## VOL. 2 BABCOCK RANCH WATER UTILITIES

### TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>SECTION</th>
<th>DESCRIPTION</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>General</td>
<td>1</td>
</tr>
<tr>
<td>2.2</td>
<td>Potable Water Distribution</td>
<td></td>
</tr>
<tr>
<td>2.3</td>
<td>Non-Potable Water Distribution</td>
<td>42</td>
</tr>
<tr>
<td>2.4</td>
<td>Sanitary Sewer System</td>
<td>57</td>
</tr>
<tr>
<td>2.5</td>
<td>Irrigation</td>
<td>130</td>
</tr>
</tbody>
</table>
2.1 GENERAL

Work that is located within the right-of-way (ROW) shall conform to the specifications for work within the right of way in the District Lands Specifications of the Babcock Ranch Community Design and Specification Manual (DSM).

All water and wastewater improvements shall conform to the Babcock Ranch Community Utility System Analysis report. This report is available through the Babcock Ranch Community Independent Special District (District) and the Utility Operator (Town & Country)* by request.

All irrigation improvements shall conform to the Babcock Ranch Community Irrigation Master Plan. The latest phase of this plan shall be utilized and updated accordingly. The Babcock Ranch Community Irrigation Master Plan is available through the District and the Utility Operator by request.

All site improvements shall conform to the Potable Water Distribution, Non-Potable Water Distribution, Sanitary Sewer System, Irrigation and District Lands Sections of this DSM as well as the Babcock Ranch Water Utilities Policies Manual.

To ensure the ability of the District to provide efficient and effective Utility Service, a property owner shall be required to extend on-site facilities along the full length of the road frontage and boundaries of the Development Project, unless otherwise agreed to by the District.

2.1.1 DISTRICT AVAILABILITY

The District shall have the right to refuse to extend service if the use is deemed detrimental, by the District in its sole discretion, to the utility system operation or resource availability.

The District does not guarantee availability of service including volume and pressure of water and or irrigation quality water.

A request must be made to District for a Utility Availability Letter to verify utility availability for the site. Available record drawings and known utility locations can also be requested as part of the availability letter.

2.2 POTABLE WATER DISTRIBUTION

The following Specifications are intended for the design, selection of materials, and construction of potable water distribution systems. Potable water distribution systems, if applicable, shall meet the requirements of the Florida Department of Environmental Protection (FDEP) permit and all other governing bodies.

The District reserves the right to oversize any extension and will pay for such oversizing based on additional cost beyond that necessary to serve only the subject development. The District will pay an established unity amount based upon the pipe size of a facility multiplied by the length of that facility. The established unit amount shall be determined by the District based on the difference in cost between that line size required by the development and the District’s study of current
construction costs. The District will pay the Owner for the cost of the District’s share of oversized mains and this payment will be in the form of a credit. The District also reserves the right to limit the amount of its participation in the cost of oversizing depending on current economic conditions.

2.2.1 SYSTEM DESIGN

Potable water distribution systems shall be designed by a Florida Registered Professional Engineer (Engineer of Record) and constructed in accordance with the design and installation requirements as specified by the DSM, the FFDEP, the Florida Department of Health (DOH), the Florida Department of Transportation (FDOT) and any other relevant state and local regulatory agencies as well as with the requirements established by the District as amended from time to time.

Potable water distribution systems shall be looped systems whenever possible for optimal system performance. If the system is designed with a main that dead ends, the main shall not be smaller than six inches in diameter and the end of the main shall be designed and constructed to include an automatic flushing assembly to ensure water quality standards are maintained throughout the system, unless written approval is provided by the District. Water mains providing fire flow shall be a minimum of six inches in diameter.

2.2.1.1 Flow Demands:

A. The District does not guarantee flow, fire flows, or pressure.

B. Flow demands for design shall be calculated based on full development as known or projected. The average daily flow for domestic use shall be calculated at the minimum rate as follows:

<table>
<thead>
<tr>
<th>Type of Development</th>
<th>Projected Water Demands</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single/Multi-Family Residential</td>
<td>175</td>
<td>gpd/ERU</td>
</tr>
<tr>
<td>Retail</td>
<td>0.2</td>
<td>gpd/ft²</td>
</tr>
<tr>
<td>Office</td>
<td>0.2</td>
<td>gpd/ft²</td>
</tr>
<tr>
<td>Medical Office</td>
<td>0.2</td>
<td>gpd/ft²</td>
</tr>
<tr>
<td>Industrial</td>
<td>0.2</td>
<td>gpd/ft²</td>
</tr>
<tr>
<td>Golf Course Facilities</td>
<td>500</td>
<td>gpd/hole</td>
</tr>
<tr>
<td>Hotel</td>
<td>42</td>
<td>gpd/ft²</td>
</tr>
<tr>
<td>School</td>
<td>22</td>
<td>gpd/student</td>
</tr>
<tr>
<td>Religious Facilities</td>
<td>0.2</td>
<td>gpd/ft²</td>
</tr>
<tr>
<td>Parks</td>
<td>200</td>
<td>gpd/acre</td>
</tr>
<tr>
<td>Hospital</td>
<td>250</td>
<td>gpd/bed</td>
</tr>
<tr>
<td>Assisted Living</td>
<td>200</td>
<td>gpd/unit</td>
</tr>
<tr>
<td>Civic</td>
<td>0.2</td>
<td>gpd/ft²</td>
</tr>
</tbody>
</table>

gpd = gallons per day; ERU = equivalent residential unit; ft² = square foot. For types of development not included in the table above, projected water demands shall be based on Chapter 64E-6 of the Florida Administrative Code guidelines and/or historical flow data for similar establishments. When referring to F.A.C. 64E-6, projected water demands can be computed by converting estimated sewage flows under F.A.C. 64E-6 Table 1. Consider estimated sewage flows as 90% of potable water demands.
1. To use historical flow data; a minimum of the most recent 12 months of billing histories for at least six (6) similar establishments within the state of Florida must be provided.

2. Similarities must be demonstrated including but not limited to; size, hours of operation, number of employees, etc.

C. The peak hour flow (PHF) shall be calculated using a peak factor of 3.0 and the max day flow (MDF) shall be calculated using a max day peak factor of 1.5.

D. If the system is proposed to provide fire flow, the system shall be designed to meet minimum fire flow requirements of 1,000 gpm for residential units and 1,250 gpm for commercial units or those specified by Charlotte County and Lee County standards if they exceed the requirements of the District.

2.2.1.2 Master Plan Update

The Babcock Ranch Community Utility System Analysis shall be updated as directed and at the discretion of the District. All master plan update submittals shall be made during the Site Plan Review process at the expense of the Owner. Any required master plan updates shall include but is not limited to:

A. Update of demands for buildout conditions;

B. Update of transmission main sizing; and

C. Necessity of future infrastructure needs.

2.2.1.3 System Size Computation

All design data and reports shall be signed and sealed by a Professional Engineer and submitted to the District showing any adverse effect the design may have on the existing utility system and is subject to review and approval by the District.

A. The minimum design for water distribution systems shall provide for the greater of the two scenarios below:

   1. Peak Hour Flow (PHF)
   2. Max Day Flow (MDF) + Required Fire Flow

B. System shall be modeled based on a source pressure of 40 pounds per square inch (psi) serving the Project or based on a fire flow test of existing source system, whichever is lower. The minimum residual node pressure within the project system shall be no less than 20 psi under any design condition.

C. Velocity in potable water mains must meet the following conditions:

   1. Velocity shall not exceed three (3) feet per second (fps) during peak hour flow.
2. Velocity shall not exceed ten (10) fps during max day flow + required fire flow.

3. Head loss shall not exceed 10 feet/1000 feet.

D. Design computations shall be done by Bentley WaterCAD V8i (or newer) or another District approved model, if done using modeling software.

1. Pipe sizes shall be input to the model as the nominal diameter.

2. Pipe friction losses shall be modeled using the Hazen Williams equation with a pipe roughness factor “C” of 130.

3. Losses through master meters or other appurtenances shall be accounted for in the design.

E. Minimum pipe size for a potable water main shall be six inches in diameter unless written approval is provided by the District.

2.2.1.4 Location and depth

A. The location of potable water mains shall conform to the alignment of mains, valves, and hydrants detail found in the standard details as included herein.

B. Main separations shall conform to the main separation detail found in the standard details as included herein.

C. Potable water mains shall have a minimum of 36 inches of cover above the top of main.

D. All water mains shall be placed within the right-of-way.

E. Under no circumstances shall utility mains be located under buildings or other infrastructure that limits maintenance accessibility.

2.2.1.5 Backflow Prevention

Backflow prevention devices are required on all potable water supplies and shall adhere to the Cross-Connection Control Policy as adopted by the District. A Reduced Pressure Principle backflow preventer or a Double Check Valve backflow preventer must be used for residential applications. A Reduced Pressure Principle backflow preventer must be used for all commercial applications. See section 2.2.2.1.1.5(E.) for approved products. Backflow prevention devices shall conform to AWWA standards and shall meet District standard details and backflow prevention devices shall also conform to FDEP regulations. The following list covers the general backflow device required by customer type.
2.2.2 Hazard

<table>
<thead>
<tr>
<th>Backflow Device</th>
<th>Health Hazard</th>
<th>Non-health Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Back-siphonage</td>
<td>Back-pressure</td>
</tr>
<tr>
<td>Air Gap</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Reduced Pressure Principle (RPZ)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Double Check Valve Assembly (DCVA)</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Pressure Vacuum Breaker (PVB)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Atmospheric Vacuum Breaker (AVB)</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

All proposed backflow prevention devices are subject to review and approval by the District. The District has the authority to determine the appropriate type of backflow prevention device for the application, based on a risk assessment completed by the District.

2.2.2 SCOPE OF WORK

The work to be performed under this Section consists of furnishing all labor, materials, equipment, tools and other associated appurtenances required for the complete installation of all pipe, fittings, valves, valve boxes, and fire hydrants necessary for a complete and workable unit as detailed in the contract drawings and further described in this DSM.

Piping and other material and equipment shall be of the size, type, and number shown on the contract drawings and/or specified in this DSM. Items described in this DSM and not included on the contract drawings shall be disregarded. All pipe shall bear the class pressure rating and the DR number on each section of pipe and shall be solid-wall blue pipe unless otherwise specified.

2.2.2.1 Materials

2.2.2.1.1 Pipe

A. Polyvinyl Chloride (PVC) Pressure Pipe and Fittings

The materials used shall be new and conform to the requirements for class, kind, size, and material as described in these Specifications and shown on the Contract Drawings. Plastic pipe shall be manufactured from virgin PVC compound and the manufacturer shall insure all quality control test and AWWA requirements are complied with during the production of PVC pipe.
B. PVC pipe joints shall be the bell and spigot type using rubber gasket push-on type joints. Rubber gaskets shall be molded to a circular form to the proper cross section and shall consist of a vulcanized high grade elastomeric compound conforming to ASTM D-1869 and AWWA C-900 elastomeric seals for joining plastic pipe.

C. All ductile iron (DI) fittings shall meet the requirements of AWWA Specification C-153 and at a minimum have the same pressure rating of the connecting pipes. All ductile iron fittings shall be cement mortar or fusion bonded epoxy coated. All coatings in contact with potable water shall be certified to NSF 61. Exposed fasteners shall be type 316 stainless steel and all buried fasteners shall be “Cor-Ten” steel or “Cor-blue” coated.

D. All pipe shall be solid-wall blue pipe and adhere to the requirements listed below:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2” and Over</td>
<td>No solvent weld joints allowed</td>
</tr>
<tr>
<td>Less than 3”</td>
<td>ASTM D2241, SDR-21 with a pressure rating of 200 psi</td>
</tr>
<tr>
<td>Distribution Piping (3”-12”)</td>
<td>AWWA C900, DR-25</td>
</tr>
<tr>
<td>Distribution Piping (14”-36”)</td>
<td>AWWA-C905, DR-25</td>
</tr>
<tr>
<td>Distribution Piping providing fire flow (6”-12”)</td>
<td>AWWA C900, Class 150, DR-18</td>
</tr>
<tr>
<td>Distribution Piping providing fire flow (&gt;12”)</td>
<td>AWWA C905, Class 150, DR-18</td>
</tr>
<tr>
<td>Dedicated Fire lines servicing building structure sprinkler systems</td>
<td>AWWA-C900 or C904, DR-14 (Installed by a Contractor licensed in the State of Florida to install fire lines)</td>
</tr>
</tbody>
</table>

2.2.2.1.1.2 High Density Polyethylene (HDPE) Pipe and Fittings

A. High Density Polyethylene (HDPE) pipe shall meet the requirements of AWWA C-906 for polyethylene pressure pipe and fittings and for PE-3408 SDR 11. HDPE pipe shall meet ASTM D-3350 cell classification of 345434C. Permanent identification of the pipe shall be provided by co-extruding blue longitudinal stripes into the pipe’s outside surface for potable water. All polyethylene piping shall have ductile iron pipe nominal outside diameters.

B. Individual sections of HDPE piping shall be joined together by thermal butt-fusion to make a continuous section of pipe as recommended by the pipe manufacturer. Bends in HDPE pipe shall not be within ten (10) pipe diameters from any fitting or valve. The minimum radius of curvature shall be thirty (30) pipe diameters and bending shall not cause kinking. HDPE piping shall not be joined by solvent cements, adhesive or threaded type connections.
C. The color marking stripes shall be aligned during the fusing process and the pipe shall be pulled through the bore to allow identification of the type of system utilizing the HDPE pipe.

D. All fittings and sleeves used with HDPE pipe shall be cement mortar or fusion bonded epoxy coated ductile iron with mechanical joints rated to 350 psi and conforming to AWWA C-153 and C-111. All coatings in contact with potable water shall be certified to NSF-61. All MJ fitting connections to polyethylene pipe shall be restrained with Mega-Lug restrainers. The HDPE pipe shall be reinforced on the ends using stainless steel wedge internal stiffeners.

E. The mechanical connection to MJ fittings and sleeves shall use mechanical restraints that meet specification requirements. Size-on-size mechanical connection to PVC or DI pipe shall be by compact ductile iron solid sleeves with Mega-Lug restrainers.

F. No electro fusion fittings shall be used with HDPE unless specific written approval is provided by the District.

G. HDPE molded butt fittings and couplings for non-standard fittings and couplings shall require special written approval from the District for installation.

2.2.2.1.3 Polyethylene (PE) Pipe and Fittings for Service Connections

A. Polyethylene (PE) water service pipe shall be used for single and double lot services of two inches or less in diameter. The pipe shall meet AWWA C-901, ASTM D-3350 cell classification of 334434C and be permanently marked with the type/size/use of the pipe. PE pipe two and one half (2½) inches or three (3) inches shall meet the same requirements as mentioned above and shall only be permitted by specific written approval provided by the District. The minimum radius of curvature shall be thirty (30) pipe diameters and bending shall not cause kinking. The potable water pipe shall be blue in color. Inspect pipe for defects, damage, or imperfections prior to installation. All PE pipe and tubing shall conform to all applicable requirements in the latest revision of the following standards unless otherwise specified:
Table 3. Polyethylene Pipe and Tubing Standards

<table>
<thead>
<tr>
<th>Organization</th>
<th>Reference Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWWA</td>
<td>C-901</td>
<td>Standard Specification for Polyethylene (PE) Pressure Pipe, Tubing and Fittings, ½” through 3” for Water</td>
</tr>
<tr>
<td>ASTM</td>
<td>D1248</td>
<td>Standard Specification for Polyethylene Molding and Extrusion Materials</td>
</tr>
</tbody>
</table>

B. All coupling fittings shall meet or exceed the maximum design pressure requirements of the piping system and shall be permitted if written approval is provided by the District. The following products are approved:

1. Mueller INSTA-TITE
2. A.Y. McDonald
3. Ford ULTRA-TITE
4. Hydrosert Polyethylene Water Fittings as manufactured by Elster

2.2.2.1.4 Ductile Iron (DI) Pipe

A. The ductile iron (DI) pipe covered by this Specification shall be the push-on joint type or mechanical joint type, centrifugally cast to conform to all requirements of AWWA Specifications C-151 and C-153, latest revisions. The maximum allowable deflection shall not exceed two percent (2%) of the pipe’s diameter. Ductile iron pipe will be fully encased in an 8 mil polyethylene sleeve, in accordance with AWWA C-105, Method A. The pipe and the polyethylene sleeve shall be color coded blue for potable water by a means acceptable to the District. All pipes shall have a cement mortar or fusion bonded epoxy coating in accordance with the AWWA Specifications, latest revision and shall be color coded blue by a means acceptable to the District. All coatings in touch with potable water shall be certified to NSF-61.

B. Polyethylene material shall conform to ASTM Standard Specification D1248-68, latest revision. All ductile iron piping shall be marked “DUCTILE IRON” in large letters and have the nominal wall thickness marked on each piece of pipe and installed so that the markings can be read from the top of the trench.

C. Minimum thickness of ductile iron pipe shall be as follows:

<table>
<thead>
<tr>
<th>Table 4. Minimum Ductile Iron Pipe Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>3”-12” Ductile Iron Pipe</td>
</tr>
<tr>
<td>14”-42” Ductile Iron Pipe</td>
</tr>
</tbody>
</table>

D. Rubber gasket joints shall be in accordance with AWWA Specification C111 latest revision.
E. All fittings shall be in accordance with AWWA Specification C-153 latest revision and have the same pressure rating of the connecting pipe. All ductile iron fittings shall be cement mortar or fusion bonded epoxy coated. All coatings in touch with potable water shall be certified to NSF-61. All exposed fasteners such as bolts, nuts, washers, and threaded rod shall be type 316 stainless steel. All buried fasteners such as bolts, nuts, washers, and threaded rod shall be “Cor-Ten” steel or “Cor-blue” coated steel. Mechanical joint bolts shall not protrude more than one half inch through the nut after joints are assembled. All stainless-steel fasteners threads shall be coated with an anti-seize compound as approved by the District. Each length of pipe shall be clearly marked with the pressure rating, metal thickness class, net weight of pipe without lining, length of pipe, and manufacturer name.

2.2.2.1.1.5 Service Connections

Approved products are listed below for each category. Other products shall not be used until a thorough evaluation is completed by the District to determine if the same standards are met. The Contractor shall submit to the District all documentation necessary to complete this thorough evaluation. Final written approval by the District is required in writing to confirm acceptability prior to construction. The following products shall conform to AWWA standards and shall meet District standard details and backflow prevention devices shall also conform to FDEP regulations.

A. Corporation Stops

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mueller</td>
<td>H15024</td>
<td>¾” or 1”</td>
</tr>
<tr>
<td>Mueller</td>
<td>H10045</td>
<td>½” to 2”</td>
</tr>
<tr>
<td>Mueller</td>
<td>H10046</td>
<td>1-1/2” to 2”</td>
</tr>
<tr>
<td>Mueller</td>
<td>H15014</td>
<td>1-1/2” or 2”</td>
</tr>
<tr>
<td>Mueller</td>
<td>H15015</td>
<td>1-1/2” or 2”</td>
</tr>
<tr>
<td>Ford</td>
<td>F1100-X</td>
<td></td>
</tr>
</tbody>
</table>

B. Curb Stops

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mueller</td>
<td>B25170</td>
</tr>
<tr>
<td>Ford</td>
<td>B13-332W</td>
</tr>
<tr>
<td>Ford</td>
<td>B53-232W</td>
</tr>
<tr>
<td>Ford</td>
<td>B41-XXX</td>
</tr>
</tbody>
</table>

C. Service Saddles

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ford</td>
<td>FC202</td>
</tr>
<tr>
<td>A.Y. McDonald</td>
<td>4855A</td>
</tr>
<tr>
<td>Cascade</td>
<td>CSC2</td>
</tr>
<tr>
<td>Power Seal</td>
<td>3417DI</td>
</tr>
<tr>
<td>A.Y. McDonald</td>
<td>4835A</td>
</tr>
<tr>
<td>Romac</td>
<td>202NS</td>
</tr>
</tbody>
</table>

Service saddles for HDPE pipe include fusion bonded HDPE saddles as per AWWA.
D. U Branch

Mueller   H15365

E. Backflow Prevention Devices

1. Reduced Pressure Principle (RPZ):
   - Wilkins 975 XL Series
   - Wilkins 375 OSY Series
   - Ames 4000 B Series
   - Watts 009 Series
   - Watts 919 Series
   - Watts 957 Series
   - Combraco 40-200 Series

2. Double Check Valve:
   - Wilkins 950 Series
   - Wilkins 350 DA OSY Series

3. Double Detector Check Assembly:
   - Ames 3000SS Series
   - Watts 757 DCDA Series
   - Combraco 40-600 Series
   - Wilkins 450 (N-Shape) DCDA

4. Pressure Vacuum Breaker:
   - Wilkins Model 420
   - Wilkins Model 720A
   - Watts 800M4QT

2.2.2.1.2 Valves

2.2.2.1.2.1 Gate Valves

A. All gate valves in applications such as hydrant valves, in-line valves, wet tapping valves, and cut-in valves shall meet all the gate valve material, manufacturer, installation, performance, and execution requirements.

B. Gate valves shall be used on all potable and Irrigation Quality (IQ) water mains for all sizes. Gate valves fourteen (14) inches and larger shall be side actuated.

C. Gate (tapping) valves shall be used for all tapping sleeves. Tapping valves 14” and larger shall be side actuated and the Contractor shall notify the supplier of this fact to ensure that the tapping valve has the same bolt pattern as the tapping sleeve.

D. Hydrant gate valves shall be used when a hydrant tee is used for the installation of a hydrant from a water main.
2.2.2.1.2.1.1 Manufacture:

A. Gate valves shall conform to the latest revision of AWWA C-500 "Gate Valves - 2 inch through 48 inch for Water and Sewage Systems" and be resilient wedge seated. The additional requirements and exceptions to the AWWA standards contained herein shall also be applicable. All components of this type of joint shall conform to AWWA Standard C-111, "Rubber-Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings". All ductile iron valves shall be fusion bonded epoxy coated.

B. All coatings on valves in contact with potable water shall be certified to NSF 61.

C. Valves and required operating appurtenances shall be the product of the same manufacturer. All valves shall have the manufacturer and size of the valve visibly cast on the body or on a plate attached to the body of the valve. All valves shall be suitable for throttling service and/or frequent operation as well as service involving long periods of inactivity.

D. The operating pressure for all sizes shall be a minimum of 150 psi gage or of the adjacent piping whichever is greatest. Buried valves with diameters of 2" to 12" shall be installed vertically on horizontal pipelines without gearing, bypasses, rollers, or tracks.

E. Valves shall be provided with a fully enclosed, permanently lubricated actuator of the traveling nut or worm gear design. The actuator shall be connected to the valve shaft by means of a key and keyway connection. All actuators shall have adjustable, mechanical stop limits in accordance with AWWA C-504 Section 3.8.2. All valve actuators shall be capable of withstanding 450 ft-lbs of input torque against the open or closed stops without damage.

F. Valves for below ground applications shall have an AWWA wrench nut with a cast-in with an arrow indicating the direction on of opening. For a smooth shaft, the wrench nut shall be fastened to the input shaft by means of a minimum 5/16" diameter steel pin passing entirely through the shaft and the wrench nut; a key with keyway is acceptable. For a splined shaft, the wrench nut shall be formed to fit the splined shaft. The actuator shall be designed to produce the specified torque with a maximum input of 150 ft-lbs applied to the wrench nut. For above ground valves, a hand wheel will be used with an arrow cast-in arrow indicating the direction of the opening. The hand wheel shall be fastened to the actuator input shaft to produce the specified torque with a maximum pull of 80 pounds of the hand wheel rim.
G. Cut-in gate valves shall be resilient full seat and capable of handling working pressures up to +250 psi. The insert valve shall have the capability of insertion into steel; C-900, C-905, and C-909 PVC; cast iron; and ductile iron piping. The cut-in valve shall be capable of installation and placing into operation in active potable and IQ water mains and active force mains and low pressure systems force mains without spillage or stopping the flow by isolating the inserting valve during installation.

H. Insert Valves, Ductile Iron 250 p.s.i.g., shall be a Resilient Wedge Gate Valve including ductile iron body, bonnet and wedge shall provide a strength and a pressure rating that meets or exceeds the requirements of AWWA C-515. The insert valves shall be designed for use in potable water, raw water, and IQ water systems. The design shall allow the valve to be installed into an existing pressurized pipeline while maintaining constant pressure and service as usual. The resilient wedge shall seat on the valve body and not the pipe to obtain the optimum seating and flow control results. The resilient wedge shall be totally independent of the carrier pipe. The resilient wedge shall not come into contact with the carrier pipe or depend on the carrier pipe to create a seal.

I. Tapping Sleeve shall be type 316 stainless steel.

J. All interior and exterior ferrous surfaces of the valve, including the disc, shall be coated with fusion bonded epoxy, NSF 61 certified when in contact with potable water. The epoxy shall be fusion bonded and have a nominal thickness of 8 mils and be in accordance with AWWA C-550.

K. All exposed bolts, nuts, fasteners, and washers shall be type 316 stainless steel and all buried bolts, nuts, fasteners, and washers shall be “Cor-Ten” steel or “Cor-blue” coated. Mechanical joints bolts shall not protrude more than ½ inch through the nut after joints are assembled. Accessories for the mechanical joint consisting of the gasket, gland and fasteners shall be furnished and packaged separately from the valves. Each package shall be labeled in such a manner as to provide for proper identification and number of units per package or bundle.

L. All stainless-steel fastener threads shall be coated with an anti-seize compound as approved by the District.

2.2.2.1.2.1.2 Flanged Joints:

Flanges shall be drilled in accordance with ANSI-B16.1 Class 150 Cast-Iron Flange Specifications. Flanges shall be machined to a flat face with a finish of 250 micro-inches AARH maximum or machined to a flat surface with a serrated finish in accordance with AWWA Standards C-
207, Section 6 for Steel Pipe Flanges. Flange gaskets shall be one-eighth inch ring type of a synthetic rubber material. All thread studs shall be used on all valve flange connections in accordance with ASTM Standard Designations A-307, Grade B, with heavy hex nuts.

2.2.2.1.2.1.3 Bolting Material:

A. All exposed bolts, nuts, fasteners, washers, shall be type 316 stainless steel and all buried bolts, nuts, fasteners, and washers shall be “Cor-Ten” steel or Cor-blue coated. Bolts and hex nuts used on the valve shall be the manufacturer's standard either fabricated from a low-alloy steel for corrosion resistance or electroplated with zinc or cadmium. The hot-dip process in accordance with ASTM Standard Designate A-153 is not acceptable for the threaded portion of the bolts and nuts.

B. All stainless-steel fasteners threads shall be coated with an anti-seize compound as approved by the District.

2.2.2.1.2.1.4 Approved Products

A. All valves and tapping sleeves shall conform to AWWA standards and shall meet District standard details.

B. The following product(s) are approved for valves:

AFC 2500-1 SERIES
Clow/M&H/Kennedy 4000 SERIES
Mueller A 2360 SERIES
Clow 6100 SERIES
U.S. Pipe METROSEAL 250

C. The following product(s) are approved for tapping sleeves:

JCM 432 SERIES
Romac SST III SERIES
Cascade CST/EX
Smith Blair 662, 663
Powerseal 3490MJ/3940AS

2.2.1.2.2 Rubber-seated Butterfly Valves

A. Rubber-Seated Butterfly Valves shall only be used in specifically approved applications as per written District approval.

B. This Section addresses class 150 rubber-seated butterfly valves, 3 inches through 72 inches. All products furnished shall be in conformance with the latest revision of American National Standards Institute and American Water
2.2.2.1.2.2.1 Works Association C-504 Standard (ANSI/AWWA C-504) or latest revision thereof. All coatings in contact with potable water shall be certified to NSF 61. Valves shall be Class 150 of the short-body type with a 150 psig bi-directional shut-off rating. Valve shall be in the same alignment as a horizontal pipe and shall be for buried service, unless otherwise specified. Valve shall be configured with a horizontal valve shaft and a vertical actuator shaft with standard 2” AWWA operating nut. The actuator shall be side mounted.

2.2.2.1.2.2.1 Manufacture

A. The valve body shall be of cast iron conforming to ASTM Specification A-126, Class B with flat-faced flanged valve body ends in accordance with ANSI B16.1, Class 125. All valves shall conform to AWWA C-504, Table 2 of Section 3.1 Valve Bodies, laying lengths for flanged valves and minimum body shell thickness for all body types and AWWA C-509. The valve design shall be of such design that the disc will seat at 90 degrees with the pipe axis and the disc will not flutter or vibrate when operated in a throttled position.

B. The valves disc shall be of Cast Iron A-48, class 40 Cast Iron A-126, class B or Ductile Iron ASTM A-536, grade 65-45-12 with a disc design to provide 360-degree uninterrupted seating. The valve seat shall be natural or synthetic rubber resilient seating applied integrally to the body or disc. For valves 24 inches or larger, the rubber seat shall be capable of mechanical adjustment in the field and shall be field replaceable. Special tools required for seat adjustment and replacement shall be furnished with the valve and the seat respectively. Mechanical adjustment or attachment of the seat and seat ring shall not include welding. The mating seat surface shall be type 316 stainless steel. Sprayed or plate mating seat surfaces shall not be used.

