved by the Engineer. Retest.

3.03 DISINFECTION

- A. After satisfactory testing, all plant water and water collection and distributed systems shall be thoroughly disinfected with a solution of not less than 50 ppm of available chlorine. The disinfecting solution shall be allowed to remain in the system for a period of three hours after which time all valves and faucets shall be opened and the system shall be flushed with clean water.
- B. Water being flushed from structures or pipelines after disinfection with a chlorine residual of two mg/l or greater, shall be treated with a dechlorination solution, in a method approved by the Engineer, prior to discharge

END OF SECTION

SECTION 16450  
600 VOLTS AND BELOW DRY TYPE TRANSFORMERS

PART 1 GENERAL

1.01 SUMMARY

- A. Furnish and install dry type transformers as specified herein and as shown on the PLANS.

1.02 RELATED REQUIREMENTS

- A. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
- B. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
- C. The PLANS designate the number, size and rating of transformers required.
- D. Related work as called for on the PLANS, as specified herein or in other Sections of the Specifications.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01300 of the Specifications. For each individual Transformer include:
  - 1. Dimensioned/scaled plan view and elevation,
  - 2. Ratings, product data sheets, including weight and nameplate data
  - 3. Wiring connection diagram
- B. Submit Operations and Maintenance Manuals (O&M) in accordance with Section 01730 of the Specifications. O&M Manuals shall include copies of the approved shop drawings, factory and on-site/field test data.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver, receive, unload and handle equipment by suitable methods. Inspect for damage before accepting shipment. Wrap in protective plastic wrapping and store in humidity controlled environment. Use heat lamps as necessary to prevent condensation.

1.05 ACCEPTABLE MANUFACTURER

- A. General Use (Power & Lighting) Dry-Type Ventilated Isolation Transformers shall be Watchdog Premium Quality units manufactured by Sorgel (Square D) class 7430, or approved equal

- B. Ultra-Isolator, Highly Shielded and Noise and Transient Voltage Suppressing Transformers IN ALL AREAS: shall be as manufactured by "Eaton" Power-Suppress T7 Series 30 Ultra-Isolation Transformers with "K" Factor 13 Rating (with electrostatic shielding) and all other specified accessories, or approved equal.

PART 2 PRODUCT

2.01 GENERAL AND BASIC REQUIREMENTS FOR ALL 600 VOLT AND BELOW DRY TYPE TRANSFORMERS

A. Type:

- 1. Manufacturer's premium quality dry type transformers.
- 2. Primary and secondary voltage ratings, and, KVA ratings to be as shown on the PLANS.
- 3. All windings shall be copper.
- 4. Transformers shall be of ventilated type.

B. Core and coils:

- 1. Continuous wound core impregnated with non-hygroscopic, thermosetting varnish.
- 2. Core to be of high grade, non-aging silicon steel with high magnetic permeability.
- 3. Core and coil bolted to base of enclosure but isolated from it by rubber vibration absorbing mounts.

C. Additional Requirements:

- 1. Furnish with four (4) 2-1/2 percent full capacity primary taps, two (2) above and two (2) below rated primary voltage.
- 2. Core is to be visibly grounded to enclosure by means of a flexible grounding conductor sized per NEMA, IEEE and ANSI standards.
- 3. All transformers shall be U.L. listed and certified and carry the U.L. label.
- 4. Sound levels: Guaranteed not to exceed the following:

<u>Transformer KVA Range</u>	<u>Sound Level</u>
15 to 50KVA	45dB
51 to 150KVA	50dB
151 to 300KVA	55dB

2.02 GENERAL USE (POWER & LIGHTING) VENTILATED DRY TYPE ISOLATION TRANSFORMERS

A. General:

1. Transformers shall be suitable for indoor installation. Comply with all requirements/specifications outlined in subsection 2.01, above (Basic and General Requirements for All 600 volt and Below Dry Type Transformers).
2. Transformers shall meet NEMA TP-1 efficiency requirements.

B. Temperature Rise and Insulation System:

1. Temperature Rise: 80 degrees Celsius above a 40 degree Celsius. ambient
2. All insulating materials shall be in accordance with NEMA ST20 standards for a 220 degree Celsius. U.L. component recognized insulation system.

C. Enclosure: Heavy gauge sheet steel with ventilation openings designed in accordance with U.L., NEMA and the N.E.C. Phosphatized, primed and finished with ANSI#61 gray baked enamel. Provide surface/wall mounting brackets where surface/wall mounting is shown on the PLANS.

2.03 CONTROL AND INSTRUMENT POWER ULTRA-ISOLATOR, HIGHLY SHIELDED AND NOISE SUPPRESSION TRANSFORMERS

A. General:

1. Transformers shall be of the dry type suitable for indoor installation. Comply with all specifications requirements outlined in subsection 2.01, above (Basic and General Requirements for All Dry Type Transformers) in addition to the requirement specified in this subsection 2.02. Note: Requirements hereinafter specified take precedence over the requirements outlined in subsection 2.01 above

B. Ratings:

1. Input Voltage Range: Plus or minus 10 percent of nominal.
2. Isolation: All winding are to be electrically isolated from each other
3. Temperature Rise and Insulation System:
  - a. Temperature Rise: 115 degrees Celsius above a 40 degree Celsius. ambient.
  - b. All insulating materials shall be in accordance with NEMA ST20 standards for a 200 degree Celsius. U.L. component recognized insulation system.
4. Load Regulation: 3.5 percent or less from no load to full load at unity power factor.
5. Frequency Range: 57 Hz to 63 Hz.
6. Overload Capacity: 500 percent for one cycle with no adverse effects

7. Harmonic Distortion: 1 percent added to the output waveform, at maximum
8. Efficiency: 95 percent at all load levels, at minimum.
9. Maximum Audible Noise: Less than 50 dBA measured at a distance of 3-feet.
10. Common-Mode Noise Attenuation: 120 dB minimum
11. Shielding: 100 percent electrostatic shield wound between the primary and secondary windings. Shield must be connected to a terminal inside the transformer enclosure.
12. "K" Factor Rating: 13, U. L. Listed.
13. **Transient voltage surge suppression network conforming to UL 1449 rating.**

- C. Enclosure: Heavy gauge sheet steel with ventilation openings designed in accordance with U.L., NEMA and the N.E.C. Phosphatized, primed and finished with gray baked enamel.

#### 2.04 NAMEPLATES

##### A. General:

1. Type: 3-ply, 1/8" thick, rigid thermoset phenolic resin laminated cellulose paper base engraving stock per ASTM D-709, Type I. Nameplates shall be ASTM Grade ES-1, ES-2, or ES-3 as applicable for the face and lettering colors specified hereinafter. Flexible or acrylic tags will be not be accepted
2. Color: White-Black-White
3. Lettering: 3/8 inch height, minimum, engraved through the face layer to the melamine middle layer.
4. Accessories: Provide holes for mechanical fastening.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install at the locations shown on the PLANS in accordance with manufacturer's recommendations. Furnish and install equipment pads as shown on the PLANS for floor mounted transformers and surface/wall mounted brackets for surface/wall mounted transformers as required.
- B. Make grounding connections as required by the N.E.C. and as shown on the PLANS.

C. Tagging:

1. Tag each transformer with the name as it appears on the PLANS using the specified nameplates attached with stainless steel screws. Include the following additional information: name of the load served by the transformer, primary voltage rating, secondary voltage ratings, KVA rating, phase, wire, primary and secondary winding configuration, and transformer type.

3.02 TESTS AND INSPECTIONS

- A. All test results (including factory test) shall be certified.

3.03 MEASUREMENT AND PAYMENT

- A. No separate measurement or payment for work performed under this Section. Include cost of same in Contract price bid for work of which this is a component part.

