HAINES CITY

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Ms. Catherine Murray
Project Manager
Drinking Water State Revolving Fund
Division of Water Restoration Assistance
Florida Department of Environmental Protection
3900 Commonwealth Blvd. MS3505
Tallahassee, FL 32399

RE: SRF Project: 530461- City of Haines City Reclaimed Water Ground Storage Tank and Pump Stations Project

Subject: AIS Availability Waiver Request for 16" x 12" Eccentric Reducers with ½" Tap

Dear Ms. Murray:

On behalf of the City of Haines City, we are respectfully requesting a waiver from the American Iron and Steel (AIS) provisions required by the Clean Water State Revolving Fund loan program for QTY. 3 - 16" x 12" Eccentric Reducers with ½" Tap for Pressure Gauges specified for the Haines City Reclaimed Water GST and Pump Stations Project. The original contract drawings required a 16" x 10" Eccentric Reducer with ½" tap provided. This is what our Contractor provided for the project.

During shop drawing review and material procurement process, pumps with 12" discharge flanges were ultimately procured and as such, 16" x 12" reducers are required in lieu of the 16" x 10" that were the original basis of design. Our Contractor has tried to procure these AIS reducers and found that the lead times are excessive and will result in a significant 4-6 month delay for our project.

The following items are in EPA's Information Checklist for waiver requests and are provided as follows:

1. **General Description:**
   - 3- 16" x 12" Eccentric Reducers with ½" Tap for Pressure Gauges. Previously purchased 3- 16" x 10" Eccentric Reducers with ½" Tap for Pressure Gauges.

2. **Unit of Measure/Quantity/Pricing:**
   - Incorporated into Exposed piping provided for Transfer Pump area. Price for Domestic 16" x 12" Eccentric Reducers= [redacted] + Tax/Freight.
   - Non-Domestic 16" x 12" Eccentric Reducers= [redacted] + Tax/Freight

3. **Time and Delivery or Availability:**
   - 22-24 Weeks for Domestic
   - 2 weeks for Import

4. **Location of Construction Project:**
   - This project is located at the City of Haines City Wastewater Treatment Plant, 851 E. Park Rd. Haines City, FL 33844

5. **Name and Address of Supplier:**
   - Wesley Bunn
     McDade Waterworks
     6520 Harney Rd.
     Tampa, FL 33610

6. **Supporting documentation, including that the Contractor made a reasonable survey of the market, such as a description of the process for identifying suppliers and a list of contacted suppliers.**
   - See attached email correspondence from McDade and Sigma/Tyler

7. **Supplier information or pricing information from the leading domestic supplier indicating availability/delivery date for construction materials:**
   - See attached email correspondence.

8. **Contractor and/or Supplier to provide statement confirming the non-availability of the domestic construction material which is sought:**
   - See email from Contractor

9. **Has the State received other waiver requests for the materials described in the request for comparable projects?**
   - This information is unknown to us for these specific fittings, but we do believe that waivers have been granted for special fittings that will prolong the overall project.

10. **Project Schedule:**

- See project startup schedule for Haines City GST and Pump Stations Project

11. Engineering

- The Engineer of Record has no issues with the said waiver request. We have experienced several delays on this project as a result of the global supply chain issues that are affecting the industry worldwide. Our contractor, Vogel Brothers Building Company has done a good job in proactively identifying potential issues and working to develop a solution. They have also been diligent about completing work immediately once materials arrive to the site.

Please do not hesitate to contact me should you need any additional information to process this request.

Sincerely,

Terry Holley- City Water/Wastewater Superintendent

CC: James Keene-, Public Infrastructure Director, City of Haines City
Allen Dethloff- Project Manager, CHA Consulting
Christian Spires- Project Manager, Vogel Brothers Building Co.

SECTION 15050

PROCESS AND UTILITY PIPING, FITTINGS, VALVES, AND ACCESSORIES

PART 1-GENERAL

1.01 DESCRIPTION

A. Scope of Work: The Work included in this Section consists of furnishing all labor, equipment, and materials and in performing all operations necessary for the construction or installation of all process and utility piping, valves, and appurtenances complete and ready for operation as shown on the Drawings and specified herein. The following items are included in this Specification Section:

1. Ductile Iron Pipe and Fittings,
2. Polyethylene Encasement for Buried Ductile Iron Pipe,
3. Polyvinyl Chloride (PVC) Pipe and Fittings,
4. Stainless Steel Pipe and Fittings,
5. Wall Sleeves, Seals and Pipes and Non-Standard Castings,
6. Restrained Pipe Couplings,
7. PVC Valves,
8. Stainless Steel Ball Valves,
9. Gate Valves,
10. Butterfly Valves,
11. Swing Check Valves,
12. Automatic Air Release Valves,
13. Flow Control Valves,
14. Service Saddles and Corporation Stops,
15. Restrained Flange Pipe Adapters,
16. Dismantling Couplings,
17. Flexible Expansion Joints,
18. Flexible Concentric and Eccentric Reducer Expansion Joints,
19. Pressure Gauge Assemblies,
20. Valve Boxes.
21. Pipe Identification System,
22. Valve Identification System,
23. Extended Deflection and Extending Coupling,
24. Hose Bibb
25. Wash Down Hose,
26. In-Line Static Mixer,
27. Other Miscellaneous Items.

B. Related Work Described Elsewhere:

1. Section 09905: Piping, Valve and Equipment Identification System
2. Section 15126: Pipe Hangers and Supports
3. Section 15144: Pressure Testing of Piping

1.02 QUALITY ASSURANCE

A. Construction Requirements:

1. All the lines shall be installed with at least 36 inches of cover, unless otherwise shown or indicated on the Drawings.
2. For underground utilities, changes in horizontal alignment of less than 11-1/4 degrees may be achieved through the use of allowable pipe deflection in lieu of fittings shown on the Drawings at the Contractor's option, but subject to approval of the Engineer as to layout. Said deflection shall not exceed 70 percent of the maximum allowable deflection as stated in the pipe manufacturer's installation instructions.
3. All piping installed underneath structures or concrete slabs shall be ductile iron Pressure Class 250 for 14-inch pipe and larger and Pressure Class 350 for 12-inch pipe and smaller.

B. Pipe Inspection: The Contractor shall obtain from the pipe manufacturers a certificate of inspection to the effect that the pipe and fittings supplied for this Contract have been inspected at the plant and that they meet the requirements of these Specifications. All pipe and fittings shall be subject to visual inspection at time of delivery by rail or truck and also just before they are lowered into the trench to be laid. Joints or fittings that do not conform to these Specifications will be rejected and must be removed immediately by the Contractor.

The entire product of any plant may be rejected when, in the opinion of the Engineer, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.

1.03 SUBMITTALS

A. Shop Drawings:

1. In general, the following Shop Drawings shall be submitted to the Engineer for approval prior to construction:

a) Mill test certificates or certified test reports on pipe and fittings.
b) Details of restrained and flexible joints.
c) Valve boxes.
d) All valves including: gate, butterfly, check, and air release valves.
e) Couplings and dismantling joints.

f) Service saddles.
g) Pressure gauges.
h) Flexible expansion joints, flanged coupling adapters and flange adapters.
i) Joint lubricant.
j) Detailed piping layout drawings and pipe laying schedule (see below).
k) Temporary plug and anchorage system for hydrostatic pressure test.

2. Tabulated layout schedule for each pipe system including:

a) Pipe invert station and elevation at each change of grade and alignment.
b) The limits of each reach of pipe thickness class and of restrained joints.
c) The limits of each reach of concrete encasement.
d) Locations of valves and other mechanical equipment.
e) Methods and locations of supports.
f) Details of special elbows and fittings.

3. A separate Shop Drawing submittal will be required for each major item listed above and for each different type of an item within a major item. For example, separate submittals will be required for gate, butterfly, check and automatic air release valves. All submittals shall be in accordance with the General and Special Conditions and Section 01340: Shop Drawings, Working Drawings, and Samples.

B. Acceptance of Material:

1. The Contractor shall furnish an Affidavit of Compliance certified by the pipe manufacturer that the pipe, fittings, and specials furnished under this Contract comply with all applicable provisions of current AWWA and ASTM standards and these Specifications. No pipe or fittings will be accepted for use in the Work on this project until the Affidavit has been submitted and approved by the Engineer.
2. The Owner reserves the right to sample and test any pipe or fitting after delivery and to reject all pipe and fittings represented by any sample which fails to comply with the specified requirements.

C. Operation and Maintenance Manuals: Submit operation and maintenance manuals for applicable components requiring periodic maintenance and/or explanation of operation, at the discretion of the Engineer. Manuals shall be prepared in accordance with *Section 01730: Operating and Maintenance Data*. Information shall include:

1. Detailed assembly drawings, clear and concise instructions for operating, adjusting, overhauling, troubleshooting and, other maintenance. Include Shop Drawings previously submitted and approved with all corrections made.
2. A complete lubrication schedule including lubricant types, grades, and recommended frequency of lubrication.
3. A list of parts for all products with catalog numbers and all data necessary for ordering replacement parts. Such instructions and parts lists shall be prepared for the specific product furnished and shall not refer to other types or models.

1.04 DELIVERY, STORAGE AND HANDLING

A. Pipe, fittings, valves, and accessories shall be handled in such manner as to ensure a sound undamaged condition during shipping, delivering, and installing.

B. Particular care shall be taken not to injure the pipe coating and linings.

C. Insides of valves and piping shall be kept free of dirt and debris.

1.05 JOB CONDITIONS

A. Water in Excavation: Water shall not be allowed in the trenches while underground pipes are being laid and/or tested. The Contractor shall not open more trench than the available pumping facilities are able to dewater to the satisfaction of the Engineer. Trench dewatering shall be in accordance with *Section 02140 – Dewatering*. The Contractor shall assume responsibility for disposing of all water so as not to injure or interfere with the normal drainage of the area in which he is working. In no case shall the pipelines being installed be used as drains for such water, and the ends of the pipe shall be kept properly and adequately plugged during construction by the use of approved stoppers and not by improvised equipment. All necessary precautions shall be taken to prevent the entrance of mud, sand, or other obstructing matter into the pipelines. If on completion of the work any such materials have entered the pipelines, it must be cleaned as directed by the Engineer so that the entire system will be left clean and unobstructed.

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE AND FITTINGS

A. Ductile Iron Pipe: Ductile iron pipe shall conform to the requirements of ANSI, A21.51 and AWWA C151, latest revision. The minimum thickness class for underground pipe shall be Pressure Class 350 for 12-inch pipe and smaller and Pressure Class 250 for 14-inch pipe and larger. Flanged pipe shall have a minimum thickness class of Class 53.

B. Pipe shall have a minimum rated water working pressure of 250 psi and shall be furnished in laying lengths of 20 feet or less, unless specifically shown otherwise on the Drawings. All piping and fittings shall be new and unused, no refurbished piping or fittings will be accepted.

C. Coating and Lining:

1. Cement-Mortar Interior Lining (Reclaimed Water): Ductile iron pipe, fittings, and specials shall be cement lined in accordance with ANSI/AWWA C104, current revision, "Cement-Mortar Lining for Ductile Iron and Gray Iron Pipe and Fittings for Water". The cement lining shall have standard thickness and, after curing, the lining shall have a seal coat of bituminous material in accordance with AWWA C104, current revision and shall be listed by ANSI/NSF Standard 61 for potable water contact.
2. Exterior Coatings for Buried Pipe: Ductile iron pipe, fittings, and specials to be installed underground shall be coated on the exterior at the factory with one coat, 1 mil DFT, of asphaltic coating per AWWA C151, C110 and C153. All clamps, bolts, nuts, studs, and other uncoated parts of joints for underground installation shall be coated with coal tar epoxy prior to backfilling. Coal tar epoxy shall be equal to Carboline Bitumastic No. 300-M.
3. Exterior Coating for Exposed Pipe: Ductile iron pipe, fittings, and specials to be installed aboveground shall be furnished with a shop applied primer on the exterior. The shop primer shall be as specified in Section 09900: Coatings. Exposed piping shall be coated in accordance with Sections 09900 and 09905.
4. Pipe Labeling: Pipe manufacturer shall label in large legible lettering on the exterior of the pipe the type of pipe interior lining.

D. Fittings: Fittings for ductile iron pipe shall be either mechanical joint, restrained joint, or flanged joint as indicated on the Drawings and shall have a minimum working pressure of 250 psi. Fittings shall be ductile iron and shall conform to ANSI/AWWA C110, ANSI/AWWA C111 and ANSI/AWWA C153, latest revisions for flanged and mechanical joint pipe. Fittings shall be coated and lined

as indicated on the Drawings, in the manner specified above for ductile iron pipe. The rubber gaskets for flanged, mechanical, and push-on joints shall be as described below.

E. Push-On Joints: Pipe using push-on joints shall be in strict accordance with AWWA C111 and ANSI A21.11, latest revision and shall be as manufactured by American Cast Iron Pipe Company (Fastite Joint), United States Pipe Company (Tyton Joint), or McWane Corporation. Jointing materials shall be provided by the pipe manufacturer and installation shall be in strict accordance with the manufacturer's recommended practice.

F. Mechanical Joints: Jointing materials for mechanical joints shall be provided by the pipe and fitting manufacturer. Materials assembly and bolting shall be in strict accordance with ANSI/AWWA C111 and ANSI/AWWA C153, latest revisions. Tee head bolts and nuts for mechanical joints shall be manufactured of CORTEN, high strength, low alloy, corrosion resistant steel in accordance with ASTM A242, or an equal approved by the Engineer.

G. Flanged Joints: Flanges shall be Class 125 per ANSI B16.1 with any special drilling and tapping as required to insure correct alignment and bolting.

1. Gaskets: Fullface, 1/8-inch thick, cloth-inserted rubber. Gaskets shall be suitable for a water pressure of 350 psi at a temperature of 180°F.
2. Bolts and Nuts for Flanges:

    a. Bolts and nuts for flanges located indoors, in enclosed vaults, in structures, and outdoors aboveground shall be Type 304 stainless steel ASTM A193 for bolts and ASTM A194 for nuts.
    b. Bolts and nuts for buried and submerged flanges and flanges located below grade in open vaults and structures shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts. The nuts shall have a hardness that is lower than that of the bolts and washers by a difference of 50 Brinnell hardness to percent galling during installation.

3. Flanges shall be long-hub type screwed tightly on pipe by machine at the foundry prior to facing and drilling. Flange machine surfaces shall be coated with rust inhibitor immediately after facing and drilling. Field assembled screwed on flanges are prohibited.

H. Restrained Joints and Fittings: Pipe joints and fittings shall be restrained in accordance with the Drawings and the requirements of this Specification. It is intended that, at a minimum, all fittings shall be restrained. In cases where the calculated required length of restrained pipe is not evenly divisible by nominal laying lengths of pipe, the total required length of restrained pipe shall be rounded up to the next closest nominal length that is evenly divisible by the standard

laying length.

1. Manufactured Restrained Joints: Manufactured restrained joints shall be Flex-Ring®, Lok-Ring®, or Lok-Fast® manufactured by the American Cast Iron Pipe Company, Lok-Tyte® or Tr-Flex® Type manufactured by the United States Pipe Company, or an equal approved by the Engineer. Joints shall be manufacturer's standard specifically modified push-on type joints with joint restraint provided by ductile iron retainer rings joined together by corrosion-resistant, high strength steel tee head bolts and nuts or with joint restraint provided by a welded-on retainer ring and a split flexible ring assembled behind the retainer ring.
2. Gripping-Type Gasket Restraint: The Fast-Grip® gripping-type gasket as manufactured by the American Cast Iron Pipe Company and other similar gripping-type gaskets may be used for ductile iron pipe 20-inches in size and smaller, when approved by the Owner. This type of restrained joint shall be the manufacturer's standard push-on type joint with joint restraint provided by a specially designed gasket with high strength stainless steel gripping elements which have sharp teeth on its inner surface for gripping the spigot end of the pipe joint. The gripping type gasket manufacturers joint restraint shall only be considered for use on pipe sizes from 4-inch to 20-inch.
3. Restrained joint pipe and fittings shall be ductile iron only and shall comply with applicable portions of this Specification. Manufactured restrained joints shall be capable of deflection during assembly. Deflection shall not exceed 70 percent of the manufacturer's recommendations.
4. Tee head bolts and nuts for restrained joints shall be manufactured of CORTEN, high strength, low alloy, corrosion resistant steel in accordance with ASTM A242, or an equal approved by the Engineer.