C. Valve shafts shall be type 304 stainless steel conforming to ASTM A-276 and shall have a diameter equal to or greater than that shown for Class 150B in Table 3 of AWWA C504. Shafts shall conform to the requirements of Section 3.3, Valves Shaft of AWWA C504 for one-piece or stub shaft types. Connection between the shaft and disc shall be dowel or taper pins, which are mechanically secured. The valve assembly shall be furnished with a factory-set, non-adjustable disc shaft thrust bearing that insures the valve disc is centered within the valve body seat at all times. Valve shaft bearings shall be permanent, self-lubricated bearings providing continuous, low-friction maintenance-free operation. Shaft bearing shall be contained in integral hubs of the valve body. Valve shaft seal shall consist of O-ring, V-type, or U-cup type packing where the shaft projects through the valve body for the actuator connection.
D. The valve shall be provided with a fully enclosed, permanently lubricated actuator of the traveling nut or worm gear design. The actuator shall be connected to the valve shaft by means of a key and keyway connection. All actuators shall have adjustable, mechanical stop limits in accordance with AWWA C504 Section 3.8.2 and shall be capable of withstanding 450 ft-lbs of input torque against the open or closed stops without damage.

E. Valves for below ground applications shall have an AWWA wrench nut with a cast-in arrow indicating the direction of opening. For a smooth shaft, the wrench nut shall be fastened to the input shaft by means of a minimum 5/16” diameter steel pin passing entirely through the shaft and the wrench nut; a key with keyway is acceptable. For a splined shaft, the wrench nut shall be formed to fit the splined shaft. The actuator shall be designed to produce the specified torque with a maximum input of 150 ft-lbs applied to the wrench nut. For above ground valves, a hand wheel will be used with a cast-in arrow indicating the direction of the opening. The hand wheel shall be fastened to the actuator input shaft to produce the specified torque with a maximum pull of 80 pounds of the hand wheel rim.

F. All interior and exterior ferrous surfaces of the valve, including the disc, shall be coated with fusion bonded epoxy, NSF 61 certified for use in potable water. The epoxy shall have a nominal thickness of 8 mils and shall be in accordance with AWWA C550 latest revision.

2.2.2.1.2.2 Approved Products

A. All valves shall conform to AWWA standards and shall meet District standard details.

B. The following product(s) are approved:

   Clow/M&H/Kennedy 4500 SERIES
   Mueller LINE SEAL

2.2.2.1.2.3 Check Valves

The in-line check valves shall be of the swing flex, full body, flanged type with a domed access cover; shall have only one moving part, the valve disc; and shall be fully operational when mounted in the vertical position.

2.2.2.1.2.3.1 Manufacture

A. The valve body shall have full flow equal to nominal pipe diameter at any point through the valve. The seating surface shall be on a 45-degree angle to minimize disc travel. The top access port shall be full
size to allow removal of the disc without removing the valve from the pipeline. The access cover shall be domed in shape to allow the disc to be fully operational in lines containing high solids content. The disc shall be of one piece precision molded construction with an integral O-ring type sealing surface and contain steel and nylon reinforcements in both the Memory Flex and central disc areas. Non-slam closing characteristic shall be provided through a short 35-degree disc stroke and a Memory Flex disc return action. The valve body and cover shall be ASTM A-126, Class B cast iron. The disc shall be Buna-N (BNR), ASTM D2000-BG.

B. The interior of the valve shall be fusion bonded epoxy coated NSF 61 certified for use in potable water, and the exterior shall be coated with a universal primer.

2.2.1.2.3.2 Approved Products

A. All valves shall conform to AWWA standards and shall meet District standard details.

B. The following product(s) are approved:

<table>
<thead>
<tr>
<th>Company</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clow/M&amp;H/Kennedy C508/106LW</td>
<td></td>
</tr>
<tr>
<td>Mueller</td>
<td>A - 2600 SERIES</td>
</tr>
<tr>
<td>AFC</td>
<td>SERIES 2100</td>
</tr>
</tbody>
</table>

2.2.1.2.4 Air Release Valves

This section includes air release valves, automatic air release valves, and automatic combination air release/vacuum release valves that are to be used for potable water mains, and IQ water mains as specified. Air release valves shall be located at system high points. Vacuum release valves shall be located as necessary to admit air into a system.

A. Automatic water air release valves shall be used on potable water mains. The automatic air release valves shall be constructed in accordance with District standard details.

B. Automatic Combination Air Release/Vacuum Release Valves shall be used for IQ water mains and shall include odor control and shall be constructed in accordance with District standard details.

C. Automatic air release valves and automatic combination air release/vacuum release valves shall have a high-density polyethylene enclosure blue in color for potable water mains and purple in color for IQ water mains.

D. The vacuum portion of the automatic combination air release/vacuum release valves shall be deactivated in all applications unless otherwise directed by the District.
2.2.2.1.2.4.1 Manufacture

A. Automatic air release valves and automatic combination air release/vacuum release valves shall be manufactured in accordance with AWWA C-512.

B. Type 316 stainless steel shall be used for all internal components of automatic air release valves and automatic combination air release/vacuum release valves, unless written approval is provided by the District.

C. All automatic air release valves and automatic combination air release/vacuum release valves shall be fusion bonded epoxy coated and shall be certified to NSF 61 for use in potable water.

2.2.2.1.2.4.2 Approved Products

A. All valves shall conform to AWWA standards and shall meet District standard details.

B. The following product(s) are approved:
   - Valmatic 15A - 15A.3 (Water)
   - Valmatic 200 SERIES (Water Combo)

2.2.2.1.2.5 Valve Box and Valve Box Cover

2.2.2.1.2.5.1 Manufacture

A. The valve box and cover shall be constructed of Grade 35 cast-iron in accordance with ASTM A48 and coated with bituminous material to a minimum thickness of 1.5 mil.

B. The valve box cover shall include a 3M read and write capable locator marker for the function of the valve.

C. Valve boxes are to be designed to prevent transmission of surface loads directly to the valve or piping.

D. The valve box cover shall meet the dimensions and marking requirements of the District standard details and include a three 3” round brass identification plate to be inserted into the concrete valve pad. The identification plate shall include the valve size, date of installation, and number of turns as shown on the brass identification plate used on the valve pad.
2.2.2.1.2.5.2 Approved Products

A. The following product(s) are approved:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROSELECT</td>
<td>PSVB461</td>
</tr>
<tr>
<td>EJ Company</td>
<td>8550</td>
</tr>
<tr>
<td>Sigma</td>
<td>VB262</td>
</tr>
<tr>
<td>Tyler/Union</td>
<td>32U</td>
</tr>
</tbody>
</table>

2.2.2.1.3 Main End Blow Off Assembly

The Contractor shall furnish and install main end blow off assemblies in the size and locations shown on the Contract Drawings. Each assembly shall consist of main end blow off assembly device, piping, tees, fittings, meter box, restraints and any other appurtenances necessary to install the unit complete in place at the depth specified on the Contract Drawings.

2.2.2.1.4 Automatic Flushing Assembly

The automatic flushing assembly shall meet the requirements of the District standard details or as determined by the District. The flushing device shall be a Kupferle Model 9400-WC, Hydro-Guard or approved equivalent. Where a sewer line is available the flushed water should have an option to be captured and diverted to the collection system with an approved air gap to prevent the possibility of a cross connection. All flushing activities that are proposed to be diverted to a sewer collection system shall require written approval from FDEP prior to implementation.

2.2.2.1.5 Meter Box Assembly

A. The Contractor shall furnish and install meter box assemblies by acceptable manufacturers as shown on the detail drawings in the locations shown on the Contract Drawings. The Contractor shall furnish and install all required materials except the meter. All water meters will be installed by the Utility Operator.

B. Potable water meter boxes and covers installation shall be rated as follows:

1. For low vehicle traffic areas, such as sidewalk, property line/easement, shall be at a minimum ANSI/SCTE Tier 8 rated potable water meter boxes and covers.

2. The following products are approved for Tier 8:

   a) GlasMasters model numbers:

   1) S151712F3N08-4 (box)
   2) S1517SN08-2 (lid)
b) DFW Plastics model numbers:

1) DFW1200TT-12-BODY (box)
2) DFW1200-1A-LID (lid)

c) Or District approved equal.

3. For medium vehicle traffic areas, such as residential driveways, roadways, and parking lots, shall be at a minimum ANSI/SCTE Tier 15 rated water meter boxes and covers.

4. For high vehicle traffic areas, such as county arterial roadways, state roads, commercial driveways, industrial parks, shall be at a minimum ANSI/SCTE Tier 22 rated water meter boxes and covers.

5. Water meter boxes and covers shall be color impregnated or painted based on the meter box and cover materials and be blue in color for potable water.

6. Water meter box covers shall be designed for an Automated Meter Reading (AMR) antenna. All water meter boxes shall be delivered with the water source and service access holes installed.

2.2.2.1.6 Marker Balls and Marker Tape

Potable water marker balls shall be 3M 4-inch marker ball model 1423XR/iD blue in color. Marker tape stripes shall be blue in color for potable water.

2.2.2.1.7 Fire Hydrants Assembly

This product specification covers post-type, dry-barrel fire hydrants with compression shutoff (opening against pressure) or gate shutoff. All products furnished shall conform to the latest revision of the American National Standards Institute and American Water Works Association C-502 Standard (ANSI/AWWA C502) and shall be UL/FM approved.

A. Each hydrant shall be designed for a minimum working pressure of 200 psig. All parts of the hydrant shall be designed to withstand without being functionally impaired or structurally damaged a hydrostatic test of not less than 400 psig or twice the rated working pressure, whichever is greater, with the hydrant completely assembled and pressurized as follows:

1. With the nozzle caps in place, the main valve open, the hydrant inlet capped, and the test pressure applied to the interior of the hydrant.

2. With the main valve closed, the hydrant inlet capped, and the test pressure applied at the hydrant inlet.
3. The design safety factor of the operating mechanism shall not be less than 5 and shall be based on the foot-pounds of torque required for the closing and opening of the hydrant at a working pressure of 200 psig.

B. Hydrants shall be functional and capable of being opened or closed without difficulty following an application of an operating torque of 200 lb-ft at the operating nut in the opening direction with the hydrant fully closed and the closing direction with the hydrant fully opened. The torque requirements apply only to hydrants of five-foot bury or less.

C. The fire hydrant shall have two hose nozzles and one pumper nozzle. The nominal inside diameter of the hose nozzle shall be 2 ½ inches. The nominal inside diameter for the pumper nozzle shall be four inches. The outlet-nozzle threads are to conform to the National Fire Protection Association (NFPA) 2003, Standard for Fire Hose Connections. The nominal diameter of the main valve opening shall be 5 ¼ inches. The hydrant shoe shall be provided with a six-inch mechanical joint connection to fit the connecting pipe.

D. The fire hydrant shall open left (counterclockwise). The fire hydrant shall have a non-rising stem. No more than one six (6) inch stem extension shall be provided if required to make the base of the fire hydrant grade level without prior written District approval.

E. The bonnet section shall have all bearing surfaces and stem threads sealed in a lubricant reservoir. If oil is used as a lubricant, the reservoir shall be designed to allow for easy filling through a fitting or plug. Where grease is used as a lubricant, the reservoir shall be sealed. The reservoir shall be adequately sealed with "O" rings.

F. The fire hydrant shall have a safety flange or breakaway flange at the ground line as stipulated in Section 3.1 General Design of ANSI/AWWA C-502 latest revision.

G. Parts that require lubrication and come into contact with water shall be lubricated with a nontoxic food grade lubricant that does not pose a health hazard to the public if consumed.

H. Fire hydrant nozzles shall have a cast iron weather caps with chain retainers.

I. Fire hydrants shall be painted with two (2) coats of paint above the finished grade or factory coated with electrode position (e-coat) epoxy primer and catalyzed with a two-part polyurethane top coating. Surface preparation and field painting shall be in accordance with Section 2.2.3.8. Color of hydrant shall be in accordance with Section 2.2.3.8.4.

J. Fire hydrants shall have the manufacturer’s name and the date of manufacture in raised one (1) inch letters cast into the barrel of the fire hydrant above the installed ground line.
2.2.3 K. All hydrant valves shall have a valve pad in accordance with the District valve specification requirements including the installation of the three (3) inch bronze disc with the valve size, date of installation, etc.

L. The following products are approved:

- Mueller
- Kennedy K81D
- AFC B84B
- Clow Medallion
- M & H 929

2.2.3 CONSTRUCTION

A. Prior to connection of new mains to existing stubs, the Utility Operator shall install a locking valve box cover on the existing tie-in valve to prevent unsupervised opening of the valve.

B. All potable pipe shall be installed with a minimum of thirty-six (36) inches of cover unless specifically designated on the Contract Drawings or so ordered by the Engineer with prior written approval from the District.

C. All open ends of pipe shall be covered sufficiently at the end of each work day and/or to prevent pipe from being exposed for long periods.

D. Any material rejected by the Engineer of Record shall be immediately removed from the job site or destroyed. Any pipe installed and subsequently removed shall not be reinstalled and shall be removed from the job site.

2.2.3.1 Direct Bury

A. Prior to laying pipe, the trench shall be clear of all stones, roots, debris, other organics, etc. The pipe shall be laid by snaking in the trench. Care should be taken to carefully lower the pipe, valves, and fittings into the trench as to prevent damage.

B. No pipe shall be laid in direct contact with cap rock. At a minimum, there shall be 3 inches of compacted suitable material between any pipe and cap rock.

C. Prior to joining pipe and fittings, the spigot end shall have a bevel and a stop mark on the outside diameter to indicate proper insertion depth and shall be smooth, free of cracks, fractures, or imperfections that could adversely affect the performance of the joint. Pipes to be installed with “compression ring” fittings, a bell ring lubricant of the type and quality as recommended by the pipe manufacturer shall be applied to the beveled portion of the spigot end. The pipe shall be laid with the manufacturer’s lettering visible from the top of the open trench. The amount of pipe or joint deflection shall not exceed seventy-five percent (75%) of the manufacturer’s recommended limit.
D. Open cutting of roads for trenching and direct bury of water mains shall not exceed eight feet (8’) in width. All efforts shall be made to minimize the width of the trench and in-turn, the amount of restoration.

E. All existing materials removed to facilitate the tunneling or deflecting of direct bury piping under or adjacent to an existing storm piping and/or structures shall be replaced by flowable fill. Prior to placing flowable fill the area between the direct bury piping and existing piping or structure shall be hollowed out to a defined cavity along the length of the direct bury piping. The Contractor is responsible for filling the cavity with flowable fill and replacing the flowable fill as necessary throughout the contract and warranty period should erosion occur.

F. Cutting pipe for inserting valves, fittings, or closure pieces shall be in a neat and workmanlike manner without damaging the pipe or lining and to leave a smooth end at right angles to the axes of the cut pipe. The cut end of the mechanical joint pipe shall be dressed to remove sharp edges or projections which may damage the rubber gasket. For push-on joints, the Contractor shall dress the pipe cut ends by beveling as recommended by the manufacturer.

2.2.3.2 Directional Bore of Material

A. Proper implements, tools, and facilities shall be provided and used by the Contractor for the safe and convenient execution of the work. The Contractor shall meet the jointing and cutting pipe direct bury potable water main piping requirements as they apply to the directional bore. A log of the bore depths shall be based on one foot intervals staking from the entry and exit locations and intermediate centerline. The vertical and horizontal location readings shall be plotted on a one inch (1”) equals twenty feet (20’) natural scale drawing which shall be provided to the District within 48 hours of completion of the bore.

B. For mains eight (8”) inches in size or smaller, the HDPE pipe shall have the same outside diameter as the connecting mains. For larger sizes, the HDPE pipe shall have the same size or larger inside diameter as the connecting mains unless otherwise noted on the plans; or if written approval is provided by the District.

C. The slurry may be recycled for reuse in additional hole opening operations if written approval is provided by the District or it shall be removed and disposed of at an approved dump site. No fluids shall be allowed to enter any unapproved areas or natural waterways.

D. For directional bores under any surface water (subaqueous) the drilling contractor must submit a ‘frac-out’ response plan for review and approval prior to starting the directional bore. During execution of all subaqueous directional bores, the drilling contractor must have at the site the necessary material, equipment, and manpower to properly respond to a ‘frac-out’ in accordance with the ‘frac-out’ response plan.
2.2.3.3 Moling

A. Moling shall be used to install smaller diameter potable water service connection pipe under road surfaces from the potable water main in the right-of-way. The moling process consists of punching a hole beneath the surface to be spanned, installing the casing (schedule 40 PVC pipe), and installing the polyethylene (PE) potable water service connection pipe. The casing shall be sized to allow the PE pipe to be installed with no chafing or damage.

B. To connect new construction potable water piping to an existing potable water stub-out of a different diameter, the contractor shall use District approved materials, unless a written deviation of equivalent material is approved prior to construction.

2.2.3.4 Marker Balls and Metallic Marker Tape

Contractor shall provide and install metallic marker tape and marker balls for all installed trenched pipe. For trenchless pipe installations, the Contractor shall provide and install marker balls. Metallic marker tape is not required on trenchless pipe installations. The tape shall be marked blue and laid 12 to 18 inches above the pipe and the marker balls placed directly on top of the pipe or fitting. For trenchless pipe installations, the marker balls shall be placed with a minimum of 18 inches of cover. The marker balls shall be installed at all changes of direction and fittings absent of any valve. For cul-de-sacs having continuous fused or roll piping with no in-line fittings, the balls shall be placed starting at the point of curvature of the cul-de-sac and every 50 linear feet to the end of the line. On straight runs of pipe, the balls shall be installed at every power pole. If power poles do not exist, the balls shall be placed every 250 feet from the nearest change of direction or fitting. At road and driveway crossings the marker balls shall be placed on each side of the road or driveway, two feet (2’) from the pavement or driveway edge, or other written approval by the District. On vertical deflections, the marker ball shall be placed on the top fitting only. The Contractor shall program all balls and provide a copy of the programmed data in each marker ball in either Microsoft Excel or Access electronic format to the District. The Contractor as-built drawings shall show the location of all marker balls.

2.2.3.5 Fittings

When tightening bolts, the Contractor shall bring the gland up toward the flange evenly while maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Tighten all nuts progressively a little at a time. DO NOT over stress bolts to compensate for poor alignment. If effective sealing is not attained at the maximum torque, disassemble the joint and reassemble again after cleaning. Fittings shall be installed in accordance with the manufacturer's printed instructions.

2.2.3.6 Valves

Handling, Storage, Protection and Delivery: Unloading, distribution, and storage of pipe and appurtenant materials on the job site shall be approved in writing by the District. All materials shall be handled carefully to prevent damage to protective coatings, linings, and joint fittings; to preclude contamination of interior areas; and to avoid jolting contact and dropping or dumping.
2.2.3.6.1 Valve Installation

A. All below ground valves in paved areas shall be installed with a 30” x 30” x 6” concrete valve pad including a brass identification tag, ductile iron riser, specified cap, with main designation, and extension if required, in accordance with District standard details.

B. Installation shall conform to manufacturer's recommendations.

C. The Contractor shall verify the existing utilities such as fittings and valves are restrained prior to the start of installation of the valve. If not restrained, the Contractor shall notify the Utility Operator in writing and shall restrain the existing utility per written approval by the District.

D. The Contractor shall carefully clean the valves flanged faces and threaded ends of all foreign material and inspect valves in open and closed positions. The Contractor shall notify the Utility Operator and not install the valves if the valves do not function properly for the intended purpose. After cleaning flanges, the Contractor shall insert the gasket and tighten the nuts progressively and uniformly. If flanges leak under pressure, the Contractor shall loosen the nuts, reseat or replace the gasket, retighten the nuts, and retest the joints.

E. Bolt holes of flanged valves shall straddle the centerline of the pipe run.

F. All above ground valves shall be prepped, primed, and finish painted in accordance with the installed assembly and DCS.

G. The operating nut on a valve or extension bar shall be set between eighteen (18) and thirty (30) inches.

H. All valves shall have a centering ring that sits below the operating nut of the valve and centers the valve in the middle of the valve box.

2.2.3.6.2 Valve Cap Color Coding Schedule

Valve caps shall be color coded per Section 2.2.3.8.4.

2.2.3.7 Fire Hydrants

A. Hydrant water pipes shall be installed to the depth and the locations shown on the Contract Engineering Drawings and the District standard details. Hydrants shall not be installed on water mains less than six (6) inches in diameter.

B. Four (4), each six (6) inch in diameter, bollards shall be installed to protect the hydrants in high vehicle traffic areas in accordance with the engineering drawings.
2.2.3.7.1 Installation Location

2.2.3.7.1.1 Right-of-Way:

A. All hydrants shall be installed in accordance with these specifications and as defined in the NFPA 24. Distances shall be measured by “hose lay” along the path of vehicle travel. Hydrants shall be installed one (1) foot inside the right-of-way on lot line between two (2) properties.

B. No fire hydrant shall be obscured from the adjacent roadway by plantings, wall, fence, or other form of visual screening. No visual screening shall be placed or allowed to spread to any point within eight (8) feet of the hydrant.

2.2.3.7.1.2 Hydrant Separation:

A. Mobile home parks, mobile home subdivisions, and recreational vehicle parks: fire hydrants shall be installed such that the distance between the hydrants does not exceed 800 feet as measured along the vehicular travel path. All hydrants shall be designed to deliver a minimum flow of 1,000 gallons per minute at 20 pounds per square inch residual pressure for a minimum of one (1) hour.

B. Single family residences except as defined in “a” above include single-family, duplex, and triplex units: fire hydrants shall be installed such that the distance between hydrants does not exceed 800 feet as measured along the vehicular travel path. All hydrants shall be designed to deliver a minimum flow of 1,000 gallons per minute and at 20 pounds per square inch residual pressure for a minimum of one (1) hour.

C. Industrial, commercial, apartment areas, and other high-value areas as defined but not limited to in NFPA Standard 1231: fire hydrants shall be installed such that the distance between the hydrants does not exceed 600 feet as measured along the vehicular travel path. All hydrants shall be designed to deliver a minimum flow of 1,250 gallons per minute at 20 pounds per square inch residual pressure for a minimum of one (1) hour.

D. Heavy manufacturing and heavy industrial areas as defined but not limited to NFPA Standard 1231: fire hydrants shall be installed such that the distance between hydrants does not exceed 600 feet as measured along the vehicular travel path. All hydrants shall be designed to deliver a minimum flow of 1,250 gallons per minute and at 20 pounds per square inch residual pressure for a minimum of one (1) hour.

2.2.3.8 Surface Preparation, Painting and Coating

The following section defines the furnishing of all labor, materials, equipment and incidentals required to perform all surface preparation and application of shop primers on ferrous metals, shop and field painting and/or coating, excluding stainless steels, as specified herein.
2.2.3.8.1 Work Included

The Contractor shall furnish all labor, materials, equipment, tools and all other associated appurtenances required to perform the surface preparation and application of shop primers all shop painting, field painting and coating as specified herein for the project.

A. The following items shall not be painted:

1. Stainless steels unless specifically noted otherwise.
2. Packing glands and other adjustable parts and name plates of mechanical equipment.
3. Painting shown in schedules may not provide the Contractor with complete indication of all painting Work.

B. All new and specifically identified existing surfaces and items except where the natural finish of the material is specified as a corrosion resistant material not requiring paint; or is specifically indicated in the Contract Documents as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint them the same as adjacent similar materials or areas.

2.2.3.8.2 Location

All exposed surfaces shall be painted in accordance with this specification and District standard details.

2.2.3.8.3 Materials

A. All painting materials shall be delivered to the mixing room in unbroken packages bearing the manufacturer's brand and name.

B. All painting materials shall be used without adulteration and mixed, thinned, and applied in strict accordance with manufacturer's directions for the applicable materials and surface.

C. Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with the finish coats to be used.

D. No paint containing lead shall be used.

E. Oil shall be pure boiled linseed oil.

F. Materials shall be in full compliance with the requirements of pertinent codes and fire regulations.

2.2.3.8.3.1 Approved products

A. All priming, painting and coating products shall be supplied by the following manufacturers:
B. The painting schedule shall be prepared based on each manufacturer’s recommendation for application. Specific products are listed below for particular applications:

1. New and Existing Ferrous Metals, Structural Steel (With or Without Sprayed Fireproofing), Miscellaneous Ferrous Metals, Exterior Surfaces of Valves, Exterior Surfaces of Ferrous Piping, and Exterior Surfaces of All Ferrous Metal (Both Exposed and to be Later Covered with Insulation); Non-submerged, Interior:
   a) Shop Primer: Minimum 67 percent volume solids, build, two component, cycloaliphatic amine-catalyzed epoxy or polyamido-amine epoxy coating; 250 grams per liter VOC, maximum, or approved functional equivalent.

   The following product(s) are approved:

   1) Series N69 Hi-Build Epoxoline (TCI);
   2) Carboguard 893 (TCC);
   3) Macropoxy HS Epoxy (SWC):

   One coat, 4.0 to 6.0 dry mils.

b) Field Primer and Touch-Up: Minimum 67 percent volume solids, high-build, two-component, Polyamidoamine-catalyzed epoxy; 250 grams per liter VOC, maximum, or approved functional equivalent.

   The following product(s) are approved:

   1) Series N69 Epoxoline II
   2) Carboguard 890 or 890 LT (TCC);
   3) Macropoxy 646 Epoxy (SWC)

   One coat, 4.0-6.0 dry mils.

   c) Finish: High-Gloss: Minimum 67 percent high build, two component, cycloaliphatic amine-catalyzed epoxy or polyamido-amine epoxy coating; 250 grams per liter VOC, maximum, or approved functional equivalent.
The following product(s) are approved:

1) Series N69 Hi-Build Epoxoline II
2) Carboguard 890 or 890 LT (TCC);
3) High Performance Epoxy B67-200 Series (SWC):

Horizontal Surfaces: One coat, 3.0 to 5.0 dry mils.

Vertical Surfaces: One coat, 3.0-5.0 dry mils.

C. New and Existing Ferrous Metals, Galvanized Metals and Non-Ferrous Metals and Exterior Surfaces of Piping; Submerged and Intermittently Submerged, including up to 4.0 feet above liquid surface; Certified per ANSI/NSF Standard 61; Low VOC Content, Interior:

1. Prime/Finish: Semi-Gloss: Minimum 100 percent solids, modified polyamine epoxy or flake filled epoxy; 8 grams per liter VOC, maximum, or approved functional equivalent.

The following product(s) are approved:

a) Series 22 Pota-Pox 100 (TCI);
b) Plastite 4500 S (TCC); One coat, 25 – 35 mils as desired.
c) Dura-Plate UHS NSF (SWC)

Two coats, 12.0-16.0 dry mils, per coat.

D. New and Existing Ferrous Metals, Non-Ferrous Metals, and Galvanized Metals, including Water Storage Tanks; Low VOC Content, Non-Submerged, Exterior:

1. Ferrous Metal Primer: Minimum 67 percent volume solids, build, two-component, cycloaliphatic amine-catalyzed epoxy coating; 250 grams per liter VOC, maximum, or approved functional equivalent.

The following product(s) are approved:

a) Series N69 Hi-Build Epoxoline (TCI);
b) Carboguard 890 or 890 LT (TCC);
c) Macropoxy 646 Epoxy (SWC)

One coat, 4.0 to 6.0 dry mils.

2. Ferrous Metal Touch-Up: For Low-temperature Curing Conditions: Minimum 80 percent solids, modified polyamido-amine or polyamine epoxy; 296 grams per liter VOC, maximum. For Warm-temperature Curing Conditions: Minimum 80 percent volume solids, modified
polyamido-amine or polyamine epoxy; 296 grams per liter VOC, maximum, or approved functional equivalent.

The following product(s) are approved:

a) For Low-temperature Curing Conditions:

1) Tnemec Series N69 with Tnemec Series 44-700 Epoxy Accelerator (TCI);
2) Carboguard 890 LT (TCC);
3) Macropoxy HS Epoxy (SWC)

One coat, 10.0 dry mils.

b) For Warm-temperature Curing Conditions:

1) Series N69 Epoxoline II (TCI);
2) Carboguard 890 (TCC);
3) Macropoxy HS Epoxy (SWC)

One coat, 3.0-5.0 dry mils.

3. Finish Gloss: Minimum 66 percent volume solids, two-component, waterborne acrylic polyurethane or aliphatic acrylic polyurethane coating; 297 grams per liter VOC, maximum, or approved functional equivalent.

The following product(s) are approved:

a) Series 1074 Endurashield (TCI);
b) Carbothane 134 or HG (TCC);
c) Acrolon 218 HS Polyurethane (SWC)

Two coats, 2.5-4.0 dry mils.

4. New and Existing Galvanized Metal, Non-Ferrous Metal, and Fiberglass; Nonsubmerged, Interior:

a) Primer: Minimum, 39 percent volume solids single-component, self-cross linking acrylic primer-sealer, 140 grams per liter VOC, maximum, or approved functional equivalent.