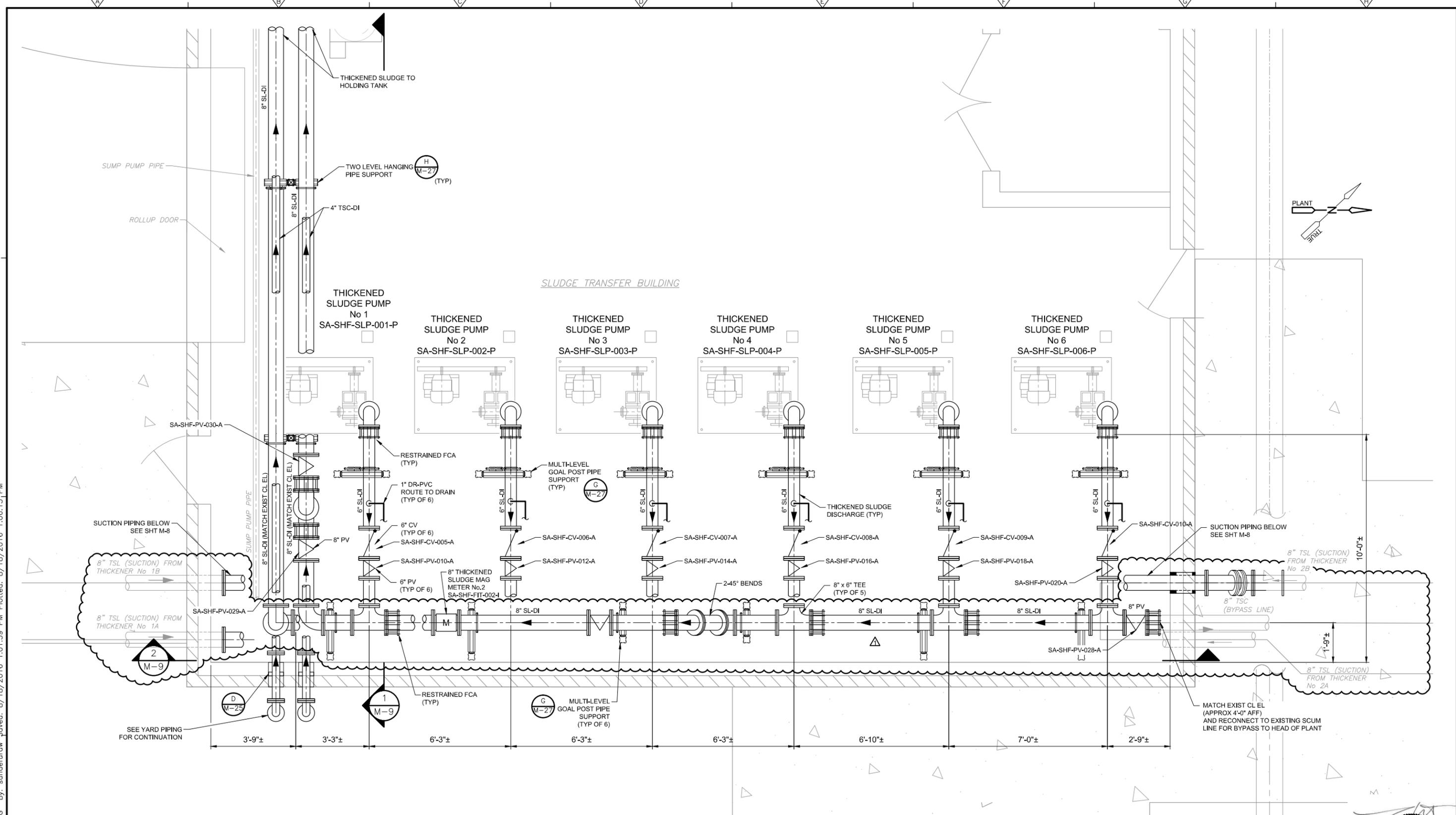
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DISCHARGE PIPING PLAN  
 GRAPHIC SCALE: 1/2" = 1'-0"

- NOTE:
- CONTRACTOR TO FIELD VERIFY ALL EXISTING PIPE LOCATIONS AND DIMENSIONS.
  - REFER TO SECTION 15140 FOR ADDITIONAL PIPE SUPPORT REQUIREMENTS.
  - THICKENED SLUDGE PIPING WORK SHALL BE INSTALLED IN TWO PHASES BASED ON THE SEQUENCE OF CONSTRUCTION. REFER TO COA SPECIFICATION SECTION 01010 - SUMMARY OF WORK.



REV No	DATE	DRWN	CHKD	REMARKS
08-18-16	DWS	DMH		ADDENDUM No 1

DESIGNED BY: WOO  
 DRAWN BY: SANDEFURD  
 SHEET CHK'D BY: HURTADO  
 CROSS CHK'D BY:  
 APPROVED BY:  
 DATE: MAY 2016

**CDM Smith**  
 Riata Corporate Park, 12357-A Riata Trace Parkway, Suite 210  
 Austin, TX 78727  
 Tel: (512) 346-1100  
 Texas Registration Number F-3043

CITY OF AUSTIN, TEXAS - AUSTIN WATER UTILITY  
 CIP 3333.016  
 SOUTH AUSTIN REGIONAL WWTP  
 THICKENER IMPROVEMENTS PROJECT

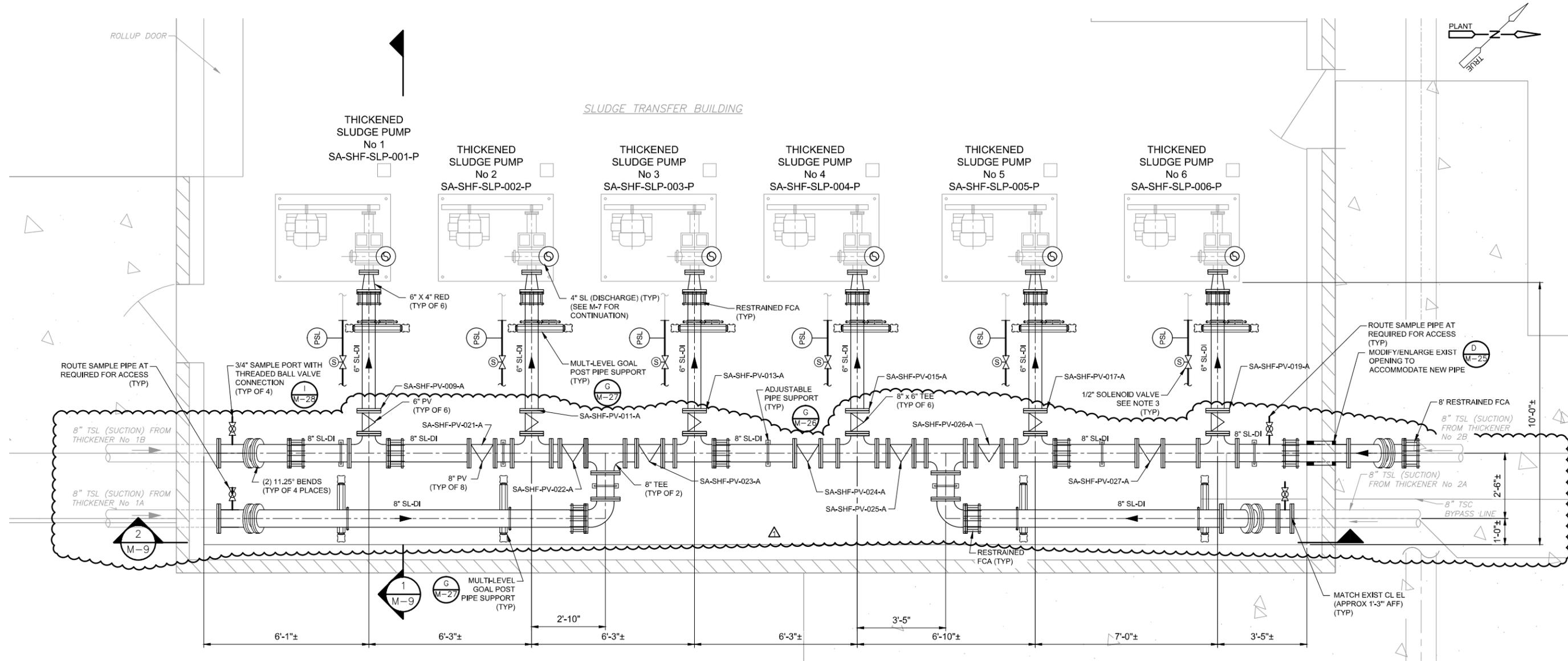
THICKENED SLUDGE PUMP MODIFICATIONS  
 UPPER PLAN

PROJECT No 590-104217  
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**SUCTION PIPING PLAN**



- NOTE:**
1. CONTRACTOR TO FIELD VERIFY ALL EXISTING PIPE LOCATIONS AND DIMENSIONS.
  2. REFER TO SECTION 15140 FOR ADDITIONAL PIPE SUPPORT REQUIREMENTS.
  3. REPLACE PUMP PRESSURE SWITCH AND 1/2\"/>

REV No	DATE	DRWN	CHKD	REMARKS
08-18-16	DWS	DMH		ADDENDUM No 1

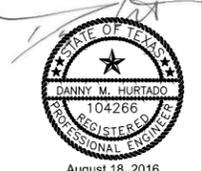
DESIGNED BY: WOO  
 DRAWN BY: SANDEFUR  
 SHEET CHK'D BY: HURTADO  
 CROSS CHK'D BY:  
 APPROVED BY:  
 DATE: MAY 2016