I. Alternate Mechanically Restrained Joints: When prior approval is obtained from the Engineer, ductile iron pipe and fittings with mechanical joints may be restrained using a follower gland which includes a restraining mechanism. When actuated during installation, the restraining device shall impart a multiple wedging action against the pipe wall which increases resistance as internal pressure in the pipeline increases.

1. The joint shall maintain flexibility after installation. Glands shall be manufactured of ductile iron conforming to ASTM A536 and restraining devices shall be of heat treated ductile iron with a minimum hardness of 370 BHN. The gland shall have standard dimension and bolting patterns for mechanical joints conforming to ANSI/AWWA C111 and C153, latest revisions.
2. Tee head bolts and nuts shall be manufactured of corrosion-resistant, high strength, low alloy CORTEN steel in accordance with ASTM A242.
3. The restraining wedges shall have twist-off nuts to insure proper torquing.

The mechanical joint restraint device shall have a minimum working pressure rating of 250 psi with a minimum safety factor of 2 to 1 and shall be MEGALUG® as manufactured by EBBA Iron, Inc. No other retainer gland type device will be acceptable. After installation prior to backfilling, all parts of the joint restraint system shall be coated with coal tar epoxy equal to Carboline Bitumastic No. 300-M.

J. All underground ductile iron pipe and fittings shall be identified as specified below in Article 2.20- Pipe Identification Systems.

2.02 POLYETHYLENE ENCASEMENT FOR BURIED DUCTILE IRON PIPE

A. Polyethylene tube encasement shall be provided and installed for all buried ductile iron pipe segments and fittings for corrosion protection as specified herein. Both material and installation procedures shall be in accordance with AWWA C105/ ANSI A21.5-10. Polyethylene encasement material shall be manufactured with UV inhibitors. The polyethylene encasement shall be color coded as follows:

1. Potable Water Service – Blue Polyethylene Encasement.
2. Reclaimed Water Service – Pantone Purple Polyethylene Encasement.
3. Wastewater Service – Green Polyethylene Encasement.

B. The polyethylene encasement shall be a minimum of 8 mils thick and shall be certified by the manufacturer to provide suitable protection of pipe installation in corrosive soil.

C. All pipe joints shall consist of a minimum of one foot of polyethylene overlap onto the adjacent pipe at both ends. All overlap material shall be secured in place with at least two wraps of 1/2-inch wide x 8 mils thick polyethylene adhesive tape. Any slack liner material along the pipe barrel shall be taken up by folds secured in-place with adhesive tape. Repair any rips, punctures or other damage to polyethylene with tape or by patching.

D. All valves, fittings and specialty items shall be jointed with proper overlaps and fastening as described above. Prepare openings for service taps, air-reliefs, etc., by making a cut in the polyethylene and temporarily folding back the edges. After installation is completed, replace the polyethylene and repair the cut with polyethylene adhesive tape.

E. Care shall be taken during backfilling so that no damage will occur to the polyethylene liner. In general, backfilling shall be done in accordance with AWWA Standard C 600.

F. The Contractor shall install polyethylene encasement in accordance with all liner and pipe manufacturer recommendations.

G. Polyethylene encasement shall be required for below ground installations of ductile iron pipe and fittings where the installed ductile iron utility pipe will be located less than 10 feet from a gas main.

2.03 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. Each length of PVC pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant, and the class or strength classification of the pipe. All PVC pipe shall bear the NSF-DW seal. The markings shall be plainly visible on the pipe barrel. Pipe which is not marked clearly is subject to rejection. All rejected pipe shall be promptly removed from the project site by the Contractor.

B. Small Gravity Drainage Piping: PVC pipe smaller than 4 inches nominal diameter used for gravity drainage piping shall be Schedule 40 pipe in accordance with ASTM D1785. Schedule 40 PVC pipe shall have solvent welded joints as specified for PVC pressure pipe.

C. Large Gravity Drainage or Sewer Piping: Unless otherwise noted, large gravity drainage and sewer piping for nominal diameters 4-inches and larger in size, shall conform to the requirements of AWWA C900 DR25 for pipe up to 12-inches and AWWA C900 DR32.5 for pipe larger than 12-inches, with gasketed integral bell ends. Pipe shall be designed for a maximum working pressure at not less than 100 psi and with not less than a 4 to 1 sustained hydrostatic pressure safety factor. Fittings shall be ductile iron fittings with restrained mechanical joint and as specified hereinbefore. Large PVC Gravity Drainage or Sewer Pipe shall be manufactured to ductile iron pipe O.D.'s instead of IPS O.D.’s.

D. Small PVC Pressure Piping: Unless otherwise specified, aboveground PVC pressure pipe 4 inches and smaller, in nominal diameter, and below ground PVC pressure pipe smaller than 4 inches, in nominal diameter, shall be Schedule 80 PVC in accordance with ASTM D1785. Schedule 80 pipe shall have either solvent welded or threaded joints. PVC pressure pipe shall bear the approved seal of the National Sanitation Foundation (NSF). PVC pipe that is exposed to sunlight shall be manufactured with additives to provide resistance to ultraviolet deterioration.

1. Fittings: Socket type, solvent welded fittings for Schedule 80 PVC pipe shall be in conformance with ASTM D2467. Threaded type fittings for Schedule 80 PVC pipe shall be in conformance with ASTM D2464. All solvent welded or threaded joints shall be watertight.

2. Flanges: Flanges for Schedule 80 PVC pipe shall be rated for a 150 psi working pressure with ANSI B 16.1 dimensions and bolting pattern. Flanges shall be connected to PVC piping with either solvent welded or threaded joints in accordance with ASTM D2467 or ASTM 2464, respectively. Gaskets shall be neoprene, full faced type with a minimum thickness of 1/8-inch. Nuts and bolts shall be hexagonal with machine threads, manufactured of Type 316 stainless steel in accordance with ASTM A320, Class 2. Type 316 stainless steel flat washers w/lock washers shall be used against PVC flanges. The nuts shall have a hardness that is lower than that of the bolts and washers by a difference of 50 Brinnell hardness to prevent galling during installation.
3. Solvent Cement: PVC solvent cement shall be in compliance with ASTM D2564 and in accordance with the pipe manufacturer's recommendations.
4. Thread Lubricant: Lubricant for Schedule 80 threaded joints shall be Teflon tape only.

E. Large PVC Pressure Piping (Underground): Unless otherwise noted, PVC pressure pipe for nominal diameters 4 inches and larger in size shall conform to the requirements of AWWA C900, DR18 for pipe up to 16 inches with gasketed integral bell ends. Pipe shall be designed for maximum working pressure of not less than 150 psi and with not less than a 4 to 1 sustained hydrostatic pressure safety factor for AWWA C900 pipe. The minimum standard length of pipe shall be 20 feet. Pipe shall be manufactured to ductile iron pipe O.D.'s only.

1. Bell and Spigot: Pipe joints shall be made with integral bell and spigot pipe ends. The bell shall consist of an integral thickened wall section designed to be at least as strong as the pipe wall. The bell shall be supplied with factory glued rubber ring gasket which conforms to the manufacturer's standard dimensions and tolerances. The gasket shall meet the requirements of ASTM F477 "*Elastomeric Seals (Gaskets) for Joining Plastic Pipe*" and shall be manufactured of EPDM elastomeric material. PVC pipe shall be approved by the Engineer and the Owner and shall be as listed on the Owner's *Approved Products List*.
2. All PVC pipe and fittings for potable water mains and reclaimed water mains shall be extruded or fabricated with an integral color in the PVC material. The integral color for the PVC pipe shall be as follows:

    a. Potable Water PVC pipeline color - Blue.
    b. Reclaimed Water PVC pipeline color – Purple
    c. Wastewater PVC pipeline color – Green

    The use of white or any other color pipe for potable water or reclaimed water service shall be prohibited.

3. Fittings: Fittings for PVC pressure pipe shall be ductile iron fittings with restrained mechanical joint ends, linings and coatings as specified hereinbefore for ductile iron fittings.

4. Restrained Joints: Where indicated on the Drawings, to prevent pipe joints and fittings from separating under pressure, pipe joints and fittings shall be restrained as follows:

    a. PVC pipe bell and spigot joints shall be restrained with the EBBA Iron MEGALUG® Series 1500 TD Restrainer or an equal approved by the Engineer and the Owner and shall be listed on the Owner's *Approved Products List*. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A536, Grade 6542-10. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy CORTEN steel meeting the requirements of ASTM A242.
    b. Mechanical joint fittings used with PVC pipe shall be restrained with the EBBA Iron MEGALUG® Series 2000 PV Restrainer or an equal approved by the Engineer and the Owner and shall be listed on the Owner's *Approved Products List*. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A536, Grade 65-42-10. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy CORTEN steel meeting the requirements of ASTM A242.

F. All underground PVC pipe shall be identified as specified below in Article 2.20-Pipe Identification Systems.

2.04 STAINLESS STEEL PIPE AND FITTINGS

A. All stainless steel pipe and fittings shall be fabricated from Type 316L extra low carbon grade austenitic stainless steel sheet with a working pressure of 150 psi and maximum temperature of 250º Fahrenheit.

1. Pipe shall conform to ASTM A312 and be die-formed or rolled true to dimension and round within a tolerance of plus or minus 1/6-inch.
2. The two edges of sheet shall be brought to line so as not to leave a shoulder on the inside of the pipe. Fittings shall conform to ASTM A-403.
3. Ends of pipe and fittings shall be true and perpendicular to the longitudinal axis with the edges de-burred.
4. Pipes shall be straight within maximum of 1/8-inch deviation over 10 feet.
5. Longitudinal seams on pipe and fittings shall be welded by either the tungsten gas plasma, flux covered or the metallic-gas method. Welding rod or wire shall be of same composition or superior to the pipe and fittings material.
6. Weld deposit at the seams shall have a slight crown on both sides of the weld and no cracks or crevices shall be allowed. Excessive weld deposits, slag, weld spatter and projections into interior of pipe shall be removed by

grinding. The interior welds shall be smooth, even and shall not have an internal bead higher than 1/16 inch.

7. All pieces shall be marked with gauge and type of stainless steel.
8. Pipe and fittings shall be passivated by immersing in pickling solution in manufacturer's plant and scrubbed and washed until discoloration and possible iron, picked up from manufacturing process, is removed.

B. All stainless steel piping 2-inches and smaller shall be Schedule 80 for gas service and schedule 40 for water service. Piping 2 1/2-inches and larger shall be Schedule 10 for general use and Schedule 40 for high pressure gas.

C. Fittings:

1. Fittings three inches and smaller shall be threaded conforming to 150 pound, forged ASTM A182, Grade F 316, or bar stock to ASTM A276, Class WP, Type 316, same material and wall thickness as the pipe, conforming to ANSI B16.11.
2. Fittings for buried or submerged pipe larger than three inches shall be butt-welded, conforming to ASTM A403, Class WP, same material and wall thickness as the pipe, conforming to ANSI B16.9. Elbows shall be long radius.
3. Fittings for above ground or exposed pipe larger than three inches shall be flanged or coupled, as shown on the drawings, conforming to ASTM A403, Class WP, same material and wall thickness as the pipe, conforming to ANSI B16.9. Elbows shall be long radius.
4. Branches:

    a. Outlets of size three inches and smaller in piping 4 inches and larger shall be of the Thredolet type, per AWWA Manual M11 (1964 edition), Figure 19.24. Outlets shall be 3,000 pound WOG stainless steel per ASTM A 182, or ASTM A 403. Threads shall comply with ANSI B2.01. Outlets shall be Bonny Forge Co. "Thredolet", Allied Piping Products Co. "Brachlet", or equal.
    b. For outlets three inches and smaller in piping smaller than four inches, use a threaded tee in accordance with C.1. above.
    c. For outlets larger than three inches, use a tee conforming to ASTM A403, Class WP, with a flanged outlet or as shown on the Drawings.

D. Joints:

1. Joints for pipes three inches and smaller shall be threaded or socket welded, same material as the pipe, 3,000 pound WOG, conforming to ANSI B16.11.
2. Joints for buried or submerged pipe larger than three inches shall be butt-welded.

3. Joints for above-ground or exposed pipe larger than three inches shall be flanged or grooved end joints as shown on the Drawings.

E. Flanges:

1. Provide weld-neck flanges conforming to ANSI B16.5 for piping three inches and smaller to connect to flanged valves, fittings, or equipment. Provide slip-on flanges for piping larger than three inches. Flanges shall be Class 150 per ANSI B16.5 unless specified otherwise. Material for weld-neck and slip-on flanges shall conform to ASTM A182, Grade F316. Flanges shall match the connecting flanges on the adjacent fitting, valve or piece of equipment.
2. Determine the pressure class of the flanges based on the test pressure specified in Section 15144.
3. Where a raised face steel flange connects to a flat face flange, remove the raised face on the steel flange.

F. Field welding will be allowed when approved by the Engineer. All field welding shall be performed by a AWS Certified welder and shall be tested for verification of weld.

G. Pipe ends shall be prepared for either mechanical or flexible couplings where shown on the Drawings.

H. Dead Ends of pipe runs shall have butt-welded ASME Code dished heads designed to meet the test pressures for the various pipes.

I. Bolts and Nuts for Flanges:

1. Bolts and nuts for flanges shall be Type 316 stainless steel conforming to ASTM A 913, Grade B8M, for bolts and ASTM A 194, Grade 8M, for nuts.
2. Provide washer for each nut. Washers shall be of the same material as the nuts.

J. Gaskets for Flanges: Provide full-face gaskets for flat faced flanges. Provide ring gaskets for raised face flanges. Gaskets shall be nylon reinforced EPDM, 1/8-inch thick minimum.

2.05 WALL SLEEVES, SEALS, AND PIPES AND NON-STANDARD CASTINGS

A. Wall Sleeves:

1. Wall sleeves shall be of cast iron, ductile iron, or carbon steel hot-dip galvanized after fabrication (see below for plastic alternate) and shall have a seep ring (waterstop) located in the center of the wall. Sleeves shall be provided with seals and shall be oversized as required for the installation of seals. Sleeves shall terminate flush with finished surfaces of walls and ceilings, and shall extend 2 inches above the finished floor.
2. When noted on the Drawings, smaller pipe sleeves in CMU specified as PVC, shall be Sch 80 PVC. Sleeves shall be grouted in place and shall be oversized as required for the installation of process pipe and sealant materials. Sleeves shall terminate flush with finished surfaces of walls and ceilings, and shall extend 2 inches above the finished floor.
3. For poured or grouted in place sleeves, lightweight, high-impact thermoplastic sleeves may be substituted. Plastic sleeves shall have integral waterstop and anchoring ribs. Plastic sleeves shall be a product of the wall sleeve seal manufacturer and shall be Century Line Sleeves as manufactured by Link-Seal, or approved equal.
4. Wall sleeves shall be installed for all piping passing through building walls and floors, except where noted on the Drawings. Sleeves shall be of sufficient size to pass the pipe without binding. Sleeves shall terminate flush with finished surfaces of walls and ceilings, and shall extend 2 inches above the finished floor. Escutcheons shall be provided at walls and floor to completely conceal the sleeves smaller than 3 inches. Escutcheons shall be cast iron, nickel plated split-type.