The following product(s) are approved:

1) Series N69 Epoxoline II(TCI);
2) Galoseal WB Wash Primer (TCC); 0.5 – 1.0 mils dry mils
3) Pro Cryl Universal Primer (SWC)
One coat, 2.0 to 4.0 dry mils.

b) Finish: Satin: Minimum, 41 percent volume solids, single component, self-cross linking acrylic; 208 grams per liter VOC, maximum, or approved functional equivalent.

The following product(s) are approved:

1) Series 1029 Enduratone
2) Carbocrylic 3359 (TCC);
3) DTM Acrylic Coating (SWC)

One coat, 2.0-3.0 dry mils.

5. New and Existing Pipe and Duct Insulation, Cloth, Paper and Canvas Jacketed; Non-submerged, Interior:

a) Primer: Minimum 38 percent volume solids single-component, self-cross linking acrylic primer-sealer; 159 grams per liter VOC, maximum, or approved functional equivalent.

The following product(s) are approved:

1) Series 6 Tneme-Cryl(TCI);
2) Sanitile 120 (TCC); 1 – 2 mils dft
3) DTM Acrylic Coating (SWC)

One coat, 2.0 to 3.0 dry mils.

b) Finish: Satin: Minimum 37 percent volume solids, single component, self-cross linking acrylic; 226 grams per liter VOC, maximum, or approved functional equivalent.

The following product(s) are approved:

1) Series 1029 Enduratone (TCI);
2) Carbocrylic 3359 (TCC);
3) Pro-Cryl Universal Primer (SWC)

One coat, 2.0 to 3.0 dry mils.

6. New and Existing PVC and CPVC Piping and Fiberglass Insulation Covering; Non-submerged, Interior:

a) Primer: Minimum 37 percent volume solids single-component, self-cross linking acrylic primer-sealer; 226 grams per liter VOC, maximum, or approved functional equivalent.
The following product(s) are approved:

1) Series 115 Uni-Bond DF (TCI);
2) Sanitile 120 @ 1 – 2 mils dry mils (TCC);
3) DTM Acrylic Coating (SWC)

One coat, 2.0 to 4.0 dry mils.

b) Finish: Satin: Minimum 37 percent volume solids, single component, self-cross linking acrylic; 226 grams per liter VOC, maximum, or approved functional equivalent.

The following product(s) are approved:

1) Series 1029 Enduratone (TCI);
2) Carbocrylic 3359 (TCC);
3) DTM Acrylic Primer/Finish (SWC)

One coat, 2.0 to 3.0 dry mils.

2.2.3.8.4 Color Coding for Pipes and Equipment

A. Guidelines:

1. The District reserves the right to select non-standard colors for paint systems specified within ability of paint manufacturer to produce such non-standard colors. Provide such colors at no additional expense to the District.

2. The color code establishes, defines, and assigns a definite color for each process system.

3. All elements originating from the equipment and/or supplying the equipment shall be painted between and up to, but not including, the fixed flanges nor the flexible conduit connections on the equipment.

4. Valves and fittings shall be painted in the color of the main body of the pipe.

5. Stainless steel components, bolts, washers, and nuts shall not be painted.

6. All pipes and equipment shall be “paint and color coding schedule” as described in this specification. Elements not listed on the schedule shall be assigned a color by the District and shall be treated as an integral part of the Contract.

7. All hanger saddles and pipe support floor stands shall be painted the same color and with the same paint as the pipe it supports unless made of stainless steel.

8. For equipment on roofs or exposed to view, such as on exterior building facades and in offices and lobbies, color shall be selected by the District.
B. Color Codes:

Unless otherwise specified, use the following color codes:

<table>
<thead>
<tr>
<th>Standard Colors</th>
<th>Color Designation*</th>
</tr>
</thead>
<tbody>
<tr>
<td>POTABLE WATER LINES</td>
<td>BLUE (PANTONE 287)</td>
</tr>
<tr>
<td>POTABLE WATER VALVE CAPS</td>
<td>BLUE (PANTONE 287)</td>
</tr>
<tr>
<td>FIRE LINES</td>
<td>ANSI SAFETY RED (PANTONE 485)</td>
</tr>
<tr>
<td>FIRE LINE VALVE CAPS</td>
<td>ANSI SAFETY RED (PANTONE 485)</td>
</tr>
<tr>
<td>WASTE WATER LINES</td>
<td>ANSI SAFETY GREEN (PANTONE 3415)</td>
</tr>
<tr>
<td>WASTE WATER VALVE CAPS</td>
<td>ANSI SAFETY GREEN (PANTONE 3415)</td>
</tr>
<tr>
<td>IQ WATER LINES</td>
<td>PURPLE (PANTONE 522C)</td>
</tr>
<tr>
<td>IQ WATER VALVE CAPS</td>
<td>PURPLE (PANTONE 522C)</td>
</tr>
<tr>
<td>FIRE HYDRANTS</td>
<td>ANSI SAFETY YELLOW (PANTONE 109)</td>
</tr>
<tr>
<td>FIRE HYDRANTS VALVE CAPS</td>
<td>ANSI SAFETY YELLOW (PANTONE 109)</td>
</tr>
<tr>
<td>FIRE HYDRANTS (IQ WATER)</td>
<td>PURPLE (PANTONE 522C)</td>
</tr>
<tr>
<td>FIRE HYDRANT VALVE CAPS (IQ WATE)</td>
<td>PURPLE (PANTONE 522C)</td>
</tr>
</tbody>
</table>

*Equivalent colors matching these colors are acceptable. Provide with Shop Drawing submittal direct color comparisons of color numbers available from manufacturer submitted.

2.2.3.8.5 Surface Preparation

A. Surface Preparation and Priming

1. All waste residues resulting from surface preparation and priming shall be handled in accordance with all applicable federal, state, and local regulations.

2. Non-submerged components scheduled for priming shall be blast cleaned in accordance with SSPC-SP-6, Commercial Grade, immediately prior to priming.

3. Submerged components scheduled for priming shall be sand blast cleaned in accordance with SSPC-SP-10.

4. Surfaces shall be dry and free of dust, oil, grease, and other foreign material before priming.

5. Field and shop prime shall be in accordance with approved manufacturer's recommendations.

6. All metal welds, blisters, etc., shall be ground and sanded smooth. All pits and dents shall be filled and all imperfections shall be corrected to provide a smooth surface for painting. All rust, loose scale, oil, tar, and asphalt bearing coatings, grease, and dirt shall be removed by use of approved solvents, wire brushing, grinding, or sanding.

7. All PVC pipe and other plastic matrix surfaces to be painted shall be lightly sanded and cleaned of residue before painting.
8. Galvanized surfaces shall have all oxidation and foreign material removed before painting by SSPC SP 1, Solvent Cleaning using an approved V.O.C. compliant method.

9. Surfaces required to support 24 mils (or more) of coating shall have a minimum Anchor Profile of 3.0 mils.

B. Non-Primed Surfaces

Approved coating shall be applied in accordance with manufacturer's recommendations.

C. Painted and Coated Surfaces

1. All surfaces to be painted and coated shall be prepared as follows and shall be dry and clean before painting:

   a) Painting and coating shall be in accordance with approved manufacturer's recommendations.

   b) Connection points of all surfaces for products shop painted shall be covered to retain a clean surface and allow for proper installation to adjoining materials and there after field painted as required.

   c) Valves and fittings shall be painted in the color of the main body of the pipe.

   d) Stainless steel components, bolts, washers, and nuts shall not be painted.

   e) All pipes and equipment shall be painted to meet the “paint and color coding schedule” as described in this specification. Elements not listed on the schedule shall be assigned a color by the District and shall be treated as an integral part of the contract.

   f) All hanger saddles and pipe support floor stands shall be painted the same color and with the same paint as the pipe it supports unless made of stainless steel.

D. Application

1. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint, until paint film is uniform finish, color, and appearance, particularly for intense Chroma primary colors. Ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a film thickness equivalent to that of flat surfaces.

2. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint before final installation of registers or grilles.
3. Paint backs of access panels and removable or hinged covers to match exposed surfaces.

4. Paint aluminum parts in contact with dissimilar materials with specified paint system.

5. Paint tops, bottoms, and side edges of doors the same as exterior surfaces.

6. Omit field-applied primer on metal surfaces that have been primed in the shop. Touch-up paint shop-primed coats and pre-finished items only when written approval is provided by the District using compatible primers and manufacturer’s recommended compatible field-applied finishes.

7. Welds shall be stripe-coated with intermediate or finish coat of paint after application of prime coat.

E. Surface Preparation and Priming, Painting, and Coating of Existing and Previously Painted or Coated Surfaces and Existing Non-Primed Surfaces

1. Surface preparation and priming, painting and coating of existing or previously painted or coated surfaces and existing non-primed surfaces shall be in accordance with approved manufacturer's recommendations.

2. The condition of existing paint or coating shall be determined by approved manufacturer and District written approval.

3. Existing paint or coating shall be scarified to produce an anchor profile to support the new coatings per approved manufacturer and the District.

4. The thickness of new coatings applied to old existing coatings shall be in accordance with approved manufacturer recommendations and with the District written approval.

5. During surface preparation of old coatings, bare steel surfaces shall be spot surface prepared and spot primed. Additionally, the edges of the surrounding coatings shall be feathered so that the new coatings may blend with the old coatings.

2.2.3.8.6 Workmanship

A. General

1. At the request of the District, samples of the finished work prepared in strict accordance with these Specifications shall be furnished and all painting shall be equal in quality to the approved samples. Finished areas shall be adequate for determining the quality of workmanship. Experimentation with color tints shall be furnished to the satisfaction of the District where standard chart colors are not satisfactory.
2. Protection of movable objects, equipment, fittings and accessories shall be provided throughout the painting operation. Remove all electric plates, surface hardware, etc., before painting, protect and replace when completed. Mask all machinery name plates and all machined parts not receiving a paint finish. Dripped or spattered paint shall be promptly removed. Lay drop cloths in all areas where painting is being done to adequately protect flooring and other work from all damage during the operation and until the finished job is accepted.

3. On metal surfaces, apply each coat of paint at the rate specified by the manufacturer to the minimum dry mil thickness required. If material has thickened or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. One gallon of paint as originally furnished by the manufacturer shall not cover a greater area when applied by spray gun than when applied un-thinned by brush. Deficiencies in film thickness shall be corrected by the application of an additional coat(s). On porous surfaces, it shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage rate or by applying additional coats of paint.

B. Protection of Property and Structures:

1. Protect property and structures adjacent to the Work from waste residues resulting from cleaning, surface preparation and paint application.

2. Use shrouding, vacuum blasting, or other approved methods for cleaning and surface preparation of exterior surfaces.

3. During blast cleaning and surface preparation of interior and exterior surfaces, control discharge of dust and grit, using shrouding, negative-pressure containment/dust collection systems, or other means to protect adjacent property and structures and prevent dust/grit from escaping. Similarly control removal and temporary storage of residues to protect adjacent property and structures.

4. For painting of exterior surfaces, use rollers, shrouding or other approved methods as required to protect adjacent property and structures from wind-blown paint residues.

5. Submit proposed procedures for cleaning, surface preparation and paint application describing methods for protecting adjacent property and structures from residues. Do not proceed with cleaning, surface preparation or painting until proposed procedures have obtained written approval by the District.

6. Tint undercoats to match color of finish coat of paint, but provide sufficient difference in shade of undercoats to distinguish each separate coat. Provide a code number to identify material tinted by manufacturer.

7. Non-Primed Surfaces Gears, bearings surfaces, and other similar surfaces shall not be painted and shall be given a heavy shop coat of grease or other suitable rust resistant coating. This coating shall be maintained by the contractor as
necessary to prevent corrosion during all periods of storage, erection, final acceptance test and acceptance by the District.

C. Field Priming

1. Steel members, metal castings, mechanical and electrical equipment, and other metals which are shop primed before delivery at the site will not require a prime coat on the job. All piping and other bare metals to be painted shall receive one coat of primer before exposure to the weather, and this prime coat shall be the first coat as specified in the painting schedule.

2. Equipment which is specified to receive a baked-on enamel finish or other factory finish shall not be field painted unless the finish has been damaged in transit or during installation. Surfaces that have been shop painted and have been damaged or where the shop coat or coats of paint have deteriorated shall be properly cleaned and retouched before any successive painting is done on them in the field. All such field painting shall match as nearly as possible the original finish.

3. Equipment shipped with a protective shop painting coat or coats shall be touched up to the satisfaction of the District with primers as recommended by the manufacturer of the finish paint.

D. Field Painting

1. All painting at the site shall be designated as field painting and shall be under the direct and complete control of the Contractor and only skilled painters and specialists, and where required, shall be used on the Work.

2. All paint shall be at room temperature before applying and no painting shall be done when the temperature is below 50°F, in dust-laden air, when rain is falling, or until all traces of moisture have completely disappeared from the surface to be painted.

3. Painting shall be continuous and shall be accomplished in an orderly manner to facilitate inspection. Materials subject to weather shall be primed coated as quickly as possible. Surfaces of exposed members that will be inaccessible after erection shall be cleaned and painted before erection.

4. All painting shall be performed by approved methods with number of coats modified as required to obtain the total dry film thickness specified. Spray painting shall be performed specifically by methods submitted and as approved by the District in writing.

5. All surfaces to be painted as well as the atmosphere in which painting is to be done shall be kept dry by heating and ventilation, if necessary, until each coat of paint has hardened. Any defective paint shall be scraped off and repainted in accordance with these specifications.
6. Before final acceptance of the Work, all damaged surfaces of paint shall be cleaned and repainted as approved by the District.

2.2.3.8.7 Cleanup

A. The premises shall be free from accumulation of waste material and rubbish caused by employees or work.

B. The Contractor shall remove all paint where it has been spilled, splashed, or spattered on all surfaces at the completion of all painting.

C. All clean up and disposal of waste materials from the surface preparation, painting and coating activities shall be disposed of, by the Contractor, in conformance with all laws, regulations and standard practices.

2.2.3.9 Storm Sewer Conflicts

Potable water mains that must be installed with less than 12 inches of clearance under storm sewer pipes or structures due to existing physical limitations that prohibit deflection or directional drilling, require construction of a bridging structure that is acceptable to the District to support the storm sewer prior to installation of the potable water main. The potable water main pipe section under the storm sewer pipe or structure shall be replaced with a single 20 linear foot stick of ductile iron pipe centered under the storm sewer pipe or structure. The ductile iron pipe shall be fully encased in an 8 mil. polyethylene sleeve in accordance with AWWA C-105, Method A. Polyethylene material shall conform to ASTM Standard Specification D 1248-68. The Contractor shall submit details of the proposed bridging structure and potable water main pipe installation to the District for review and approval prior to the start of construction at the conflict location.

2.2.3.10 Testing

All pressure and bacteriological tests shall be in accordance with AWWA Standards C-600, C-651, and C-652, latest revision. A pressure test shall be required for all installations of potable water mains and all appurtenances. Bacteriological testing shall be done for all installations of potable water mains except as noted hereafter. No bacteriological testing is required for certain limited pipe installations as approved by the District such as a new potable water service connection installation, the addition of a fire hydrant assembly to an existing potable water main, or the installation of limited additional piping and fittings such as a dive under new storm sewer to an existing potable water main. Upon completion of the installation of the potable water service connection, the service connection shall be flushed prior to connection to the on-site potable water service connection. The inside of the fire hydrant assembly or the inside of the new limited potable water main piping and fittings shall be wiped clean and shall be wiped with a chlorine soaked rag in compliance with FDEP regulations prior to installation. All such potable water mains and service connections and potable water mains taken out of service for inspection, alteration, or any other activity exposing the interior pipeline to the possibility of contamination shall be disinfected in compliance with FDEP regulations before they are placed in and/or returned to service.
2.2.3.10.1 Pressure Test

The Contractor shall notify the Utility Operator and the District 48 hours before testing commences. A representative from the Utility Operator and an Owner Representative shall be present at the time of testing. The Utility Operator hydrostatic test results form shall be filled out and submitted to the District as documentation of the testing results.

2.2.3.10.1.1 Pipe:

A. The Contractor shall hydrostatically pressure test all PVC, HDPE, and DI potable water mains in accordance with the latest revision of AWWA C-600 series as applicable. Oil filled gauges shall only be used for all pressure tests. The tests shall be at 150 psi for a period of two (2) hours. The allowable loss for one (1) hour shall be determined by the following formula:

\[
\text{Allowable Leakage} = \frac{D \times L \times PY}{133,200}
\]

Where:
- \(D\) = nominal diameter of the pipe in inches
- \(L\) = length of pipe in feet
- \(PY\) = square root of test pressure during the leakage test in pounds per square inch

B. Calibrated test equipment shall be on site to verify the loss of water during the testing period.

C. Pressure testing shall not exceed 1500 linear feet unless otherwise written approval is provided by the District.

2.2.3.10.1.2 Tapping Sleeves:

All potable water tapping sleeves shall be hydrostatically pressure tested in accordance with the latest revision of AWWA C-600. The test shall be conducted at 150 psi for a period of two (2) hours. No loss of pressure is allowed.

2.2.3.10.1.3 Procedures:

A. The Contractor shall notify the Utility Operator and the District 48 hours before testing commences.

B. A representative from the Utility Operator and an Owner Representative shall be present at the time of testing.

C. Each section of pipe between valves, between the tapping sleeve and the pipe, and/or the valve and the tapping sleeve shall be slowly filled with water from a safe source, and the specified test pressure shall be applied by means of a water pump in a manner satisfactory to the District. In the case of testing a pipe where valves do not exist, the Contractor shall plug the end of the line.
as approved by the District. The pump, pipe, and/or tapping sleeve connections, gauge, and all necessary apparatus shall be furnished by the Contractor and shall obtain written approval by the District prior to the conduct of any test. All necessary pipe taps for testing shall be made by the Contractor as approved by the District. The District may request testing of isolated portions between valves within the test section if a portion of that main has critical components such as multiple fittings at an extreme deflection. The Contractor shall be responsible to remove any pipe taps installed for this purpose upon completion of the test as approved by the District.

D. Pressure shall be measured from sample points, blow-off assemblies, water services, or fire and flush hydrants for potable water main pressure tests. The District shall witness all tapping sleeve and potable water main pressure tests.

2.2.3.10.2 Bacteriological Test

A. All disinfection shall be in accordance with AWWA C-651, the Ten States Recommended Standards for Water Works as incorporated by FDEP, other pertinent FDEP regulations, and the Florida Administrative Code unless other specific written approval by the District is issued. Materials and equipment for keeping the pipe clean (during construction), chlorinating the main, flushing/disposing of the heavily chlorinated water, bacteriological sampling and any re-disinfection, if required, shall be provided by the contractor. A 48 hour notice to the Utility Operator is required prior to any flushing activity. Chlorination shall be done by the continuous feed method using either a liquid chlorine gas-water mixture or a calcium or sodium hypochlorite solution. Direct feed chlorination or placing concentrated quantities of commercial disinfectants such as calcium hypochlorite granules in the line prior to filling with water shall not be used.

B. Chlorine residuals shall be tested using a color meter. NOTE: A color wheel shall not be used.

C. Sample points shall be located on the far side of all loops, at all dead ends, and not further than 1200 linear feet apart unless otherwise written approval is provided by the District. Samples shall be collected from sample points, blow-off assemblies, or water services. Fire hydrants or flushing devises shall not be used as bacteriological sample points. Test samples shall be collected and transported by certified laboratory personnel. The Utility Operator shall witness the collection of all samples and shall be notified 48 hours prior to sample collection.

2.2.3.10.3 Hydrant Testing

2.2.3.10.3.1 Pressure and bacteriological tests:

Pressure and bacteriological tests shall be conducted for all installations of fire hydrants as specified above. These tests shall be conducted as part of the water main. The hydrant valve shall remain open as part of the pressure testing.
2.2.3.10.3.2 Installation with a wet tap on an existing water main:

Pressure and bacteriological tests shall be conducted for all installations of fire hydrants as specified in Section 2.2.3.10. The hydrant gate valve shall remain open as part of the pressure testing.

2.2.3.10.3.3 Water Pressure Classification (If Required)

A. The Contractor shall request from the Utility Operator a fire flow test on individual hydrants to determine the class of the hydrant and paint the tops and nozzle caps in the colors as noted below.

B. The hydrants shall be classified in accordance with their rated capacities at 20 psi (1.4 bar) residual pressure or other designated value and the tops, and nozzle caps shall be painted with two (2) coats of the following capacity-indicating color scheme.

<table>
<thead>
<tr>
<th>Class</th>
<th>Color</th>
<th>Rated Capacity (gpm)</th>
<th>Rated Capacity (L/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>Light Blue</td>
<td>1500</td>
<td>5680 or greater</td>
</tr>
<tr>
<td>A</td>
<td>Green</td>
<td>1000 to 1499</td>
<td>3785 to 5675</td>
</tr>
<tr>
<td>B</td>
<td>Orange</td>
<td>500 to 999</td>
<td>1900 to 3780</td>
</tr>
<tr>
<td>C</td>
<td>Red</td>
<td>Less than 500</td>
<td>1900</td>
</tr>
</tbody>
</table>

2.2.3.10.4 Backfilling

A. Excavated material shall be freed of large clods or stones prior to backfilling. Material shall be carefully deposited in layers not to exceed 12 inches and thoroughly and carefully rammed until enough fill has been placed to provide a cover of not less than two feet above the pipe. The remainder of the backfill material may then be placed and should be moistened and tamped to insure proper compaction.

B. Backfill material and pipe shall be brought to the approximate same temperature before backfilling. This can be obtained by either running water through it or by backfilling in the early morning when the pipe and the ground are at an approximate equal temperature. Backfill shall not be placed over any plastic pipe while in a heated state.

C. In the case of improperly filled trenches or settling, the trenches shall be refilled, compacted, smoothed, and made to conform to the surface of the ground. In areas that are to be repaved, such as roadways, backfilling shall be completed as specified above except that the entire fill above pipe shall be deposited in layers not to exceed 12 inches in thickness, moistened and compacted to 98% of maximum density as determined by AASHTO T-180 so that upon completion of backfilling, re-pavement may commence immediately.
2.2.3.10.5 Plumbing Code

Plumbing Code for the State of Florida, local authorities, and manufacturers’ recommendations shall be adhered to as they relate to all piping and fittings. Where these Specifications exceed the requirements of code or manufacturer, these Specifications shall be followed. All piping shall be installed in a strong, neat, and workmanlike manner subject to the restrictions indicated.

2.2.3.10.6 Close Out

Prior to placing project into service, permittee shall submit, at a minimum, everything required under Section 2.1.5.2 As-Built Requirements and the following to the District for records and approval for operation:

A. Certified record drawings

B. Letter of clearance issued by the Florida Department of Environmental Protection
2.3 NON-POTABLE WATER DISTRIBUTION

The following specifications are intended for the design, selection of materials, and construction of non-potable water distribution systems. Non-potable water distribution systems, if applicable, shall meet the requirements of the Florida Department of Environmental Protection (FDEP) permit and all other governing bodies.

The District reserves the right to oversize any extension which may provide a regional benefit, and will pay for such oversizing based on additional cost beyond that necessary to serve only the subject development. The District will pay an established unit amount based upon the pipe size of a facility multiplied by the length of that facility. The established unit amount shall be determined by the District based on the difference in cost between that line size required by the development and the District’s study of current construction costs. The District will pay the Property Owner for the cost of the District’s share of oversized mains and this payment will be in the form of credit. The District also reserves the right to limit the amount of its participation in the cost of oversizing, depending on current economic conditions.

2.3.1 SYSTEM DESIGN

Non-potable water distribution systems shall be designed by a Florida Registered Professional Engineer (Engineer of Record) and constructed in accordance with the design and installation requirements as specified by the DCS, the Utility Operator, the Florida Department of Environmental Protection (FDEP), the Florida Department of Health (DOH), the Florida Department of Transportation (FDOT) and any other relevant state and local regulatory agencies as well as with the requirements established by the District as amended from time to time.

Non-potable water distribution systems shall be looped systems whenever possible for optimal system performance. Non-potable water mains providing fire flow shall be a minimum of six inches in diameter.

2.3.1.1 Flow Demands:

A. The District does not guarantee flow, fire flows, or pressure.

B. Flow demands for design shall be calculated based on full development as known or projected. Irrigation flows shall be calculated based on an average daily flow of 3,930.5 gpd/acre.

C. If the system is proposed to provide fire flow, the system shall be designed to meet minimum fire flow requirements of 1,000 gpm for residential units and 1,250 gpm for commercial units.

2.3.1.2 System Size Computation

All design data and reports shall be signed and sealed by a Professional Engineer registered in the state of Florida and submitted to the District showing any adverse effect the design may have on the existing utility system and is subject to review and approval by the District.
A. The minimum design for non-potable water distribution systems shall provide for 100% of the average daily flow plus the required fire flow.

B. System shall be modeled based on a source pressure of 40 psi serving the project or based on a fire flow test of existing source system, whichever is lower. The allowable minimum service pressure under such design conditions shall be 20 psi.

C. Velocity in non-potable water mains must meet the following conditions:

1. Velocity shall not exceed ten (10) fps during average day flow + required fire flow.
2. Head loss shall not exceed 10 feet/1000 feet.

D. Design computations shall be done by Bentley WaterCAD V8i (or newer) or another model with written District approval, if done using modeling software.

1. Pipe sizes shall be input to the model as the nominal diameter.
2. Pipe friction losses shall be modeled using the Hazen Williams equation with a pipe roughness factor “C” of 130.
3. Losses through master meters or other appurtenances shall be accounted for in the design.

2.3.1.3 Location and depth

A. The location of the non-potable water main shall conform to the alignment of mains, valves, and hydrants detail found in the standard details.

B. Main separations shall conform to the main separation detail found in the standard details.

C. Non-potable water mains shall have a minimum of 36 inches of cover above the top of main.

D. All water mains shall be placed within the right-of-way.

E. Under no circumstances shall utility mains be located under buildings or other infrastructure that limits maintenance accessibility.

2.3.2 SCOPE OF WORK

2.3.2.1 General

The work to be performed under this Section consists of furnishing all labor, materials, equipment, tools and other associated appurtenances required for the complete installation of all pipe, fittings, valves, valve boxes, and fire hydrants necessary for a complete and workable unit as detailed in the Contract Drawings and further described in these Specifications.

Piping and other material and equipment shall be of the size, type, and number shown on the Contract Drawings and/or specified in these Specifications. Items described in these Specifications and not included on the Contract Drawings shall be disregarded. All pipe shall
bear the class pressure rating and the DR number on each section of pipe and shall be solid-wall purple pipe unless otherwise specified.

2.3.2.2 Materials
2.3.2.2.1 Pipe
2.3.2.2.1.1 Polyvinyl Chloride (PVC) Pressure Pipe and Fittings

The materials used shall be new and conform to the requirements for class, kind, size, and material as described in these Specifications and shown on the Contract Drawings. Plastic pipe shall be manufactured from virgin PVC compound and the manufacturer shall insure all quality control test and AWWA requirements are complied with during the production of PVC pipe.

PVC pipe joints shall be the bell and spigot type using rubber gasket push-on type joints. Rubber gaskets shall be molded to a circular form to the proper cross section and shall consist of a vulcanized high grade elastomeric compound conforming to ASTM D-1869 and AWWA C-900 elastomeric seals for joining plastic pipe.

All ductile iron fittings shall meet the requirements of AWWA Specification C-153 and at a minimum have the same pressure rating of the connecting pipes. All ductile iron fittings shall be cement mortar or fusion bonded epoxy coated. Exposed fasteners shall be type 316 stainless steel and all buried fasteners shall be “Cor-Ten” steel or “Cor-blue” coated.

All pipe shall be solid-wall purple pipe and adhere to the requirements listed below:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2“ and Over</td>
<td>No solvent weld joints allowed</td>
</tr>
<tr>
<td>Less than 3”</td>
<td>ASTM D2241, SDR-21 with a pressure rating of 200 psi</td>
</tr>
<tr>
<td>Distribution Piping (3”-12”)</td>
<td>AWWA C900, DR-25</td>
</tr>
<tr>
<td>Distribution Piping (14”-36”)</td>
<td>AWWA-C905, DR-25</td>
</tr>
<tr>
<td>Distribution Piping providing fire flow (6”-12”)</td>
<td>AWWA C900, Class 150, DR-18</td>
</tr>
<tr>
<td>Distribution Piping providing fire flow (&gt;12”)</td>
<td>AWWA C905, Class 150, DR-18</td>
</tr>
<tr>
<td>Dedicated Fire lines servicing building structure sprinkler systems</td>
<td>AWWA-C900 or C904, DR-14 (Installed by a Contractor licensed in the State of Florida to install fire lines)</td>
</tr>
</tbody>
</table>

2.3.2.2.1.2 High Density Polyethylene (HDPE) Pipe and Fittings

A. High Density Polyethylene (HDPE) pipe shall meet the requirements of AWWA C-906 for polyethylene pressure pipe and fittings and for PE-3408 SDR 11. HDPE pipe shall meet ASTM D-3350 cell classification of 345434C. Permanent identification of the pipe shall be provided by co-extruding purple longitudinal stripes into the pipe’s outside surface for non-potable water. All polyethylene piping shall have ductile iron pipe nominal outside diameters.
B. Individual sections of HDPE piping shall be joined together by thermal butt-fusion to make a continuous section of pipe as recommended by the pipe manufacturer. Bends in HDPE pipe shall not be within ten (10) pipe diameters from any fitting or valve. The minimum radius of curvature shall be thirty (30) pipe diameters and bending shall not cause kinking. HDPE piping shall not be joined by solvent cements, adhesive or threaded type connections.