**CDM Smith**  
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 Austin, TX 78727  
 Tel: (512) 346-1100  
 Texas Registration Number F-3043

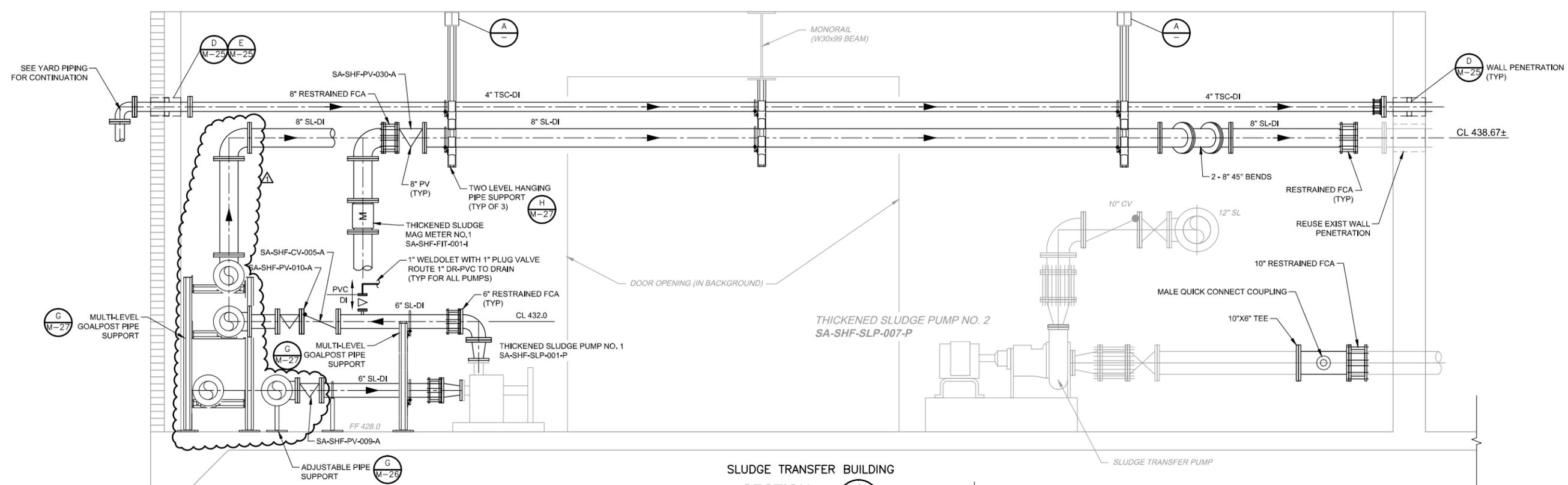
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 CIP 3333.016  
 SOUTH AUSTIN REGIONAL WWTP  
 THICKENER IMPROVEMENTS PROJECT

**THICKENED SLUDGE PUMP MODIFICATIONS  
 LOWER PLAN**

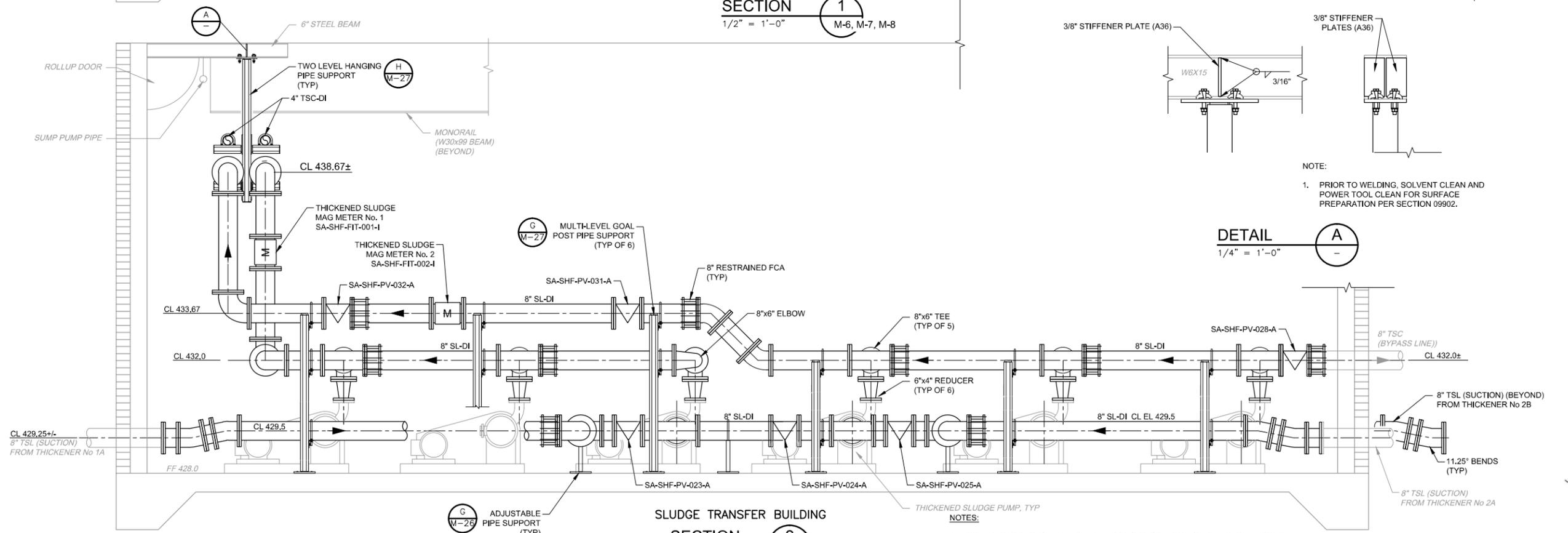
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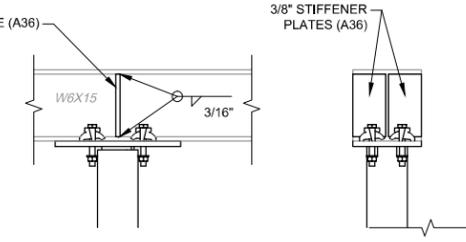
August 18, 2016



SECTION 1  
1/2" = 1'-0" M-6, M-7, M-8



SECTION 2  
1/2" = 1'-0" M-7, M-8



DETAIL A  
1/4" = 1'-0"

NOTE:  
1. PRIOR TO WELDING, SOLVENT CLEAN AND POWER TOOL CLEAN FOR SURFACE PREPARATION PER SECTION 09902.

NOTES:  
1. CONTRACTOR TO FIELD VERIFY ALL EXISTING PIPE LOCATIONS AND DIMENSIONS.  
2. REFER TO SECTION 15140 FOR ADDITIONAL PIPE SUPPORT REQUIREMENT.

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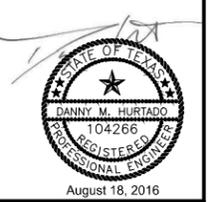
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 DRAWN BY: SANDEFUR  
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 CROSS CHK'D BY: HURTADO  
 APPROVED BY: HURTADO  
 DATE: MAY 2016

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 CIP 3333.016  
 SOUTH AUSTIN REGIONAL WWTP  
 THICKENER IMPROVEMENTS PROJECT