B. Wall Sleeve Seals: Wall sleeve seals shall be modular mechanical type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall sleeve. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely water-tight seal between the pipe and wall sleeve. The synthetic rubber shall be suitable for exposure to water, wastewater, and groundwater. Bolts, nuts, and hardware shall be 316 stainless steel. The seals shall be Link Seal as manufactured by Enpro Industries, Inc. or approved equal, and the wall sleeve and seal shall be sized as recommended by the seal manufacturer.

C. Wall Pipes: Wall pipes shall be of the size and types indicated on the Drawings. All wall pipes shall be of ductile iron and shall have a central fin not less than 1/2-inch thick and the same diameter as the bolting flange cast midway of the length to form a waterstop. Each wall pipe shall be of the same grade, thickness and interior coating as the piping to which it is joined. Those portions of the wall pipes that are buried shall have a coal tar epoxy outside coating.

D. Non-Standard Fittings and Castings: Fittings having non-standard dimensions and cast especially for this project shall be of an approved design. Fittings shall be manufactured to meet the requirements of the same Specifications and shall have the same diameter and thickness as standard fittings but laying lengths and types of ends shall be determined by positions in the pipelines and by the particular piping to which it is connected. Flange facing and drilling shall conform to the 125 pound American National Standard. Where required, flanges shall be drilled and tapped for studs. Other dimensions shall be substantially equal to corresponding parts of standard bell and spigot fittings.

2.06 RESTRAINED JOINT COUPLINGS

A. Restrained Joint Pipe Couplings: Restrained joint pipe couplings used to join and restrain two pieces of plain end pipe shall be sized to suit the outside diameter of the pipe ends to be jointed with restrained ends. Transition couplings shall be used to join pipes of different outside diameters. Pipe couplings shall be bolted type with ASTM A536 ductile iron middle ring and end followers.

B. Coating: All ductile iron parts of the coupling shall be coated on the interior and exterior with a fusion bonded thermosetting epoxy coating, applied electrostatically prior to assembly, and complying with AWWA C550 with a 12-mil nominal coating thickness. The coating shall be equal to Mega-Bond as manufactured by EBBA Iron, Inc., or an equal approved by the Engineer.

C. Gaskets: Gaskets for the coupling shall be wedge type manufactured of EPDM resilient rubber.

D. Bolts: Torque limiting nuts and gripping restraint wedges shall be manufactured of corrosion resistant, low alloy, high strength steel. Threaded restraint rods and hexagonal nuts shall be manufactured of high strength, Type 316 stainless steel. Bolts and nuts shall conform dimensionally to ANSI/AWWA C111, latest revision.

E. Manufacturer: Restrained joint couplings shall be Series 3800 as manufactured by EBBA Iron, Inc., or an equal approved by the Engineer.

2.07 PVC VALVES

A. Ball Check Valves: All PVC ball check valves 1/2-inch through 2-inch in size shall be of a solid thermoplastic construction manufactured of Type 1, Grade 1 PVC. Ball check valves shall be true union design with solvent welded socket or NPT threaded ends as noted on the Drawings. Ball check valves shall be furnished with a solid thermoplastic ball and Type 316 stainless steel spring to assist ball in seating faster. Ball seat shall be Teflon coated Viton. The same seal

shall function as both the ball seat and the union seal. PVC ball check valves shall be designed for a 150 psi water working pressure at 120°F. Valves shall be manufactured by Asahi/America, George Fischer Signet, Inc., or an equal approved by the Engineer.

2.08 STAINLESS STEEL BALL VALVES

A. Stainless steel ball valves shall be standard port type for the sizes indicated on the Drawings or specified herein. Ball valves shall be designed for a working pressure of 200 psi with positive shut off when in the closed position. Valve body and ends shall be constructed of forged Type 316 stainless steel and valve ends shall be NPT threaded connections. The ball shall have a full bore port design machined from a solid metal piece with highly polished surfaces. The ball and stem shall be manufactured from Type 316 stainless steel. Manually operated ball valves shall be furnished with lever operators manufactured of forged Type 316 stainless steel with a molded vinyl sleeve. Stainless steel ball valves shall be Type 1000 Neles-Jamesbury screwed end ball valves, or an equal approved by the Engineer.

2.09 GATE VALVES

A. Bronze Gate Valves: Gate valves installed aboveground, 2 inches in size and smaller, shall be Class 150 all bronze valves conforming to Fed. Spec. WW-V-54d, Type 1, Class B designed for a non-shock water pressure of 300 psi. Bronze for valve body and internals shall be in accordance with ASTM B62 for non-potable water service or shall be lead-free silicon bronze in accordance with ASTM B584, Alloy C87850 or ASTM B171, Alloy C46500 for potable water service, NSF 61 certified. Valves shall be furnished with screwed ends, handwheel operator, non-rising stem, one-piece solid wedge disc and screwed bonnet. Valves shall be as manufactured by Crane, Powell, or an approved equal. The minimum weight of valves shall be as follows:

Valve Size (Inches)	Valve Weight (Pounds)
1/2	0.8
3/4	1.2
1	1.8
1-1/4	2.6
1-1/2	3.6
2	5.6

B. Iron Gate Valves:

1. Iron gate valves shall open by turning to the left (counter-clockwise), when viewed from the stem. When fully open, gate valves shall have a clear waterway equal to the nominal diameter of the pipe. Operating nut or hand wheel shall have an arrow cast in the metal indicating the direction of opening. Each valve shall have the manufacturer's distinctive marking, pressure rating and year of manufacture cast on the body. Prior to shipment from the factory, each valve shall be tested by applying to it a hydrostatic pressure equal to twice the specified working pressure. Hydrostatic and leakage tests shall be conducted in strict accordance with ANSI/AWWA C500 or ANSI/AWWA C509, latest revisions, whichever is applicable.
2. Gate valves with nominal sizes from 2 to 2 1/2 inches shall conform to ANSI/AWWA C500, latest revision, and shall be designed for a minimum working pressure of 200 psi. Valves 2 to 2 1/2 inches in size shall be iron body, bronze-mounted, double disc, parallel seat, non-rising stem type with double, Buna-N, O-ring stem seals. Bronze items of construction shall include the stems, seat rings, stem nuts, wedge bushings, and upper and lower wedges. Bronze used for construction of these items shall be low zinc, lead free alloy bronze. Valve ends shall be screwed and as specified for steel pipe and fittings. Interior ferrous surfaces of valve, except for finished or bearing surfaces, shall be coated with a fusion bonded or thermo-setting epoxy coating in accordance with AWWA C550, latest revision. Coating shall be holiday-free, NSF approved, with a minimum thickness of 12 mils. Surfaces shall be clean, dry, and free from rust and grease before coating. Exterior surfaces shall be coated as specified hereinafter. Gate valves for this size range shall be as manufactured by American Flow Control Valve Company, Kennedy Valve Manufacturing Company, or Dresser Industries, Inc.
3. Large Gate Valves: Gate valves with nominal sizes from 3- to 12-inches shall conform to ANSI/AWWA C509, latest revision, and shall be designed for a minimum working pressure of 250 psi. Gate valves with nominal sizes from 16- to 66-inches shall conform to AWWA C515, latest revision, and shall be designed for a working pressure of 250 psi. Valves shall be iron body resilient wedge type with Nitrile rubber O-ring stem seals. Stems shall be sealed with three (3) O-rings. The top two O-rings shall be replaceable with the valve fully open and subject to the full rated working pressure. O-rings in a cartridge shall not be allowed. All cast ferrous components of the gate valve including the valve body, wedge, bonnet and stuffing box shall be constructed of ductile iron in conformance with ASTM A536. The valve stem shall be manufactured of manganese bronze in accordance with ASTM B763 and the wedge nut shall be manufactured of bronze in accordance with ASTM B584. The valve stem shall have an integral thrust collar; two-piece stem collars shall not be acceptable. The valve shall have Delrin thrust washers above and below the thrust collar to assist in the operation of the valve. Valve wedge shall be symmetrical and constructed to assure uniform seating pressure

between the wedge seat circumference and body seating surface, providing a complete seal at the rated pressure with flow from either direction. Resilient wedge of the valve shall be formed by a special corrosion and chloramine resistant, EPDM synthetic elastomer which is permanently bonded to and completely encapsulates the ductile iron valve disc. The wedge nut shall be independent of the wedge and held in place on three sides by the wedge to prevent possible misalignment. All bolting materials for aboveground gate valves shall be Type 316 stainless steel with hexagonal shaped heads with dimensions conforming to ANSI B18.2.1; metric bolting materials shall not be allowed. Bolting materials for underground mechanical joints on gate valves shall be in accordance with ductile iron mechanical joint pipe joint bolting materials as specified above under Paragraph 2.01 Ductile Iron Pipe and Fittings. Gate valves shall be NSF 61 listed. Resilient wedge type gate valves shall be manufactured by American Flow Control Valve Company, Mueller or an equal approved by the Engineer and the Owner.

4. Valve End Joints: All gate valves shall have either mechanical joint or restrained joint for underground service, or flanged ends for above ground service or valves in vaults to fit the pipe run in which they are to be used. Gate valves installed on push-on joint pipe shall have mechanical joint ends unless otherwise specified.
5. Gate Valve Operators: Unless otherwise shown on the Drawings or specified herein, gate valves shall have non-rising stems. Buried gate valves shall be furnished with a 2-inch square AWWA standard nut operator with a valve box and cover. All buried gate valves shall be installed in the vertical position only. Buried gate valves 16-inches and larger in nominal size installed vertically shall be provided with a spur gear box, valve operator. The spur gear shall be an EXEECO 1S-5 to IS-10 spur gear, depending on the valve size, with a gear ratio not more than 2:1. Gate valves located aboveground or inside structures shall be furnished with a handwheel operator which shall have an arrow cast in the metal indicating the direction of opening. Gate valves used as isolation valves for reduced pressure back flow preventers shall be of the open screw and yoke (OS&Y) design with a handwheel operator.
6. Interior Valve Lining: Interior of the valve body shall be lined with a fusion bonded or thermo-setting epoxy coating in accordance with AWWA C550, latest revision. Lining shall be holiday-free, NSF 61 approved, with a minimum thickness of 16 mils. Surfaces shall be clean, dry, and free from rust and grease before lining.
7. Exterior Valve Coatings: All exterior surfaces of iron body gate valves shall be clean, dry, and free from rust and grease before coating. For buried service, the exterior ferrous parts of all valves shall be coated at the factory with coal tar epoxy with a minimum total finish dry film thickness of 20 mils. Prior to back filling, all uncoated nuts, bolts, glands, rods, and other parts of joints shall be coated in the field with coal tar epoxy equal to Carboline Bitumastic No. 300-M. For valves installed above-ground, the

exterior ferrous parts of all valves shall be shop primed at the factory with one coat, minimum dry film thickness of 4 mils, of a rust-inhibitive universal epoxy primer. Primer shall be suitable for finish paint specified. Following installation, above-ground valves shall be finish painted in accordance with Section 09900: Industrial Coatings.

2.10 BUTTERFLY VALVES

A. General: As noted on the Drawings, butterfly valves for clean water service, 4 inches in size and larger, shall be Class 150-B in conformance with ANSI/AWWA C504, latest revision and designed for a minimum working pressure of 150 psi. Butterfly valves shall be of the tight closing rubber seat type. Valves shall be bubble tight with 150 psi on the upstream side of the valve and 0 psi on the downstream side and shall be satisfactory for applications involving valve operation after long periods of inactivity. Valve discs shall rotate 90 degrees from the fully open position to the fully closed position. Butterfly valves shall be as manufactured by DeZurik, Henry Pratt Company, Kennedy Valve Manufacturing Company, or Mueller Company.

B. Valve Bodies: Valve bodies shall be constructed of high-strength cast iron conforming to ASTM A126, Class B. Buried valves shall have integrally cast mechanical joint ends as specified for ductile iron pipe and above-ground valves shall have cast iron flanges. End flanges shall conform in dimensions and drilling to ANSI B16.1, Class 125. Two trunnions for shaft bearings shall be integral with each valve body. Valve body thickness shall be in strict accordance with ANSI/AWWA C504 latest revision for Class 150-B valves.

C. Valve Seat Ring: Valve seat ring shall be constructed of Type 304 stainless steel. Seating edges of the seat ring shall be smooth and polished. The seat ring shall be capable of compensating for changes in direction of flow to assure a bubble tight seal in either direction.

D. Valve Discs: Valve discs shall be solid (no cores) for 24-inch and smaller valves, and shall be either solid or hollow core for valves greater than 24-inch. Discs shall be constructed of ductile iron ASTM A536, Grade 65-45-12. Valve disc shall be of the offset design to provide 360 degree uninterrupted seating.

E. Valve Shafts: Valve shafts may consist of a one piece unit extending completely through the valve disc bearings and into the operating mechanism or may be of the "stub shaft" type, which comprises two separate shafts inserted into the valve disc hubs. If used, stub shafts shall extend a minimum of 1 1/2 shaft diameters into the valve disc hubs. Valve shafts shall be constructed of ASTM A276, Type 304 stainless steel or a stainless steel with greater overall corrosion and oxidation resistance. The minimum shaft diameter shall conform to ANSI/AWWA C504, latest revision for Class 150B valves. The valve disc shall be attached to the shaft

by means of "O" ring sealed taper pins. The valve shaft seal shall consist of "O" rings in bronze cartridge or self-adjusting Nitrile Vee-type ring seals.

F. Valve Seats: Valve seats shall be of a corrosion and chloramine resistant synthetic rubber compound bonded to a high grade stainless steel retaining ring and secured to the valve disc by Type 304 stainless steel set screws or shall be molded in, vulcanized, and bonded to the body. Seats bonded to the body shall withstand a 75-pound pull tested in accordance with ASTM D429, Method B. The valve seat shall be adjustable and replaceable in the field without dismantling operator, disc, or shaft.

G. Valve Bearings: Valve shafts shall be fitted with sleeve-type bearings. Bearings shall be corrosion resistant and self-lubricating (Nylon or Teflon). Bearings shall be designed for a pressure not exceeding the published design load for the bearing material, or 1/5 of the compressive strength of the bearing or shaft material.

H. Valve Operators: All butterfly valves shall open left or counter-clockwise when viewed from the stem. Automatic valve operators shall have motorized valve actuators as specified in *Section 11195 - Electric Motor Actuators*. Manual valve operators shall be of the worm gear or traveling nut type and shall be fully enclosed suitable for buried or submerged service. All operators shall have adjustable mechanical stop limiting devices to prevent over travel of disc. Should an adjustment of the disc be required to maintain a bubble tight seal, this adjustment shall be made externally without removing the operator housing cover. The operator shall be designed such that all adjustments can be made under pressure and without the possibility of dirt getting into the operator lubricant. Any adjustments necessary through the lower shaft will not be acceptable. Units furnished for buried service shall be fully gasketed and grease packed. Manual valves located above ground shall be equipped with hand-wheel or chain-wheel operators and shall have a suitable indicator arrow to give valve position from fully open to fully closed. Buried butterfly valves shall be furnished with 2-inch square AWWA nut operator with valve box and cover. Operator components shall, at the extreme operator positions, withstand without damage a pull of 200 lbs. for hand-wheel or chain-wheel operators or an input torque of 300 ft.-lbs. for operating nuts.

I. Interior Valve Coating: Interior of valve body and valve disc except for valve seat and stainless steel valve seat ring shall be coated with a fusion bonded or thermosetting epoxy coating in accordance with AWWA C550, latest revision. Coating shall be holiday-free, NSF approved, with a minimum thickness of 16 mils. Surfaces shall be clean, dry, and free from rust and grease before coating.

J. Exterior Valve Coating: All exterior surfaces of butterfly valves shall be clean, dry, and free from rust and grease before coating. For buried or submerged service, the exterior ferrous parts of all valves shall be coated at the factory with coal tar epoxy with a minimum total finish dry film thickness of 20 mils. Prior to backfilling, all uncoated nuts, bolts, glands, rods, and other parts of joints shall be

coated in the field with coal tar epoxy equal to Carboline Bitumastic No. 300-M. For valves installed aboveground, the exterior ferrous parts of all valves shall be shop primed at the factory with one coat, minimum dry film thickness of 4 mils, of a rust inhibitive, universal epoxy primer. Primer shall be suitable for the finish coating specified. Following installation above-ground valves shall be finish painted in accordance with Section 09900: Industrial Coatings.