C. The color marking stripes shall be aligned during the fusing process and the pipe shall be pulled through the bore to allow identification of the type of system utilizing the HDPE pipe.

D. All fittings and sleeves used with high density polyethylene (HDPE) pipe shall be cement mortar or fusion bonded epoxy coated ductile iron with mechanical joints rated to 350 psi and conforming to AWWA C-153 and C-111. All MJ fitting connections to polyethylene pipe shall be restrained with Mega-Lug restrainers. The HDPE pipe shall be reinforced on the ends using stainless steel wedge internal stiffeners.

E. The mechanical connection to MJ fittings and sleeves shall use mechanical restraints that meet specification requirements. Size-on-size mechanical connection to PVC or DI pipe shall be by compact ductile iron solid sleeves with Mega-Lug restrainers.

F. No electro fusion fittings shall be used with HDPE unless specific written approval is provided by the District.

G. HDPE molded butt fittings and couplings for non-standard fittings and couplings shall require special written approval from the District for installation.

2.3.2.2.1.3 Polyethylene (PE) Pipe and Fittings for Service Connections

A. Polyethylene water service pipe shall be used for single and double lot services of two inches or less in diameter. The pipe shall meet AWWA C-901, ASTM D-3350 cell classification of 334434C and be permanently marked with the type/size/use of the pipe. PE pipe two and one half inches (2 ½”) or three inches (3”) shall meet the same requirements as mentioned above and shall only be permitted by specific written approval by the District. The minimum radius of curvature shall be thirty (30) pipe diameters and bending shall not cause kinking. The non-potable water pipe shall be purple in color. Inspect pipe for defects, damage, or imperfections prior to installation. All PE pipe and tubing shall conform to all applicable requirements in the latest revision of the following standards unless otherwise specified:

<table>
<thead>
<tr>
<th>Organization</th>
<th>Reference Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWWA</td>
<td>C-901</td>
<td>Standard Specification for Polyethylene (PE) Pressure Pipe, Tubing and Fittings, ½” through 3” for Water</td>
</tr>
<tr>
<td>ASTM</td>
<td>D1248</td>
<td>Standard Specification for Polyethylene Molding and Extrusion Materials</td>
</tr>
</tbody>
</table>
B. All coupling fittings shall meet or exceed the maximum design pressure requirements of the piping system and shall be permitted as approved by the Utility Operator. The following products are approved:

1. Mueller INSTA-TITE
2. A.Y. McDonald
3. Ford ULTRA-TITE
4. Hydrosert Polyethylene Water Fittings as manufactured by Elster

2.3.2.1.4 Ductile Iron Pipe

A. The ductile iron (DI) pipe covered by this Specification shall be the push-on joint type or mechanical joint type, centrifugally cast to conform to all requirements of AWWA Specifications C-151 and C-153, latest revisions. The maximum allowable deflection shall not exceed two percent (2%) of the pipe’s diameter. Ductile iron pipe will be fully encased in an 8 mil polyethylene sleeve, in accordance with AWWA C-105, Method A. The pipe and the polyethylene sleeve shall be color coded purple for Irrigation Quality (IQ) water by a means acceptable to the District. All pipes shall have a cement mortar or fusion bonded epoxy coating in accordance with the AWWA Specifications, latest revision and shall be color coded purple by a means acceptable to the District.

B. Polyethylene material shall conform to ASTM Standard Specification D1248-68, latest revision. All ductile iron piping shall be marked “DUCTILE IRON” in large letters and have the nominal wall thickness marked on each piece of pipe and installed so that the markings can be read from the top of the trench.

C. Minimum thickness of ductile iron pipe shall be as follows:

<table>
<thead>
<tr>
<th>Table 3 Minimum Thickness of Ductile Iron Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Diameter</td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>3”-12” Ductile Iron Pipe</td>
</tr>
<tr>
<td>14”-42” Ductile Iron Pipe</td>
</tr>
</tbody>
</table>

D. Rubber gasket joints shall be in accordance with AWWA Specification C111 latest revision.

E. All fittings shall be in accordance with AWWA Specification C-153 latest revision and have the same pressure rating of the connecting pipe. All ductile iron fittings shall be cement mortar or fusion bonded epoxy coated. All exposed fasteners such as bolts, nuts, washers, and threaded rod shall be type 316 stainless steel. All buried fasteners such as bolts, nuts, washers, and threaded rod shall be “Cor-Ten” steel or “Cor-blue” coated steel. Mechanical joint bolts shall not protrude more than ½ inch through the nut after joints are assembled. All stainless steel fasteners threads shall be coated with an anti-seize compound as approved by the District. Each length of pipe shall be clearly marked with the pressure rating, metal thickness class, net weight of pipe without lining, length of pipe, and manufacturer name.
2.3.2.2.1.5 Service Connections

Approved products are listed below for each category. Other products shall not be used until a thorough evaluation is completed by the District to determine if the same standards are met. The contractor shall submit to the District all documentation necessary to complete this thorough evaluation. Final approval by the District is required in writing to confirm acceptability. The following products shall conform to AWWA standards and shall meet District standard details.

A. Corporation Stops

1. Mueller H15024 ¾” or 1”
2. Mueller H10045 ¾” to 2”
3. Mueller H10046 1-1/2” to 2”
4. Mueller H15014 1-1/2” or 2”
5. Mueller H15015 1-1/2” or 2”
6. Ford F1100-X

B. Curb Stops

1. Mueller B25170
2. Ford B13-332W
3. Ford B53-232W
4. Ford B41-XXX

C. Service Saddles

Service saddles for HDPE pipe include fusion bonded HDPE saddles as per AWWA.

1. Ford FC202
2. A.Y. McDonald 4855A
3. Cascade CSC2
4. Power Seal 3417DI
5. A.Y. McDonald 4835A
6. Romac 202NS

D. U Branch

1. Mueller H15365

E. Backflow Prevention Devices
1. Reduced Pressure Principle (RPZ):
   a. Wilkins 975 XL Series
   b. Wilkins 375 OSY Series
   c. Ames 4000 B Series
   d. Watts 009 Series
   e. Watts 919 Series
   f. Watts 957 Series
   g. Combraco 40-200 Series

2. Double Check Valve:
   a. Wilkins 950 Series
   b. Wilkins 350 DA OSY Series

3. Double Detector Check Assembly:
   a. Ames 3000SS Series
   b. Watts 757 DCDA Series
   c. Combraco 40-600 Series
   d. Wilkins 450 (N-Shape) DCDA

4. Pressure Vacuum Breaker:
   a. Wilkins Model 420
   b. Wilkins Model 720A
   c. Watts 800M4QT

2.3.2.2.2 Valves

Refer to Potable Water Section 2.2.2.1.2 Valves for valve material specifications.

2.3.2.2.3 Pressure Sustaining and Check Valve for Pond Discharge

   A. The valve shall be designed to act as a normally closed back pressure sustaining and check valve. It shall have a normally closed pressure sustaining pilot designed to stay open as and fill the pond as long as upstream pressure is higher than the spring setting on the pilot. This sustaining valve shall modulate to maintain a minimum of 30-80psi on the upstream feed system. It shall stay open as long as pressure is above this setting to protect the upstream system. The sustaining valve shall have 20-105psi adjustable back pressure adjustment ranges. This valve also shall act as a check valve to prevent reverse flow.

   B. The main valve shall be a 100-01KO full ported or 100-20KO reduced ported main valve. It shall be a flanged, diaphragm actuated main valve. The main valve shall be ductile iron and have 316 stainless steel anti-cavitation trim internals. The valve shall have a one piece stainless steel seat with radial slots. The valve shall also have a disc guide that has angular radial slots. It shall break the pressure three times through the valve seat to dissipate any cavitation damage. 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 150ansi flanged ends 250psi working pressures. The CRL60 sustaining pilot shall have a 20-105 psi spring range. There shall be pilot isolation valves installed. There shall be a 0-100psi gauge mounted on the main valve inlet and outlet. The pilot system shall have an X43 “Y” strainer. There shall be an X101 valve position indicator for visual indication of valve position. The rubber parts shall be BUNA-N. There shall also be opening and closing speed controls (CV Speed Control).

C. The manufacturer shall provide a direct factory employee for startup and training.

D. The manufacturer shall warranty the valve for three (3) years from date of shipment.

E. The valve shall be a model 50G-90BCDPSVY KC D.S. SSB as manufactured by Cla-Val Co. Newport Beach, Ca.

2.3.2.2.4 Float Control and Pressure Sustaining Valve for Pond Discharge

A. The pond feed level shutoff control valve shall be installed at the end of the fill line and open when the lake level drops by means of a float actuator. The valve shall close off when the pond level is at high water level. When open and filling, the valve shall limit flow to 1000gpm by throttling on back pressure. The valve shall be completely hydraulic with an on/off remote mounted float control and a pressure sustaining CRL pilot. The contractor shall supply two feed lines from the valve to the float and then from the float back to the auxiliary valve in the pilot system.

B. The main valve shall be ductile iron and have 316 stainless steel anti-cavitation trim. It will have 150ansi flanged ends rated to 250psi working pressure. The main valve shall be diaphragm actuated and consist of three major components: the body, with seat installed, the diaphragm assembly and the cover with cover bearing. The diaphragm shall be the seal between the cover chamber and the flow through the main valve. It shall fit tightly around the main valve stainless steel stem. The diaphragm assembly shall be fully guided throughout its entire stroke, by a bearing in the main valve seat and a bearing in the cover. The 316 stainless steel anti-cavitation trim shall consist of two components. The parts shall consist of a 316ss seat with radial slots and the disc guide, which has angular radial slots. It shall break the pressure three times through the main valve body. The main valve shall have a fusion bonded epoxy coating on all ferrous metal surfaces. The main valve shall be a packless design with no o-rings or packing glands anywhere within the main valve. Snap ring seat rings are not permitted. The main valve cover shall have a locating lip to ensure proper alignment. There shall be no pinned covers for alignment.

C. The pilot control system shall have two pilot controls. The CF1-C1 float control shall monitor level and open the valve as the lake level drops. The CF1-C1 float control shall have a 4’ stainless steel float rod and a stainless steel float. When open, the CRL back pressure control shall modulate the valve to limit the flow. The back pressure adjustment range shall be 20-105. The pilot system shall also have opening and closing speed controls. The pilot system shall have an X101 visual valve position indicator. Contractor shall install a minimum 8” diameter stilling well around the float control to protect the float control from damage created by the turbulence. The pilot control system shall be stainless steel.

D. The manufacturer shall warranty the valve for three years from date of shipment.
E. The level control valve shall be an 8” 124-14BCPSYKCKO D.S. SSB as manufactured by Cla-Val Co. Newport Beach, CA.

2.3.2.5 Main End Blow Off Assembly

The Contractor shall furnish and install main end blow off assemblies in the size and locations shown on the Contract Drawings. Each assembly shall consist of main end blow off assembly device, piping, tees, fittings, meter box, restraints and any other appurtenances necessary to install the unit complete in place at the depth specified on the Contract Drawings.

2.3.2.6 Meter Box Assembly

A. The Contractor shall furnish and install meter box assemblies by acceptable manufacturers as shown on the detail drawings in the locations shown on the Contract Drawings. The Contractor shall furnish and install all required materials except the meter. All water meters will be installed by the Owner.

B. IQ water meter boxes and covers installation shall be rated as follow:

1. For low vehicle traffic areas, such as side walk, property line/easement shall be at a minimum ANSI/SCTE Tier 8 rated IQ water meter boxes and covers.

2. The following products are approved for Tier 8:

   a. GlasMasters model numbers:
      
      1) S151712F3N08-2 (box)
      2) S1517RN08-2 (lid)

   b. DFW Plastics model numbers:
      
      3) DFW1200TT-12-BODY (box)
      4) DFW1200-1A-LID (lid)

   c. Or District approved equal.

3. For medium vehicle traffic areas, such as residential driveways, roadways, and parking lots shall be at a minimum ANSI/SCTE Tier 15 rated water meter boxes and covers.

4. For high vehicle traffic areas, such as county arterial roadways, state roads, commercial driveways, industrial parks shall be at a minimum ANSI/SCTE Tier 22 rated water meter boxes and covers.

5. Water meter boxes and covers shall be color impregnated or painted based on the meter box and cover materials and be purple in color for IQ water

6. Water meter box covers shall be designed for an Automatic Meter Reading (AMR) antenna. All water meter boxes shall be delivered with the water source and service access holes installed.
2.3.2.7 Marker Balls and Marker Tape

Non-potable water marker balls shall be 3M 4-inch marker ball model 1428XR/ID purple in color. Marker tape stripes shall be purple in color for non-potable water.

2.3.2.8 Fire Hydrants

Refer to Potable Water Section 2.2.2.1.7 Fire Hydrants Assembly for fire hydrant material specifications.

2.3.3 CONSTRUCTION

2.3.3.1 General

A. Prior to connection of new mains to existing stubs, the District shall install a locking valve box cover on the existing tie-in valve to prevent unsupervised opening of the valve.

B. All non-potable pipe shall be installed with a minimum of thirty-six inches (36”) of cover unless specifically designated on the Contract Drawings or so ordered by the Engineer with prior written approval from the District.

C. All utility main separation shall conform to the main separation detail in the standard details.

D. All open ends of pipe shall be covered sufficiently at the end of each work day and/or when the pipe will be exposed for long periods.

E. Any material rejected by the Engineer shall be immediately removed from the job site or destroyed. Any pipe installed and subsequently removed shall not be reinstalled and shall be removed from the job site.

2.3.3.2 Direct Bury

A. Prior to laying pipe, the trench shall be clear of all stones, roots, debris, other organics, etc. The pipe shall be laid by snaking in the trench. Care should be taken to carefully lower the pipe, valves, and fittings into the trench as to prevent damage.

B. No pipe shall be laid in direct contact with cap rock. At a minimum, there shall be 3 inches of compacted suitable material between any pipe and cap rock.

C. Prior to joining pipe and fittings, the spigot end shall have a bevel and a stop mark on the outside diameter to indicate proper insertion depth and shall be smooth, free of cracks, fractures, or imperfections that could adversely affect the performance of the joint. Pipes to be installed with “compression ring” fittings, a bell ring lubricant of the type and quality as recommended by the pipe manufacturer shall be applied to the beveled portion of the spigot end. The pipe shall be laid with the manufacturer’s lettering visible from the top of the open trench. The amount of pipe or joint deflection shall not exceed seventy-five percent (75%) of the manufacturer’s recommended limit.

D. Open cutting of roads for trenching and direct bury of water mains shall not exceed eight feet (8’) in width. All efforts shall be made to minimize the width of the trench and in-turn, the amount of restoration.
E. All existing materials removed to facilitate the tunneling or deflecting of direct bury piping under or adjacent to existing storm piping and/or structures shall be replaced by flowable fill. Prior to placing flowable fill the area between the direct bury piping and existing piping or structure shall be hollowed out to a defined cavity along the length of the direct bury piping. The Contractor is responsible for filling the cavity with flowable fill and replacing the flowable fill as necessary throughout the contract and warranty period should erosion occur.

F. Cutting pipe for inserting valves, fittings, or closure pieces shall be in a neat and workmanlike manner without damaging the pipe or lining and to leave a smooth end at right angles to the axes of the cut pipe. The cut end of the mechanical joint pipe shall be dressed to remove sharp edges or projections which may damage the rubber gasket. For push-on joints, the Contractor shall dress the pipe cut ends by beveling as recommended by the manufacturer.

2.3.3.3 Directional Bore of Material

A. Proper implements, tools, and facilities shall be provided and used by the Contractor for the safe and convenient execution of the work. The Contractor shall meet the jointing and cutting pipe direct bury IQ water main piping requirements as they apply to the directional bore. A log of the bore depths shall be based on one foot intervals staking from the entry and exit locations and intermediate centerline. The vertical and horizontal location readings shall be plotted on a one inch (1”) equals twenty feet (20’) natural scale drawing which shall be provided to the District within 48 hours of completion of the bore.

B. For mains eight (8”) inches in size or smaller, the HDPE pipe shall have the same outside diameter as the connecting mains. For larger sizes, the HDPE pipe shall have the same size or larger inside diameter as the connecting mains unless otherwise noted on the plans; or as approved by the District in writing.

C. The slurry may be recycled for reuse in additional hole opening operations if written approval is provided by the District or it shall be removed and disposed of at an approved dump site. No fluids shall be allowed to enter any unapproved areas or natural waterways.

D. For directional bores under any surface water (subaqueous) the drilling contractor must submit a ‘frac-out’ response plan for review and approval prior to starting the directional bore. During execution of all subaqueous directional bores, the drilling contractor must have at the site the necessary material, equipment, and manpower to properly respond to a ‘frac-out’ in accordance with the ‘frac-out’ response plan.

2.3.3.4 Moling

A. Moling shall be used to install smaller diameter IQ water service connection pipe under road surfaces from the IQ water main in the right-of-way. The moling process consists of punching a hole beneath the surface to be spanned, installing the casing (schedule 40 PVC pipe), and installing the polyethylene (PE) IQ water service connection pipe. The casing shall be sized to allow the PE pipe to be installed with no chafing or damage.
B. To connect new construction IQ water piping to an existing IQ water stub-out of a different diameter, the Contractor shall use District approved materials.

2.3.3.5 Marker Balls and Metallic Marker Tape

A. Contractor shall provide and install metallic marker tape and marker balls for all installed trenched pipe. For trenchless pipe installations, the Contractor shall provide and install marker balls. Metallic marker tape is not required on trenchless pipe installations. The tape shall be marked purple and laid 12 to 18 inches above the pipe and the marker balls placed directly on top of the pipe or fitting. For trenchless pipe installations, the marker balls shall be placed with a minimum of 18 inches of cover. The marker balls shall be installed at all changes of direction and fittings absent of any valve. For cul-de-sacs having continuous fused or roll piping with no in-line fittings, the balls shall be placed starting at the point of curvature of the cul-de-sac and every 50-linear feet to the end of the line. On straight runs of pipe, the balls shall be installed at every power pole. If power poles do not exist, the balls shall be placed every 250 feet from the nearest change of direction or fitting. At road and driveway crossings the marker balls shall be placed on each side of the road or driveway, two feet from the pavement or driveway edge, or as otherwise approved by the District in writing. On vertical deflections, the marker ball shall be placed on the top fitting only. The Contractor shall program all balls and provide a copy of the programmed data in each marker ball in either Microsoft Excel or Access electronic format to the District. The Contractor as-built drawings shall show the location of all marker balls.

2.3.3.6 Fittings

When tightening bolts, the Contractor shall bring the gland up toward the flange evenly while maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Tighten all nuts progressively a little at a time. DO NOT over stress bolts to compensate for poor alignment. If effective sealing is not attained at the maximum torque, disassemble the joint and reassemble again after cleaning. Fittings shall be installed in accordance with the manufacturer's printed instructions.

2.3.3.7 Valves

Refer to Potable Water Section 2.2.3.6 Valves for valve installation and construction specifications.

2.3.3.8 Fire Hydrants

Refer to Potable Water Section 2.2.3.7 Fire Hydrants for fire hydrant installation and construction specifications.

2.3.3.9 Surface Preparation, Painting and Coating

Refer to potable water section 2.2.3.8 Surface Preparation, Painting and Coating for location, approved products, surface preparation, workmanship, and cleanup.
2.3.3.10 Storm Sewer Conflicts

IQ water mains that must be installed with less than 12 inches of clearance under storm sewer pipes or structures due to existing physical limitations that prohibit deflection or directional drilling, require construction of a bridging structure that is acceptable to the District to support the storm sewer prior to installation of the IQ water main. The IQ water main pipe section under the storm sewer pipe or structure shall be replaced with a single 20 linear foot stick of ductile iron pipe centered under the storm sewer pipe or structure. The ductile iron pipe shall be fully encased in an 8 mil polyethylene sleeve in accordance with AWWA C-105, Method A. Polyethylene material shall conform to ASTM Standard Specification D 1248-68. The Contractor shall submit details of the proposed bridging structure and IQ water main pipe installation to the District for review and approval prior to the start of construction at the conflict location.

2.3.3.11 Water Main Crossing

All IQ water mains shall cross under water mains at ninety (90) degrees and with a minimum angle of forty-five (45) degrees.

2.3.3.12 Clearance Requirement

When a IQ water/non-potable irrigation line is transporting water for public access irrigation or fire protection, the maximum obtainable separation of IQ water/non-potable irrigation lines and potable water lines shall be practiced. Minimum separation requirements are specified in the standard detail for potable water separation.

2.3.3.13 Testing

All pressure tests shall be in accordance with AWWA Standards C-600, C-651, and C-652, latest revision. A pressure test shall be required for all installations of IQ water mains and all appurtenances.

2.3.3.13.1 Pressure Test

The contractor shall notify the Utility Operator and the District 48 hours before testing commences. A representative from the Utility Operator and an Owner Representative shall be present at the time of testing. The Utility Operator hydrostatic test results form shall be filled out and submitted to the District as documentation of the testing results.

A. Pipe:

1. The Contractor shall hydrostatically pressure test all PVC, HDPE, and DI Irrigation Quality water mains in accordance with the latest revision of AWWA C-600 series as applicable. Oil filled gauges shall only be used for all pressure tests. The tests shall be at 150 psi for a period of two (2) hours. The allowable loss for one (1) hour shall be determined by the following formula:
Allowable Leakage = \[\frac{D \times L \times PY}{133,200}\]

Where:
- \(D\) = nominal diameter of the pipe in inches
- \(L\) = length of pipe in feet
- \(PY\) = square root of test pressure during the leakage test in pounds per square inch

2. Calibrated test equipment shall be on site to verify the loss of water during the testing period.

3. Pressure testing shall not exceed 1,500 linear feet unless otherwise approved by the District in writing.

B. Tapping Sleeves:

All IQ water tapping sleeves shall be hydrostatically pressure tested in accordance with the latest revision of AWWA C-600. The test shall be conducted at 150 psi for a period of two (2) hours. No loss of pressure is allowed.

C. Procedures:

1. The contractor shall notify the Utility Operator and the District 48 hours before testing commences.

2. A representative from the Utility Operator and an Owner Representative shall be present at the time of testing.

3. Each section of pipe between valves, between the tapping sleeve and the pipe, and/or the valve and the tapping sleeve shall be slowly filled with water from a safe source, and the specified test pressure shall be applied by means of a water pump in a manner satisfactory to the District. In the case of testing a pipe where valves do not exist, the Contractor shall plug the end of the line as approved by the District in writing. The pump, pipe, and/or tapping sleeve connections, gauge, and all necessary apparatus shall be furnished by the Contractor and shall be approved by the District in writing prior to any test. All necessary pipe taps for testing shall be made by the Contractor as approved by the District in writing. The District may request testing of isolated portions between valves within the test section if a portion of that main has critical components such as multiple fittings at an extreme deflection. The Contractor shall be responsible to remove any pipe taps installed for this purpose upon completion of the test as approved by the District in writing.

4. Pressure shall be measured from sample points, blow-off assemblies, water services, or fire and flush hydrants for IQ water main pressure tests. The District, or an acceptable representative of the District, shall witness all tapping sleeve and IQ water main pressure tests.
2.3.3.14 Hydrant Testing

Refer to Potable Water Section 2.2.3.10.3 Hydrant Testing for testing requirements, and water pressure classification requirements for fire hydrants. No bacteriological testing will be required for fire hydrants located on a non-potable water main.

2.3.3.15 Backfilling

A. Excavated material shall be freed of large clods or stones prior to backfilling. Material shall be carefully deposited in layers not to exceed 12 inches and thoroughly and carefully rammed until enough fill has been placed to provide a cover of not less than two feet (2’) above the pipe. The remainder of the backfill material may then be placed and should be moistened and tamped to insure proper compaction.

B. Backfill material and pipe shall be brought to the approximate same temperature before backfilling. This can be obtained by either running water through it or by backfilling in the early morning when the pipe and the ground are at an approximate equal temperature. Backfill shall not be placed over any plastic pipe while in a heated state.

C. In the case of improperly filled trenches or settling, the trenches shall be refilled, compacted, smoothed, and made to conform to the surface of the ground. In areas that are to be repaved, such as roadways, backfilling shall be completed as specified above except that the entire fill above pipe shall be deposited in layers not to exceed 12 inches in thickness, moistened and compacted to 98% of maximum density as determined by AASHTO T-180 so that upon completion of backfilling, re-pavement may commence immediately.

2.3.3.16 Plumbing Code

Plumbing Code for the State of Florida, local authorities, and manufacturers’ recommendations shall be adhered to as they relate to all piping and fittings. Where these Specifications exceed the requirements of code or manufacturer, these Specifications shall be followed. All piping shall be installed in a strong, neat, and workmanlike manner subject to the restrictions indicated.

2.3.3.17 Close Out

Prior to placing project into service, permittee shall submit, at a minimum, everything required under Section 2.1.5.2 As-Built Requirements and the following to the District for records and written approval for operation:

A. Certified record drawings

B. Copy of a satisfactory pressure test of the process piping performed in accordance with AWWA Standards.
2.4 SANITARY SEWER SYSTEM

The following Specifications are intended for the design, selection of materials, and construction of wastewater collection/transmission systems. Sanitary sewer systems shall meet the requirements of the Florida Department of Environmental Protection (FDEP) permit and all other governing bodies.

The District reserves the right to oversize any extension or extend any facility which may provide a regional benefit, and will pay for such oversizing, or extension, based on additional cost beyond that necessary to serve only the subject development. The District will pay an established unit amount based upon the pipe size of a facility multiplied by the length of that facility. The established unit amount shall be determined by the District based on the difference in cost between that line size required by the development (minimum of four (4) inch for sanitary sewer force main) and the District study of current construction costs. The District will pay the Property Owner for the cost of the District share of oversized mains and this payment will be in the form of credit. The District also reserves the right to limit the amount of its participation in the cost of oversizing, depending on current economic conditions.

2.4.1 SYSTEM DESIGN

Wastewater collection/transmission systems shall be designed by a Florida Registered Professional Engineer (Engineer of Record) and constructed in accordance with the design and installation requirements as specified by District, the Florida Department of Environmental Protection (FDEP), the Florida Department of Transportation (FDOT) and any other relevant state and local regulatory agencies as well as with the requirements established by the District, as amended from time to time.

2.4.1.1 Flow Demands:

A. Flow demands for design shall be calculated based on full development as known or projected.

B. For phased development, the design shall be based on the total build out conditions for the development, or the anticipated service area of the proposed pump station.

C. The average daily flow for domestic use shall be calculated at the minimum rate as follows:
Table 1. Average Daily Flow for Domestic Use

<table>
<thead>
<tr>
<th>Type of Development</th>
<th>Projected Wastewater Flows (90% of Water Usage)</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single/Multi-Family Residential</td>
<td>157.5</td>
<td>gpd/ERU</td>
</tr>
<tr>
<td>Retail</td>
<td>0.18</td>
<td>gpd/ft²</td>
</tr>
<tr>
<td>Office</td>
<td>0.18</td>
<td>gpd/ft²</td>
</tr>
<tr>
<td>Medical Office</td>
<td>0.18</td>
<td>gpd/ft²</td>
</tr>
<tr>
<td>Industrial</td>
<td>0.18</td>
<td>gpd/ft²</td>
</tr>
<tr>
<td>Golf Course Facilities</td>
<td>450</td>
<td>gpd/hole</td>
</tr>
<tr>
<td>Hotel</td>
<td>378</td>
<td>gpd/ft²</td>
</tr>
<tr>
<td>School</td>
<td>19.8</td>
<td>gpd/student</td>
</tr>
<tr>
<td>Religious Facilities</td>
<td>0.18</td>
<td>gpd/ft²</td>
</tr>
<tr>
<td>Parks</td>
<td>180</td>
<td>gpd/acre</td>
</tr>
<tr>
<td>Hospital</td>
<td>225</td>
<td>gpd/bed</td>
</tr>
<tr>
<td>Assisted Living</td>
<td>180</td>
<td>gpd/unit</td>
</tr>
<tr>
<td>Civic</td>
<td>0.18</td>
<td>gpd/ft²</td>
</tr>
</tbody>
</table>

For types of development not included in the table above, estimated wastewater flows shall be based on Chapter 64E-6 of the Florida Administrative Code guidelines and/or historical flow data for similar establishments.

1. To use historical flow data; a minimum of the most recent 12 months of billing histories for at least six (6) similar establishments in the state of Florida must be provided.