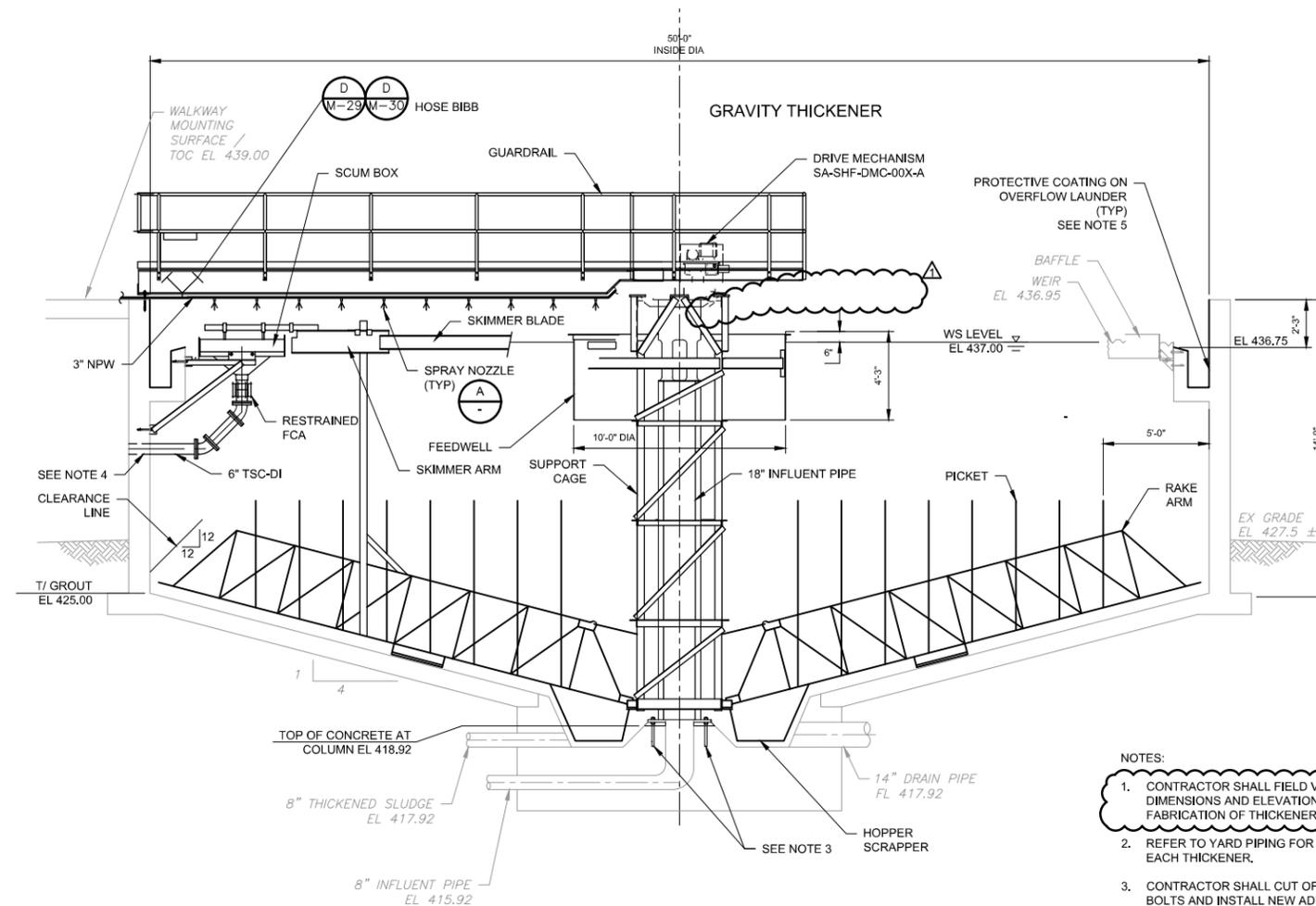
THICKENED SLUDGE PUMP MODIFICATIONS  
 SECTIONS  
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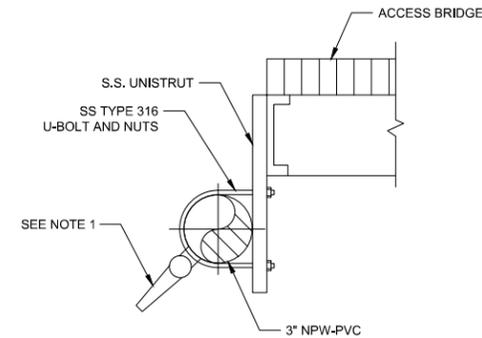
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ILLUSTRATIVE SECTION  
SECTION 1  
1/4" = 1'-0" M-10, M-11

- NOTES:
1. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING DIMENSIONS AND ELEVATIONS PRIOR TO FABRICATION OF THICKENER MECHANISMS.
  2. REFER TO YARD PIPING FOR PIPING LAYOUT OF EACH THICKENER.
  3. CONTRACTOR SHALL CUT OFF EXISTING ANCHOR BOLTS AND INSTALL NEW ADHESIVE ANCHORS PER MANUFACTURER'S INSTRUCTIONS.
  4. FOR THICKENER 1B RE-USE EXISTING PIPE PENETRATION AND PROVIDE 6" X 8" REDUCER.
  5. PROVIDE PROTECTIVE COATING ON LAUNDER INTERIOR SURFACE PER SPECIFICATION 09850.



- NOTE:
1. PROVIDE SADDLES FOR CONNECTING SPRAY NOZZLES TO THE 3" NPW EVERY 2'-0" OC. PROVIDE HIGH IMPACT SPRAY NOZZLES, F SERIES BY BEX SPRAY NOZZLES OR EQUAL. EACH NOZZLE SHALL PROVIDE 2.0 GPM AT 60 PSI WITH A SPRAY ANGLE OF 45°. NOZZLES SHALL BE NPT THREADED CONSTRUCTED OF TYPE 316 SST EXTENSION PIPES SHALL BE USED TO PLACE NOZZLES A DISTANCE FROM THE WATER SURFACE RECOMMENDED BY NOZZLE MANUFACTURER.

SPRAY SYSTEM  
DETAIL A  
NTS

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REV No	DATE	DRWN	CHKD	REMARKS
08-18-16	DWS	DMH		ADDENDUM No 1

DESIGNED BY: WOO  
DRAWN BY: SANDEFUR  
SHEET CHK'D BY: HURTADO  
CROSS CHK'D BY:  
APPROVED BY:  
DATE: MAY 2016

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Texas Registration Number F-3043

CITY OF AUSTIN, TEXAS - AUSTIN WATER UTILITY  
CIP 3333.016  
SOUTH AUSTIN REGIONAL WWTP  
THICKENER IMPROVEMENTS PROJECT

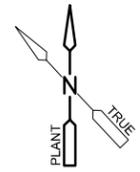
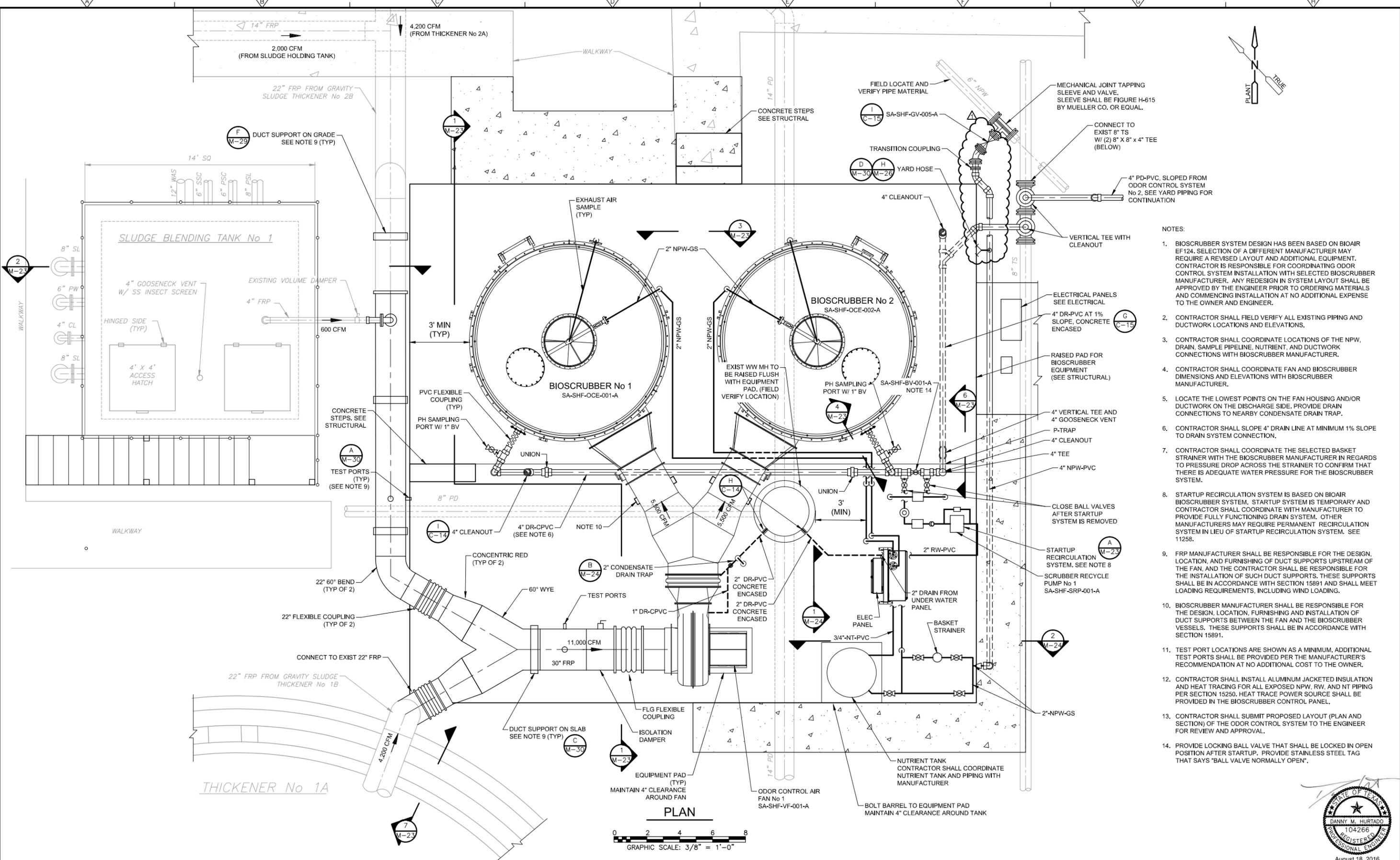
GRAVITY THICKENERS  
TYPICAL ILLUSTRATIVE  
SECTION AND DETAILS