K. Valve Testing: Prior to shipment from the factory, hydrostatic and leakage tests shall be conducted for each butterfly valve. Hydrostatic and leakage tests shall be conducted in strict accordance with ANSI/AWWA C504, latest revision, and results shall be submitted to the Engineer.

2.11 SWING CHECK VALVES

A. Swing check valves 4-inch and larger in size shall conform to AWWA C508, latest revision, and shall be designed for a minimum water working pressure of 150 psi. Check valves shall have cast iron body, swing type and the valve ends shall be flanged, Class 125 in accordance with ANSI B16.1. When open, the valve shall have a straight way passage with a minimum flow area equal to the full pipe area. Swing check valves shall be completely bronze fitted with renewable bronze seat ring and a rubber faced disc; valve hinge pin shall be stainless steel. Check valves shall be supplied with an outside lever and weight. The check valve bonnet shall be provided with a tapped boss with plug for future installation of a pressure gauge.

B. The check valves for High Service Pump Nos. 3, 4 and 5 shall be oil cushioned, as shown on the Drawings, and the check valves for the Golf Course Booster Pumping Station Pump Nos. 1 and 2 shall be oil cushioned as stated in Section 11235. Each oil cushioned check valve shall open smoothly on pump start-up and close at a controlled rate of speed for the final predetermined portion of its stroke following pump shut-down. A single cushioning device mounted on the external side of the valve shall control the valve closure by way of the interchange of oil to and from an oil reservoir. The use of an air or gas pressurized oil reservoir shall not be permitted. On start-up of the pump, the check valve disc shall open in response to the flow and then afford the minimum resistance to the flow. Upon pump shut-down, the valve's counterweight shall initiate the valve closure at an unrestricted rate until the valve disc reaches the pre-selected point of closure. The point at which the adjustable closing speed occurs shall be field-adjustable. The closing speed shall also be adjustable in the field by way of a micrometer type needle valve.

C. Swing check valves shall absolutely prevent the return of water back through the valve when the inlet pressure decreases below the downstream pressure. The check valve shall be constructed such that the disc and body seat ring may be easily removed and replaced without removing the valve from the line. Each valve shall be hydrostatically tested at the factory, at a test pressure of 250 psi.

D. For each pump valve, provide an externally mounted, NEMA 4X, lever or rod actuated limit switch, mounted on the valve body. The switch shall be mounted such that the contacts close when the valve is closed as sensed by the valve's lever arm position. Contacts shall be rated for 120 VAC service. Switch shall be as manufactured by Square D, Allan Bradley, or approved equal. Limit switch bracket shall be Type 316 stainless steel.

E. Interior Valve Coating: Prior to shipment from the factory, the interior ferrous surfaces of the valve, except for finished, non-ferrous, or bearing surfaces, shall be coated with a fusion bonded or thermosetting epoxy coating in accordance with AWWA C550, latest revision. Coating shall be holiday-free, NSF approved, with a minimum thickness of 16 mils. Surfaces shall be clean, dry, and free from rust and grease before coating.

F. Exterior Valve Coating: All exterior surfaces of swing check valves shall be clean, dry, and free from rust and grease before coating. For valves installed in below-ground valve vaults, the exterior ferrous parts of all valves shall be coated at the factory with coal tar epoxy with a minimum total finish dry film thickness of 20 mils. Following installation, all uncoated nuts, bolts, glands, rods, and other parts of joints shall be coated in the field with coal tar epoxy equal to Carboline Bitumastic No. 300-M. For valves installed above ground, the exterior ferrous parts of all valves shall be shop primed at the factory with one coat, minimum dry film thickness of 4 mils, of a rust inhibitive, universal epoxy primer. Primer shall suitable for finish paint specified. Following installation, above-ground valves shall be finish painted in accordance with *Section 09900: Industrial Coatings*.

G. Valve Manufacturer: Non-cushioned swing check valves shall be American Flow Control Series 52-SC or Series 600, M & H Style 159-02-0200, Kennedy Figure 106A-LW, or approved equal. Oil cushioned lever and weight swing check valves shall be Golden-Anderson Figure No. 25-DXH, ValMatic Series 7900S, 2 Stage or an equal approved by the Engineer.

2.12 AUTOMATIC AIR RELEASE VALVES

A. Clean Water (Potable and Reclaimed Water) Air Release Valves:

1. Air release valves for clean water shall have a 2-inch threaded connection with a 316 stainless steel main valve body, foamed polypropylene float and Type 316 stainless steel stem, main float and internal parts. All nuts, bolts, clamps and other valve hardware shall be Type 316 stainless steel. Valves shall have a working pressure of at least 250 psi. Air release valves shall be as manufactured by A.R.I. USA, Inc., as follows:

a. Reclaimed Water Mains - 2-inch threaded connection, 316 Stainless Steel Combination ARV, Model D-040 (SS).

B. Valve End Connections:

1. Valves 2-inches and smaller shall have threaded ends. Valves 3-inches or larger shall have flanged ends.
2. Flanges for Class 150 valves shall comply with ANSI B16.1, Class 125.
3. Threaded ends shall comply with ANSI B2.1.

C. All air release and vacuum relief valves shall be isolated from the service line with a Type 316 stainless steel ball valve for valves 2-inches and smaller in size or a flanged resilient seated gate valve for air release valves for potable water or reclaimed water service 3-inches and larger in size or a flanged plug valve for air release valves for wastewater service 3-inches and larger in size.

D. The discharge orifice of all air release valves shall be piped for discharge into the nearest floor drain or as shown on the Drawings. Piping shall be Schedule 80 PVC and properly supported acceptable to the Engineer.

E. All air release valves on buried potable water or reclaimed water mains shall be installed above ground with a polyethylene enclosure. The polyethylene enclosure shall be a rotationally molded high impact resistant polyethylene construction. Hardware for the enclosure shall be constructed of Type 316 stainless steel. The enclosure shall lock by means of a padlock. The air release valve with the enclosure shall be installed where shown and as detailed on the Drawings. The enclosure shall be as manufactured by Water Plus Corporation or an equal as approved by the Engineer. The air release valve enclosure model for potable water, reclaimed water or wastewater service shall be as follows:

1. Potable Water – Model 131632-H30-B (44-inches tall, blue color).
2. Reclaimed Water - Model 131632-H30-P (44-inches tall, pantone purple color).
3. Wastewater - Model 131632 H30-G (44-inches tall, green color).

2.13 FLOW CONTROL VALVES

A. Functions: The Rate of Flow Control function shall limit flow to the preset maximum rate regardless of changing line pressure. The Pressure Sustaining function shall maintain pressures settings by opening rapidly to bypass system pressure that exceeds the pressure control setting. The valve shall operate without cavitation damage over specified pressure ranges.

B. Main Valve: The valve shall be hydraulically operated, single diaphragm-actuated and globe or angle pattern. The valve shall consist of three major components: the body with seat installed, the cover with bearings installed and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve separating operating

pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.

C. Main Valve Body: No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be of cast material. No fabrication or welding shall be used in the manufacturing process.

D. The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section contained on three and one-half sides by a disc retainer, forming a tight seal against a single removable seat insert. No O-ring type disc (circular, square, or quad type) shall be permitted as the seating surface.

E. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place.

F. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted and no V-type or slotted type disc guides shall be used.

G. The diaphragm assembly containing a non-magnetic stainless steel stem of sufficient diameter to withstand high hydraulic pressures, shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The seat shall be a solid, one-piece design and shall have a minimum of a five-degree taper on the seating surface for a positive, drip-tight shut off. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve separating operating pressure from line pressure.

H. The diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position.

I. The main valve seat and the stem bearing in the valve cover shall be removable. The valve seat shall be retained by flat head machine screws for ease of maintenance.

J. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits. To insure

proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No "pinned" covers to the valve body shall be permitted. Cover bearing, disc retainer, and seat shall be made of the same material. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted and components including cast material shall be of North American manufacture.

K. Pilot Control System: The pilot system shall be a direct acting diaphragm valve designed to close when the controlling differential exceeds the adjustable spring setting. The pilot control is normally held open by the force of the compression on the spring above the diaphragm and it closes when the pressure acting on the underside of the diaphragm exceeds the spring setting. The pilot control system shall contain a fixed orifice. No variable orifices shall be permitted. An orifice plate flange assembly shall be included and mounted one to five pipe diameters downstream. The Contractor shall connect the sensing line between the pilot system and the orifice plate with minimum 1/2-inch 316 SS pipe. A full range of spring settings shall be available in ranges from 0-300 psi.

L. A direct factory representative shall be made available for two (2) days for start-up service, inspection and necessary adjustments, and to instruct Owner's personnel in operation, care and maintenance.

M. Valve and all components shall have a 3-year warranty from the date of startup.

N. Manufacturer shall be Cla-Val Co., Bermad, or an equal approved by the Engineer.

O. Flow Control Valve Project Applications:

1. **Southern Dunes Golf Course Surge Relief and Anticipator Valve:**

   a. Valve shall be designed to act as a pressure relief and surge anticipator. It shall have a normally closed high pressure pilot designed to open if the pressure exceeds the normal pressure while pumping. It shall also have a low pressure pilot that is held closed as long as the system is at or above static. If there is a pressure drop, due to a power outage the low pressure pilot shall open anticipating the returning high wave. The main valve cover shall have a hydraulic stem valve flow limiter. On the drop in pressure this hydraulic stem valve shall keep the valve from opening too far to ensure it shall reseat when the pressure rises.

   b. The main valve shall be ductile iron and have stainless steel trim internals. It shall have a one-piece stainless steel seat. No snap rings shall be accepted. The valve shaft shall be fully guided throughout the valve stroke by a bearing in the seat and a bearing in the cover. Center guided shafts shall not be acceptable. It shall have an NSF approved

fusion bonded epoxy coating. The cover shall have a locating lip. The main body shall have 150 ANSI flanged ends rated to 250 PSI working pressure. The main valve shall be packless and shall have no O-rings or other packing anywhere on the disc and diaphragm assembly. The CRL relief pilot shall have a 20-200 PSI spring range. The CRA low pressure pilot shall have a 15-75 PSI range. When the valve opens on a pressure drop the X102 flow limiter shall keep the valve from going fully open. The manufacturer shall install a gauge on the inlet for monitoring and set up. There shall be a "Y" strainer on the inlet feed to the pilot system. The strainer shall have a manual blowdown port. The pilot system shall also have an enclosed site glass with a stem for visual indication of valve position.

c. The manufacturer shall provide a direct factory trained employee for start-up and training.

d. The manufacturer shall warranty the valve for 3 years from date of shipment.

e. The valve shall be a Model 8-inch 652G-03BPVYKC D.S. FSB 150AG, as manufactured by Cla-Val Co., Newport Beach, California, or an equal approved by the Engineer.

2. **Southern Dunes Golf Course Booster Pump Station - Dual Stage Pressure Control Valve to Fully Open When Outlet Pressure is Low:**

a. The 12-inch Dual Stage Pressure Control Valve shall maintain a constant downstream pressure regardless of changing flow rate and/or inlet pressure. If the outlet pressure drops below the second stage setting the valve shall open fully.

1) Main Valve Upstream Pressure – 115 to 118 psi.
2) Main Valve Downstream Pressure - 105 psi (Not to Exceed).

b. The valve shall be hydraulically operated, single diaphragm-actuated, globe pattern. The valve shall consist of three major components: the body, with seat installed; the cover, with bearings installed; and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes shall not be permitted and there shall be no pistons operating the main valve or pilot controls.

c. No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be of cast ductile iron material. No fabrication or welding shall be used in the manufacturing process.

d. The main valve shall be an 100-01 fully ported, flanged, diaphragm actuated main valve. The main valve shall be ASTM A536 ductile iron and have Type 303 stainless steel trim internals. The diaphragm assembly, containing a non-magnetic Type 303 stainless steel shaft with sufficient diameter to withstand high hydraulic pressures, shall be

fully guided on both ends by a bearing in the valve cover and an integral bearing in the valve seat. Center guided shafts shall not be acceptable. The main valve shall have a one-piece stainless steel seat. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.

e. The valve shall have an NSF approved fusion bonded epoxy coating (KC) on all interior and exterior surfaces. The cover shall have a locating lip. The main body shall be supplied with a 150 ANSI flat faced flanged ends, 250 PSI working pressures. The CRL60 sustaining pilot valves shall have a 20-200 PSI spring range and the pilot valves shall have Type 316 stainless steel isolation ball valves installed (B). The pilot valve will have both closing "C" and opening "S" speed controls. There shall be a 0-200psi gauge mounted on the main valve inlet (P) and outlet. The pilot system will have a "Y" strainer (Y). There shall be an X101valve position indicator (V) to give a visual indication of valve position. The rubber parts for the valve shall be EPDM.

f. The manufacturer shall provide a direct factory employee for start-up and training.

g. The manufacturer shall warranty the valve for 3 years from date of shipment.

h. The valve shall be a model 12-inch 90G-58BCSY KC DS 150A X101 as manufactured by Cla-Val Co. Newport Beach, California or an equal approved by the Engineer.

3. **High Service Pump Station Pressure Relief Valve:**

a. Valve shall be designed to act as a normally closed pressure relief valve. The valve shall have a normally closed pressure relief pilot designed to open on an increase in upstream pressure and close on a decrease. The valve shall be designed to open when inlet pressure on the header rises above the normal system pressure being pumped at the station. It will stay open as long as pressure is above this setting to protect the system.

b. The 6-inch main valve will be a 100-01 full ported globe body. The valve shall be a flanged, diaphragm actuated main valve. The main valve shall be ductile iron and have stainless steel trim internals. The stainless steel stem shall be fully guided throughout its stroke, by a bearing in the valve cover and an integral bearing in the valve seat. Center guided stem shaft shall not be acceptable. The valve shall have a one-piece stainless steel seat. There shall not be any bearing bushings. The valve shall have an NSF approved fusion bonded epoxy coating (KC) on all interior and exterior surfaces. The cover shall have a locating lip. The main body shall be supplied with 150 ANSI flanged ends, 250 PSI working pressures. The CRL relief pilot shall have a 20-200 PSI spring range. There shall be pilot isolation valves

installed (B). There shall be a 0-160 PSI gauge mounted on the main valve inlet (P) and outlet. The pilot system shall have a "Y" strainer (Y). There shall be an X101valve position indicator (V) to give a visual indication of valve position. The rubber parts for the valve shall be EPDM.

c. The manufacturer shall provide a direct factory employee for start-up and training.

d. The manufacturer shall warranty the valve for 3 years from date of shipment.

e. The valve shall be a model 6-inch 50G-01BPVY KC D.S. SSE 150AG as manufactured by Cla-Val Co. Newport Beach, California or an equal approved by the Engineer.

2.14 SERVICE SADDLES AND CORPORATION STOPS

A. Service Saddles: Service saddles shall have ductile iron bodies in accordance with ASTM A536, latest revision, with double stainless steel straps. Ductile iron body shall have a fusion bonded nylon coating with a minimum thickness of 12 mils. Straps shall be Type 316 stainless steel with premium grade Type 316 L stainless steel bolts and Type 316 stainless steel washers and nuts. The nuts shall be Teflon coated. The gasket material shall be an EPDM elastomeric compound resistant to degradation by oil, natural gas, acids, alkalies, most aliphatic fluids, and chloramines. The outlet of the saddle shall have female NPT threads. Service saddles shall be Smith-Blair No. 317 or an equal approved by the Engineer.

B. Corporation Stops: Corporation stops shall all bronze bodies with an all bronze ball and Teflon seats, in accordance with AWWA C800. Inlet and outlet threads shall have NPT threads. Corporation stops shall be Model FB1700 as manufactured by Ford Meter Box Company, or an equal approved by the Engineer.