2. Similarities must be demonstrated including, but not limited to; size, hours of operation, number of employees, etc.

D. Gravity collection systems shall be sized to provide ample capacity for the required peak flow rates. The maximum required capacity shall be the product of the cumulative average daily flow for the total service area and the peak factor as calculated below:

\[
\text{Peak Factor for wastewater} = \left(18 + \left(\frac{\text{population}}{1000}\right)^{1/2}\right) \left(4 + \left(\frac{\text{population}}{1000}\right)^{1/2}\right)
\]

Minimum Peak Factor is 2.5 and Maximum Peak Factor is 4.0.

2.4.1.2 Gravity Main Design

This section sets forth the general requirements for design and installation of sanitary sewer gravity mains, gravity manholes and service laterals.
2.4.1.2.1 Gravity Main Size Computation

A. Gravity sewer pipes shall be sized to provide ample capacity for the required peak flow rates. Max flow depth shall never exceed 80% of the nominal diameter of the main.

B. The minimum allowable size for public gravity sewer conveying raw wastewater, other than service connections, shall be eight inches in diameter.

C. All gravity sewer pipes shall be designed at slopes providing minimum velocities of not less than two fps when flowing full, based on Manning’s formula using an “n” value of 0.013.

D. The following minimum slopes shall be used for design for gravity mains:

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Minimum Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>8”</td>
<td>0.40%</td>
</tr>
<tr>
<td>10”</td>
<td>0.28%</td>
</tr>
<tr>
<td>12”</td>
<td>0.22%</td>
</tr>
<tr>
<td>15”</td>
<td>0.15%</td>
</tr>
<tr>
<td>18”</td>
<td>0.12%</td>
</tr>
</tbody>
</table>

E. Sewers shall be laid with uniform slope between manholes.

F. Projects are to be constructed at the slopes shown on the approved construction plans unless otherwise approved by the District in writing.

G. Sanitary sewer services shall be installed at slopes not less than 0.63% and no more than 14%.

2.4.1.2.2 Location and Depth

A. Gravity mains shall be installed with straight alignment and grade between manholes.

B. Manholes shall be located in the center of the roadway unless written approval is provided by the District.

C. Manhole spacing may not exceed 400 feet for sewers 15 inches or less, and 500 feet for sewers greater than 15 inches in size.

D. Gravity mains shall have a minimum four feet of cover to the top of the pipe unless written approval is provided by the District.

E. All sanitary sewer mains shall be PVC, SDR-26 unless written approval is provided by the District.
F. All gravity mains shall be placed within the right-of-way.

G. Under no circumstances shall gravity sewer mains be located under buildings or other infrastructure that limits maintenance accessibility.

2.4.1.2.3 Design Considerations

A. Manholes shall be constructed at all changes in size, direction, and/or termination of gravity mains.

B. The minimum diameter of manholes shall be 48 inches and the minimum access diameter shall be 24 inches. A minimum line drop of 0.1 feet shall be provided across every manhole. All inverts shall be poured.

C. Drop manholes are required when an invert exceeds 24 inches from the manhole bench. The drop pipe shall be external unless written approval is provided by the District. The entire outside drop connection shall be encased in concrete.

2.4.1.3 Force Main Design

The following specification is intended for use for the design, selection of materials, and construction of force main projects. The force mains, if applicable, shall meet the requirements of the Florida Department of Environmental Protection (FDEP) permit.

2.4.1.3.1 Force Main Size Computation

A. Force mains shall be of adequate size to efficiently transmit the total peak operational flow. The minimum force main diameter shall not be less than four inches unless written approval is provided by the District.

B. At design pumping rates, a cleansing velocity of at least two feet per second should be maintained. With multiple pumping station systems or phased development, this minimum velocity requirement may not be possible. These system designs shall receive special attention regarding hydrogen sulfide formation and control, and cleaning maintenance such as installation of pressure clean outs.

2.4.1.3.1.1 Hydraulic Computations

A. Hydraulic computations also known as ‘Head-Capacity Curves’ will be required as follows:

1. For all developments connecting to a pressurized collection system,

2. For developments with contributor flow greater than 5,000 gallons per day connecting to low pressurized collection systems, and/or

3. When deemed necessary by the District.

B. Hydraulic calculations shall be prepared for proposed gravity collection systems to determine the various operational conditions as follows:
1. Hydraulic computations shall be done in accordance with standard engineering formulas.

2. Pipe friction loss shall be calculated using the Hazen-William's Formula

3. A conservative coefficient of friction factor “C” of 120 shall be used for all pipes.

4. The following values for “K” coefficients shall be used for minor head loss calculations:

<table>
<thead>
<tr>
<th>Fitting</th>
<th>Coefficient, K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plug Valves (Fully Opened)</td>
<td>0.77</td>
</tr>
<tr>
<td>Swing Check Valves (Fully Opened)</td>
<td>2.50</td>
</tr>
<tr>
<td>90° Bends</td>
<td>0.80</td>
</tr>
<tr>
<td>45° Bends</td>
<td>0.20</td>
</tr>
<tr>
<td>Tees (Straight Run)</td>
<td>0.35</td>
</tr>
<tr>
<td>Tees (Branch Run)</td>
<td>1.28</td>
</tr>
<tr>
<td>Wyes (Straight Run)</td>
<td>0.30</td>
</tr>
<tr>
<td>Wyes (Branch Run)</td>
<td>0.50</td>
</tr>
<tr>
<td>Expansion Sudden D2/D1 = 0.75</td>
<td>0.19</td>
</tr>
<tr>
<td>Pipe Exit</td>
<td>1.00</td>
</tr>
</tbody>
</table>

C. Computerized Hydraulic Modeling Software approved by the District are as follows:

1. SewerCAD
2. WaterCAD
3. Use of other hydraulic models may be approved by the District on a case by case basis.

D. The effect of the proposed pump station on the hydraulic capacity of the existing sewer system must be evaluated prior to District written approval for connection of the proposed pump station.
1. A hydraulic analysis must be performed to demonstrate that the increase in wastewater flow from the proposed pump station:
   a. Must not surcharge any existing gravity sewers,
   b. Must not cause any existing lift station to operate below its design capacity.
   c. Must not cause the receiving pump station to exceed its design capacity.

E. For force main systems with only one pump station, the system’s head capacity shall be calculated under peak hour flow conditions utilizing the maximum of:
   1. one pump running,
   2. all pumps running and
   3. other combinations, if applicable

F. System head capacity for force main systems with multiple pumping stations that manifold together shall be calculated under the maximum static head, i.e. wet well level of the proposed pump station set at the pump off elevation and under peak hour flow conditions as follows:
   1. The design pump station is the only station on the system therefore, utilizing above-stated conditions.
   2. All pump stations running with one pump running at each station.
   3. With one pump running in the proposed pump station together with a pump running at each of the following number of flowing pump stations:

<table>
<thead>
<tr>
<th>Number of Pump Stations Manifolded on the Same Force Main System</th>
<th>Number of Flowing Pump Stations Running Simultaneously</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Greater than 4</td>
<td>Sufficient number of pump stations running to pump at least 60% of the peak hour design flow when all pump stations are running</td>
</tr>
</tbody>
</table>

G. A copy of the hydraulic computations signed and sealed by a licensed professional engineer certified in the State of Florida and a CD of the
corresponding electronic input and output files of the computerized hydraulic model shall be submitted to the District for written approval.

2.4.1.3.2 System Capacity

A. Consideration shall be given to possible future connecting pumping stations and this probability shall be reviewed with the District.

B. Capacity computations shall be coordinated with the proposed pumping system and future flow requirements, if applicable.

2.4.1.3.2 Design Considerations

A. Friction losses: Friction losses through force mains shall be based on the Hazen and Williams formula and the value for “C” shall be 100 for unlined iron or steel pipe for design. For other smooth pipe materials, such as PVC, polyethylene, lined ductile iron, etc., a “C” value of 120 shall be used for design.

B. When initially installed, force mains will have a significantly higher “C” factor. The effect of the higher “C” factor should be considered in calculating maximum power requirements and duty cycle time to prevent damage to the motor. The effects of higher discharge rates on selected pumps and downstream facilities should also be considered.

C. Terminal discharge: To minimize turbulence and release of sewer gases, force mains shall enter the terminal facility (gravity sewer manhole or pumping station wet well) at a point not more than 1 foot above the flow line. At manholes, the point of force main entry shall be in the same direction as the flow line. The last twenty (20) feet of pipe into the manhole shall be upsized two diameter inches.

D. For new force main connections to existing manholes or pump station wet wells, the Property Owner must install a District approved liner, coating system for corrosion protection of the manhole structure. For discharge of new force main flow into an existing Utility Operator pump station wet well, the Property Owner must install a new inline master manhole unless one already exists.

E. Air and Vacuum Relief Valve: An air relief valve shall be placed at high points in the force main to prevent air locking. Vacuum relief valves may be necessary to relieve negative pressures on force mains. The force main configuration and head conditions should be evaluated as to the need for and placement of vacuum relief valves. Air release valves shall be suitably housed in a properly vented underground vault or casting and shall conform to the District standard force main air release valve detail.

F. Valve Locations: Isolation valves should be considered where force mains connect into a common force main. Where force mains are to be extended, valves shall be placed at the future connection point to preclude line shutdown at the time of extension. At future connection branches or ends, valves shall be followed by at least one length of pipe which is to be capped.
G. Valve Boxes: Cast iron valve boxes shall be provided for all valves installed underground which do not have extended operators such as required for plug valves. Valve boxes shall have an interior diameter of not less than five inches, be adjustable to fit the designated depth of each cover over the valve, be designed to prevent the transmission of surface loads directly to the valve or piping and be provided with covers marked with the word “SEWER”.

H. Location and Depth: Sanitary sewer force main shall be installed at the edge of the road within the right-of-way unless written approval is provided by the District. Sanitary sewer force mains shall be designed to have 36 inches minimum cover and shall meet water main separation requirements as specified in the District standard details. All force mains shall cross under water mains at ninety (90) degrees and with a minimum angle of forty-five (45) degrees.

I. Restraining Devices: Restraining joints shall be placed at all bends, tees, plugs, reducers, and other fittings to provide lateral support. Restraining joints shall conform to applicable District standard details. In addition, the restraints may be supplemented with thrust blocks. The District may require the Engineer to provide the dimensions of the thrust block for written approval prior to construction.

J. Under no circumstances shall force mains be located under buildings or other infrastructure that limits maintenance accessibility.

2.4.1.3.2.1 Operational Cost Consideration

A. In addition to initial capital expenditure, long-term pumping station operational costs shall receive consideration when sizing force main systems.

B. Should a pipe size option be available within the design limits, the cost of sewage pumps and motors, force main system and pump operating power (computed for design average daily flow rate for ten (10) years at existing electricity cost) shall be compared for like amounts for the alternate design.

C. The final force main size selection shall be based on the least long range capital and operational cost.

D. Said cost analysis shall be subject to review and approval by the District.

2.4.1.4 Pump Station Design

The following specification is intended for use for the design, selection of materials, and construction of a standard submersible sewage pump lift station, hereinafter referred to as “standard lift station”, and all appurtenances. All standard lift station installations shall also meet the requirements of the Florida Department of Environmental Protection (FDEP) permit and the Florida Administrative Code, as applicable.
A. The standard lift station has optional capabilities such as a standby generator, telemetry control unit, an odor control system, variable frequency drives (VFDs), and other options as specified.

B. The equipment shall form a completely operable non-clog submersible sewage pump system complete with pumps and rails, wet well liquid level sensors, wet well, hatch cover, valves, piping, water service(s), motor control center (MCC), grounding rods, all wiring and conduits, standard lift station concrete pad, fencing, driveway, landscaping and all associated appurtenances. The standard lift station shall include the following optional equipment as specified: standby generator, telemetry system, odor control system, VFDs, and other specified options. The Contractor shall install the Florida Power and Light (FPL) meter and install/connect the electrical service to the FPL service point at a hand hole for electrical service as shown on the Engineering Drawings and as defined in this Specification.

2.4.1.4.1 Master Plan Update

The Babcock Ranch Community Utility System Analysis shall be updated as directed and at the discretion of the District. All submittals to update the Babcock Ranch Community Utility System Analysis shall be made during the Site Plan Review process at the expense of the Owner. Any required master plan updates shall include but is not limited to:

A. Update of sanitary sewer demands for buildout conditions.

B. Update of transmission main sizing

C. Master Lift Station siting

D. Necessity of future infrastructure needs

2.4.1.4.2 Design

2.4.1.4.2.1 Pumps

A. Pump selections shall be based on the design conditions as determined in 2.4.1.3.1 Force Main Size Computation and as determined below.

B. Multiple pumps shall be provided. Where only two units are provided, they shall be of the same size. Units shall have capacity such that, with any unit out of service, the remaining units will have capacity to handle the design peak hourly flow. Pumps shall be tested by the manufacturer in conformance with the ANSI/HI 14.6 Rotodynamic Pumps for Hydraulic Performance Acceptance Tests (or latest test standard). Additional testing may be required at the Utility Operator’s discretion. (See 2.4.3.6)

C. Pumps handling raw wastewater shall be capable of passing spheres of at least 3 inches (80 mm) in diameter.
D. The pump shall be placed so that under normal operating conditions it will operate under a positive suction head.

E. Each pump shall have an individual intake. Wet well and intake design should be such as to avoid turbulence near the intake and to prevent vortex formation.

F. Submersible pumps and motors shall be designed specifically for raw wastewater use, including totally submerged operation during a portion of each pumping cycle and shall meet the requirements of the National Electrical Code for such units. An effective method to detect shaft seal failure or potential seal failure shall be provided.

G. Submersible pumps shall be readily removable and replaceable without personnel entering or dewatering the wet well or disconnecting any piping in the wet well.

2.4.1.4.2.2 Wet Wells

A. The design fill time and minimum pump cycle time shall be considered in sizing the wet well. The effective volume of the wet well shall be based on design average flow and a filling time not to exceed 30 minutes unless the facility is designed to provide flow equalization. The pump manufacturer's duty cycle recommendations shall be utilized in selecting the minimum cycle time. When the anticipated initial flow tributary to the pumping station is less than the design average flow, provisions should be made so that the fill time indicated is not exceeded for initial flows. When the wet well is designed for flow equalization as part of a treatment plant, provisions should be made to prevent septicity.

B. Wet well shall be designed to meet the following minimum requirements:

1. Operating volume to ensure a minimum pump run time of two minutes.

2. Minimum pump cycle time of 15 minutes based on peak hourly flow conditions.

3. The wet well design shall assume a soil density of 112 pounds per cubic foot and a concrete density of 150 pounds per cubic foot and shall resist flotation under the conditions of an empty wet well and a groundwater level from the wet well base to the finished grade including a safety factor of 1.5.

4. The wet well depth shall not exceed 25 feet.

C. Wet well liquid level sensors shall be set based on the following*:
1. Low Level/All pumps off- 2.5 feet above poured invert of wet well or written approval provided by the District.

2. Lead pump on- Distance above low level/all pumps off sensor required to achieve optimal operating volume.

3. Lag pump on- one foot above lead pump on sensor.

4. High water level alarm- six inches above lag pump on and a minimum or six inches below influent pipe invert.

*Or as otherwise approved by the District in writing.

2.4.1.4.3 Equipment

All equipment and products shall be permanently identified with the model number and manufacturer’s nomenclature.

2.4.1.4.3.1 Submersible Sewage Pumps

A. The submersible sewage pumps covered by this specification are intended to be standard pumping equipment of proven ability as manufactured by Flygt Pumps.

B. The submersible sewage pumps shall be designed, constructed and installed in accordance with the best practices and methods and shall operate satisfactory when installed as shown on the engineering Drawings and/or standard details.

C. The submersible sewage pumps shall be heavy duty electric submersible, centrifugal non-clog units designed for handling raw and unscreened wastewater (minimum of three-inch sphere). The submersible sewage pumps shall be capable of operating in a liquid temperature up to 115°F and to a depth of 65 feet.

D. The submersible sewage pump and motor unit shall be suitable for continuous operation at full data plate load while the motor is completely submerged, partially submerged or totally non-submerged. The use of shower systems, secondary submersible sewage pumps or cooling fans to cool the motor shall not be acceptable. The submersible sewage pumps mechanical seals and motor units shall be from the same manufacturer to achieve standardization of operation, maintenance, spare parts, manufacturer’s service, and warranty.

E. The submersible sewage pump shall be tested and approved by Factory Mutual or U.L. as explosion proof for use in Class I, Groups C and D, Division 1 hazardous locations.
F. The submersible sewage pump shall have a sliding bracket for connecting to the dual guide stainless steel rail system. The sliding bracket, either directly or with an adaptor, shall allow for the interchangeability of all Utility Operator acceptable submersible sewage pump manufacturers at alternative locations.

G. The submersible sewage pump shall have a manufactured sized electrical cable and shall be a minimum of 50 linear feet. The cable shall conform to NEC and ICDA Standards with P-MSHA approval. The cable shall be sealed with a protective covering prior to installation.

H. The submersible sewage pump shall include a type 316 stainless steel chain capable of supporting the weight of the submersible sewage pump for installation and removal of the submersible sewage pump. The chain shall be connected to the submersible sewage pump bail using a type 316 stainless steel clevis. The length of the chain shall be equivalent to the depth of the wet well plus additional six feet.

I. The submersible sewage pump discharge diameter shall be as specified on the Engineering Drawings and/or District standard details. For discharge diameters four inches or larger, the manufacturer supplied submersible sewage pump discharge shall be compatible among all Utility Operator acceptable manufacturers’ submersible sewage pump discharge base elbows.

J. The submersible sewage pump shall be cast iron with appropriate coating to protect submersible sewage pump from corrosive properties of wastewater.

K. The impeller shall be mounted directly on the motor shaft extension in such a manner that it shall not become detached if the submersible sewage pump is operated in the wrong direction. The impeller shaft shall be 420 stainless steel or greater and shall extend from the motor to the impeller cap nut.

L. All submersible sewage pump mated surfaces shall be machine fitted for watertight sealing.

M. A type 316 stainless steel lifting bail handle shall be provided on the submersible sewage pump housing suitable for lifting the entire submersible sewage pump assembly and attaching the lift chain.

N. The submersible sewage pump shall operate to a maximum submergence of 65 feet including electrical cable entry.

O. All electrical parts shall be housed in an air or oil filled cast iron, watertight casing.

P. All external hardware shall be type 316 stainless steel.
Q. The motor shall be capable of a minimum of 15 starts per hour.

R. The motors shall include thermal and moisture protection to shut down the motor due to high operational temperatures or infiltration of moisture. The motor shall be automatic restarted once the operational temperature is achieved.

S. All other components and appurtenances shall be as specified on the Engineering Drawings and in the District standard details.

T. Approved Products:

1. Flygt

2.4.1.4.3.2 Motor Control Center (MCC)

No direct connection between the wet well and electrical panel is permitted. Refer to lift station detail LS-01 for the required junction box between the wet well and electrical panel. The submersible sewage pump motor control elements shall be installed in a type 316 stainless steel NEMA 4X enclosure and include the following equipment:

A. The panel shall be constructed of a heavy-duty box frame of all welded construction, utilizing specially formed #12-gauge type 316 stainless steel angle and channel members.

B. The dead front interior panel(s) for instrument mounting shall be constructed of a minimum of #11-gauge aluminum.

C. The interior panel(s) for instrument mounting shall be constructed of a minimum of #14-gauge epoxy coated steel.

D. Panel mounted controls and indicators shall maintain panel integrity. Suitable stiffness shall be provided when required to maintain flatness and provide extra rigidity.

E. All panels wiring to external equipment shall be terminated on screw-type terminal strips.

F. Terminal blocks shall be separated into groups (power, AC control, DC signal, data, etc.). All terminals shall be marked with legible permanent labels or otherwise identified.

G. The MCC shall be mounted on four-inch tubular top capped aluminum posts installed in concrete above the 100-year flood plain in accordance with the engineering drawings and standard details.

H. All circuit breakers shall be accessible without opening the MCC dead front door(s).
I. The MCC shall include at a minimum the following for each submersible sewage pump: a motor starter, a HOA switch, a circuit breaker mounted with the operating handles through the dead front door(s), a leak seal indicating light, and an elapsed time meter.

J. The MCC shall include at a minimum: a 24-volt AC wet well liquid level sensors control circuit, 120-volt AC audio and visual alarms, an emergency generator receptacle with circuit breaker, a main circuit breaker, a control circuit breaker, and a 12-volt DC audio and visual battery backup alarm system.

K. All power shall be disconnected from the control elements when the standard lift station main disconnect is in the “OFF” position.

L. In each motor, a heat sensor thermometer and a seal leak probe shall be wired to a red warning signal light on the dead front door and shall be marked with legible permanent labels.

M. An alternator relay shall be supplied to alternate the individual submersible sewage pump on each successive cycle.

N. A fused wet well liquid level sensors control circuit transformer shall be supplied to operate controls.

O. In 480-volt AC applications, a fused control circuit transformer shall be supplied to provide 120-volts AC auxiliary equipment power.

P. An adjustable single or three phase power monitor shall be provided to indicate and protect the pump via the control circuit in the event of loss of any phase, low and high voltage on any or all phases, and phase reversal with automatic reset and built-in time delay on trip.

Q. Audio and visual alarms shall be installed for monitoring high water levels, system equipment failures, and main input power levels failures. Audio and visual alarms shall be wired to sensors provided for a high-water level. Water level and system equipment failure alarms shall be powered directly from the main power supply to the MCC. The audio alarm shall be disabled by a manual silence switch; however, the visual alarm shall remain on until the alarm condition is corrected. If the alarm is a result of a loss of power to the standard lift station, the alarms shall automatically reset with the restoration of land line power or from a portable generator set. The loss of power audio and visual alarms shall be connected to a continually charged 24-hour back-up 12-volt battery.

R. The panels shall be wired and assembled per UL 508 Standards. All electrical components and materials shall be listed by UL and shall bear the appropriate UL listing mark or classification. Each panel shall be listed and labeled as UL 508 Industrial MCC. Panels shall comply with NFPA 79 -
Industrial Machinery. A permanent, non-paper wiring diagram shall be mounted on the inside of the cabinet door.

S. A 120 VAC time delay relay (0 to 60 second adjustable on delay) to re-energize control circuit of lag submersible sewage pump after power restoration shall be provided for step loading on submersible sewage pumps over 20 HP. VFDs or soft starts shall be provided for submersible sewage pumps over 10 HP as approved in writing by the District.

T. All MCCs shall include a grounding rod with 10-gauge wire that is installed in accordance with current local, state and national codes.

U. Type 316 stainless steel and schedule 80 polyvinyl chloride conduit piping shall be provided and installed as shown on the District design detail for connections between the MCC and the wet well structure, the MCC and the Telemetry Control Unit (if required), the MCC and the standby generator (if required), the MCC and the odor control (if required), the MCC and the ground rod, and the MCC and the FPL service point. Explosion proof fittings shall be provided and installed on the conduit as shown on the District design detail for connections between the MCC and the wet well structure.

V. A trouble light including switches shall be mounted in the MCC.

W. Surge protector equipment in accordance with UL 1449 Standards shall be installed on the load side of the MCC main circuit breaker for protection of all AC electrical equipment in the MCC and the motors from the effects of lightning induced currents, substation switching transients, and internally generated transients.

X. All other components and appurtenances shall be as specified on the engineering drawings and in the District standard details.

Y. Approved Products:

All electrical and accessories shall meet District standard details and specifications and shall be reviewed by the District with the standard lift station submittals except as noted below.

1. Emergency Generator Connector: Pyle National MFG JRE 4100 PR.
2. Trouble Light: Leviton 9880
3. 120 Volt Alarm Light: Ingram LXR-40 or Ohio Electric RL-3K
4. 120 Volt Alarm Horn: Edwards ALA-896-N5
5. 12 Volt Alarm Light: Ingram SLR-123
6. 12 Volt Alarm Horn: Ingram AH-122DG
7. Elapsed Time Meter: ETMAC 200-10NG7 Round Mount
8. Surge Suppressor: Current Technology Transguard 150
2.4.1.4.3.3 Soft Starter

A. A dedicated soft starter for each submersible sewage pump and connecting wiring shall be supplied by the submersible sewage pump manufacturer for all motors equal to or greater than twenty (20) horsepower unless a VFD is required as per the Special Provisions. The soft starter shall be installed in a separate MCC, if required in the Special Provisions. No supplementary cooling in the form of an air conditioning unit shall be used, unless required in the Special Provisions.

B. All the components shall be a complete unit, factory wired, and tested as a complete system. Each soft starter shall operate as a stand-alone unit with no interaction with each other.

C. The soft starter is a function control integrated in the lift station control panel sized to operate a variable torque load at the rated pump horsepower. The speed range shall be from a minimum speed of 0.5 Hz to a maximum speed of 60 Hz with an input voltage frequency range between 47.5 to 63 Hz.

D. The soft starter shall be adjustable between 30-70% of the normal line voltage and shall be adjustable between 200 and 500% of the soft starter’s full load current.

E. The ramp time between initial torque and full load torque shall be adjustable between 1 and 120 seconds in increments of one second. The soft start shall include a jog function initialized directly from the keypad.

F. The soft starter shall have Deceleration Control (soft stop) as a standard feature with an adjustable deceleration time from 1 to 120 seconds in increments of one second.

G. The soft starter shall include the following integrated motor and load protection:

1. Overload protection based on dynamic thermal register retained in the memory even upon loss of power.

2. A manual reset and an automatic reset for unattended remote applications.

3. Phase imbalance protection - adjustable sensitivity of two phases between 10% to 80% of the rated current.

4. Phase reversal protection - motor will not run the inappropriate direct.

5. High current protection - unit shall trip if the current exceeds eight times the set rated current.
6. Under load protection - trip level shall be programmable from 40 to 100% of the full load motor current.

7. Fault detection - all fault signals are to be reported to the LCD screen and the system shall not be disabled with a minimum recording of the last 20 events.

H. Two programmable input signals shall be available, and each input shall have the capability of being programmed for None, Reset, Jog, and Enable Motor.

I. All input and control devices shall be rated for 24 VDC control.

J. Three physical signal relays and one virtual relay for communication shall be provided and individually programmed for Run, Top of Ramp, and Event Listing.

K. The soft starter shall be provided with a 2-line 20 character per line LCD display screen that does not use any type of code to allow for operator interface.

L. Serial communications shall be a built-in function as a standard feature and shall include MODBUS, DeviceNet, Profibus DP, and ASI as the communication protocol available through the Field Bus Plug.

M. The soft starter shall be programmable with a key pad and display that can be viewed/operated from the inside dead-front panel.

N. Internal calibration adjustments are as follows:

1. Minimum speed.
2. Maximum speed.
3. DC boost.
5. Stop mode (ramp or coast).
6. Automatic restart after fault trip with lockout after five attempts to restart.
7. Anti-wind milling adjustable brake time.
8. Adjustable volts/Hertz.

O. Unit mounted operator controls are as follows:
1. Drive keypad display and a keypad Control Panel with a setting dial for each drive.

2. PID values (optional).


4. Indicating speed meter.

5. Power ON light.

6. Alarm reset switch.

P. The soft starter shall include the following standard features which shall be enabled if a Telemetry Control Unit is specified:

1. Built-in communication via a cable connection or terminal block.

2. Built-in Modbus-Telemetry Control Unit communications via a terminal block connection.

3. One (1) connector slot for internally mounting plug-in options.

4. Removable control terminal block.

5. Sink/source selectable control logic.

Q. The soft starter shall include the following provisions for remote external controls, if a Telemetry Control Unit is specified:

1. Two (2) wire ON-OFF control.

2. One (1) analog input for speed set point.

3. Two (2) analog outputs: one for motor current and one optional for motor speed tied to a programmable logic controller (PLC).

4. Two (2) digital outputs: one for drive running and one for drive fault.

5. Four (4) digital inputs: one for start/stop, one for enable (trips, low wet well level, and emergency stop push button), one for auxiliary for high motor winding temperature, and one for speed select signal for Hand-Off-Auto.

6. One (1) hand-off auto switch.

2.4.1.4.3.4 Wet Well Liquid Level Sensors

A. The wet well liquid level sensors shall be operated by reduced voltage, mechanical sensor sealed in a solid polyurethane float ball.
B. The wet well liquid level sensors cords shall be suspended from a type 316 stainless steel bracket attached to the lip of the access hatch at the depth specified as shown on the District design detail.

C. All pump stations shall be equipped with an ultrasonic level sensor probe in accordance with the District standard lift station details or an approved equal by the District.

D. Approved Products:

1. All mechanical wet well liquid level sensors and accessories shall meet District standard details and specifications.

2. The following mechanical wet well liquid level sensors manufacturer is approved:

   Roto-Float Mechanical Liquid Level Sensor

2.4.1.4.3.5 Telemetry Control Unit

A. The telemetry control unit transmits analog signals from the lift station MCC to the Utility Operator central monitoring location at the Water Reclamation Facility (WRF) of the utility system and from the Utility Operator central monitoring location to the lift station MCC.

B. The telemetry control unit includes a grounding rod with 10-gauge wire and shall be installed in accordance with current local, state and national codes.