PROJECT No 590-104217  
FILE NAME: M-12\_SC-GRAV  
SHEET No  
M-12



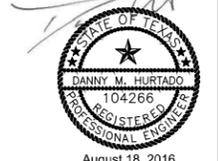
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- NOTES:
- BIOSCRUBBER SYSTEM DESIGN HAS BEEN BASED ON BIOAIR EF124. SELECTION OF A DIFFERENT MANUFACTURER MAY REQUIRE A REVISED LAYOUT AND ADDITIONAL EQUIPMENT. CONTRACTOR IS RESPONSIBLE FOR COORDINATING ODOR CONTROL SYSTEM INSTALLATION WITH SELECTED BIOSCRUBBER MANUFACTURER. ANY REDESIGN IN SYSTEM LAYOUT SHALL BE APPROVED BY THE ENGINEER PRIOR TO ORDERING MATERIALS AND COMMENCING INSTALLATION AT NO ADDITIONAL EXPENSE TO THE OWNER AND ENGINEER.
  - CONTRACTOR SHALL FIELD VERIFY ALL EXISTING PIPING AND DUCTWORK LOCATIONS AND ELEVATIONS.
  - CONTRACTOR SHALL COORDINATE LOCATIONS OF THE NPW, DRAIN, SAMPLE PIPELINE, NUTRIENT, AND DUCTWORK CONNECTIONS WITH BIOSCRUBBER MANUFACTURER.
  - CONTRACTOR SHALL COORDINATE FAN AND BIOSCRUBBER DIMENSIONS AND ELEVATIONS WITH BIOSCRUBBER MANUFACTURER.
  - LOCATE THE LOWEST POINTS ON THE FAN HOUSING AND/OR DUCTWORK ON THE DISCHARGE SIDE. PROVIDE DRAIN CONNECTIONS TO NEARBY CONDENSATE DRAIN TRAP.
  - CONTRACTOR SHALL SLOPE 4\"/>

PLAN  
 0 2 4 6 8  
 GRAPHIC SCALE: 3/8" = 1'-0"



REV No	DATE	DRWN	CHKD	REMARKS
08-18-16	DWS	DMH		ADDENDUM No 1

DESIGNED BY: WOO  
 DRAWN BY: SANDEFUR  
 SHEET CHK'D BY: HURTADO  
 CROSS CHK'D BY:  
 APPROVED BY:  
 DATE: MAY 2016

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CITY OF AUSTIN, TEXAS - AUSTIN WATER UTILITY  
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 THICKENER IMPROVEMENTS PROJECT

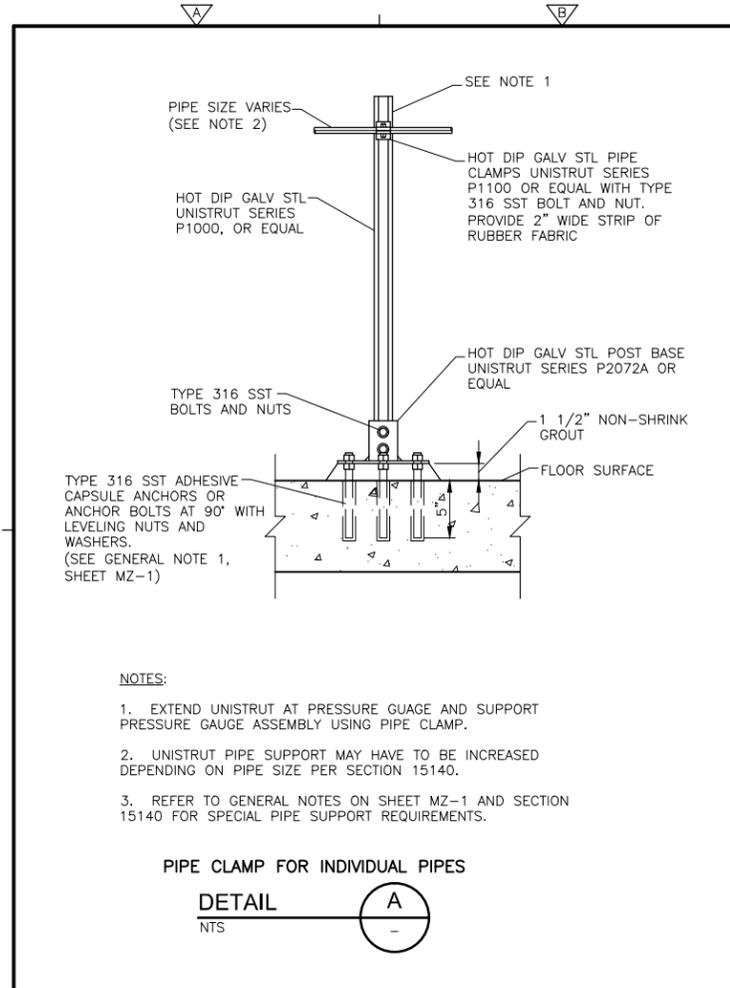
ODOR CONTROL SYSTEM No 1  
 PLAN  
 SHEET No  
 M-21

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 August 18, 2016

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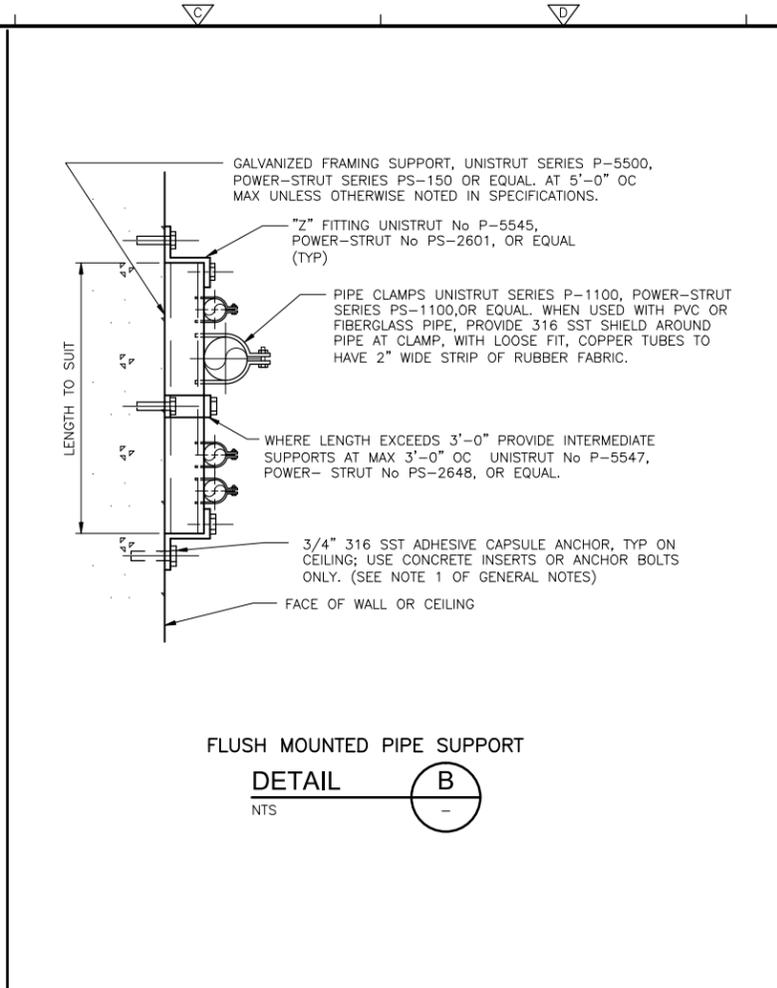
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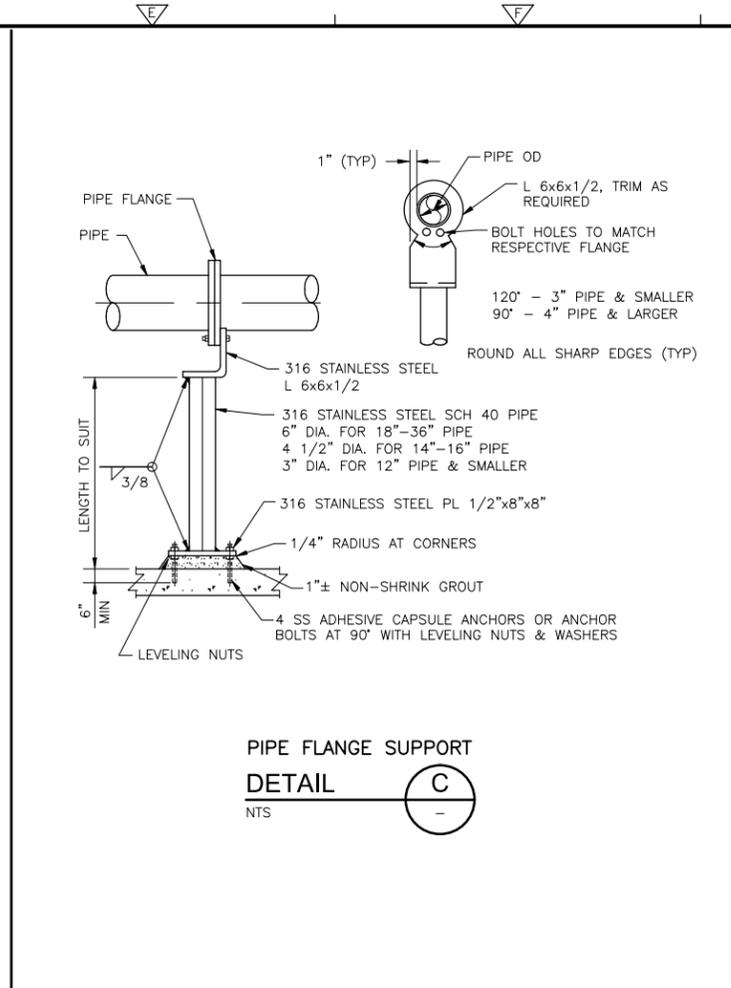