2.15 RESTRAINED FLANGED PIPE ADAPTERS

A. Flanged pipe adapters shall be suitable for joining plain-end pipe to flanged pipes and fittings. The flanged pipe adapter shall be fully restrained for the maximum pressure stated below. Adapters shall conform in size and bolt hole placement to ANSI/AWWA C110/A21.10 standards for steel and/or cast iron flanges 125 pound / 150 pound bolting pattern, unless otherwise required for connections.

B. Adapters shall be constructed of ductile iron in accordance with ASTM A536 grade 65-45-12.

C. Restraint for the flanged pipe adapter shall consist of a plurality of individually actuated gripping wedges to maximize restraint capability. Torque limiting actuating screws shall be used to insure proper initial setting of the gripping wedges.

D. The flanged pipe adapters shall be capable of allowing pipe deflection during assembly.

E. The flanged pipe adapter shall have a minimum pressure rating of 150 psi with a 2 to 1 safety factor.

F. All wedge assemblies and related parts shall be phosphate acid washed, rinsed and dried, and coated with two coats of liquid Xylan® fluoropolymer coating that is heat cured following each coat. All cast bodies shall be phosphate acid washed, rinsed and dried, and coated with a polyester based powder that is electrostatically applied and heat cured. The coating system for the flanged pipe adapter shall be the Mega-Bond® Coating System by EBBA Iron, Inc. or an equal approved by the Engineer.

G. Flanged pipe adapters shall be the Megaflange® Series 2100 Restrained Flange Adapter with a Mega-Bond® Restraint Coating System by EBBA Iron, Inc. for above ground and below ground piping with diameters of 3 inches through 48 inches.

H. Flange bolts and nuts for flanged pipe adapters shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts. The nuts shall have a hardness that is lower than that of the bolts and washers by a difference of 50 Brinnell hardness to percent galling during installation.

2.16 DISMANTLING COUPLINGS

A. Dismantling couplings shall be provided where shown on the Drawings to facilitate dismantling and removal of flow meters for maintenance or replacement.

B. The dismantling coupling flange shall have a flanged adapter body made of carbon steel per ASTM A53 or ASTM A512 and having a minimum yield of 30,000 psi. It shall have an integral “Cam-Lock” restraint gland made of ductile iron per ASTM A536, Grade 65-45-12. The end connection flanges shall be carbon steel per AWWA C207 Class D. The dismantling coupling joint shall have a spigot made of carbon steel per ASTM A53 or ASTM A512, and having a minimum yield strength of 30,000 psi. The finish shall be fusion-bonded epoxy, to an average thickness of 12-mils DFT.

C. The gaskets for the coupling shall be Nitrile (Buna N) NSF 61 listed, compounded to resist water, oil acids, alkalis, most (aliphatic) hydrocarbon fluids and many other chemicals.

D. The integral "Cam-Lock" mechanical restraint shall be wedge action utilizing multiple single tooth wedges. Each restraining gland shall incorporate cam action, independent wedge engagement and meet applicable requirements of ANSI/AWWA C111/A21.11. The integral restraint glands sized 4-inch through 8-inch, shall utilize no more than three wedges per gland. Assembled restraint glands through 12-inch shall allow for five degree deflection and 14-inch through 48-inch shall allow for three degrees of deflection. Each assembled restraint gland shall maintain flexibility after installation. Integral wedge action restraints shall incorporate positive visual indication that each wedge has properly engaged the pipe onto which it is installed. Integral restraint gland actuating bolts shall not have limited thread travel. The break-away nut torque value for each wedge shall be approximately 47 ft. lbs. Restraint gland shall be applicable for installations with the standardized tee head bolts conforming to the requirements of ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53 of latest revision. The dismantling coupling shall be rated for a 150 psi working pressure with a minimum 2:1 safety factor.

E. Restraint glands shall have a factory applied Flexi-Coat epoxy coating with an average thickness of 12-mils DFT. All restraint gland actuating components shall be manufactured of 60-40-18 ductile iron at a minimum, and coated with an electro-fusion bonded epoxy coating with an average thickness of 12-mils DFT.

F. The restrained dismantling coupling fittings shall generally conform to a Smith-Blair, Inc., 900 Series or an equal approved by the Engineer.

G. Flange bolts and nuts for dismantling couplings shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts. The nuts shall have a hardness that is lower than that of the bolts and washers by a difference of 50 Brinnell hardness to percent galling during installation.

2.17 FLEXIBLE EXPANSION JOINTS

A. Flexible expansion joints shall be of the molded wide double arch design manufactured of neoprene rubber with polyester fabric reinforcement. Neoprene body shall be supplied with a Hypalon coating. Joints shall be flanged suitable for 150 psi water working pressure and in accordance with ANSI B16.1 dimensions and bolting patterns. Flanged ends shall be furnished with Type 316 stainless steel retaining rings.

B. Provide limit restraint bolts on all flanged connections. Expansion joints 6 inches and larger in size shall have a minimum of four limit restraint bolts. Restraint bolts and nuts shall be Type 316 stainless steel.

C. Minimum performance for flexible expansion joints shall be as follows:

Size (Inches)	Axial Compression (Inches)	Axial Elongation (Inches)	Lateral Deflection (Inches)	Angular Deflection (Degrees)
2	0.875	0.50	1.00	30
4	0.875	0.50	1.00	25
6	0.875	0.50	1.00	20
8	1.375	0.75	1.00	19
10	1.375	0.75	1.00	15
12	1.375	0.75	1.00	13
14	1.750	0.875	1.118	9
16	1.750	0.875	1.118	8
18	1.750	0.875	1.118	7
20	1.750	0.875	1.118	7
24	1.750	0.875	1.118	5
30	1.750	0.875	1.118	4

D. Flexible expansion joints shall be Style 1015, Maxi-Joint as manufactured by General Rubber Corporation, Style 711, Metrasphere as manufactured by the Metraflex Company, Series 242 as manufactured by Proco, or an equal approved by the Engineer.

2.18 FLEXIBLE CONCENTRIC AND ECCENTRIC REDUCER EXPANSION JOINTS

A. Flexible concentric and eccentric reducer expansion joints shall be provided where indicated on the drawings to provide transition from one pipe size to another for the connection of pumps to piping, to reduce noise and vibration from being transferred from the pump to the piping. Flexible concentric reducer expansion joints shall be used on the discharge side of pumps and flexible eccentric reducer expansion joints shall be used on the suction side of pumps.

B. Flexible concentric and eccentric reducer expansion joints shall be of the molded, filled single arch design manufactured of neoprene rubber with polyester fabric reinforcement suitable for sludge service. Neoprene body shall be supplied with a Hypalon coating. Joints shall be flanged suitable for 150 psi water working pressure and in accordance with ANSI B16.1 dimensions and bolting patterns. Flanged ends shall be furnished with Type 316 stainless steel retaining rings.

C. Provide limit restraint bolts on all flanged connections. Expansion joints 6-inches and larger in size shall have a minimum of four limit restraint bolts. Restraint bolts and nuts shall be Type 316 stainless steel.

D. Minimum performance for flexible concentric and eccentric reducer expansion joints shall be as follows:

Size (Inches)	Axial Compression (Inches)	Axial Elongation (Inches	Lateral Deflection (Inches)	Concentric Angular Deflection (Degrees)	Eccentric Angular Deflection (Degrees)
2	0.25	0.125	0.3	8	8
3	0.25	0.125	0.3	5.2	5.2
4	0.25	0.125	0.3	4.1	4.1
5	0.25	0.125	0.3	3.2	3.2
6	0.25	0.125	0.3	2.6	2.6
8	0.375	0.188	0.3	3.1	3.1
10	0.375	0.188	0.3	2.4	2.4
12	0.375	0.188	0.3	1.9	1.9
14	0.375	0.188	0.3	1.7	1.7
16	0.375	0.188	0.3	1.4	1.4
18	0.375	0.188	0.3	1.2	1.2

E. Flexible expansion joint concentric and eccentric reducers shall be Series RC and RE, respectively, as manufactured by Proco, or an equal approved by the Engineer.

2.19 PRESSURE GAUGE ASSEMBLIES

A. Pressure gauges shall have the following design features: silicone oil filled, 4-inch aluminum dial with black numerals on white background, Type 316 stainless steel bourdon tube and internal movement, 330 series stainless steel case and ring, safety glass lens, threaded lens retaining ring, adjustable pointer, either friction or gear adjustable, blowout protection, 1/2-inch Type 316 stainless steel stem mounting, and 1.0 percent accuracy based on full scale. No stop pins shall be permitted on the dial face. Internal stop pins shall be required to prevent the sector gear from becoming disengaged from the geared needle post as a result of over or under pressure range. Provide Type 316 stainless steel pressure snubbers on all gauges not protected by diaphragm seals. Provide a supply of replacement fill liquid for all gauges supplied for the entire Project. Pressure gauges shall be as manufactured by Ashcroft Type 1009, H. O. Trerice Model 700LFSS; Wika Type 233.30; Winters PFP Series, or approved equal.

B. Pressure Gauge Service and Ranges: Pressure gauges shall be furnished for the following services with the indicated ranges. Diaphragm seals shall be furnished for gauges as indicated. This table is for the Contractor's convenience only, and may not depict all systems or all services that require gauges.

Service	**Number Required**	**Pressure Range**	**Diaphragm Seal**
Vertical Turbine Transfer Pump Discharges	3	0-60 psi	No
High Service Pump Suctions	5	30”-0-30 psi	No
High Service Pump Discharges	5	0-160 psi	No
Golf Course Booster Pump Suctions	2	30”-0-160 psi	No
Golf Course Booster Pump Discharges	2	0-160 psi	No

C. Diaphragm Seals: As indicated in the table above, pressure gauges shall be furnished with diaphragm protection seals which shall be joined to the pressure gauges and filled at the manufacturer's factory. The seals shall be of the removable design such that the bottom member can be removed for cleaning without disturbing the diaphragm. The diaphragm shall be Type 316 stainless steel. The top and bottom members of the seal shall be Type 316 stainless steel. The upper housing connection for the gauge shall be a 1/2-inch female NPT threaded connection. The lower housing process connection shall be 1-inch female NPT threaded connection. The bottom member shall have a 1/2-inch plugged flushing connection with a Type 316 stainless steel plug. Liquid filling for the diaphragm seals shall be silicone fluid. Provide a supply of replacement fill liquid for all diaphragm seals supplied for the entire Project. Diaphragm protection seals shall be supplied by the manufacturer of the gauge.

D. Each pressure gauge assembly shall be furnished with an isolation ball valve. Body, stem, and all other parts of valves shall be manufactured of Type 316 stainless steel. Valve packing shall be high-density TFE. The pressure rating for the isolation ball valve shall be equal to the maximum pressure rating for the gauge. Valve connections shall be 1-inch female NPT threaded connections. Ball valves for pressure gauge assembly isolation shall be 45 Series as manufactured by the Whitey Company, or an equal approved by the Engineer.

2.20 VALVE BOXES

A. Furnish, assemble, and place a valve box over the operating nut for each buried valve. The valve box shall be designed so as to prevent the transmission of surface loads directly to the valve or piping.

B. Valve boxes shall be of the adjustable screw-type of suitable length with an interior diameter of not less than 5-1/4 inches. The valve boxes shall be manufactured of cast iron and shall be of the three piece design including a bottom section, middle section and top section with cover. The bottom section shall have a flange at the bottom having sufficient bearing area to prevent settling. The cast iron cover shall be cast with the applicable service; “WATER”, markings for potable water mains, "SEWER", markings for wastewater force mains or “RECLAIMED” marking for reclaimed water mains. The top section shall be adjustable for elevation and shall be set to allow equal movement above and below finished grade.

C. The castings shall be manufactured of clean, even grain, gray cast iron conforming to ASTM A48, Class 30B for Gray Iron Castings; and shall be smooth, true to pattern, free from blow holes, sand holes, projections, and other harmful defects. The seating surfaces of both the cover and the top section shall be machined so that the cover will not rock after it has been seated.

D. The valve boxes shall be coated inside and outside with an asphaltic coating prior to machining, so that the machined seating surfaces will be free of any coating. Cast iron valve box assemblies shall be Tyler Corp. Series 6850 or an Owner approved equal. Valve extension stems shall be provided for all buried valves when operating nut is deeper than 3 feet below final grade.

2.21 PIPE IDENTIFICATION SYSTEMS

A. Identification systems for above-ground and below-ground pipelines shall be as specified under *Section 15080 – Piping, Valve and Equipment Identification System* of these Specifications.

2.22 VALVE IDENTIFICATION SYSTEM

A. Identification systems for above-ground and below-ground valves shall be as specified under *Section 15080 – Piping, Valve and Equipment Identification System* of these Specifications.

2.23 EXTENDED DEFLECTION AND EXTENDING COUPLING

A. The extended deflection and extending coupling shall consist of a telescoping sleeve and two pipe ball joints. The entire assembly shall be manufactured of ductile iron conforming to the material requirements of ASTM A536 and ANSI/AWWA C153/A21.53 and shall include a restrained joint system. The minimum deflection capability of the pipe ball joints shall be 15 degrees.

B. Each flexible expansion joint shall be pressure tested prior to shipment against its own restraint to a minimum internal test pressure of 250 psi. A minimum 2:1 safety factor shall apply.

C. All internal surfaces (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213. Sealing gaskets shall be constructed of EPDM. The internal lining shall meet ANSI/NSF-61. Exterior surfaces shall be coated with a minimum of 12 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16.

D. The assembly shall be shipped preassembled with a non-water soluble lubricant meeting the requirements of the National Sanitation Foundation Standard NSF-61 and shall be shipped with a polyethylene encasement sleeve. The assembly shall be installed with the polyethylene encasement left in place on the assembly to prevent backfill material from impeding the elongation and contraction capabilities of the assembly during service.

E. The extended deflection and extending coupling unit shall be TR FLEX® Telescoping Sleeve and USIFLEX® Joints as manufactured by U.S. Pipe and Foundry Company, Inc., FLEX-TEND® Flexible Expansion Joints as manufactured by EBAA Iron Sales, Inc., or an equal approved by the Engineer.

2.24 HOSE BIBB (AS SHOWN ON THE DRAWINGS)

2.25 WASHDOWN HOSE

A. Hoses shall be 50 feet long, 1-inch diameter abrasion and weather resistant (0.47 lb/LF) EPDM red cover, rayon braided hose with 8-inch adjustable brass hose nozzle on discharge end and 1-inch stainless steel male x female (NPT) QF series quick connect coupling on supply end. All components shall be as manufactured by Amazon Hose & Rubber Company or an equal approved by the Engineer.

2.26 IN-LINE STATIC MIXER

A. The Contractor shall furnish and install the following static mixer complete with elements, injection nozzles, pipe housing with flanges and any other appurtenances required at the locations shown on the Drawings and as specified herein.

1. One (1), 18-inch diameter FRP in-line static mixer for sodium hypochlorite injection service.

B. These Specifications are intended to give a general description of what is required but do not cover details of construction which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to include the furnishing, installation, and field testing of equipment and appurtenances, as herein specified, whether specifically mentioned in these Specifications or not.

C. The static mixer design criteria shall be as indicated below. It shall be fully suitable for use in mixing 12% sodium hypochlorite with treated reclaimed water.

1. Flow Metering Station Static Mixer (Process 130):

a. Number of Units: 1.
b. Location: Flow Metering Station downstream of the High Service Pump Discharge.
c. Pipeline Diameter: 18-inches.
d. Application:

1) Design Water Flow Rate: 500 gpm (min); 2,100 gpm (avg); 3,200 gpm (max).
2) Sodium Hypochlorite Flow Rate: 0.22 gph (min); 7.18 gph (max).

e. Number of Elements: 1 set of DSM Series x 0.5 D elements.
f. Maximum Pressure Drop: 0.4 psi at 3,200 gpm.
g. Overall Length of Unit: 9 inches.
h. Approved Manufacturer: Statiflo DSM Series Static Mixer as manufactured by Statiflo Corporation, or an equal approved by the Engineer.