C. The data shall be displayed continuously at the telemetry control unit by a default screen and indicating LED and shall indicate, at a minimum:

1. Operating status of each submersible sewage pump

2. Operating mode of the standard lift station

3. Wet well liquid level sensors status

D. All other components and appurtenances including antenna, control box, conduits, etc. shall be as specified on the engineering drawings and in the District standard details.

E. The Utility Operator will provide the telemetry control unit frequency to the contractor.

F. Approved Products:

1. The telemetry control unit and accessories shall meet District standard details and specifications.
2. The following telemetry control unit manufacturer is approved:

Flygt Multismart

2.4.1.4.3.6 Lift Station Remote Terminal Unit (LS RTU)

A. The specific attention of the Contractor is directed to the fact that the District has an existing TAC II SCADA System manufactured by Data Flow Systems, Inc. (DFS), of Melbourne, Florida. For compatibility purposes, the Contractor will be required to obtain the Lift Station Remote Terminal Unit (LS RTU) specified herein from DFS.

B. The LS RTU shall be mounted inside the Lift Station’s Motor Control Panel as provided by others.

C. These specifications are intended to cover the furnishing, the shop testing, the delivery, complete installation and field testing of all equipment and appurtenances for the complete LS RTU system herein specified, whether specifically mentioned in the Specifications or not.

D. The unit shall be furnished and installed with all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in these specifications or not. The LS RTU installation shall include field-testing and startup services by the manufacturer as required for the onsite warranty.

E. The Lift Station Remote Terminal Unit (LS RTU) shall be the pump-controller based Telemetry Control Unit with Integrated network interface (DFS model: TCU001-IP). The TCU001-IP shall be housed in the Motor Control Panel and powered by 120 VAC commercial power. The TCU001-IP shall provide local and automatic pump station control functions, monitor local statuses and transmit those statuses to the TAC II SCADA System central site when polled by the Hyper SCADA Server (HSS) via network (network by others). An Uninterruptible Power Source (UPS) shall be an integral part of the RTU.

F. The TCU001-IP shall incorporate the following features:

1) On-Board 12-button operator interface keypad and 4x20-character LCD display. Configuration parameters shall be adjustable via the 12-button operator interface keypad or required RS-232 service port.

2) The LCD display shall provide the elapsed runtime of each pump, the average runtime of each pump, the flow of each pump, the flow of the station and the time of day.

3) Triplex/Duplex/Simplex configurable. The device shall have the capability of easily being configured for one, two or three pumps via the on-board keypad.

4) Three (3) on-board HOA switches. Local manual control provided by the HOA switches. Each HOA switch shall be fail safe and
operate in the OFF and HAND position without power. Alarms shall indicate that an HOA switch has been left in the HAND or OFF position.

5) Integrated pump alternation. The pump alternation function will operate based on the number of pumps configured. Automatic alternation around non-operational pumps shall be provided.

6) Pumps/Starter/Breaker Fault alarms shall be determined by the unit automatically. These alarms shall be activated when a pump is called to run by the Telemetry Control Unit (TCU) but fails to run, or if the pump is turned off by the TCU but continues to run.

7) Multiple level control input options. The TCU shall provide local automatic level control from float, bubbler, transducer, or ultrasonic inputs. Redundancy of level control input shall be supported. An alarm shall be generated when floats are operating out of sequence.

8) On-board 240 / 480 VAC three-phase-power monitor. The phase monitor shall be transformer-isolated and detect loss of phase, phase reversal, low phase and high phase faults. All phase monitor adjustments shall be adjustable from the keyboard. Phase voltages from phase A to B and from phase A to C shall be transmitted to the HSS.

9) Integrated Alarm Light output and Alarm Horn output, each capable of driving 120 VAC loads to ½ amp. An input shall be supplied for external alarm silence button, which shall be used to silence the Alarm Horn.

10) All inputs and outputs shall be optically or magnetically isolated and surge suppressed.

11) Multiple staged surge protection shall be provided for all power supply and power monitoring circuits. One stage of protection shall be equipped with both energy limiting and clamping circuits with slow blow fuses designed for overload conditions. This design shall provide a very high level of non-destructive transient immunity. With the exception of a direct lightning strike, the device shall protect the TCU power supply and power monitoring circuits from damage due to voltage transients. The surge protection shall provide circuit protection to withstand multiple transients in excess of 6,500 volts, 3,250 amps, without damage. Damage shall be limited to a blown fuse when exposed to larger transients. The surge protection shall be transient-tested to ANSI standard C62.41.

12) Supply voltage shall be 115 VAC. Ambient operating temperature shall be -10°C to 60°C (14°F to 140°F). The upper temperature limit is 50°C (122°F) when using the backup battery. TCU shall be UL Listed process control equipment (UL61010-1).

13) The TCU shall include a 7.0 amp-hour backup battery. The battery shall provide 12V nominal voltage. The TCU shall incorporate a battery charging system. The battery shall not be damaged by deep discharges.

14) A local RS-232 service port shall be provided for local access to all the functions of the unit.
15) A local RS-485 serial interface shall be provided for connection to external devices that support the serial Modbus RTU protocol. Standard 5-digit registers shall be used and formatted with 0XXXX for digital outputs, 1XXXX for digital inputs, 3XXXX for analog inputs, and 4XXXX for analog outputs. Packing Modbus digital input, digital output, and analog input registers into the 4XXXX range will not be permitted. Addressing of Modbus registers shall be contiguous in their associated address ranges. All analog points from the external device shall be 0-20ma signals spanned across 0-4095 (12 bit) or 0-32767 (15 bit) with a working range 4-20ma representing 0-100%. All analog outputs shall be 0-20ma signals spanned across 0-32767 with a working range of 4-20ma representing 0-100%.

16) The TCU shall be easily removed/replaced by removing two industry standard wire terminal connectors. Wire terminals shall be used as an interface between the TCU and field wiring. Fuses and voltage reducing resistors shall be used where required by the manufacturer. Wire terminals shall be housed in the same enclosure as the TCU.

17) Analog signals require shielded 2-conductor wire. DFS recommends 16 AWG stranded wire for all other signals. Terminal connectors with the TCU001-IP cannot accept signal wire that is solid core or larger than 12 AWG.

2.4.1.4.3.7 Variable Frequency Drive (VFD) (if required)

A. A dedicated VFD for each submersible sewage pump and connecting wiring shall be supplied by the submersible sewage pump manufacturer. For lift station pumps 15 horsepower and above the VFDs shall be installed in a separate MCC. All panels with VFD’s must be climate controlled as recommended by the manufacturer.

B. The VFD shall consist of a variable frequency controller, input circuit breaker, harmonic suppression equipment, output isolation contactor, input and output line reactors, and controls. All components shall be a complete unit, factory wired, and tested as a complete system. Each VFD shall operate as a stand-alone unit with no interaction with the other VFDs.

C. The VFD shall maintain a .95 minimum true power factor throughout the entire speed range and shall be used with any standard NEMA-B squirrel-cage induction motor having a 1.15 service factor.

D. Additional specific requirements are stipulated in the contract Special Provisions.

2.4.1.4.3.8 Standby Generator and Automatic Transfer Switch (ATS) (if required)

A. An in-place standby emergency generator (standby generator) shall be provided in accordance with applicable provisions of the Florida
Administrative Code and the Recommended Standards for Wastewater Flows.

B. A standby generator shall be diesel powered and shall provide the same kW as the land line power source with a maximum voltage dip of 15% if the rated load is applied in three steps with 15 second increments.

C. A standby generator shall be permanently connected to the lift station MCC via an ATS supplied by the generator manufacturer.

D. The standby generator shall be provided with a non-rusting weather housing; a 540 gallon sub-base fuel tank; a type 316 stainless steel NEMA 3R enclosure for the ATS; water and temperature gauges; a factory compatible DC battery charger including ammeter; an AC voltage regulator; a voltage adjusting rheostat; start-stop and VM-AM phase selector switches; an AC voltmeter and ammeter; frequency and elapsed time meters; two (2) dry contacts closure rated for 10 amperes at 120 volts; an automatic start/stop control with fault indication lights and corresponding safety switches for pre-warn and shutdown low oil pressure; and a pre-warn and shutdown high water temperature, low water temperature, over-speed, over-crank, battery charger malfunction and selection switch (off, auto, manual) with light.

E. The standby generator shall automatically start and attain the rated kW and frequency upon the closing of a remote starting contact with the ATS within 10 seconds.

F. The standby generator shall be mounted on a structural steel sub-base designed to maintain proper alignment of the unit and shall be installed on a concrete pad as detailed in the contract documents using properly sized epoxy HILTI anchors.

G. The standby generator shall include all required components to allow pre-programed self-operation under load in compliance with manufacturer’s recommendations.

H. The standby generator shall include a grounding rod with 10-gauge wire and installed in accordance with current local, state and national codes.

I. All other components and appurtenances shall be as specified on the engineering drawings.

J. Approved Products:

1. KCS

2.4.1.4.3.9 Emergency Generator Connector (if needed)

A. An emergency generator connector with a switching device shall be provided.
B. All other components and appurtenances shall be as specified on the engineering drawings and on the District standard details.

C. Approved Products:
   1. Pyle National

2.4.1.4.3.10 Odor Control (if required)
A. The odor control system shall be a primary biofilter unit including a built-in carbon filter stage and, if required, an optional secondary activated carbon polishing unit connected to the biofilter unit; a VFD controlled centrifugal fan installed in a with sound attenuation enclosure; interconnecting ductwork; electrical wiring and conduit; and appurtenances for a complete operating system.

B. The odor control system shall treat in a single pass odorous air from the wet well. The system shall be designed for manual and continuous automatic operation. Access man ways shall be provided to allow access to the internals of the system. The system shall be designed to withstand a temperature up to 120 degrees F. The module and all accessories shall be factory mounted, piped, and wired to the maximum extent possible. The system shall be installed on the lift station pad with stainless steel fasteners.

C. The odor control system shall be skid mounted and designed to maintain proper alignment of the installed unit on a concrete pad as detailed on the engineering drawings using properly sized epoxy HILTI anchors. The controls shall be attached to the skid assembly and shall be housed in a water proof NEMA 4X enclosure.

D. The overall system size, including the fan, controls, and appurtenances shall not exceed the dimensions shown on the engineering drawings. At a minimum, access man ways shall be provided between the treatment stages. A portion of the system top shall be removable for access to the top of the second stage.

E. The odor control system shall meet the following performance when operating:

<table>
<thead>
<tr>
<th>Table 4. Odor Control System Performance Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INLET</strong></td>
</tr>
<tr>
<td>1-10 ppm H₂S</td>
</tr>
<tr>
<td>Greater than 10 ppm H₂S</td>
</tr>
</tbody>
</table>

2.4.1.4.3.11 Biofilter
A. The biofilter odor control unit shall be a two-stage, biological absorption/adsorption system that shall include but not be limited to a
fiberglass reinforced plastic (FRP) vessel, nozzles, two independent stages of inorganic treatment media (biological and built-in carbon polishing), moisture controls, nutrient supply system, VFD controlled air supply fan, ductwork, dampers, and all necessary accessories. The biological treatment stage shall utilize a granular inorganic media to facilitate absorption and adsorption of odor compounds designed to remove minimum of 99% of H2S vapor in a single pass. The polishing stage shall utilize a granular media designed to adsorb odorous compounds with the ability to support biological degradation of the compounds. The first stage shall operate from an independent water distribution system to irrigate the top of the first media bed with complete and even coverage via spray nozzles to maintain optimum wetted conditions to support unique microbial growth for biological destruction of the odorous compounds and removal of toxic metabolites. Biofilter odor control units using any type of organic media and biofilter odor control units using a single inorganic media shall not be acceptable. The complete treatment vessel shall be fabricated of premium grade FRP.

1. The air enters the vessel through the humidification section. After humidification, the first treatment stage contains media specifically designed to support biological growth for degradation of odor compounds. This stage absorbs odors from the air stream. The second polishing stage contains media specifically designed to adsorb odor compounds and to support biological degradation of those compounds. This stage provides final removal of odors to the specified level. Overall media depth shall be a minimum of 48 inches.

B. The first stage of media shall be wetted with fresh potable or re-use make-up water.

C. The system shall include all piping, valves, control panel and internals pre-mounted and piped on the unitary constructed system. The material of construction of internals shall be as follows:

<table>
<thead>
<tr>
<th>Packing Media Support</th>
<th>HDPE and FRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid Distributor</td>
<td>PVC</td>
</tr>
<tr>
<td>Spray Nozzles</td>
<td>PVC</td>
</tr>
<tr>
<td>Humidifier Nozzles</td>
<td>316 SS</td>
</tr>
</tbody>
</table>

D. The multi-stage packaged FRP unit shall be of unitary construction. The system shall be shipped as a single piece.

E. Design and Performance Criteria:
1. Criteria: The biofilter odor control unit shall be capable of removing foul air at a rate no lower than the rate shown on the following table:

<table>
<thead>
<tr>
<th>INLET</th>
<th>OUTLET</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10 ppm H₂S</td>
<td>0.1 ppm H₂S</td>
</tr>
<tr>
<td>Greater than 10 ppm H₂S</td>
<td>1.0% of inlet (99.0% removal)</td>
</tr>
</tbody>
</table>

F. System Performance: The biofilter odor control unit shall demonstrate the following performance when operating under design flow conditions listed above:

G. Maximum Pressure Drop: The pressure drop across the odor control unit shall not exceed 5.0 in. w.c. at the maximum air flow rate specified above.

H. Miscellaneous Material of Construction

1. The vessel and accessories shall be contact molded manufactured in accordance with NBS PS 15-69, ASTM D 4097 for contact molding. Any material of construction other than FRP with premium grade resin will not be allowed.

2. Resin used in the system liner shall be a premium vinyl ester type such as Hetron 922 by Ashland Chemicals, Derakane 411 by Dow Chemical, Vipel F010 by AOC, or the District provides written approval of equal. The resin shall be reinforced with an inner veil of a suitable synthetic organic fiber such as Nexus 111-00010.

I. Glass fiber reinforcement used shall be commercial grade corrosion resistance borosilicate glass. All glass fiber reinforcement shall be Type C, chemical grade, Type E electrical grade. Surfacing veil shall be 10 mil Nexus 111-00010 or equal. Mat shall be Type "E" (electrical grade) glass, 1 1/2 oz. per sq. ft with a nominal fiber length of 1.25 + 0.25 inches, with a silane finish and styrene soluble binder. Continuous glass roving, used in chopper gun spray-up applications shall be type "E" grade with chrome or silane coupling agent. Alternate layers of mat and woven roving shall be used for reinforcement.

J. Unless otherwise specified, all fasteners, and metal attachments such as anchors, brackets etc. shall be ANSI type 316 stainless steel. Unless otherwise specified, all gaskets shall be EPDM.

K. Fabrication:

1. Fabrication shall be in accordance with NBS PS 15-69, ASTM D 3299, and ASTM D-4097. All non-molded surfaces shall be resin.
incorporating paraffin coated to facilitate a full cure of the surface. All cut edges, bolt holes, and secondary bonds shall be sealed with a resin coat prior to the final resin paraffin resin coat. All voids shall be filled with a resin paste.

L. The inner surface of all laminates shall be resin rich and reinforced with one layer of NEXUS 111-00010 with a minimum thickness of 10 mils. The interior corrosion liner shall consist of two layers of 1 and 1/2 oz. per sq. ft. chopped strand mat. If the application is by chopper gun, the spray upglass fiber shall be 1/2 in. to 2 in. long. The total corrosion liner thickness shall be a minimum of 100 mils and have a resin to glass ratio of 80/20. All edges of reinforcement to be lapped a minimum of one (1) inch.

M. Structural laminates shall consist of alternating layers of 1 and 1/2 oz. per sq. ft. mat or chopped glass and 24 oz. per sq. yard woven roving applied to reach the designed thickness. The exterior surface shall be relatively smooth and shall have no exposed glass fibers. The exterior shall be surface coated with gel coat containing ultra violet light inhibitors.

N. Accessories: Air inlet, air outlet, spray headers, baffles, media support, drain, and all connections shall be provided by the manufacturer. Tie down lugs shall be integrally molded into the walls of the vessel. All external bolts shall be type 316 stainless steel and designed for the specified loads. Interior fasteners shall be of corrosion resistant materials such as PVC or FRP.

O. Neoprene Pad: A ¼ inch thick, 60 durometer neoprene rubber sheet shall be placed underneath the vessel before installation on lift station pad.

P. Exhaust Fan

1. The exhaust fan shall be centrifugal design manufactured of FRP with a statically and dynamically balanced radial blade wheel. The fan inlet shall be slip type, and the fan outlet shall have a flanged nozzle. The fan shall have a neoprene shaft seal.

Q. Fan shall be supplied with a TEFC motor with 1.15 service factor suitable for three-phase, 60 Hz, 480-volt service and rated for Class 1, Div. 2, Group D installation. The fan shall be direct driven. The motor shall be inverter-duty and controlled by a VFD.

R. The fan shall be tested and rated in accordance with AMCA and bear the AMCA seal.

S. One of the two mineral vessels shall be fitted with a top-mounted, five-cycle multiport control valve to operate the backwash, brining, slow rinse, fast rinse, and refill cycles. An additional piston assembly shall be
included to control the duty/standby status of the two vessels. A brass control valve including fixed and self-adjusting flow regulators shall be provided. A hydraulically balanced teflon coated piston shall be provided to perform the cycles of regeneration.

T. Instrumentation and System Controls

1. The electrical control panel shall provide electrical control for the exhaust fan and water addition system. A 3-phase power supply shall be supplied to the panel from the MCC to power the system.

U. The control panel enclosure shall be rated NEMA 4X. The panel shall be remote mounted by the contractor next to the system assembly at least 3 feet away to comply with requirements of a Class 1, Division 2, and Group D installation. The Contractor shall install and wire the local control panel to the bio filter mounted fan, metering pump, and solenoid valve. The control panel shall be factory tested to full operation with all other components prior to shipment.

V. The panel shall have the following components or capabilities:

1. Fan switch (ON-OFF).
2. Push-to-test button for water valve.
3. Timer relay for on/off control of water valve.
4. Blower VFD
5. Nutrient Pump (ON-OFF-AUTO)

W. The water control cabinet shall be constructed from a NEMA 12 rated FRP cabinet with all internal piping SCH 80 PVC. The cabinet shall be mounted to the system assembly. The cabinet shall contain the following components:

1. Pressure reducing valve
2. Nutrient Pump (rated for installation in a Class 1, Division 2, Group D area)
3. Irrigation solenoid valve (Explosion-proof rating)
4. Valve for pre-humidification
5. Irrigation system pressure gauge

X. Water pressure regulator, solenoid valve, and Rota meter shall be provided for control of water application rates. These components shall be mounted in the water control cabinet.

Y. Accessories
1. The direct reading Rota meter shall be a variable area type with a Teflon float, EPR "O" rings, and PVC fittings. The Rota meter shall be sized to the pipe and have a direct reading scale.

2. A nutrient containment and metering system shall be provided with the system. Nutrients supplied as a coating to the support media shall not be allowed.

3. All water and drain piping shall be SCH 80 PVC.

Z. Nutrient Reservoir

1. The nutrient reservoir shall be integrated into the system sump. No loose external tanks shall be provided with the system.

2.4.1.4.3.12 Carbon Media Odor Control Unit

A. Stand Alone Activated Carbon Unit

1. If required, the Contractor shall install a carbon media odor control unit in accordance with the engineering plans. The carbon media odor control unit shall meet the requirements of this specification.

2. The unit shall have an AMCA certified centrifugal industrial fiberglass reinforced V-belt Arrangement No. 10 driven plastic fan equipped with undrilled inlet flange, outlet flange, Viton shaft seal, fan guard, and motor enclosure. Each fan and drive motor shall be mounted on a common base assembly designed for mounting on a concrete pad. The fan motor shall be high efficiency type, TEFC, and a with a 1.15 service factor and matched to the electrical service at the standard lift station. Accommodation to accept a hand-held tachometer shall be available for each fan. Each fan shall have a drain with plug. The fan shall include graphite impregnation for grounding.

3. The Contractor shall complete the “TBDs” for the unit fan being proposed for the following maximum operating conditions:

<table>
<thead>
<tr>
<th>Table 6. Unit Fan Maximum Operating Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Flow Rate, cfm</td>
</tr>
<tr>
<td>S.P. up to Fan Inlet, in WC</td>
</tr>
<tr>
<td>Adsorbed Pressure Drop, in WC</td>
</tr>
<tr>
<td>Total S.P., in WC</td>
</tr>
<tr>
<td>Minimum Motor HP</td>
</tr>
</tbody>
</table>

4. The unit shall have a fan sound attenuation package capable of reducing the sound level by a minimum of 25 dB which shall be placed over the fan and motor assembly. The doors shall be equipped with heavy duty hardware and with seals to minimize noise leakage. Stainless steel sheet flashing shall be provided to enclose the
penetrations in the enclosure for the fan inlet and outlet ducting. The enclosure shall be fitted with louvered vents as required for heat dissipation/ventilation.

5. The fan shall be factory wired to a stainless steel NEMA 4X panel. The panel shall have a fan control switch with a pilot lamp to indicate the fan running status. The power supplied to the panel shall be matched to the electrical service at the standard lift station. The panel shall be provided with a power disconnect switch, VFD, and control transformer. The fan speed shall be manually adjusted by the operating the VFD.

6. The contractor shall provide the necessary ductwork between the fan ductwork and the absorber vessel. The ductwork shall include a volume control damper with lockable louver for flow adjustment. The material of construction shall be same as that of absorber vessel.

7. The carbon absorber vessel shall be constructed of non-corrosive polypropylene with a minimum thickness of 1/8" is required for a vessel diameter between 18" and 24" and a 1/4" thickness for vessel diameter up to 60" and designed for the following criteria:

<table>
<thead>
<tr>
<th>Table 7. Carbon Absorber Design Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessel Diameter, ft.</td>
</tr>
<tr>
<td>Vessel Straight Side Height, ft.</td>
</tr>
<tr>
<td>Internal Positive Pressure, in. WC</td>
</tr>
<tr>
<td>Maximum Operating Temperature, °F</td>
</tr>
<tr>
<td>Carbon Bed Depth, ft.</td>
</tr>
</tbody>
</table>

8. The carbon absorber vessel shall have a differential pressure gauge to continuously monitor the pressure drop across the carbon bed. The differential pressure gauge shall be isolated with isolation valves and mounted on the vessel.

9. The carbon absorber vessel shall have shall have three (3) one (1) inch diameter sample probes per bed extending into the bed a minimum of twelve (12) inches. The sample probes shall be blocked off with a PVC ball valve.

10. The carbon absorber vessel shall accommodate a single bed of activated carbon having an average depth of three (3) feet. The carbon bed shall be supported on a polypropylene screen through an FRP support grating system. The screen and the support system shall be removable through the top cover. The top cover shall use quick release tie downs that are integral to the cover and not require the use of separate tools for the removal of the cover. The support system shall consist of removable grating. NOTE: Pall rings or other dumped packing media as a means of carbon support shall not be used. The support system shall be designed to withstand a load of at
least 150 lbs/ft2 with a minimum deflection of 1/4” under all conditions.

11. The carbon absorber vessel shall have a “gooseneck” type outlet to prevent rain water from entering the system.

12. The activated carbon media shall be virgin, pelletized, and derived from high grade bituminous coal vapor phase type suitable for the control of sewage odors. The carbon shall have the following specifications:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iodine Number, mgI2/g</td>
<td>1050 min</td>
</tr>
<tr>
<td>MPD, mm</td>
<td>3.9-4.1</td>
</tr>
<tr>
<td>Apparent Density, g/cc</td>
<td>0.46-0.52</td>
</tr>
<tr>
<td>Hardness No.</td>
<td>95 min</td>
</tr>
<tr>
<td>Butane Activity</td>
<td>26 min</td>
</tr>
<tr>
<td>H2S Capacity, gH2S/cc*</td>
<td>0.30 min</td>
</tr>
</tbody>
</table>

* The H2S breakthrough capacity is determined using ASTM standard method D6646-01. Prior to testing, the test sample shall be completely humidified by exposing the sample to a flow of humid air (>85% RH) for at least 4 hours. Testing shall be accomplished by passing a moist (85% RH) stream of air containing 1 vol. % H2S and the selected concentration of CO2 through a 1 inch diameter tube with a nine-inch deep bed of closely packed carbon at a rate of 1,450 cc/min and monitoring to a 50 ppmv H2S breakthrough.

The results shall be reported as grams of H2S adsorbed per cc of carbon.

13. All steel hardware shall be type 316 stainless steel unless stipulated in this specification or on the engineering drawings. Gaskets shall be full face with a minimum of 1/8" thickness and made of EPDM or neoprene suitable for the intended service.

14. The unit shall include a grounding rod with 10-gauge wire in accordance with current local, state and national codes.

15. All other components and appurtenances shall be as specified on the engineering drawings and in the District standard details.

B. Optional secondary activated carbon polishing unit

If the optional secondary activated carbon polishing unit is required, the contractor shall provide, as a minimum, the major components as specified under the stand-alone unit section including the concrete pad, the vessel, the carbon media, the connecting duct work and all other appurtenances necessary for a fully operational odor control system in accordance with this specification.

C. Approved Products:

The following manufacturer is approved:
1. Odor Control units shall be Siemens, or the District shall provide written approval of equal.

2.4.2 SCOPE OF WORK

2.4.2.1 Gravity Main

2.4.2.1.1 Materials

The materials used in this Work shall be all new, and conform to the requirements for class, kind, size and material as specified below.

2.4.2.1.1.1 Ductile Iron Pipe (DIP)

A. All sanitary sewer mains shall be PVC, SDR-26 unless written approval is provided by the District.

B. The ductile iron pipe covered by this specification shall be the push-on joint type, centrifugally cast to conform to all requirements of AWWA Specification C-151, latest revision. All pipes shall have an epoxy bonded lining in accordance with AWWA Specifications, latest revision. The maximum allowable deflection of the pipe shall not exceed 2% of the pipe diameter. Ductile iron pipe shall be fully encased in an 8 mil. polyethylene sleeve in accordance with AWWA Specification C-150, Method A. Polyethylene material shall conform to ASTM standard Specification D-1248-68. All ductile iron pipe shall be marked “DUCTILE IRON” in large letters. The nominal wall thickness shall be plainly marked on each piece of pipe. The pipe and the polyethylene sleeve shall be color coded green by a means acceptable to the District.

C. Ductile iron pipe joints shall be of the push-on type with rubber gasket which complies with the latest revision of AWWA Specification C-111.

2.4.2.1.1.2 Polyvinyl Chloride Sewer Pipe (PVC)

A. PVC pipe shall conform to the applicable requirements of AWWA C-900 (3” through 12”), AWWA C-905 (14” through 36”), and AWWA C-909 (6” through 12”) and shall be Class 150 SDR 18 for depths of 0 to 4 feet of cover and SDR 26 for depths greater than 4 feet of cover. PVC pipe shall be Class 200 SDR 14 between the first upstream manhole and lift station wet well regardless of pipe depth. Three (3) inch diameter and smaller schedule 40 or 80 PVC pipe shall conform to the requirements of ASTM B-1785, latest revision. The manufacturer shall insure all quality control test and AWWA requirements are complied with during the production of PVC pipe.

B. C-900, C-905, and C-909 pipes shall have an integral bell formed with a race designed to accept the gasket in accordance with AWWA requirements. The spigot end shall have a bevel and a stop mark on the outside diameter to indicate proper insertion depth. Provisions shall be
made for expansion and contraction at each joint. All surfaces of the joint where the gasket may bear shall be smooth, free of cracks, fractures, or imperfections that could adversely affect the performance of the joint.

C. Schedule 40 and 80 PVC piping can be joined by solvent cements, adhesive, or threaded type connections as approved in writing by the District prior to their use.

D. Pipe Color: All C-900, C-905, and C-909 polyvinylchloride sewer main pipes shall be green in color with a PVC ASTM D-1120 and ASTM D-2241 reference, the class pressure rating, and the SDR number permanently and plainly marked on the pipe. Schedule 40 and 80 PVC piping shall be white and/or grey and the type of pipe permanently and plainly marked on the pipe.

E. Rubber Gasket Joints: C-900, C-905, and C-909 polyvinylchloride pipe joints shall be the bell and spigot type using rubber gasket push-on type joints. Rubber gaskets shall be molded to a circular form to the proper cross section and shall consist of a vulcanized high grade elastomeric compound conforming to ASTM D-1869 and AWWA C-900, C-905, and C-909 elastomeric seals for joining PVC pipe.

2.4.2.1.1.3 Manholes

A. Manholes shall be constructed of precast sections. Manholes shall conform to ASTM C-478 and the District standard details. No brick and mortar shall be used to complete the cone between the top precast section and the ring and cover. The manhole cover ring shall be mounted in the top precast cone section.

B. A minimum of one (1) and a maximum of three (3) four-inch precast adjusting rings shall be provided between the cast iron frame and the top concrete manhole section.

C. The manhole shall be delivered to the job site with pre-installed elastomeric gasket(s) for all piping. The gasket(s) shall have a stainless steel adjustable strap to seal the gasket to the pipe. An elastomeric gasket(s) with a stainless steel adjustable strap to seal the gasket to the pipe shall be installed in all on site core bored holes.