- NOTES:**
1. EXTEND UNISTRUT AT PRESSURE GAUGE AND SUPPORT PRESSURE GAUGE ASSEMBLY USING PIPE CLAMP.
  2. UNISTRUT PIPE SUPPORT MAY HAVE TO BE INCREASED DEPENDING ON PIPE SIZE PER SECTION 15140.
  3. REFER TO GENERAL NOTES ON SHEET MZ-1 AND SECTION 15140 FOR SPECIAL PIPE SUPPORT REQUIREMENTS.

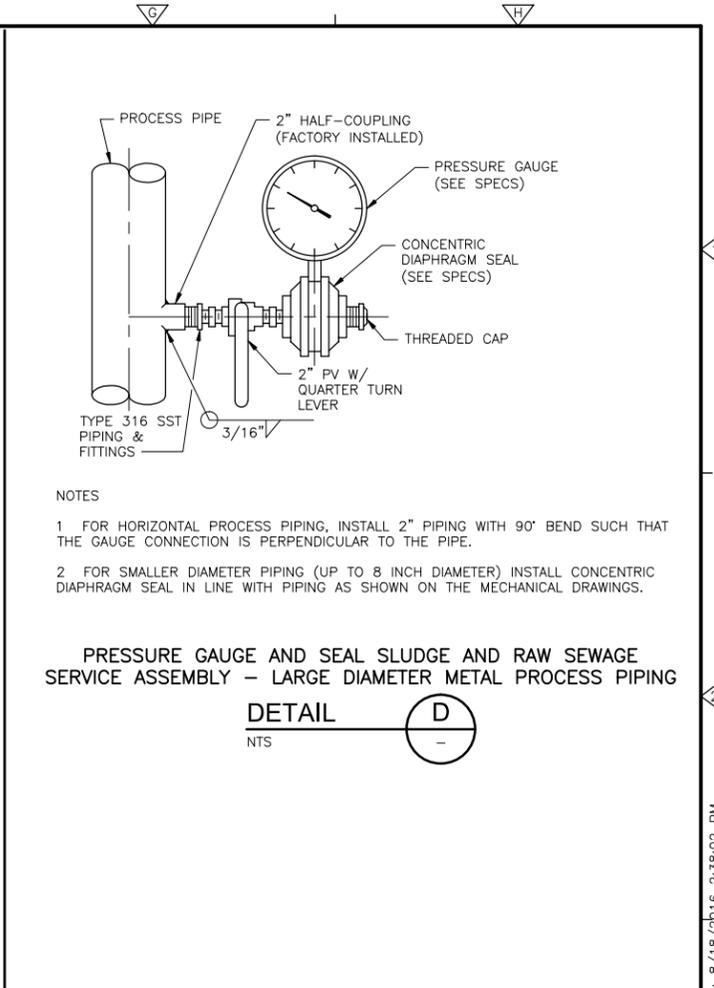
**PIPE CLAMP FOR INDIVIDUAL PIPES**  
**DETAIL A**  
 NTS



**FLUSH MOUNTED PIPE SUPPORT**  
**DETAIL B**  
 NTS

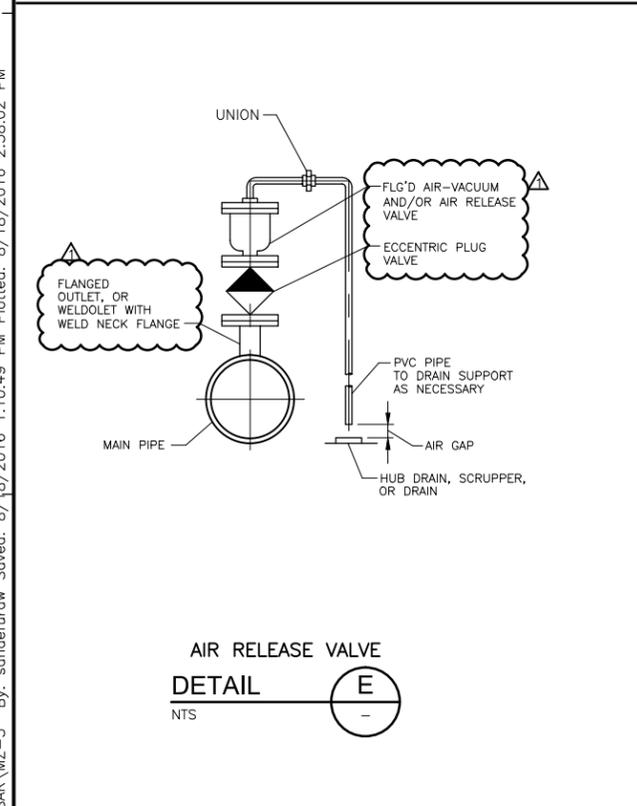


**PIPE FLANGE SUPPORT**  
**DETAIL C**  
 NTS

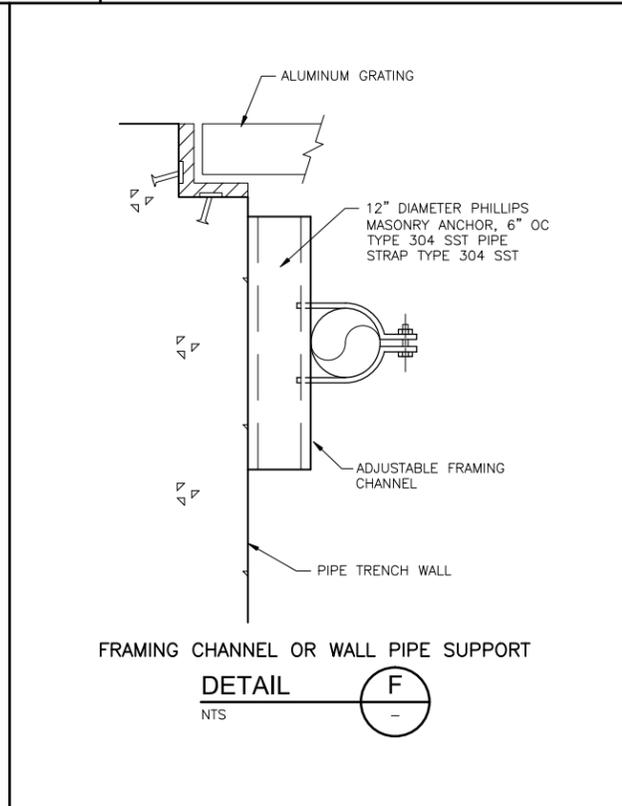


- NOTES:**
1. FOR HORIZONTAL PROCESS PIPING, INSTALL 2" PIPING WITH 90° BEND SUCH THAT THE GAUGE CONNECTION IS PERPENDICULAR TO THE PIPE.
  2. FOR SMALLER DIAMETER PIPING (UP TO 8 INCH DIAMETER) INSTALL CONCENTRIC DIAPHRAGM SEAL IN LINE WITH PIPING AS SHOWN ON THE MECHANICAL DRAWINGS.