D. In-Line Static Mixer Design:

1. The static mixer housing shall be designed to withstand a maximum of 150 psig at 100˚ F.
2. The in-line static mixer shall be 150 psi rated FRP housing, fitted with FRP flat face flanges, drilled to 18-inch diameter ANSI 150 lb. dimensions.
3. Fiberglass Materials:

a. Resin & Cure System: Reichold D9102 NSF-61 resin in contact with wetted parts. Derakane™ 411 resin in structural, with MEKP cure.
b. Corrosion Barrier (CB): 96 mils, (x)-10-mil C veil x + 86-mil Chopped Strand Mat (CSM) is included in structural calculations.
c. Structural Layers (SL): Type II.
d. Exterior to be resin coat pigmented light gray in color containing UV-9 inhibitor.

4. Flange gaskets shall be neoprene, full faced type with a minimum thickness of 1/8-inch. Nuts and bolts for flange bolting materials shall be hexagonal with machine threads, manufactured of Type 316 stainless steel conforming to ASTM A 913, Grade B8M, for bolts and ASTM A 194, Grade 8M, for nuts. Type 316 stainless steel flat washers w/lock washers shall be used against FRP flanges.
5. The static mixer shall be of the continuous mixing design wherein the elemental geometry creates turbulent flow where the internal element configuration diverts and swirls the mainstream into the chemical additive release zone for efficient and complete mixing downstream of the mixer discharge. The static mixer housing shall achieve 0.05 CoV or better at 3 to 5 pipe diameters downstream of the discharge of the mixer. Mixers utilizing baffles and back-mixing are not acceptable.
6. The minimum cross-sectional flow area of the static mixer shall be at least 95 percent of the open pipe area to avoid obstruction of flow and plugging.
7. The static mixer elements shall be constructed to eliminate material hang-up and to impart a uniform shear to process fluids. The elements shall be constructed such that they have a minimum of surface area exposed to corrosion and abrasion. Elements shall be constructed of FRP.
8. The static mixer shall be equipped with two (2), 1/2-inch diameter flat faced, flanged injection connections. Flanges shall be drilled to ANSI 150 lb. dimensions.

2.27 MISCELLANEOUS ITEMS

A. Other items necessary for the complete installation and not specified herein shall conform to the details and notes shown on the Drawings. All minor items implied, usually included, or required for the construction of a complete operating system shall be installed whether shown on the Drawings or not.

PART 3 - EXECUTION

3.01 INSPECTION

A. All pipe, fittings, valves, and other material shall be subject to inspection and approval by the Engineer and the Owner after delivery, and no broken, cracked, imperfectly coated, or otherwise damaged or unsatisfactory material shall be used. When a defect or crack is discovered, the injured portion shall not be installed. Cracked pipe shall have the defect cut off at least 12 inches from the break in the sound section of the barrel. The Contractor should refer to Paragraph 3.04.B for

additional information regarding cutting of ductile iron pipe and Paragraph 3.05.B and C for additional information regarding cutting of PVC pipe. All homing marks shall be checked for proper length so as to not allow a separation or over homing of connected pipe. Homing marks incorrectly marked on pipe shall result in rejection of pipe and removal from the site at the Contractor's expense.

3.02 PIPE SUPPLIER'S FIELD SERVICE

A. The Contractor shall arrange for a pipe supplier's field representative to be on-site to provide instruction to each pipe crew working on the installation of a minimum of four (4) restrained joints (PVC and DIP). The supplier's field representative shall certify that the installations observed were satisfactorily completed and all pipe installation crews were familiar with the proper methods and procedures for the pipeline installations.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Excavation, backfill, and compaction shall conform to the provisions of *Section 02220- Excavation, Backfill and Compaction for Utilities*. Upon satisfactory installation of the pipe bedding material as specified in Section 02220, a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.

B. Water in Excavation: Installation of utility pipelines shall proceed in the trench only after it has been dewatered and the trench has been prepared in accordance with the specifications in *Section 02140, Dewatering* and *Section 02220 – Excavation Backfilling and Compaction for Utilities* of these technical specifications. Water shall not be allowed in the trenches while the pipes are being laid and/or tested. The Contractor shall not open more trench than the available pumping facilities are able to dewater to the satisfaction of the Engineer. The Contractor shall assume responsibility for disposing of all water so as not to injure or interfere with the normal drainage of the territory in which he is working. In no case shall the pipelines being installed be used as drains for such water, and the ends of the pipe shall be kept properly and adequately plugged during construction by the use of accepted stoppers and not by improvised equipment. All necessary precautions shall be taken to prevent the entrance of mud, sand, or other obstructing matter into the pipelines. If on completion of the work any such material has entered the pipelines, it must be cleaned as directed by the Engineer and the Owner so that the entire system will be left clean and unobstructed. The Contractor shall not leave trenches open overnight

C. Cover for underground piping shall not be less than that indicated on the Drawings. The minimum cover for pipe shall be 36 inches. In areas where other piping conflicts preclude the maximum cover desired, the piping shall be laid to provide the maximum cover obtainable and only if approved in advance by the Engineer and the Owner.

D. Pipe, fittings, valves, and accessories shall be installed as shown or indicated on the Drawings. All joint lubricant compounds shall be NSF approved.

E. All connections to existing piping systems shall be made as shown or indicated on the Drawings after consultation and cooperation with authorities of the Owner. Some such connections may have to be made during off-peak hours (late night or early morning).

F. Pipe Bedding: The Contractor shall provide pipe bedding material in accordance with the Standard Details on the Drawings and *Section 02220 – Excavation Backfilling and Compaction for Utilities*. The Contractor shall hand-grade bedding to proper grade ahead of pipe laying operation. Bedding shall provide a firm, unyielding support along the entire pipe length. If the trench has been excavated below the required depth for pipe bedding material placement, the Contractor shall fill the excess depth with pipe bedding material to the proper grade. The Contractor shall excavate bell holes at each joint to permit proper assembly and inspection of the entire joint.

G. Pipe Cradle: Upon satisfactory installation of the pipe trench as specified in *Section 02220 – Excavation, Backfilling and Compaction for Utilities* and the pipe bedding, a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging so that when the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints or pipe bell from the trench bottom.

H. Cleanliness: Mud, silt, gravel and other foreign material shall be kept out of the pipe and off the jointing surface. The interior of the pipes shall be thoroughly cleaned of all foreign material before being gently lowered into the trench and shall be kept clean during laying operations by means of plugs or other methods accepted by the Engineer and the Owner. During suspension of work for any reason at any time, a suitable watertight plug shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

I. All connections to existing piping systems shall be made as shown or indicated on the Drawings after consultation and cooperation with authorities of the UAO. Some such connections may have to be made during off-peak hours (late night or early morning).

J. Pipe Joint Deflection: Whenever it is desirable to deflect pipe joints to avoid obstructions or to maintain required alignment, the amount of the joint deflection shall not exceed 70 percent of the maximum limits allowed by the pipe manufacturer for ductile iron pipe. For PVC pipe, no bending or joint deflection shall be permitted at any time. Changes in horizontal and vertical alignment of PVC pipe shall be achieved by use of fittings only.

K. In preparation for pipe installation, placement (stringing) of pipe should be as close to the trench as practical on the opposite side of the trench from the excavated material. The bell ends of the pipe should point in the direction of the work progress.

L. Before pipe is joined, gaskets shall be cleaned of all dirt and stones and other foreign material. The spigot ends of the pipe and/or pipe gaskets shall be lubricated lightly with a lubricant as specified by the pipe manufacturer and approved by the Engineer and the Owner. No sulfur based joint compound shall be used. Sufficient pressure shall be applied to the pipe so as to properly seat the spigot end into the bell of the previously laid pipe. Any damage to the pipe due to over-exertion shall be repaired at the Contractor's expense.

M. Pipe and fittings shall be laid accurately to the lines and grades indicated on the Drawings or required. The depth of cover over the pipeline shall vary to provide uniform gradient or slope to pipe, whether grading is completed or proposed at time of pipe installation. Where grades for the pipeline are not indicated on the Drawings, maintain a uniform depth of cover with respect to finish grade. All pipe laid shall be retained in position so as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. Care shall be taken to insure a good alignment both horizontally and vertically and to give the pipe a firm bearing along its entire length. Any pipe which has its grade or joint disturbed after laying shall be taken up and relayed.

N. All pipe and fittings shall be cleared of sand, dirt, and debris before laying. All precautions shall be taken to prevent sand, dirt, or other foreign material from entering the pipe during installation. If necessary, a heavy, tightly woven canvas bag of suitable size shall be placed over each end of the pipe before lowering into the trench and left there until the connection is made to the adjacent pipe. Any sand, dirt, or other foreign material that enters the pipe shall be removed from the pipe immediately. Interior of all pipe and fittings shall be kept clean after installation until accepted in the complete Work.

O. Thrust Restraint:

1. General: Thrust restraint shall be accomplished by piping restrained joints or mechanical restraining devices.

2. The length of restrained joints required shall be in accordance with the lengths shown on the Plan and Profile Drawings. The restrained joint lengths listed in the Restrained Joint Pipe Tables in the Drawings are absolute minimum lengths required and may not reflect the actual length of restrained joints required for a particular fitting arrangement or situation.
3. Concrete thrust blocks shall not be allowed on the Project for thrust restraint at fittings. Concrete thrust collars, if used and approved by the Engineer and the Owner, shall conform to the details shown on the Drawings and shall be constructed of Class I concrete, which shall have a minimum compressive strength of 3,500 psi at 28 days.

P. Any time that pipe installation is not in progress, the open ends of pipe shall be closed by a watertight plug or other method approved by the Engineer. Plugs shall remain in pipe ends until all water is removed from the trench. No pipe shall be installed when trench conditions are unsuitable for such work, including standing water, excess mud, or rain.

Q. After pipe has been laid, inspected, and found satisfactory, sufficient backfill shall be placed along the pipe barrel to hold the pipe securely in place while conducting the preliminary hydrostatic test. No backfill shall be placed over the joints until the preliminary test is satisfactorily completed, leaving them exposed to view for the detection of visible leaks.

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R. Upon satisfactory completion of the preliminary hydrostatic pressure test, backfilling of the trench shall be completed.

S. Aboveground and Exposed Piping: Piping shall be cut accurately to measurements established at the job site and shall be worked into place without springing or forcing, properly clearing all equipment access areas and openings. Changes in sizes shall be made with appropriate reducing fittings. Pipe connections shall be made in accordance with the details shown and manufacturer's recommendations. Open ends of pipe lines shall be properly capped or plugged during installation to keep dirt and other foreign material out of the system. Pipe supports and hangers shall be provided where indicated or as required to insure adequate support of the piping, refer to *Section 15126 – Pipe Hangers and Supports*.

T. Location Detection Wire: Refer to *Section 15080 – Piping, Valve and Equipment Identification System* and the Standard Detail Drawings for wire location and installation notes. Location Detection Wire shall be installed for all pressure utility pipelines installed underground. The detection wire shall be attached generally at the three o'clock position on the pipe with nylon pipe straps located at between 5 to 8 foot intervals for each 20 foot length of pipe. The wire shall be installed through valve boxes, valve vaults, air release valve enclosures, etc., and provide sufficient excess (36-inches minimum) such that a loop in the wire can be raised above ground level. An energy source shall be attached to the wire to energize the wire to facilitate location of the wire and pipe using a metal detector.

Prior to acceptance, the Contractor shall demonstrate to the Owner's Inspector that the wire is continuous and unbroken through the complete run of the pipe by performing a continuity test of the 10 gauge location detection wire for the entire length of the pressure utility main at each valve test station box. The test shall also include energizing the wire and locating the entire run of pipe with the Owner's Inspector present.

U. Install a continuous underground utility identification tape for all underground utility pipelines. The identification tape shall be installed over the centerline of the pipe at a depth of 1.0 feet below finished grade. Refer to *Section 15080 – Piping, Valve and Equipment Identification System*.

V. Utility Main Markers: Where utility main markers are required per the Owner's standards, markers shall be placed at all directional changes in the pipeline and at all underground valve locations, except water valves for fire hydrants. Additional markers shall be installed as needed so that the distance between markers does not exceed 1000 feet. Markers shall be installed as shown on the Drawings.

3.04 INSTALLATION OF DUCTILE IRON PIPE

A. Inspection and Testing:

1. All pipe shall be inspected and tested at the foundry.
2. The Owner shall have the right to have any or all piping, fittings, or special castings inspected and tested by an independent testing agency at the foundry or elsewhere. Such inspection and testing will be at the Contractor's expense.
3. Mark as rejected and immediately remove from the job site, all pipe lengths showing a crack, damaged lining, or receiving a severe blow that may cause an incipient fracture, even though no such fracture can be seen.
4. Removal of cracked portions: Any pipe showing a distinct crack, but no incipient fracture beyond the limits of the visible crack, may be cut off and the sound portion installed. Cut the pipe at least 12 inches from the visible limits of the crack. Pipe cutting shall be performed as described below. Cutting pipe that has a crack and installing the remaining pipe material in the Work shall only be performed when approved by the Engineer and the Owner, and shall be at the expense of the Contractor.

B. Handling and Cutting Pipe:

1. Care shall be taken in handling, cutting, and laying ductile iron pipe and fittings to avoid damaging the pipe and interior coal tar epoxy or cement mortar lining, scratching or marring machined surfaces, and abrasion of the pipe coating. All cracked pipe and fittings shall be removed at once from the Work at no additional cost to the Owner.

2. Pipe cutting shall be done by skilled workmen in a neat workmanlike manner without creating damage to the pipe and interior coal tar epoxy or cement mortar lining. Ductile iron pipe may be cut using an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw, milling wheel saw or oxyacetylene torch. Cut ends shall be square and rough edges of ductile iron pipe shall be ground smooth. For push-on joint connections, the cut end shall be beveled to prevent gasket damage during joint assembly. Interior lining and exterior coatings of the pipe shall be repaired at cut ends per the manufacturer's instructions prior to joint assembly.

C. Laying Pipe and Fittings:

1. Bedding for Ductile Iron Pipe: Minimum bedding requirements shall be Type 3 as defined in ANSI/AWWA C600, latest revision. Provide proper bedding required, in accordance with thickness class of pipe being laid, restrained joints required and depth of cover. Proper pipe laying conditions shall be in accordance with ANSI/AWWA C150 and C151, latest revisions, and ANSI/AWWA C600, latest revision.
2. All ductile iron pipe and fittings shall be laid in accordance with American Water Works Association Standard *ANSI/AWWA C600*, latest revision, entitled *"Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances"*, with the following sections specifically applying:

    a) Section 3.3 - Pipe Installation
    b) Section 3.4 - Joint Assembly

3. Polyethylene tube encasement shall be installed for all buried ductile iron pipe segments and fittings for corrosion protection. Installation procedures shall be in accordance with *AWWA C105/ANSI A21.5-10*, latest revision, entitled *Polyethylene Encasement for Ductile Iron Pipe Systems, Section 4.4 - Installation*.

D. Ductile Iron Pipe Joints:

1. Type: The joints of all pipelines shall be made leak tight. The particular joint used shall be approved by the Engineer and the Owner prior to installation. Where shown on the Drawings or where, in the opinion of the Engineer or the Owner, settlement or vibration is likely to occur, all pipe joints shall be bolted mechanical type or restrained type as specified above, or as indicated on the Drawings.
2. Push-on Joints: Push-on joints shall be made in strict accordance with the manufacturer's recommendations. Lubricant, if required, shall be an inert, non-toxic, water soluble compound incapable of harboring, supporting, or culturing bacterial life. Manufacturer's installation recommendations shall be submitted to the Engineer for review and approval before commencing work. The bell of the pipe shall be cleaned of excess tar or other obstructions and wiped out before the cleaned and prepared spigot of the

next pipe is inserted. The new pipe shall be shoved firmly into place until properly seated and held securely until the joint has been completed.