D. The flow channel straight through a manhole should be made to conform as closely as possible in shape of the connecting sewers. The channel walls should be formed or shaped to the full height of the crown of the outlet sewer. A bench shall be provided on each side of any manhole channel when the pipe diameter(s) are less than the manhole diameter. The bench should be sloped no less than ½ inch per foot (4 percent). No lateral sewer, service connection, or drop manhole pipe shall discharge onto the surface of the bench. Manhole inverts shall have a minimum
1% slope with bench and channels constructed of 3000 psi concrete having a smooth trowel finish.

E. The individual manhole sections shall fit together with interlocking tongue and groove joints. Four (4) foot diameter manholes shall be sealed with a R-4 rubber gasket and six (6) foot or larger diameter manholes shall be sealed with two (2) 1-½” butyl rubber or plastic manhole joint seal squeezed in and out to verify sealing. The outside of the groove joints for all manholes shall be covered with a continuous overlapping butyl rubber wrap a minimum of six (6) inches wide.

F. An external drop is required on an existing manhole that has been core bored for a new gravity sewer and/or force main unless written approval is provided by the District. Force mains at a manhole shall have a plug valve at the manhole.

G. Manhole lift holes and grade adjustment rings shall be sealed with non-shrinking mortar.

2.4.2.1.4 External Manhole Coating

The outside surface of the manhole shall be coated with three coats (black/red/black or color changes to allow the Utility Operator to verify multiple coats) of coal tar epoxy coating with a minimum dry film thickness of 10 mils per coat for a total of 30 mils dry film thickness. Subsequent coats shall be applied within 48 hours of the previous coat. The coal tar epoxy coating shall be Koppers Bitumastic No. 300m or District written approval of equal.

2.4.2.1.5 Internal Manhole Coatings

The internal manhole coatings shall be a polymorphic resin, a calcium aluminate mortar, an epoxy coating, or polyurethane coating. Coatings shall be installed in accordance with the manufacturer’s specifications.

2.4.2.1.5.1 Polymorphic resin coating system

A. The sprayed applied polymorphic resin coating system shall be the Integrated Environmental Technologies (IET) System 3 or written approval of equal. The polymorphic resin shall be a 100% solids, two components, highly modified isothalic polyester resin material. The coating shall form a mechanical and chemical bond to the manhole liner surface with less than 0.08% shrinkage (ASTM C596) in 28 days. The material shall have a minimum twenty-eight (28)-day compressive strength of 9,000-psi.

B. The three-coat system is:

1. Prime Coat: DS-101 5-10 mils thick
2. Intermediate Coat: DS-301 20 mils thick

3. Final Coat: DS-401 5 mils thick

C. The finish resin shall be resistant to sulfuric acid attack associated with domestic sewage.

D. The existing manhole and junction chambers shall be prepared for the application of the polymorphic resin system by cleaning and stoppage of infiltration as specified above. Prior to applying the resin liner, the entire manhole surface and benches shall be patched and grouted to the extent needed to provide a smooth and even surface to which the liner will adhere.

E. The cured resin system shall conform to the minimum physical standards, as listed below:

<table>
<thead>
<tr>
<th>Cured Resin</th>
<th>Standard</th>
<th>Long-Term Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength</td>
<td>ASTM D-638</td>
<td>5,000 psi</td>
</tr>
<tr>
<td>Flexural Stress</td>
<td>ASTM D-790</td>
<td>8,630 psi</td>
</tr>
<tr>
<td>Flexural Modulus</td>
<td>ASTM D-790</td>
<td>15,120 psi</td>
</tr>
</tbody>
</table>

The Contractor shall provide certified independent, third party test results verifying the minimum physical properties listed above. The tests shall be in conformance with the ASTM specifications listed. The finished liner shall be cured in strict accordance with the manufacturer’s instructions.

2.4.2.1.5.2 Pure-fused Calcium aluminate mortar liner

The spray applied pure-fused calcium aluminate mortar liner shall be SewperCoat as manufactured by Lafarge Calcium Aluminates Inc., Mainstay ML-CA or written approval of equal.

A. Lafarge Calcium Aluminates Inc. SewperCoat

The Lafarge Calcium Aluminates Inc. SewperCoat material shall form a mechanical and chemical bond to the manhole liner surface with less than 0.08% shrinkage (ASTM C596) in 28 days. The liner shall have a minimum twenty-eight (28) day compressive strength of 9,000 psi. The liner is a one coat application. The liner shall be spray applied directly to the damp manhole surface, trowel smooth, and “brushed” finished. The material shall completely cover the interior surface of the manhole with a minimum thickness of ½ inch.

B. Mainstay ML-CA

Mainstay ML-CA coating shall yield .41 cu. ft. per 50# bag per one (1) gallon of water. The coating can be applied by pneumatic spray or by trowel up to 3” in a single lift but shall have minimum thickness of ½”
but with a 1” thickness for smoothing concrete that will experience surface attack. Working time is approximately 30 minutes at 80°F. Cured properties are Compressive Strength meeting ASTM C 109 24 hrs. ≥ 8000 psi, 7 days ≥ 9000 psi, and 28 days ≥ 9000 psi; Flexural Strength meeting ASTM C 293 24 hrs. ≥ 900 psi, 7 days ≥ 1000 psi, and 28 days ≥ 1100 psi; Shrinkage @ 90% Relative Humidity meeting ASTM C 596 24 hrs. 0%, 7 days 0%, and 28 days 0%; Tensile Strength meeting ASTM C 496 28 days 600 psi; and Bond Strength meeting ASTM C 1042 28 days ≥ 3000 psi.

2.4.2.1.5.3 Urethane Resin System

A. The existing manhole and junction chambers shall be prepared for the application of the urethane system by cleaning and stoppage of infiltration as specified below:

1. General: Surface preparation shall be in strict accordance with the approved coating manufacturer’s instructions. All surfaces to be coated shall be cleaned with a high-pressure water spray (minimum 4000 psi). The use of acid for cleaning purposes will not be allowed. All deteriorated concrete and loose or protruding brick and mortar shall be removed from the wall and benches to obtain a substrate suitable for the proposed coating system. All infiltration shall be stopped with hydraulic cement or other approved means to a smooth, uniform surface before application of the coating system. All voids in the sanitary sewer structure walls shall be sealed with hydraulic cement.

2. The Contractor shall install plugs to prevent extraneous material from entering the sewer lines.

3. Applicator shall inspect all specified surfaces prior to surface preparation. Applicator shall notify the Utility Operator of any noticeable disparity in the surfaces that may interfere with the proper preparation or application of the specified repair materials.

4. Applicator personnel shall directly perform all aspects of surface preparation and shall not subcontract any element of surface preparation.

5. All contaminants including: oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants shall be removed. All concrete or mortar that is not sound or has been damaged by chemical exposure shall be removed to a sound concrete surface or replaced.
6. Surface preparation method(s) and repair materials should be based upon the conditions of the substrate, service environment and the requirements of the coating material to be applied. Surfaces to receive repair materials shall be cleaned and abraded to produce a sound surface with adequate profile and porosity to provide a strong bond between the repair materials and the substrate.

7. Infiltration shall be stopped by using a material that is compatible with the coating material to be applied. Moderate to severe infiltration control may require the use of chemical injection grouting. All costs associated with infiltration control shall be considered inclusive with the cost of the application of the appropriate coating application.

8. All surfaces shall be examined by the Inspector both during and after preparation and before the coating application.

Prior to applying the urethane liner, the entire manhole surface and benches shall be patched and grouted to the extent needed to provide a smooth and even surface to which the liner will adhere.

B. The cured urethane system shall conform to the minimum physical standards, as listed below:

<table>
<thead>
<tr>
<th>Cured Urethane</th>
<th>Standard</th>
<th>Long-Term Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength</td>
<td>ASTM D-638</td>
<td>5,000 psi</td>
</tr>
<tr>
<td>Flexural Stress</td>
<td>ASTM D-790</td>
<td>10,000 psi</td>
</tr>
<tr>
<td>Flexural Modulus</td>
<td>ASTM D-790</td>
<td>550,000 psi</td>
</tr>
</tbody>
</table>

The Contractor shall provide certified independent, third party test results verifying the minimum physical properties listed above. The tests shall be in conformance with the ASTM specifications listed. The finished liner shall be cured in strict accordance with the manufacturer’s instructions.

C. The spray applied urethane resin system shall be of Raven or Enecon products only or written approval of equal. The finished urethane shall be resistant to sulfuric acid attack associated with domestic sewage. The urethane shall be manually sprayed onto the structures or manholes to provide a uniform smooth surface. A minimum thickness of 250 mils (1/4") shall be applied for structural integrity. If design requires, one inch can be applied in a single application. The coating system shall be capable of being applied over wet surfaces without degrading the final product.

D. Epoxy coating systems will be considered equal to the specified urethane resin system if the material is a solvent-free, 100% solids epoxy and meets or exceeds the minimum physical properties listed above. Composite systems containing layers of different materials or
cured-in-place resin systems that are inflated in the manholes will not be considered as equal. The epoxy liner shall be Raven 405 or written approval of equivalent. The liner shall be applied by brush, roller, plural component airless or air-assisted spray to a moist and damp condition. The Raven 405 shall be sprayed applied at a minimum thickness of 125 mils, unless otherwise specified by the District, in a single application and shall completely cover the interior surface of the manhole. Raven 405 is a 100% solids epoxy with zero shrinkage. Therefore, actual wet film thickness and final dry film thickness are the same (i.e. 10 mils WFT=10 mils DFT). Maximum physical properties are achieved in approximately eight hours at 70°F, however maximum chemical resistance may take three to seven days.

2.4.2.1.6 Manhole – Ring and Covers

A. All covers shall be H-20 rated and conform to the requirements and dimensions shown on the Engineering Drawings and the District standard details. All covers shall fit closely in the rings in all positions and must fit the ring solidly in the ring and in all positions so that there shall be no rocking from pressure on any point of the cover. All manhole covers shall be ASTM A536, Grade 60-40-18 ductile iron; and meet the requirements of ASTM A-48, Class 35B, AASHTO M-306 or higher. The cover shall be marked as designated in the “non-hinged” cover requirements.

B. For systems that will be owned and maintained by the District, the words SANITARY SEWER, and CHARLOTTE COUNTY or LEE COUNTY shall be cast in all manhole covers.

2.4.2.1.6.1 Non-hinged Cover

Circular non-hinged covers shall be a 24” or 36” clear opening diameter, and the frame shall incorporate a 360 degree mechanically attached elastomeric seating gasket for infiltration control and traffic shock. The cover shall have two non-penetrating pick holes 180 degrees apart and Charlotte or Lee County and the date of installation cast into the cover. The cover shall have no alignment tabs protruding from the bottom of the lid which would fit into the top of the manhole riser. A removable rain shield shall be installed with each manhole. Installation location of the non-hinged cover shall meet the District standard details.

2.4.2.2 Force Main

2.4.2.2.1 Materials

The materials used in this Work shall be all new and conform to the requirements for class, kind, size and material as specified below.
All pipe furnished for force main installations shall be of the type, kind, size, and class indicated for each line segment as shown on the Engineering Drawings and/or designated in the Contract Items.

2.4.2.1.1 Polyvinyl Chloride (PVC) Pressure Pipe and Fittings

A. PVC Pipe: PVC pipe for force mains shall conform to the requirements of AWWA C-900 (4" through 12"), AWWA C-905 (14" through 36"), and AWWA C-909 (4" through 24") and shall be Class 150 DR 18 for all open cut and direct bury installations with a minimum of thirty-six (36) inches of cover. For shallower depth, the type of pipe and installation shall require prior District written approval. The manufacturer shall insure all quality control test and AWWA requirements are complied with during the production of PVC pipe.

B. C-900, C-905, C-909 pipes shall have an integral bell formed with a race designed to accept the gasket in accordance with their respective AWWA requirements. The spigot end shall have a bevel and a stop mark on the outside diameter to indicate proper insertion depth. Provisions shall be made for expansion and contraction at each joint. All surfaces of the joint where the gasket may bear shall be smooth, free of cracks, fractures, or imperfections that could adversely affect the performance of the joint.

C. Pipe Color: All C-900, C-905, and C-909 force main pipes shall be green in color with a PVC ASTM D-1120 and ASTM D-2241 reference, the class pressure rating, and the DR number permanently and plainly marked on the pipe.

D. Rubber Gasket Joints: C-900, C-905, and C-909 polyvinylchloride pipe joints shall be the bell and spigot type using rubber gasket push-on type joints. Rubber gaskets shall be molded to a circular form to the proper cross section and shall consist of a vulcanized high grade elastomeric compound conforming to ASTM D-1869 and AWWA C-900 elastomeric seals for joining plastic pipe.

E. Fittings: All ductile iron fittings shall be in accordance with AWWA Specification C-153 and as a minimum have the same pressure rating of the connecting pipe. All ductile iron fittings shall be either:

1. Fusion bonded epoxy coated per AWWA Specification C-116

2. Ceramic epoxy coated per ASTM Specifications F-4176-95A, G-95, B-117, D-1308 and E-96

F. All exposed fasteners such as bolts, nuts, washers, and threaded rod shall be type 316 stainless steel and all buried fasteners such as bolts, nuts, fasteners, washers, and threaded rod shall be “Cor-Ten” steel or “Cor-blue” coated. Mechanical joint bolts shall not protrude more than ½ inch through the nut after joints are assembled.
G. Fastener Threads: All stainless-steel fastener threads shall be coated with an anti-seize compound as approved by District.

2.4.2.2.1.2 High Density Polyethylene (HDPE) Pipe and Fittings

A. Pipe:

1. High Density Polyethylene (HDPE) pipe shall meet the requirements of AWWA C-906 for polyethylene pressure pipe and fittings and for PE-3408 SDR 11. HDPE pipe shall meet ASTM D-3350 cell classification of PE 345434C. Permanent identification of the pipe shall be provided by co-extruding green longitudinal stripes into the pipes outside surface for force mains. All polyethylene piping shall have ductile iron pipe nominal outside diameters.

2. Individual sections of HDPE piping shall be joined together by thermal butt-fusion to make a continuous section of pipe as recommended by the pipe manufacturer. Bends in HDPE pipe shall not be within ten (10) pipe diameters from any fitting or valve. The minimum radius of curvature shall be thirty (30) pipe diameters and bending shall not cause kinking. HDPE piping shall not be joined by solvent cements, adhesive or threaded type connections.

3. The color marking stripes shall be aligned during the fusing process and the pipe shall be pulled through the bore to allow identification of the type of system utilizing the HDPE pipe.

B. Fittings:

1. All fittings and sleeves used with high density polyethylene (HDPE) pipe shall be fusion bonded epoxy coated ductile iron with mechanical joints rated to 350 psi and conforming to AWWA C-153 and C-111. All MJ fitting connections to polyethylene pipe shall be restrained with Mega-Lug restrainers. The HDPE pipe shall be reinforced on the ends using stainless steel wedge internal stiffeners.

2. The mechanical connection to MJ fittings and sleeves shall use mechanical restraints that meet specification requirements. Size-on-size mechanical connection to PVC or DI pipe shall be by compact ductile iron solid sleeves with Mega-Lug restrainers.

3. No electro fusion fittings shall be used with HDPE unless specific written approval is provided by the District.

4. HDPE molded butt fittings and couplings for non-standard fittings and couplings shall require special written approval from the District for installation.
2.4.2.2.1.3 Ductile Iron Pipe and Fittings

A. The ductile iron pipe covered by this specification shall be the push-on joint type or mechanical joint type, centrifugally cast to conform to all requirements of AWWA Specifications C-151 and C-153, latest revisions.

B. The maximum allowable deflection of the pipe shall not exceed two percent (2%) of the pipe diameter. Ductile iron pipe will be fully encased in an 8 mil polyethylene sleeve, in accordance with AWWA C-105, Method A. The pipe and the polyethylene sleeve shall be color coded green by a means acceptable to the District.

C. All piping and fittings shall be either:

1. Fusion bonded epoxy coated as per AWWA Specification latest revision

2. Ceramic epoxy coated as per ASTM Specifications F-1476-95A, G-95, B-117, D1308 and E-96

D. Polyethylene material shall conform to ASTM Standard Specification D1248-68, latest revision. All ductile iron piping shall be marked "DUCTILE IRON" in large letters. The nominal wall thickness shall be plainly marked on each piece of pipe and the pipe installed so that the markings can be read from the top of the trench.

E. Minimum thickness of ductile iron pipe shall be as follows:

Table 10. Ductile Iron Pipe Minimum Thickness

<table>
<thead>
<tr>
<th>Size of D.I.P.</th>
<th>Min. Thickness</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>3”</td>
<td>0.25”</td>
<td>Class 51</td>
</tr>
<tr>
<td>4”</td>
<td>0.26”</td>
<td>Class 51</td>
</tr>
<tr>
<td>6”</td>
<td>0.25”</td>
<td>Class 50</td>
</tr>
<tr>
<td>8”</td>
<td>0.27”</td>
<td>Class 50</td>
</tr>
<tr>
<td>10”</td>
<td>0.29”</td>
<td>Class 50</td>
</tr>
<tr>
<td>12”</td>
<td>0.31”</td>
<td>Class 50</td>
</tr>
<tr>
<td>14”</td>
<td>0.33”</td>
<td>Class 50</td>
</tr>
<tr>
<td>16”</td>
<td>0.34”</td>
<td>Class 50</td>
</tr>
<tr>
<td>18”</td>
<td>0.35”</td>
<td>Class 50</td>
</tr>
<tr>
<td>20”</td>
<td>0.36”</td>
<td>Class 50</td>
</tr>
<tr>
<td>24”</td>
<td>0.38”</td>
<td>Class 50</td>
</tr>
<tr>
<td>30”</td>
<td>0.39”</td>
<td>Class 50</td>
</tr>
<tr>
<td>36”</td>
<td>0.43”</td>
<td>Class 50</td>
</tr>
<tr>
<td>42”</td>
<td>0.47”</td>
<td>Class 50</td>
</tr>
<tr>
<td>48”</td>
<td>0.51”</td>
<td>Class 50</td>
</tr>
<tr>
<td>54”</td>
<td>0.57”</td>
<td>Class 50</td>
</tr>
</tbody>
</table>
F. Rubber gasket joints shall be in accordance with AWWA Specification C-111 latest revision.

G. All fittings shall be in accordance with AWWA Specification C-153 latest revision and have the same pressure rating of the connecting pipe. All exposed fasteners such as bolts, nuts, washers, and threaded rod shall be type 316 stainless steel. All buried fasteners such as bolts, nuts, washers, and threaded rod shall be “Cor-Ten” steel or Cor-blue coated steel. Mechanical joint bolts shall not protrude more than ½ inch through the nut after joints are assembled.

H. All stainless-steel fasteners threads shall be coated with an anti-seize compound as approved by the District.

2.4.2.2.1.4 Valves

2.4.2.2.1.4.1 Gate Valves

A. All gate valves shall meet all gate valve material, manufacturer, installation, performance, and execution requirements.

B. Side actuated gate valves shall be used on 14” or larger force mains and low pressure sewer force mains. Gate (tapping) valves shall be used for all tapping sleeves. Tapping valves 14” and larger shall be side actuated and the Contractor shall notify the supplier of this fact to ensure that the tapping valve has the same bolt pattern as the tapping sleeve.

2.4.2.2.1.4.1.1 Manufacture

A. Gate valves shall conform to the latest revision of AWWA C-500 "Gate Valves - 2 inch through 48 inch for Water and Sewage Systems" and be resilient wedge seated. The additional requirements and exceptions to the AWWA standards contained herein shall also be applicable. All components of this type of joint shall conform to AWWA Standard C-111, "Rubber-Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings". All ductile iron valves shall be fusion bonded epoxy coated.

B. Valves and required operating appurtenances shall be the product of the same manufacturer. All valves shall have the manufacturer and size of the valve visibly cast on the body or on a plate attached to the body of the valve. All valves shall be suitable for throttling service and/or frequent operation as well as service involving long periods of inactivity.

C. The operating pressure for all sizes shall be a minimum of 150 psi gage or of the adjacent piping whichever is greatest.
D. Valves shall be provided with a fully enclosed, permanently lubricated actuator of the traveling nut or worm gear design. The actuator shall be connected to the valve shaft by means of a key and keyway connection. All actuators shall have adjustable, mechanical stop limits in accordance with AWWA C-504 Section 3.8.2. All valve actuators shall be capable of withstanding 450 ft-lbs of input torque against the open or closed stops without damage.

E. Valves for below ground applications shall have an AWWA wrench nut with a cast-in with an arrow indicating the direction of opening. For a smooth shaft, the wrench nut shall be fastened to the input shaft by means of a minimum 5/16" diameter steel pin passing entirely through the shaft and the wrench nut; a key with keyway is acceptable. For a splined shaft, the wrench nut shall be formed to fit the splined shaft. The actuator shall be designed to produce the specified torque with a maximum input of 150 ft-lbs applied to the wrench nut. For above ground valves, a hand wheel will be used with an arrow cast-in arrow indicating the direction of the opening. The hand wheel shall be fastened to the actuator input shaft to produce the specified torque with a maximum pull of 80 pounds of the hand wheel rim.

F. Cut-in gate valves shall be resilient full seat and capable of handling working pressures up +250 psi. The insert valve shall have the capability of insertion into steel; C-900, C-905, and C-909 PVC; cast iron; and ductile iron piping. The cut-in valve shall be capable of installation and placing into operation in active force mains and low pressure systems force mains without spillage or stopping the flow by isolating the inserting valve during installation.

G. Insert Valves, Ductile Iron 250 p.s.i.g., shall be a Resilient Wedge Gate Valve including ductile iron body, bonnet and wedge shall provide a strength and a pressure rating that meets or exceeds the requirements of AWWA C-515. The insert valves shall be designed for use in sewage systems. The design shall allow the valve to be installed into an existing pressurized pipeline while maintaining constant pressure and service as usual. The resilient wedge shall seat on the valve body and not the pipe to obtain the optimum seating and flow control results. The resilient wedge shall be totally independent of the carrier pipe. The resilient wedge shall not come into contact with the carrier pipe or depend on the carrier pipe to create a seal.

H. Tapping Sleeve shall be type 316 stainless steel.

I. All interior and exterior ferrous surfaces of the valve, including the disc, shall be coated with fusion bonded epoxy. The epoxy shall be fusion bonded and have a nominal thickness of 8 mils and be in accordance with AWWA C-550.
J. All exposed bolts, nuts, fasteners, and washers shall be type 316 stainless steel and all buried bolts, nuts, fasteners, and washers shall be “Cor-Ten” steel or “Cor-blue” coated. Mechanical joints bolts shall not protrude more than ½ inch through the nut after joints are assembled. Accessories for the mechanical joint consisting of the gasket, gland and fasteners shall be furnished and packaged separately from the valves. Each package shall be labeled in such a manner as to provide for proper identification and number of units per package or bundle.

K. All stainless-steel fasteners threads shall be coated with an anti-seize compound as approved by the District.

2.4.2.1.5 Flanged Joints:

A. Flanges shall be drilled in accordance with ANSI-B16.1 Class 150 Cast-Iron Flange Specifications. Flanges shall be machined to a flat face with a finish of 250 micro-inches AARH maximum or machined to a flat surface with a serrated finish in accordance with AWWA Standards C-207, Section 6 for Steel Pipe Flanges. Flange gaskets shall be one-eighth inch ring type of a synthetic rubber material. All thread studs shall be used on all valve flange connections in accordance with ASTM Standard Designations A-307, Grade B, with heavy hex nuts.

2.4.2.1.6 Bolting Material:

A. All exposed bolts, nuts, fasteners, washers, shall be type 316 stainless steel and all buried bolts, nuts, fasteners, and washers shall be “Cor-Ten” steel or Cor-blue coated. Bolts and hex nuts used on the valve shall be the manufacturer's standard either fabricated from a low-alloy steel for corrosion resistance or electroplated with zinc or cadmium. The hot-dip process in accordance with ASTM Standard Designate A-153 is not acceptable for the threaded portion of the bolts and nuts.

B. All stainless-steel fasteners threads shall be coated with an anti-seize compound as approved by the District.

2.4.2.1.6.1 Approved Products

All valves and tapping sleeves shall conform to AWWA standards and shall meet the District standard details.

The following product(s) are approved for valves:

- AFC 2500-1 SERIES
- Clow/M&H/Kennedy 4000 SERIES
- Mueller A 2360 SERIES
Clow 6100 SERIES
U.S. Pipe METROSEAL 250

The following product(s) are approved for tapping sleeves:

<table>
<thead>
<tr>
<th>Company</th>
<th>Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>JCM</td>
<td>432 SERIES</td>
</tr>
<tr>
<td>Romac</td>
<td>SST III SERIES</td>
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<tr>
<td>Cascade</td>
<td>CST/EX</td>
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<tr>
<td>Smith Blair</td>
<td>662, 663</td>
</tr>
<tr>
<td>Powerseal</td>
<td>3490MJ/3940AS</td>
</tr>
</tbody>
</table>

2.4.2.2.1.7 Plug Valves

A. Plug valves shall be used on 3” diameter to 12” diameter low pressure sewer systems force mains and force mains. Gate valves shall be used for all wet tapping of mains on low pressure sewer systems force mains and force mains.

B. Valves and required operating appurtenances shall be the product of the same manufacturer. All plug valves shall have the manufacturer and size of the valve visibly cast on the body or on a plate attached to the body of the valve. Valve components shall withstand the environmental conditions in contact, and provide continuous trouble-free services. Valve seals shall be able to provide tight closure and prevent metal-to-metal contact.

C. Plug valves 8 inch and larger in size require gear reduction actuators.

2.4.2.2.1.7.1 Manufacture

A. Plug valves design, component material construction, manufacture, and testing shall be in accordance with AWWA C-504 and shall provide for nominal pipe size flow with no interference or restrictions. The plug valve body shall be of cast iron conforming to ASTM A-126, Class B, for working pressures up to 175 psi. The words “Seat End” shall be cast on the exterior of the body seat end. All below ground gear actuators for plug valves shall be operated by a standard 2” AWWA operating nut. For side mounted actuators, the actuators shall have a counter clockwise rotation operating nut. For above ground applications, stop-limiting devices shall be provided in the operators for the open and closed portions and valve operators shall be provided with position indicators to show the position of the valve disc or plug.

B. Plug shall be of one-piece construction and made of ASTM A-124, grade B cast iron with a resilient facing per ASTM D2000-BG and AWWA C-504 requirements. The exterior of the plug valve shall be
coated with a universal alkyd primer. Cover bolts shall be corrosion resistant with zinc plating.

C. All plug valves shall be provided with a fully enclosed, permanently lubricated actuator of the worm gear design. The actuator shall be connected to the valve shaft by means of a key and keyway connection. Shaft seals shall conform to AWWA C-504 and consist of V-type packing in a fixed gland with an adjustable follower. Radial bearings shall be constructed of self-lubricating type 316 stainless steel. The top thrust bearing shall be Teflon, and the bottom thrust bearing shall be type 316 stainless steel.

D. All interior ferrous surfaces of the valve, including the plug, shall be coated with fusion bonded epoxy. The epoxy shall have a nominal thickness of 8 mils and be in accordance with AWWA C-550.

2.4.2.1.7.2 Valve Ends Installations

A. Flanged ends (non-buried installation): Flanged fittings have 150 lb. flanges and shall be faced and drilled in accordance with ANSI Specification B16.1, Class 125.

B. Mechanical Joint Ends (buried installation): Mechanical joint bell dimensions shall conform to AWWA C-111.

C. All valves shall conform to AWWA standards and shall meet the District standard details.

2.4.2.1.7.3 Approved Products

The following product(s) are approved:

- Milliken 600/601 Series
- Pratt Plug Valve
- SPX Dezurick 100 Series

2.4.2.1.8 Air Release Valves

This section includes air release valves, automatic air release valves, and automatic combination air release/vacuum release valves that are to be used for low pressure sewer system force mains and force mains as specified. Air release valves shall be located at system high points to release air pockets. Vacuum release valves shall be located as necessary to admit air to a system to prevent collapse.

A. Automatic wastewater air release valves shall be used on force mains, and low pressure sewer system force mains. The automatic air release valves shall be constructed in accordance with the District standard details.
B. Automatic wastewater air release valves installed on force mains and low pressure sewer system force mains shall include odor control in accordance with the District standard details.

C. Automatic air release valves and automatic combination air release/vacuum release valves shall have a high-density polyethylene enclosure green in color for force mains and low pressure sewer system force mains.

D. The vacuum portion of the automatic combination air release/vacuum release valves shall be deactivated in all applications unless otherwise directed by the District.

2.4.2.1.8.1 Manufacture

A. Automatic air release valves and automatic combination air release/vacuum release valves shall be manufactured in accordance with AWWA C-512.

B. Type 316 stainless steel shall be used for all internal components of automatic air release valves and automatic combination air release/vacuum release valves, unless written approval is provided by the District.

C. All automatic air release valves and automatic combination air release/vacuum release valves shall be fusion bonded epoxy coated.