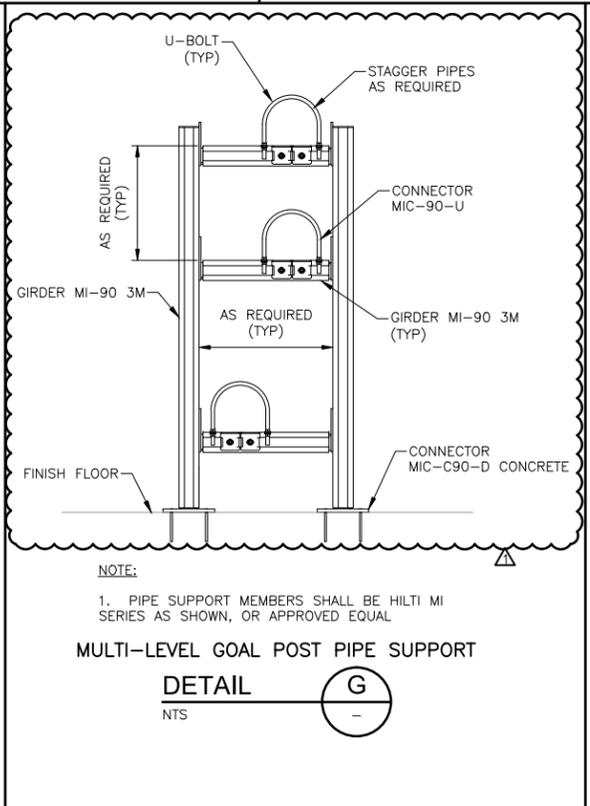
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**DETAIL D**  
 NTS



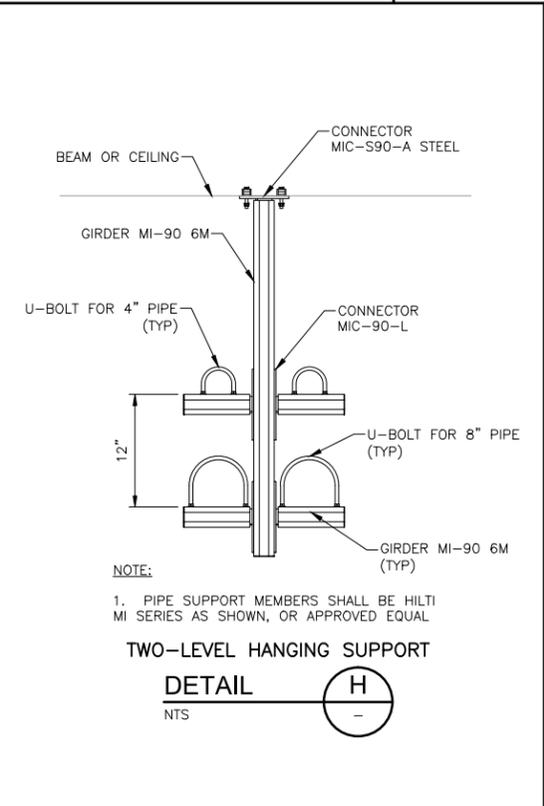
**AIR RELEASE VALVE**  
**DETAIL E**  
 NTS



**FRAMING CHANNEL OR WALL PIPE SUPPORT**  
**DETAIL F**  
 NTS



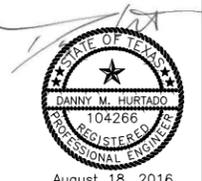
**MULTI-LEVEL GOAL POST PIPE SUPPORT**  
**DETAIL G**  
 NTS



**TWO-LEVEL HANGING SUPPORT**  
**DETAIL H**  
 NTS

**GENERAL NOTES**  
 (TYP FOR ALL STANDARD MECHANICAL DETAIL SHEETS)

1. STAINLESS STEEL ADHESIVE CAPSULE ANCHORS SHALL BE A TWO-PART STUD AND CAPSULE RESIN ANCHORING SYSTEM. CAPSULES SHALL BE SELF-CONTAINED, SEALED GLASS UNITS CONTAINING PREMEASURED AMOUNTS OF RESIN, AGGREGATES, AND HARDENER. STUD ASSEMBLIES SHALL BE ALL-THREAD ANCHOR ROD WITH NUT AND WASHER. INSTALL ANCHOR IN FULL COMPLIANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. ANCHORS SHALL BE HILTI "RE-500-SD ADHESIVE ANCHOR", MOLLY "PARABOND CAPSULE ANCHOR", OR EQUAL. PROVIDE MINIMUM EMBEDMENT OF 10 BOLT DIAMETERS IN CONCRETE.



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08-18-16	DWS	DMH		ADDENDUM No 1

DESIGNED BY: WOO  
 DRAWN BY: SANDEFUR  
 SHEET CHK'D BY: HURTADO  
 CROSS CHK'D BY:  
 APPROVED BY:  
 DATE: MAY 2016



CITY OF AUSTIN, TEXAS - AUSTIN WATER UTILITY  
 CIP 3333.016  
 SOUTH AUSTIN REGIONAL WWTP  
 THICKENER IMPROVEMENTS PROJECT