3. Mechanical Joints: All types of mechanical joint pipes shall be laid and jointed in full conformance with manufacturer's recommendations, which shall be submitted to the Engineer and the Owner for review and approval before work is begun. Only specially trained and skilled workmen shall be permitted to makeup mechanical joints. Torque wrenches, set as specified in AWWA Standard C111, shall be used; or spanner type wrenches not longer than specified therein may be used with the permission of the Engineer and the Owner. The gasket shall be inserted and the joint surfaces cleaned and lubricated with soapy water before tightening the bolts to the specified torque.
4. Restrained Joints: Restrained joints shall be provided where indicated on the Drawings. Joint assembly shall be made in strict accordance with the manufacturer's instructions, which shall be submitted to the Engineer and the Owner for review and approval before commencing work.
5. Flanged Joints: Flanged joints shall be made up by inserting the gasket between the flanges. The threads of the bolts and the faces of the gaskets shall be coated with suitable lubricant immediately before installation. Joints shall be fitted so that the contact faces bear uniformly on the gasket.

    a. Bolt holes of flanges shall straddle the horizontal and vertical centerlines of the pipe. Clean flanges by wire brushing before installing flanged fittings. Clean flange bolts and nuts by wire brushing and lubricate bolts with oil and graphite.
    b. Insert the nuts and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension.
    c. Execute care when tightening joints to prevent undue strain upon valves, pumps, and other equipment.
    d. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight; no leaks shall be allowed.

3.05 INSTALLATION OF PVC PIPE

A. Storage and Handling:

1. PVC pipe shall be delivered to the site in unbroken bundles packaged in such manner as to provide protection against damage. When possible, pipe should be stored at the job site in the unit packages until ready for use. Packaged units shall be handled using a forklift or a spreader bar with fabric straps. Packaged units shall not be stacked at the job site higher than two units high.

2. When it is necessary to store PVC pipe for long periods of time, exposure to direct sunlight shall be prevented by covering the pipe with an opaque material. Adequate air circulation above and around the pipe shall be provided as required to prevent excessive heat accumulation. PVC pipe shall not be stored close to heat sources of hot objects such as heaters, fires, boilers, or engine exhaust. Pipe gaskets shall be protected from excessive exposure to heat, direct sunlight, ozone, oil, and grease. The interior and all sealing surfaces of pipe, fittings, and other appurtenances shall be kept clean and free of dirt and foreign matter.
3. Care shall be taken in handling and laying pipe and fittings to avoid severe impact blows, crushing, abrasion damage, gouging, or cutting. Pipe shall be lowered, not dropped, from trucks or into trenches. All cracked, damaged, or defective pipe and fittings, or any length of PVC pipe having a gouge, scratch, or other permanent indentation of more than 10 percent of the wall thickness in depth, shall be rejected and removed at once from the Work and replaced with new acceptable pipe at no additional cost to the Owner.

B. Field Cutting PVC Pipe: Field cutting of pipe shall be done in a neat workmanlike manner without creating damage to the pipe. The pipe shall be cut square with a fine-toothed hand or power saw or other cutter or knife designed for use with plastic pipe. Prior to cutting, the pipe shall be marked around its entire circumference or a square-in vise shall be used to ensure the pipe end is cut square. Remove burrs by smoothing edges with a knife, file, or sandpaper.

C. Field Cutting Bell and Spigot PVC Pipe: Bevel the cut end of the pipe using a pipe beveling tool, wood rasp, or portable sander to prevent damage to the gasket during joint assembly. A factory-finished beveled end should be used as a guide to ensure proper beveling angle and correct depth of bevel. Round off any sharp edges on the leading edge of the bevel with a knife or file. The Contractor shall provide a seat homing mark on the field cut pipe in accordance with the pipe manufacturer's written instructions.

D. Laying PVC Pipe:

1. Pipe Bedding: Bedding for PVC pipe shall be as specified in *Section 02220 - Excavation, Backfilling and Compaction for Utilities* using granular pipe bedding material.
2. All PVC pipe shall be laid in accordance with the pipe manufacturer's published installation guide, the *AWWA Manual of Practice No. M23 "PVC Pipe - Design and Installation"* and the Uni-Bell Plastic Pipe Association installation recommendations.

E. PVC Pipe Joint Assembly for Rubber Gasketed Bell and Spigot Pipe:

1. The PVC bell and spigot joint shall be assembled in accordance with the pipe manufacturer's installation instructions, ASTM D2774, and AWWA Manual M23. Clean the interior of the bell, the gasket, and the spigot of the pipe to be jointed with a rag to remove any dirt or foreign material before assembling. Inspect the gasket, pipe spigot bevel, gasket groove, and sealing surfaces for damage or deformation.
2. Lubricate the spigot end of the pipe with a lubricant supplied or specified by the pipe manufacturer for use with gasketed PVC pipe in potable water systems. The lubricant should be supplied as specified by the pipe manufacturer. After the spigot end is lubricated, it must be kept clean and free of dirt and sand. If dirt and sand adhere to the lubricated end, the spigot must be wiped clean and re-lubricated.
3. Insert the spigot into the bell so that it contacts the gasket uniformly. Align the pipe sections and push the spigot end into the bell until the manufacturer's reference mark on the spigot is flush with the end of the bell. The pipe should be pushed into the bell using a bar and wood block. The joint shall not be assembled by "stabbing" or swinging the pipe into the bell, nor shall construction machinery be used to push the pipe into the bell. After joining the pipe, a metal feeler gauge shall be used to verify that the joint gasket is properly located.
4. If undue resistance to insertion of the spigot end is encountered or if the reference mark does not reach the flush position, disassemble the joint and check the position of the gasket. If the gasket is twisted or pushed out of its seat, inspect the components, repair or replace damaged items, clean the components, and repeat the assembly steps. Be sure the pipe is in proper alignment during assembly. If the gasket was not out of position, check the distance between the spigot end and the reference mark and relocate the mark if it is out of position.
5. Restrained Joints: Restrained joints for PVC pipe shall be provided where indicated on the Drawings. Joint assembly shall be made in strict accordance with the joint restraint manufacturer's instructions, which shall be submitted to the Engineer for review and approval before commencing work.
6. Joints for Dissimilar Pipe: Joints between pipes of different materials or different outside diameters shall be made using a flexible mechanical compression-type coupling with Type 304 stainless steel bands.

F. PVC Pipe Joint Assembly for Threaded and Solvent Welded Pipe:

1. All threaded and solvent welded joints shall be made watertight in accordance with ASTM D2855, ASTM D2564, and AWWA Manual M23. All pipe cutting, threading, and jointing procedures for threaded and solvent welded PVC pipe joints shall be in strict accordance with the pipe and fitting manufacturer's printed installation instructions. Thread lubricant for threaded joints shall be Teflon tape only.

2. At threaded joints between PVC and metal pipes, the metal side shall contain the socket end and the PVC side the spigot. A metal spigot shall not, under any circumstances, be screwed into a PVC socket.

3.06 INSTALLATION OF STEEL PIPE (CARBON STEEL OR STAINLESS STEEL)

A Threads shall be neatly cut with sharp tools, and the jointing procedure shall conform to the best practice of the trade. After cutting, all pipe shall be reamed. All pipe shall be screwed together with an application of approved lubricant applied to male threads, and once a joint has been tightened, it shall not be backed-off unless the threads are re-cleaned and new lubricant applied. Application shall be neatly made and all excess lubricant and dirt shall be thoroughly wiped off the inside of every joint.

B. All glands, clamps, bolts, nuts, studs, and other uncoated parts of fitting joints for underground installation shall be coated with two coats, 10 mils DFT per coat, of coal tar epoxy equal to Carboline Bitumastic No. 300-M.

3.07 FITTING INSTALLATION FOR UNDERGROUND DUCTILE IRON OR PVC PIPING

A. The weight of ductile iron fittings shall not be carried by the pipe on which they are installed. The fitting shall be supported by a concrete cradle as shown on the standard details. Concrete used for supports shall have a minimum compressive strength of 3,500 psi at 28 days. Concrete for the support cradle shall be poured against undisturbed soil.

B. All glands, clamps, bolts, nuts, studs, and other uncoated parts of fitting joints for underground installation shall be coated with two coats, 10 mils DFT per coat, of coal tar epoxy equal to Carboline Bitumastic No. 300-M.

3.08 CONCRETE PIPE ENCASEMENT

A. Concrete for concrete pipe encasement shall have a minimum strength of 3,500 psi at 28 days and encasement shall be constructed in accordance with Details shown on the Drawings. Encasement shall be constructed where:

1. Indicated on the Drawings.
2. The Engineer or the Owner shall order the pipeline encased.

B. The points of beginning and ending of concrete pipe encasement shall be not more than 6-inches from a pipe joint to protect the pipe from cracking due to uneven settlement of its foundation or the effects of superimposed live loads.

C. Pipe encasement shall provide a minimum coverage of 6-inches all around the pipe including pipe bells.

3.09 INSTALLATION OF PIPE SLEEVES, WALL CASTINGS, AND COUPLINGS

A. Pipe sleeves and wall castings shall be provided at the locations called for on the Drawings. These units shall be as detailed and of the material as noted on the Drawings. They shall be accurately set in the concrete or masonry to the elevations shown. All wall sleeves and castings required in the walls shall be in place when the walls are poured. Ends of all wall castings and wall sleeves shall be of a type consistent with the piping to be connected to them.

B. Link seals for wall sleeves shall be installed in strict accordance with the manufacturer's printed installation instructions. For watertight applications in tanks or treatment units, the link seal installation shall be tested hydrostatically for leaks at the same time as the tank or treatment unit. Any leaks that occur during the test period shall be repaired by checking the link seals for proper installation and replacement of unit(s) found to be defective at no additional cost to the Owner.

C. Pipe couplings shall be installed in strict accordance with the manufacturer's published instructions and recommendations. Pipe couplings shall be pressure tested with the pipeline. Any leaks that occur at couplings during the testing period shall be repaired or replaced, for unit(s) found to be defective.

3.10 INSTALLATION OF VALVES

A. Valves of the size and type shown on the Drawings shall be set plumb and installed at the locations indicated on the Drawings. Valves shall be installed in accordance with manufacturer's written installation and operation instructions; with the approved shop drawing submittals; and with the details shown on the Drawings.

B. Valves shall be installed such that they are supported properly in their respective positions, free from distortion and strain. Valves shall be installed such that their weight is not borne by pumps and equipment that are not designed to support the weight of the valve.

C. Valves shall be carefully inspected during installation; they shall be opened wide and then tightly closed and the various nuts and bolts shall be tested for tightness. Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat. Check and adjust all valves for smooth operation.

D. Install valves with the operating stem in either horizontal or vertical position depending on the type of valve.

E. Allow sufficient clearance around the valve operator for proper operation.

F. Clean iron flanges by wire brushing before installing flanged valves. Clean carbon steel flange bolts and nuts by wire brushing, lubricate threads with oil or graphite, and tighten nuts uniformly and progressively. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight; no leaks shall be allowed.

G. For buried valves, a valve box shall be centered accurately over the operating nut and the entire assembly shall be plumb. Extensions or risers for valve boxes shall be an integral part of the box. No cut sections of ductile iron or PVC pipe shall be used to extend the valve box to its proper height. The tops of valve boxes shall be adjusted to the proper elevation as specified below and as shown on the Drawings. Care shall be taken while constructing valve boxes to ensure that valve stems are vertical and the cast iron valve box has been placed centered over the valve stem with base bearing on compacted fill and the top flush or above final grade, as specified below. Valve boxes shall have sufficient bracing to maintain alignment during backfilling. When installation is complete, no pressure shall be exerted by the valve box on either the valve or the pipe. The Contractor shall remove any sand or undesirable trash or debris from valve box interior prior to final inspection.

1. In paved areas, tops of valve box covers shall be set 1/4-inch below pavement. Following paving operations, a 24-inch square shall be neatly cut in the pavement around the box and the paving removed. The top of the box shall then be adjusted to the proper elevation and a 24-inch square by 6-inch thick concrete pad poured around the box cover. Concrete pads in traffic areas shall be reinforced with No. 4 reinforcement bars as shown on the Drawings. Concrete for the pad shall be 3,500 psi compressive strength at 28 days.
2. In unpaved areas, tops of valve box covers shall be set 2 inches above finished grade. After the top of the box is set to the proper elevation, a 24-inch square by 6-inch thick concrete pad shall be poured around the box cover. Concrete for the pad shall be 3,500 psi compressive strength at 28 days.
3. The concrete pad for the valve box cover shall have a 3-inch diameter, stainless steel identification disc embedded in the concrete surface as shown on the Drawings. The stainless steel identification disc shall be as specified in *Section 15080 – Piping, Valve and Equipment Identification System*, and shall have the information as shown on the Drawings neatly engraved on it.

H. Valves shall be tested hydrostatically, concurrently with the pipeline in which they are installed. Protect or isolate any parts of valves, operators, or control and instrumentation systems whose pressure rating is less than the pressure used for the pressure test(s). If valve joints leak during pressure testing, loosen or remove

the nuts and bolts, reseat or replace the gasket, reinstall or retighten the bolts and nuts, and hydrostatically retest the joints.

I. Following installation, all aboveground valves shall be coated in accordance with the coating system specified in *Section 09900: Industrial Coatings*. Following installation of buried valves or valves installed in valve vaults, repair any scratches, marks and other types of surface damage, etc., with a coating equal to the original coating supplied by the manufacturer. Prior to backfilling, all nuts, bolts, and other parts of the valve joints shall be coated with two coats, 10 mils DFT per coat, of coal tar epoxy equal to Carboline Bitumastic No. 300-M.

3.11 SEPARATION OF NON-POTABLE WATER MAINS AND POTABLE WATER MAINS

A. Refer to the Pipe Separation Detail included in the Standard Detail Drawings for additional information specific to each case. In general, reclaimed water mains, wastewater force mains and gravity sewer mains (non-potable mains) shall be installed with at least a 6 foot horizontal separation from any potable water main. At crossings the installation shall provide for a minimum vertical separation distance of 12-inches between the outside of the pipes when crossing non-potable and potable water mains. This separation shall be provided where the potable water main is either below or above the non-potable water main. When the 12-inch minimum vertical separation distance cannot be maintained, the potable water main shall be encased in concrete. Concrete encasement shall be as specified above. The potable water main shall be encased for 10 feet each way of the crossing.

3.12 HYDROSTATIC PRESSURE AND LEAKAGE TESTING - (Refer to Section 15144 – Pressure Testing of Piping)

3.13 INSTALLATION OF AIR RELEASE VALVES

A. Piping, fittings, and the air release valves shall be installed in accordance with the manufacturer’s written recommendations; and where shown and as detailed on the Drawings.

B. The air release valve assemblies shall be installed so that they are vertical and properly supported and such that they will function properly and freely and no parts shall be strained.

C. Air release valve testing shall be performed during the pressure testing of pipeline which the air release valve is connected.

3.14 INSTALLATION OF IN-LINE STATIC MIXERS

A. The in-line static mixer equipment manufacturer shall furnish the services of a competent and experienced factory representative who is familiar with the installation of the respective equipment furnished to supervise the installation and testing of the equipment.

B. The units shall be installed where shown on the Drawings in accordance with the manufacturer's instructions and accurately aligned in relation to related equipment.

C. The Contractor shall supply all necessary accessories, temporary lifting equipment, labor, materials and all other requirements for satisfactory installation.

D. Flange bolting materials shall be Type 316 stainless steel as specified in Part 2 above.

E. Upon completion of installation, the Contractor, shall perform a preliminary test on the system to ensure all component parts are functioning properly. The Contractor shall furnish all labor, materials and equipment required to perform each test.