STANDARD MECHANICAL DETAILS III

PROJECT No 590-104217  
 FILE NAME: MZ-3  
 SHEET No  
 M-27

Plotted: 8/18/2016 2:38:02 PM

LIGHTING FIXTURE SCHEDULE

TYPE	LAMP	MANUF./CATALOG NO.	DESCRIPTION
A	LED MINIMUM 6500 LUMENS	LITHONIA (CONTOUR SERIES) #KAD LED 40C 530 30K SR2 208 DF DDBXD  OR APPROVED EQUAL	POLE MOUNTED LED LUMINAIRE, SUITABLE FOR OUTDOOR USE. LUMINAIRE SHALL HAVE ZERO UPLIGHT, AND SHALL BE LISTED AS "NIGHTTIME FRIENDLY", CONSISTENT WITH LEED GOALS FOR LIGHT POLLUTION REDUCTION. TYPE II DISTRIBUTION. POWER FACTOR GREATER THAN OR EQUAL TO 90 PERCENT LAGGING. TOTAL HARMONIC DISTORTION LESS THAN 20 PERCENT. LIGHT ENGINE SHALL HAVE L85 LIFE OF 50,000 HOURS AT MINIMUM IN AMBIENT OF 25 DEGREES C. THE DRIVER SHALL BE FUSED. LED SHALL HAVE MINIMUM CRI OF 65 AND A COLOR TEMPERATURE OF 3000K. HOUSING SHALL BE OF CORROSION-RESISTANT CAST COPPER-FREE ALUMINUM, FACTORY SEALED AND GASKETED TO ISOLATE FROM THE ENVIRONMENT. STAINLESS STEEL HARDWARE. POWDER COAT FINISH FOR CORROSION RESISTANCE. DARK BRONZE IN COLOR. DRIVERS/LEDS/BOARDS SHALL BE CAPABLE OF BEING DISCONNECTED FROM FIXTURE AND REPLACED IN THE FIELD. MOLDED ACRYLIC LENS. INTEGRAL ALUMINUM HEAT SINKS. COMPLETE UNIT SHALL COME WITH A 5-YEAR FULL WARRANTY. LUMINAIRE SHALL BE SUITABLE FOR OPERATION IN AMBIENT TEMPERATURES FROM -30°C TO +40°C. LUMINAIRE SHALL BE UL LISTED FOR WET LOCATIONS.  FURNISH AND INSTALL DEDICATED COPPER-FREE ALUMINUM POLE COMPLETE WITH ALL ACCESSORIES. FURNISH AND INSTALL ALL REQUIRED LUMINAIRE INSTALLATION ACCESSORIES TO COORDINATE WITH LIGHT POLE. REFER TO LIGHTING PLANS AND DETAILS FOR ADDITIONAL REQUIREMENTS. COORDINATE FINAL LUMINAIRE COLOR WITH THE OWNER AND MATCH COLOR TO POLE.
B	LED MINIMUM 9000 LUMENS	COOPER CROUSE-HINDS #VMV 9L W J R3 G /UNV1 P3001 5891  OR APPROVED EQUAL	POLE MOUNTED ANGLE STANCHION LED LUMINAIRE, SUITABLE FOR OUTDOOR USE. LUMINAIRE SHALL BE SUITABLE FOR CLASS 1, DIV. 2 ENVIRONMENT. LUMINAIRE SHALL HAVE ZERO UPLIGHT, AND SHALL BE LISTED AS "DARK SKY COMPLIANT", CONSISTENT WITH LEED GOALS FOR LIGHT POLLUTION REDUCTION. TYPE 3 DISTRIBUTION. POWER FACTOR GREATER THAN OR EQUAL TO 90 PERCENT LAGGING. TOTAL HARMONIC DISTORTION LESS THAN 20 PERCENT. LIGHT ENGINE SHALL HAVE L85 LIFE OF 50,000 HOURS AT MINIMUM IN AMBIENT OF 25 DEGREES C. THE DRIVER SHALL BE FUSED. LED SHALL HAVE MINIMUM CRI OF 82 AND A COLOR TEMPERATURE OF 3000K. HOUSING SHALL BE OF CORROSION-RESISTANT CAST COPPER-FREE ALUMINUM, FACTORY SEALED AND GASKETED TO ISOLATE FROM THE ENVIRONMENT. STAINLESS STEEL HARDWARE. POWDER COAT FINISH FOR CORROSION RESISTANCE. DARK BRONZE IN COLOR. DRIVERS/LEDS/BOARDS SHALL BE CAPABLE OF BEING DISCONNECTED FROM FIXTURE AND REPLACED IN THE FIELD. HEAT AND IMPACT RESISTANT DIFFUSED LENS. COMPLETE UNIT SHALL COME WITH A 5-YEAR FULL WARRANTY. LUMINAIRE SHALL BE SUITABLE FOR OPERATION IN AMBIENT TEMPERATURES FROM -30°C TO +40°C. LUMINAIRE SHALL BE TYPE 4X AND UL LISTED FOR WET LOCATIONS, RATED NEMA 4X.  FURNISH AND INSTALL DEDICATED COPPER-FREE ALUMINUM POLE COMPLETE WITH ALL ACCESSORIES. FURNISH AND INSTALL ALL REQUIRED LUMINAIRE INSTALLATION ACCESSORIES TO COORDINATE WITH LIGHT POLE. REFER TO LIGHTING PLANS AND DETAILS FOR ADDITIONAL REQUIREMENTS. COORDINATE FINAL LUMINAIRE COLOR WITH THE OWNER AND MATCH COLOR TO POLE.
C	LED MINIMUM 5500 LUMENS	COOPER CROUSE-HINDS #VMV 7L W J R1 G /UNV1 P3001 5891  OR APPROVED EQUAL	POLE MOUNTED ANGLE STANCHION LED LUMINAIRE, SUITABLE FOR OUTDOOR USE. LUMINAIRE SHALL BE SUITABLE FOR CLASS 1, DIV. 2 ENVIRONMENT. LUMINAIRE SHALL HAVE ZERO UPLIGHT, AND SHALL BE LISTED AS "DARK SKY COMPLIANT", CONSISTENT WITH LEED GOALS FOR LIGHT POLLUTION REDUCTION. TYPE 1 DISTRIBUTION. POWER FACTOR GREATER THAN OR EQUAL TO 90 PERCENT LAGGING. TOTAL HARMONIC DISTORTION LESS THAN 20 PERCENT. LIGHT ENGINE SHALL HAVE L85 LIFE OF 50,000 HOURS AT MINIMUM IN AMBIENT OF 25 DEGREES C. THE DRIVER SHALL BE FUSED. LED SHALL HAVE MINIMUM CRI OF 82 AND A COLOR TEMPERATURE OF 3000K. HOUSING SHALL BE OF CORROSION-RESISTANT CAST COPPER-FREE ALUMINUM, FACTORY SEALED AND GASKETED TO ISOLATE FROM THE ENVIRONMENT. STAINLESS STEEL HARDWARE. POWDER COAT FINISH FOR CORROSION RESISTANCE. DARK BRONZE IN COLOR. DRIVERS/LEDS/BOARDS SHALL BE CAPABLE OF BEING DISCONNECTED FROM FIXTURE AND REPLACED IN THE FIELD. HEAT AND IMPACT RESISTANT DIFFUSED LENS. COMPLETE UNIT SHALL COME WITH A 5-YEAR FULL WARRANTY. LUMINAIRE SHALL BE SUITABLE FOR OPERATION IN AMBIENT TEMPERATURES FROM -30°C TO +40°C. LUMINAIRE SHALL BE TYPE 4X AND UL LISTED FOR WET LOCATIONS, RATED NEMA 4X.  FURNISH AND INSTALL DEDICATED COPPER-FREE ALUMINUM POLE COMPLETE WITH ALL ACCESSORIES. FURNISH AND INSTALL ALL REQUIRED LUMINAIRE INSTALLATION ACCESSORIES TO COORDINATE WITH LIGHT POLE. REFER TO LIGHTING PLANS AND DETAILS FOR ADDITIONAL REQUIREMENTS. COORDINATE FINAL LUMINAIRE COLOR WITH THE OWNER AND MATCH COLOR TO POLE.
D	LED MINIMUM 6000 LUMENS	COOPER CROUSE-HINDS #EVLL 7L C CX 3 1 /UNV1 OR APPROVED EQUAL	CEILING MOUNTED LED LUMINAIRE, SUITABLE FOR OUTDOOR USE. LUMINAIRE SHALL BE SUITABLE FOR CLASS 1, DIV. 1 ENVIRONMENT. POWER FACTOR GREATER THAN OR EQUAL TO 90 PERCENT LAGGING. TOTAL HARMONIC DISTORTION LESS THAN 20 PERCENT. LIGHT ENGINE SHALL HAVE L85 LIFE OF 60,000 HOURS AT MINIMUM IN AMBIENT OF 25 DEGREES C. THE DRIVER SHALL BE FUSED. LED SHALL HAVE MINIMUM CRI OF 65 AND A COLOR TEMPERATURE OF 5000K. HOUSING SHALL BE OF CORROSION-RESISTANT CAST COPPER-FREE ALUMINUM, FACTORY SEALED AND GASKETED TO ISOLATE FROM THE ENVIRONMENT. STAINLESS STEEL HARDWARE. POWDER COAT FINISH FOR CORROSION RESISTANCE. DARK BRONZE IN COLOR. DRIVERS/LEDS/BOARDS SHALL BE CAPABLE OF BEING DISCONNECTED FROM FIXTURE AND REPLACED IN THE FIELD. HEAT AND IMPACT RESISTANT DIFFUSED LENS. COMPLETE UNIT SHALL COME WITH A 5-YEAR FULL WARRANTY. LUMINAIRE SHALL BE SUITABLE FOR OPERATION IN AMBIENT TEMPERATURES FROM -25°C TO +65°C. LUMINAIRE SHALL BE TYPE 4X AND UL LISTED FOR WET LOCATIONS, RATED NEMA 4X.  FURNISH AND INSTALL ALL REQUIRED LUMINAIRE INSTALLATION ACCESSORIES TO COORDINATE WITH CEILING MOUNTING. REFER TO LIGHTING PLANS AND DETAILS FOR ADDITIONAL REQUIREMENTS.
E	LED MINIMUM 4000 LUMENS	COOPER CROUSE-HINDS #LL46-60W-765/-C-1N OR APPROVED EQUAL	CEILING MOUNTED LINEAR LED LUMINAIRE. HOUSING SHALL BE COPPER-FREE ALUMINUM WITH EPOXY POWDER COAT. LENS SHALL BE HEAT AND IMPACT RESISTANT GLASS.  FURNISH AND INSTALL ALL REQUIRED LUMINAIRE INSTALLATION ACCESSORIES TO COORDINATE WITH CEILING MOUNTING. REFER TO LIGHTING PLANS AND DETAILS FOR ADDITIONAL REQUIREMENTS.

REUSE OF DOCUMENTS

This document, and the designs incorporated herein, is an instrument of professional service that has been developed, designed and prepared by Harutunian Engineering, Inc., and is not to be used, in whole or part, for any other project without giving written notice to Harutunian Engineering, Inc.

REV No	DATE	DRWN	CHKD	REMARKS
▲	8/17/16	HEI	HEI	ADDENDUM NO. 1

DESIGNED BY: HEI  
 DRAWN BY: HEI  
 SHEET CHK'D BY: HEI  
 CROSS CHK'D BY: HEI  
 APPROVED BY: HEI  
 DATE: APRIL 2016



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CITY OF AUSTIN, TEXAS - AUSTIN WATER UTILITY  
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 SOUTH AUSTIN REGIONAL WWTP  
 THICKENER IMPROVEMENTS PROJECT

LIGHT FIXTURE SCHEDULE



8/17/2016

PROJECT No 590-104217  
 FILE NAME: E-35  
 SHEET No  
 E-35