3.15 MAIN CLEANING AND FLUSHING

A. Prior to the hydrostatic and leakage tests for all pressure utility pipelines and the disinfection of potable water pipelines, all the pressure mains constructed under this contract shall be cleaned and flushed to remove sand, loose dirt, and other debris.

B. Prior to testing for the gravity drain line system, drain lines shall be flushed to remove dirt, sand, stones, and other debris which may have entered the lines during construction and settled out in the lines. Materials and debris flushed from the drain lines shall be removed from a downstream lift station and disposed of at an approved disposal area.

C. All pipelines shall be hydraulically cleaned utilizing multiple pass operations with a polypropylene swabbing device, also referred to as "pigging" operations, of the piping system. Between successive operations, the pig diameter shall increase and the pig material shall stiffen. Poly pigs shall be blown elastomer polyurethane with open cell-type construction having a material density suitable for use within the system to be cleaned. Pipe cleaning poly pigs shall have a parabolic nose, crisscross coated with a resilient peripheral surface that engages the inner cylindrical wall of the pipe to maintain a sliding seal. Pipe cleaning poly pigs shall be able to pass through a reduction of a minimum of sixty-five percent (65%) of the original cross-sectional area of the pipe and shall be bi-directional. Cleaning procedures shall conform to the Poly Pig manufacturer's recommendations.

D. The Contractor shall provide pig launching and retrieval points for the pipeline cleaning, as required. The poly pig cleaning operation shall be completed prior to connection of the new potable water main or reclaimed water main to an existing potable water main or reclaimed water main.

E. Passage of cleaning poly pigs through the system shall be constantly monitored, controlled, and all poly pigs entered into the system shall be individually marked and identified so that the exiting of the poly pigs from the system can be confirmed.

F. Cleaning of the system shall be done in conjunction with the initial filling of the system for its hydrostatic test.

G. The line to be cleaned shall only be connected to an existing potable water or reclaimed water distribution system at a single connection point. Only the Owner's operating personnel shall operate the supply valve from the existing potable water distribution system.

H. The Contractor shall locate and open all new in-line valves beyond the point of connection on the pipeline to be cleaned during the swabbing operation.

I. Cleaning and flushing shall be accomplished by propelling the poly pig down the pipeline to the exit point with potable or reclaimed water. Flushing shall continue until the water is completely clear and poly pig is retrieved.

1. Re-apply a series of individual poly pigs in varying diameters and/or densities as required, to attain proper cleanliness of pipeline.
2. Pigging speed shall range between two and five feet per second.

J. At the receiving or exit point for the poly pig, the Contractor is responsible for creating a safe environment for collection of debris, water, and the swab. The Contractor shall provide for the protection of surrounding personnel and property and the safe retrieval of the poly pig.

K. Following the pigging process for cleaning the pipeline, the entire length of new utility main shall be final flushed with a full bore clean water flush with a flushing velocity of at least 2.5 fps. The time required for the final full bore flush shall be based on the time needed to provide one complete turnover of the quantity of water in the pipeline based on the length and diameter of water main being flushed.

L. Temporary blowoffs may be required for the purpose of flushing mains. Temporary blowoffs shall be installed as close as possible to the ends of the main being flushed. Blowoffs installed on the main shall be the same diameter as the main. Temporary blowoffs shall be removed and plugged after the main is flushed. All costs for installing and removing temporary blowoffs shall be at no additional cost to the Owner.

M. Blowoffs and temporary drainage piping used for flushing shall not be discharged into any gravity sewer or pumping station wet well. The Contractor shall obtain prior approvals from the Engineer and the Owner as to the methods and locations of flushing water discharges.

N. The Owner shall be notified at least 72 hours prior to pigging and flushing mains.

O. Following main cleaning and flushing for all pressure utility mains, hydrostatic pressure and leakage testing shall be completed in accordance with these specifications.

3.16 FIELD QUALITY CONTROL

A. General: At the conclusion of the work, and following flushing, pressure and leakage testing, the Contractor shall perform final checks and inspections as outlined below.

B. Wire Continuity Check: The Contractor shall perform a continuity check of the 10 gauge locate wire for the entire length of all utility mains by performing a continuity test at each valve test station box.

C. Inspection of Automatic Air Release Valves: After completion of the pressure test the ARV shutoff valve shall be opened and the Owner's representative shall test the ARV for proper connection and operation.

D. Inspection of Pressure Utility Pipeline Valves and Valve Boxes: Valves shall be fully opened, then tightly closed, and the various nuts and bolts shall be tested for tightness. Any valve that does not operate correctly shall be replaced. Buried valves shall have an operating nut within two feet of finished grade. Operating nut extensions shall be installed, if necessary, to meet this requirement. Valve boxes shall be properly marked and checked for installation in accordance with the Drawings. Operating nuts, extensions, and upper guides shall not interfere with valve operation. Before acceptance by the Owner, valve boxes shall be adjusted to finished grade or top of pavement with the operating nut properly centered and shall have a concrete pad and valve identification disc installed.

3.17 CORRECTION OF NON-CONFORMING WORK

A. Correction of Non-Conforming Work: All non-conforming work shall be repaired or replaced by the Contractor at no additional expense to the Owner. Non-conforming work shall be defined as failure to adhere to any specific or implied directive of these Technical Specifications and/or the Drawings, including but not limited to pipe not laid straight, true to the lines and grades as shown on the Drawings, damaged or unacceptable materials, misalignment or diameter ring deflection in pipe due to bedding or backfilling, visible or detectable leakage and

failure to pass any specified test or inspection.

3.18 CONNECTION TO EXISTING RECLAIMED WATER SYSTEMS

A. The Contractor shall coordinate making connection of the new mains to mains which are in service at the time of construction with the Owner. All pressure utility main connections, regardless of new or existing pipe size, to existing pressure utility mains, shall be made by the Contractor only after the connection procedure and his Work scheduling has been reviewed and approved by the Engineer and the Owner. The Contractor shall submit a written request to the Engineer and the Owner a minimum of 5 working days prior to scheduling said connections. The request shall outline the following.

1. Location of points of connection, fittings to be used, and method of flushing and disinfection, if applicable.
2. Estimated construction time for said connections.

B. Connections to existing pressure utility mains shall only be made following completion of new pressure utility main cleaning operations, successful completion of pressure and leakage testing for new pressure utility mains.

C. The Engineer and the Owner shall review the submittal within three working days after receiving it and inform the Contractor regarding approval or denial of his request. If this request is rejected by the Owner, the Contractor shall resubmit his request modifying it in a manner acceptable to the Owner.

D. The Contractor shall not connect to existing facilities unless the Engineer and a representative of the Owner are present. All connections shall only be made on the agreed upon date and time. If the Contractor does not initiate and complete the connection work in the agreed upon manner, the Contractor shall be required to re-schedule the said connection by following the procedure outlined above.

E. Operation of all system valves shall be the responsibility of the Owner's personnel only. At no time shall the Contractor operate any system valves. System valves shall be defined as any valve which has main pressure against either side of the valve. The Contractor shall notify the Owner to request that a valve be operated, at least 5 days prior to the time operation is required.

F. Upon satisfactory completion of all testing and disinfection (if applicable) of new potable water or reclaimed water pipelines, remove restrained joint caps from both ends of the new pipeline, close main line isolation valves on the existing main, cut and drain the existing main and swab all pipe and fittings for the connection to be installed on the new main with 10 percent hypochlorite solution. The connection of the new main to the existing main shall be made as swiftly as possible and any water collected in the ditch shall be pumped out and kept below

the level of the pipe bottom. Following connection and make-up of all fittings, the new pipeline shall then be placed into service by the Owner's operating personnel.

END OF SECTION

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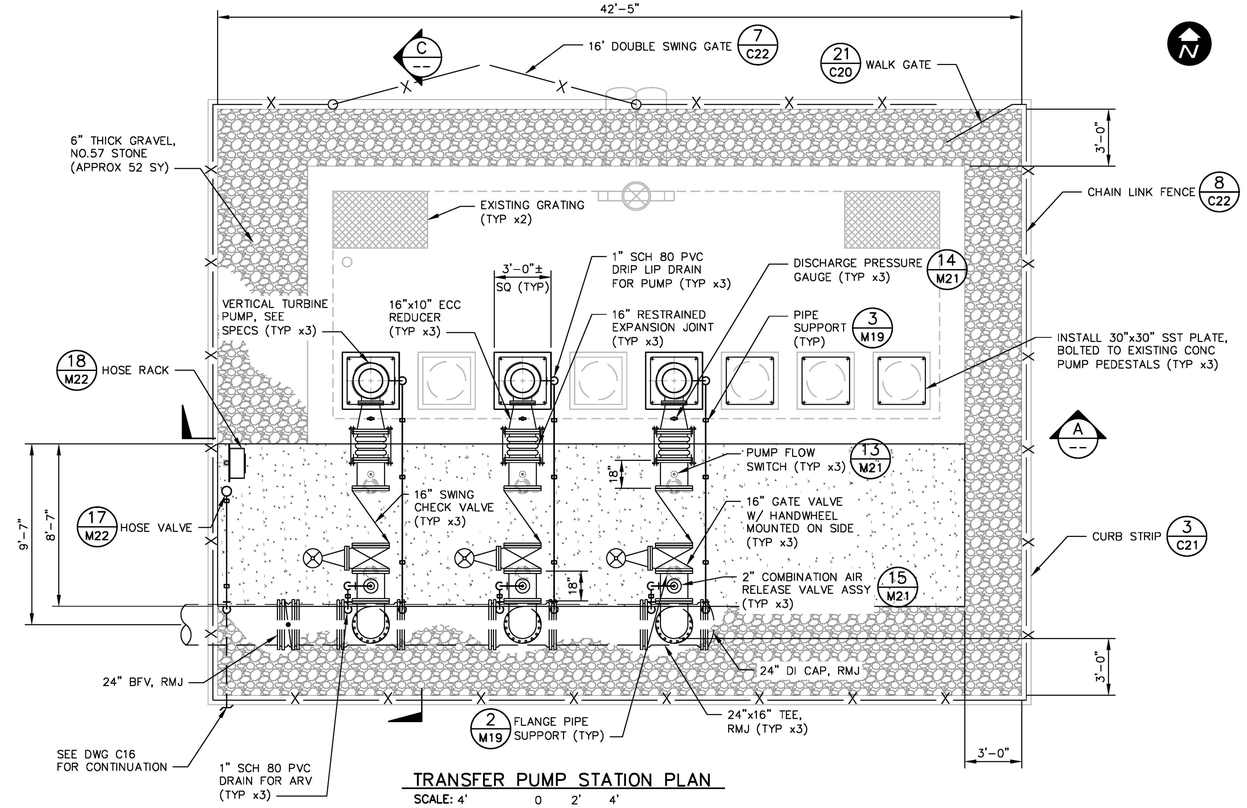
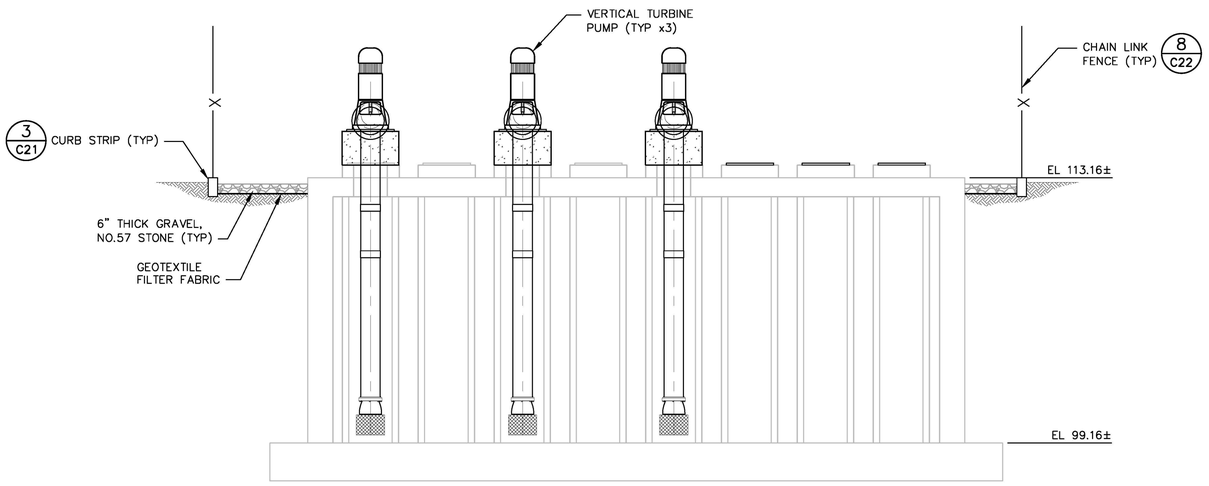


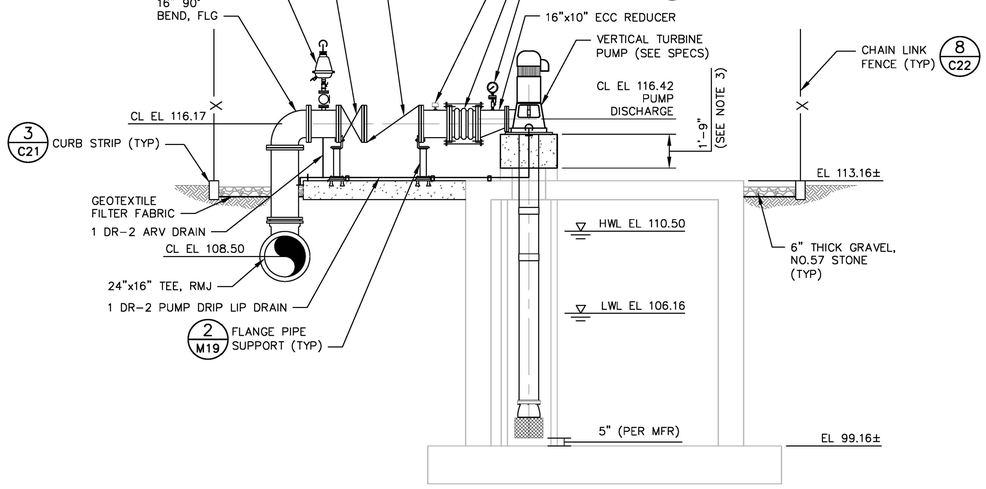
TRANSFER PUMP STATION PLAN

SCALE: 4' 0 2' 4'



A SECTION

SCALE: 4' 0 2' 4'



C SECTION

SCALE: 4' 0 2' 4'

NOTES

1. EXISTING HIGH SERVICE PUMP STATION (PROCESS 95) AND ASSOCIATED PIPING TO REMAIN IN OPERATION UNTIL NEW HIGH SERVICE PUMP STATION, TRANSFER PUMPS, AND GROUND STORAGE TANK ARE TESTED AND STARTED UP.
2. REFER TO ELECTRICAL DRAWINGS FOR ADDITIONAL DEMOLITION REQUIREMENTS.
3. CONCRETE PEDESTAL HEIGHT TO BE ADJUSTED BY CONTRACTOR AND COORDINATED WITH THE PUMP MANUFACTURER, SO THAT THE CENTER LINE OF 16" DISCHARGE ELEVATION IS MAINTAINED.

REV	DATE	DESCRIPTION	BY
0	08/2021	ISSUED FOR CONSTRUCTION	VVV

Issue Certification

J. Richard Voorhees, P.E., BCEE
Florida P.E. No. 25385

Designed JRV
Drawn VVV
Checked GWD
Reviewed JRV
Approved AWD

LINE IS 1" AT FULL SIZE

CITY OF HAINES CITY
RECLAIMED WATER GROUND STORAGE TANK AND PUMP STATIONS

MECHANICAL

TRANSFER PUMP STATION PROPOSED PLAN AND SECTIONS (PROCESS 95)

PROJECT NO.: 117013
SCALE: NOTED
REVISION: 0
DRAWING NO.: M02
SHEET NO.: 40 OF 83

CHA CONSULTING, INC.
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