2.4.2.1.8.2 Approved Products

All valves shall conform to AWWA standards and shall meet the District standard details.

The following product(s) are approved:

H-Tec Model 986 Combination ARV – 316 Stainless Steel

2.4.2.1.9 Valve Box and Valve Box Cover

2.4.2.1.9.1 Manufacture

A. The valve box shall be in ductile iron material.

B. The valve box cover shall be reinforced, high density polymer concrete including an ultraviolet (UV) inhibiting agent and a solid color throughout the cover.

C. The valve box cover shall include a 3M read and write capable locator marker for the function of the valve.
D. The valve box cover loading shall exceed the Tier-15 load rating in accordance with ANSI/SCTE 77. When installed, the top valve box cover shall be below the top rim/edge of the valve riser.

E. The valve box cover shall meet the dimensions and marking requirements of the District standard details and include a three (3)” round brass identification plate to be inserted into the concrete valve pad. The identification plate shall include the valve size, date of installation, and number of turns as shown on the brass identification plate used on the valve pad.

2.4.2.2.1.9.2 Approved Products

A. All valve boxes and valve box covers shall conform to ANSI/SCTE 77 and shall meet the District standard details.

B. The following product(s) are approved:

Valve box cover only: Glassmasters Polymer Concrete Products:

Wastewater: Mfg Part # VBC7420-5-CCWW

Valve boxes only:

General Foundry: #32461
Sigma/Russco: B122
Tyler/Union: 461S

2.4.2.2.1.10 Marker Balls and Marker Tape

A. Force main marker balls shall be 3M 4-inch marker ball model 1424XR/ID and green in color.

B. Force main marker tape stripes shall be green in color.

2.4.2.3 Pump Station

2.4.2.3.1 Materials

The materials used in this Work shall be all new and conform to the requirements for class, kind, size and material as specified below and/or as provided in other sections of the contract documents.

All stainless steel shall be type 316 austenitic, non-magnetic unless otherwise required.

2.4.2.3.1.1 Wet Well, Access Hatch and Concrete Cover and Slab

A. Pre-cast circular concrete wet wells and the wet well concrete cover shall comply with the structural requirements of ASTM C478, Type II, acid
resistant cement and shall attain a minimum compressive strength of 4000 pounds per cubic foot in 28 days. The wet well pre-cast base section shall be monolithic with the bottom section of the wet well. The precast wet well top shall include the access cover frame.

B. The wet well design shall assume a soil density of 112 pounds per cubic foot and a concrete density of 150 pounds per cubic foot and shall resist flotation under the conditions of an empty wet well and a groundwater level from the wet well base to the finished grade including a safety factor of 1.5.

C. Cast in place concrete slab shall be a minimum of 8” thick and shall comply with ACI and ASTM standards. Concrete shall be ASTM C-150 Portland Type II 3,500 psi air entrained at 6% plus or minus 1% unless otherwise noted on the engineering plans. Fine aggregate shall be ASTM C33 and course aggregate ASTM C33 ¾” maximum size. Reinforcing shall be ASTM A615 Grade 60 deformed bars and stirrups and Grade 40 ties, welded wire fabric shall meet the requirements of ASTM A185, and fabricated reinforcing steel shall be in accordance with ACI 315. Form lumber shall be in accordance with ACI 347 and shall be used with removable metal form ties, non-staining and moisture absorbing form release agents, and stainless steel dovetail anchor slots, and water stops as shown on the engineering drawings.

D. The wet well shall be set on a number 57 stone base in accordance with section 901 “Coarse Aggregate” of the latest revision Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

E. The individual wet well sections shall fit together with interlocking tongue and groove joints. Four (4) foot diameter wet wells shall be sealed with a R-4 rubber gasket and six (6) foot or larger diameter wet wells shall be sealed with two (2) 1-½” butyl rubber or plastic wet wells joint seal squeezed in and out to verify sealing. The outside of the groove joints for all wet wells shall be covered with a continuous overlapping butyl rubber wrap a minimum of eight (8) inches wide.

F. The wet well shall include elastomeric gasket(s) for all piping. The gasket(s) shall have a stainless steel adjustable strap to seal the gasket to the pipe. An elastomeric gasket(s) with a stainless steel adjustable strap to seal the gasket to the pipe shall be installed in all on site core bored holes.

G. The outside surface of the wet well shall be covered with 3 coats (black/red/black or color changes to allow the Utility Operator to verify multiple coats) of coal tar epoxy coating with a minimum dry film thickness of 10 mils per coat for a total of 30 mils dry film thickness. Subsequent coats shall be applied within 48 hours of the previous coat.
The coal tar epoxy coating shall be Koppers Bitumastic No. 300m or the District written approval of equal.

H. The internal wet well coatings (including cover) shall be a polymorphic resin, a calcium aluminate mortar, an epoxy coating, or a polyurethane coating. Coatings shall be installed in accordance with the manufacturer’s specifications.

I. The wet well access hatches and frames shall be compatible with the lift-out rail system in accordance with the Engineering Drawings and approved shop drawings. The wet well access hatch and frame shall be aluminum with type 316 stainless steel hinges, handles, and associated hardware in accordance with the District standard details.

J. The standard lift station influent piping inverts shall be a minimum of sixty (60) inches above the base invert.

K. The following access hatch and frame is approved:

1. Halliday S1R aluminum access cover with standard locking bar and frame

2.4.2.3.1.2 Valve Vault, Access Hatch and Concrete Cover (if required)

A. A valve vault, access hatch and concrete cover and all other components and appurtenances shall be as specified on the Engineering Drawings and in the District standard details.

B. Pre-cast rectangular concrete valve vault and the valve vault concrete cover shall comply with the structural requirements of ASTM C913, Type II, acid resistant cement and shall attain a minimum compressive strength of 4000 pounds per cubic foot in 28 days. The valve vault pre-cast base section shall be monolithic with the bottom section of the valve vault. The pre-cast valve vault cover shall include a cast-in-place access hatch frame.

C. The valve vault design shall assume a soil density of 112 pounds per cubic foot and a concrete density of 150 pounds per cubic foot and shall resist flotation under the conditions of an empty valve vault and a groundwater level from the valve vault base to finished grade, including a safety factor of 1.5.

D. The valve vault shall be set on a number 57 stone base in accordance with section 901 “Coarse Aggregate” of the latest revision Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

E. The individual valve vault sections shall fit together with interlocking tongue and groove joints. The valve vault precast top and walls shall be sealed with a R-4 rubber gasket or with two (2) 1-½” butyl rubber or
plastic valve vaults joint seal squeezed in and out to verify sealing. The outside of the groove joints for all valve vaults shall be covered with a continuous overlapping butyl rubber wrap a minimum of eight (8) inches wide.

F. The outside and inside surfaces (including cover) of the valve vault shall be covered with 3 coats (black/red/black or color changes to allow the Utility Operator to verify multiple coats) of coal tar epoxy coating with a minimum dry film thickness of 10 mils per coat for a total of 30 mils dry film thickness. Subsequent coats shall be applied within 48 hours of the previous coat. The coal tar epoxy coating shall be Koppers Bitumastic No. 300m or the District written approval of equal.

G. The valve vault access hatch and frame shall be aluminum with type 316 stainless steel hinges, handles, and associated hardware in accordance with the District standard details.

H. The valve vault piping inverts shall be a minimum of eighteen (18) inches above the base invert. The valve vault cover shall be minimum thirty-six (36) inches from the top of the pipe to the finished grade.

I. The following access hatch manufacturer is approved:

1. Halliday S2R aluminum access cover with standard locking bar and frame

2.4.2.3.1.3 Discharge Piping and Valves

A. The discharge piping and valves shall be designed, constructed and installed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the drawings. The piping and valves shall be supported to the wet well walls and above ground as shown on the engineering drawings and the District standard details.

B. The piping and valves shall be furnished and installed in accordance with the District Construction Standards, Details and Specifications (DCS).

C. The following aluminum clean-out coupler with cap and chain manufacturer is approved:

1. Kamlock

2.4.2.3.1.4 Water Service

A. The Contractor shall provide a water service as shown on the Engineering Drawings and the District standard details. The service shall include the labor and materials for the tap at the water main source, polyethylene piping, meter box, fittings, backflow prevention device, spigot, mounting brackets and connectors, etc. The Utility Operator will provide and install the water meter.
B. A separate water service is required for the odor control.

2.4.3.1.5 Fence and Gates
The Contractor shall provide and install fence and double eight (8) foot gates (total sixteen (16) foot width) with hold-backs, and wheels in accordance with the Engineering Drawings and the District standard details. All the fencing and gate components shall be adequate to meet the required wind resistance loading.

2.4.3.1.6 Driveways
The Contractor shall construct a sixteen (16) foot minimum concrete driveway as shown on the Engineering Drawings and the District standard details. The driveway shall include right-of-way culverts, if required, and drainage shall be in accordance with the DCS.

2.4.3.1.7 Landscaping
The Contractor shall provide landscaping, if required, in accordance with the District Specifications.

2.4.3 CONSTRUCTION

2.4.3.1 Installation of Gravity Sanitary Sewer

2.4.3.1.1 Material Handling
Manholes, piping, and other accessories shall be unloaded at the point of delivery and hauled to and distributed at the site of the Project by the Contractor and be handled with care to avoid damage. In distributing the material at the Site, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. If any manholes, piping, and other accessories are damaged, the replacement or approved repair shall be made by the Contractor at the Contractor's expense as approved in writing by the District.

2.4.3.1.2 Pipe Alignment and Grade
All pipes shall be laid and maintained to the required lines and grades with manholes at the required locations. No deviation shall be made from the required line or grade except with the written approval of the District. All construction staking requirements of the Project shall be performed by a Professional Surveyor and Mapper (PSM) licensed in the state of Florida, paid for by the Contractor, to insure compliance with the construction plans.

2.4.3.1.3 Trenching
Prior to laying the pipe the trench shall be excavated and prepared in accordance with the District standard details class of bedding, fill material, and compaction requirements. The width of the trench shall be ample to allow the pipe to be laid and jointed properly and to
allow the bedding and haunching to be placed and compacted to adequately support the pipe.

2.4.3.1.4 Laying Pipe

A. All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered into its position in the trench, and the pipe shall be kept clean by approved means during and after laying. The outside of the tongue or spigot end of the pipe shall be wire brushed and wiped clean, dry, and free from oil and grease before the pipe is laid.

B. The pipe shall be laid proceeding upgrade with the tongue or spigot ends pointed in the direction of flow. Pipe shall not be laid in water or when the trench conditions are unsuitable for such work except by written permission of the District. The excavation of trenches shall be fully completed a sufficient distance in advance of the pipe laying and the exposed ends of all pipe shall be fully protected with a board or approved stopper to prevent earth or other substances from entering the pipe. The interior of the sewer piping shall be continually cleaned of all dirt, cement, or superfluous material as the work progresses. If necessary and/or required by the District at the completion of the installation, the pipe shall be thoroughly flushed by the District approved method at the expense of the Contractor prior to testing.

C. No piping shall be laid in direct contact with cap rock. At a minimum, there shall be 3 inches of suitable material between any pipe and cap rock. Proper specified bedding shall be placed between the rock surface and the outside of the pipe to prevent damage to the pipe.

D. Pipe shall be laid with the lettering designating manufacturers name, class, and size of pipe visible from the top of the open trench.

E. The Contractor shall maintain the line and grade of the pipe in the trench by means of a laser machine. The laser apparatus shall be in good working order when being used. When directed by the District, the Contractor shall set the laser machine above ground and verify the working order of the laser machine to the Districts satisfaction. The Contractor shall check periodically the line and grade of the pipe being laid by other means. The Contractor shall check the grade of each structure placed by means of an automatic level or other means with written approval by the District. All pipes and manholes shall be installed within tolerance levels of the laser apparatus as approved by District.

F. Joints for gravity sanitary sewer PVC and DI pipe shall be made by using push on rubber gaskets only. All jointing procedure shall be in accordance with the recommendations of the pipe manufacturer as approved by the District. All sliding surface of joints shall be cleaned and lubricated immediately before the pipe is brought home.

2.4.3.1.5 Service Connections, Wyes, Tees

A. The appropriate size service connections, wyes, and tees shall be installed for service connections in accordance with the Engineering Drawings, the District standard.
details and/or at locations as determined by the District. The joints and bedding shall be made as previously specified. The tops of all risers and openings to wyes and/or tee branches shall be capped by a slip joint plug to prevent any water from entering the service until the connection is placed in service. A clean out as specified in the District standard details shall be installed at the end of all service connections which is either at the right-of-way or property line.

B. When the new sewer services are being connected to the existing sewer main, the Contractor shall video (TV) inspect the existing sewer main immediately before and after the new sewer services installation to verify the existing pipe conditions. The audio, video, and written records shall be provided to the District for review.

C. The Contractor shall keep written records of service connection, wye, tee locations, depth to top of riser, and type of connection for completion of as-built drawings. A locate ball shall be placed on the service connection at the clean out location which is either at the right-of-way or property line. The wye or tee location shall be made to the nearest manhole center downgrade from the service.

2.4.3.1.6 Marker Balls and Metallic Marker Tape

A. Marker balls and metallic marker tape: Contractor shall provide and install metallic marker tape and provide, program, and install marker balls for all installed trenched pipe. For trenchless pipe installations, the Contractor shall provide, program, and install marker balls. Metallic marker tape is not required on trenchless pipe installations. The tape shall be marked green for sewer. The metallic tape shall be laid 12 to 18 inches above the pipe and the ball markers placed directly on top of the pipe or fitting.

B. Installation: The balls shall be installed at all changes of direction and fittings absent of any valve. For cul-de-sacs having continuous fused or roll piping with no in-line fittings, the balls shall be placed starting at the point of curvature of the cul-de-sac and every 50 linear foot to the end of the line. On straight runs of pipe, the balls shall be installed at every power pole. If power poles do not exist, the balls shall be placed every 150 feet from the nearest change of direction or fitting. On vertical deflections, the marker ball shall be placed on the top fitting only.

C. Programming: The Contractor shall program all balls and provide a copy of the programmed data in each marker ball in either Microsoft Excel or Access electronic format to the District. The Contractor as-built drawings shall show the location of all marker balls.

2.4.3.1.7 Setting Manholes

A. Manholes shall be set and jointed to the line in the manner specified for laying and jointing pipe and at location(s) as shown on the Engineering Drawings, the District standard details and/or as directed by the District.

B. Frames and covers shall be set to the designated elevation on a precast concrete riser section. The bottom of all manholes shall be constructed of half section of equivalent
size pipe shaped to conform to the inlet and outlet pipe to allow a free, uninterrupted flow.

C. A minimum of one (1), and a maximum of three (3), four (4) inch precast adjusting rings shall be provided between the cast iron frame and the top concrete manhole section on a full bed of non-shrinking mortar with non-shrinking mortar between rings. The interior and exterior of rings shall be grouted.

D. The manholes shall be assembled/erected such that they are waterproof. The interlocking joints between manhole sections shall be sealed using a joint seal previously specified. A continuous and overlapping at its end outside wrap as previously specified shall be installed for all manhole joints between sections.

E. Not less than three (3) and not more than four (4) lifting holes shall be allowed in any pre-cast manhole section. All lifting holes shall be plugged with non-shrinking mortar and internally and externally coated to ensure a waterproof installation.

F. Precast concrete bases shall be of size and depth in accordance with the District standard details. Concrete used shall have a 28-day compressive strength of at least 3,000 pounds per square inch. Bases must be placed in a waterless excavation on a minimum of eight inches of Number 57 stone thoroughly compacted and leveled off across the entire width of the base.

2.4.3.1.8 Bedding, Backfill, and Compaction

All bedding, backfill and compaction shall meet the requirements of the District Standard Design Details. Final backfill shall be of a suitable material removed from excavation except where other material is specified. Debris, frozen material, large clods or stones, organic matter, or other unstable materials shall not be used for final backfill within two feet of the top of the pipe. Final backfill shall be placed in such a manner as not to disturb the alignment of the pipe.

2.4.3.2 Gravity Sanitary Sewer Testing

The Contractor shall verify the operability of the gravity sanitary sewer including service connections installed and manholes prior to the District acceptance of the system. Verification of the operability of the gravity sanitary sewer including service connections and manholes includes cleaning of the gravity sanitary sewer and manholes prior to TV testing, flow testing of gravity sanitary sewer, mandrel deflection testing, vacuum testing of manholes, and air pressure testing of gravity sanitary sewer including service connections in accordance with the specifications and the District standard details. The gravity sanitary sewer flow testing and mandrel deflection testing (if required), shall be conducted after the air pressure testing of the gravity sanitary sewer and after the backfilling is complete above the gravity sanitary sewer. Oil filled gauges shall only be used for all pressure tests. All failed testing shall be redone at no cost to District. The specifics of all these tests are outlined in the District standard details except for deflection testing as outlined herein:
2.4.3.2.1 Gravity Sewer Main Low Pressure Test:

A. Gravity sewer system testing (inclusive of sewer mains, sewer services, and manholes) shall only be conducted after the placement and compaction of backfill and base materials are completed and the compaction has been tested and approved.

B. All gravity sewer main low pressure testing shall be witnessed by the Utility Operator.

C. All services shall be installed prior to testing the gravity sewer main.

D. All gravity sewer pipe shall be air tested as follows:

1. The sewer main shall be flushed and cleaned prior to the air test.

2. The section of gravity main to be tested shall be isolated with air filled stoppers or plugs suitable for air testing.

3. The services shall be capped and weighted to preclude blowing off during the test.

4. Air shall be added slowly to the test section so that the test pressure equals 4.0 psig.

5. Test air pressure shall be maintained within 0.5 psig of the test pressure by regulating the air supply for a period of two (2) minutes to stabilize the temperature.

6. After two (2) minutes the air supply shall be disconnected and the pressure in the pipe adjusted to 3.5 psig.

7. Measure the time required for a one (1) psig drop in pressure using a stop watch.

8. Compare the recorded time with the allowable time in the following table:

<table>
<thead>
<tr>
<th>Length of Test Section (ft)</th>
<th>Test Time (Min:Sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8” Dia. Pipe</td>
</tr>
<tr>
<td>150 or Less</td>
<td>7:34</td>
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<tr>
<td>175</td>
<td>7:34</td>
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<tr>
<td>200</td>
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<td>300</td>
<td>7:35</td>
</tr>
<tr>
<td>325 &amp; greater</td>
<td>8:50</td>
</tr>
</tbody>
</table>

If the recorded time is less than the allowable time, replace the defective fittings and pipe and re-test until a satisfactory test is achieved.
2.4.3.2.2 Gravity Sewer Main Flow Test:
A. All installed gravity sewer main piping shall be flushed with a high-pressure water hose and televised with an in-line video camera having pan and tilt capabilities. A calibrated depth gauge shall be mounted to allow the camera to show the residual water in the main. Deviation from line or grade shall not be more than one half inch for linear and one half inch for grade. All sewer laterals shall be inspected. A Utility Operator representative must be present during the tele viewing.
B. The Contractor shall provide the District audio, video, and written records of the flow testing for review and written approval.

2.4.3.2.3 Gravity Sewer Deflection Test:
A. Deflection tests shall be performed on all plastic gravity sanitary sewer pipes at the discretion of the District based upon field observations indicating non-conformance(s). The test shall be conducted after the sewer trench has been backfilled to the desired finished grade and has been in place for 30 days. The deflection test shall be performed by pulling a rigid ball or nine point mandrels through the pipe without the aid of mechanical pulling drives. The ball or mandrel shall have a minimum diameter equal to 95% of the actual inside diameter of the pipe. The maximum allowable deflection shall not exceed five percent of the pipe’s internal diameter. The line will be considered acceptable if the mandrel can progress through the line without binding. The time of the test, the method of testing, and the equipment to be used for the test shall be subject to the written approval of the District.
B. All testing shall be performed by the contractor at contractor’s expense without any direct compensation being made therefore, and shall furnish all necessary equipment and materials required.
C. Test Failure and Remedy: In the event of test failure on any test section, the section shall be replaced, with all repair work subject to written approval of the District. The replaced section shall be retested for leakage and deflection in conformance with the specifications contained herein. All repairs, replacement, and retesting shall be at the Contractor’s expense.

2.4.3.2.4 Internal Coating Thickness Testing:
A. Urethane resin system, epoxy and polymorphic resin and pure-fused calcium aluminate mortar coatings shall be high voltage spark tested in accordance with ASTM D-4787 using a Model AP/W Tinker Razor Holiday Detector or the District approved equal device to verify the dry film thickness of the coating is as required by the manufacturer or engineering drawings. A test voltage of 100 volts/mil of coating thickness shall be applied to the coating. All pinholes and any other areas damaged by the test shall be marked and repaired by the contractor in accordance with the coating manufacturer’s specification.
B. Wet coatings shall be tested using a thickness gauge in a minimum of three locations: one towards the top, one towards the bottom and one in the center of the structure as
approved in writing by the District. All thickness testing shall be witnessed by the Utility Operator.

2.4.3.3 Installation of Force Main

2.4.3.3.1 Construction Requirements

A. Direct Bury, Directional Bore, and Jack and Bore: All direct bury, directional bore, and jack and bore force main pipe shall be installed at a minimum depth of thirty-six (36) inches or as approved in writing by the District.

B. NOTE: If the new construction is tying into existing utilities, the contractor shall verify the existing utilities, such as fittings and valves, are restrained prior to the start of installation of the valve or piping. If not properly restrained, the contractor shall notify the District in writing and shall restrain the existing utility as approved in writing by the District.

2.4.3.3.1.1 Direct Bury of Material

A. Open cut PVC force main piping shall be Class 150 DR 18 for all areas with a minimum of thirty-six (36) inches of cover. For shallower depth, the type of pipe and installation shall require prior the District written approval.

B. Proper implements, tools, and facilities satisfactory to the Utility Operator shall be provided and used by the contractor for the safe and convenient execution of the work and the testing. All pipe, fittings, and valves shall be carefully lowered into the trench in such a manner as to prevent damage to force main materials and protective coatings and linings. The force main materials shall not be dropped or dumped into the trench. The pipe shall be laid with the manufacturers lettering designating the type and size of pipe visible from the top of the open trench. Wherever it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane to avoid obstructions or where long-radius curves are permitted, the amount of pipe or joint deflection shall not exceed fifty (50) percent of the manufacturer's recommended limit. Pipelines intended to be straight shall not deviate from the straight line at any point in excess of one (1) inch.

C. Open cuts of roads for trenching and direct bury of force mains shall not exceed eight feet in width. All effort shall be made to minimize the width of the trench and the amount of restoration.

D. All existing materials removed to facilitate the tunneling or deflecting of direct bury piping under or adjacent to existing storm piping and/or structures shall be replaced by flowable fill. Prior to placing flowable fill, the area between the direct bury piping and existing piping or structure shall be hollowed out to a defined cavity along the length of the direct bury piping. The Contractor is responsible for filling the entire cavity
with flowable fill and replacing the flowable fill as necessary throughout the contract and warranty period should erosion occur.

E. PVC pipe may be laid in the trench in single sections or preassembled multiple sections including no more than one full stick of pipe, one partial stick of pipe, and intervening required fittings and/or valves. Preassembled sections of pipe shall be carefully fed by hand or with the use of approved equipment on the pipe bed. The Contractor shall provide pockets in the pipe bed material to eliminate any concentration of loads on the bell ends or joints. The ends of mechanical joint pipe and fittings and rubber gasket joint pipe and fittings shall be clean of all dirt, grease, and foreign matter prior to installing fittings or joining of pipe sections. A joint lubricant shall be applied to all gaskets prior to joining two pipe sections together. To preclude the possibility of cross usage between force main and potable water piping, the joint lubricant shall have been tested and approved for potable water service. No lubricant shall be used that harbor bacteria or damage the gaskets.

F. Cutting pipe for inserting valves, fittings, or closure pieces shall be in a neat and workmanlike manner without damaging the pipe or lining and to leave a smooth end at right angles to the axes of the cut pipe. The cut end of mechanical joint pipe shall be dressed to remove sharp edges or projections which may damage the rubber gasket. For push-on joints, the contractor shall dress the pipe cut ends by beveling as recommended by the manufacturer.

2.4.3.3.1.2 Directional Bore of Material

A. Proper implements, tools, and facilities shall be provided and used by the Contractor for the safe and convenient execution of the work. The contractor shall meet the jointing and cutting pipe direct bury force main piping requirements as they apply to the directional bore. A log of the bore depths shall be based on one foot intervals staking from the entry and exit locations and intermediate centerline. The vertical and horizontal location readings shall be plotted on a one inch (1") equals twenty feet (20') natural scale drawing which shall be provided to the District within 48 hours of completion of the bore.

B. No electro fusion fittings shall be used with HDPE unless specific written approval is provided by the District.

C. For force mains eight inches (8") in size or smaller, the HDPE pipe shall have the same outside diameter as the connecting mains. For larger sizes, the HDPE pipe shall have the same size or larger inside diameter as the connecting mains unless otherwise noted on the plans or approved in writing by the District.

D. The depth of all directional bores for FDOT roads shall be in accordance with the FDOT permit requirements.
E. The slurry may be recycled for reuse in additional hole opening operations if written approval is provided by the District or it shall be removed and disposed of at an approved dump site. No fluids shall be allowed to enter any unapproved areas or natural waterways.

F. For directional bores under any surface water (subaqueous) the drilling contractor must submit a ‘frac-out’ response plan for review and approval prior to starting the directional bore. During execution of all subaqueous directional bores, the drilling contractor must have at the site the necessary material, equipment, and manpower to properly respond to a ‘frac-out’ in accordance with the ‘frac-out’ response plan.

2.4.3.3.1.3 Marker Balls and Metallic Marker Tape

A. Contractor shall provide and install metallic marker tape and provide, program, and install marker balls for all installed trenched pipe. For trenchless pipe installations, the contractor shall provide, program, and install marker balls. Metallic marker tape is not required on trenchless pipe installations. The metallic marker tape shall be marked green for wastewater. The metallic tape shall be laid 12 to 18 inches above the pipe and the ball markers placed directly on top of the pipe or fitting. For trenchless pipe installations, the marker balls shall be placed with a minimum of 18 inches of cover with the exception that no marker balls are required for that portion of pipe that lies beneath the water surface at a subaqueous crossing.

B. Installation: The balls shall be installed at all changes of direction and fittings absent of any valve. For cul-de-sacs having continuous fused or roll piping with no in-line fittings, the balls shall be placed starting at the point of curvature of the cul-de-sac and every 50-linear foot to the end of the line. On straight runs of pipe, the balls shall be installed at every power pole. If power poles do not exist, the balls shall be placed every 250 feet from the nearest change of direction or fitting. At road and driveway crossings the marker balls shall be placed on each side of the road or driveway, two feet from the pavement or driveway edge, or as written approval is provided by the District. On vertical deflections, the marker ball shall be placed on the top fitting only.

C. Programming: The Contractor shall program all balls and provide a copy of the programmed data in each marker ball in either Microsoft Excel or Access electronic format to the District. The Contractor’s as-built drawings shall show the location of all marker balls.

2.4.3.3.1.4 Fittings

When tightening bolts, the Contractor shall bring the gland up toward the flange evenly while maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Tighten all nuts progressively a little at a time. DO NOT over stress bolts to compensate for poor
alignment. If effective sealing is not attained at the maximum torque, disassemble the joint and reassemble again after cleaning. Fittings shall be installed in accordance with the manufacturer's printed instructions.

2.4.3.3.1.5 Storm Sewer Conflicts

Force mains that must be installed with less than 12 inches of clearance under storm sewer pipes or structures due to existing physical limitations that prohibit deflection or directional drilling, require construction of a bridging structure that is acceptable to the District to support the storm sewer prior to installation of the force main. The force main pipe section under the storm sewer pipe or structure shall be replaced with a single 20 linear feet stick of ductile iron pipe centered under the storm sewer pipe or structure. The ductile iron pipe shall be fully encased in an 8 mil polyethylene sleeve in accordance with AWWA C-105, Method A. Polyethylene material shall conform to ASTM Standard Specification D 1248-68. The Contractor shall submit details of the proposed bridging structure and force main pipe installation to the District for review and approval prior to the start of construction at the conflict location.

2.4.3.4 Force Main Testing

2.4.3.4.1 Testing Force Main and Tapping Sleeves

All pressure tests shall be in accordance with AWWA C-600, latest revision. Pressure test shall be required for all installations of force mains and all appurtenances. Pressure testing shall not exceed 1500 linear feet unless written approval is provided by the District.

2.4.3.4.1.1 Flushing:

A. All mains shall be flushed to remove all sand and other foreign matter.

B. Flushing shall be terminated at the direction of the District.

C. The Contractor shall dispose of the flushing water without causing a nuisance or property damage, and shall meet all regulatory requirements for the protection of the environment.

2.4.3.4.1.2 Pressure Test

A. Pipe

The contractor shall hydrostatically pressure test all PVC, HDPE, and DI force mains in accordance with the latest revision of AWWA C-600 series as applicable. Oil filled gauges shall only be used for all pressure tests. The tests shall be at 150 psi for a period of two (2) hours. The allowable loss for one (1) hour shall be determined by the following formula:

Allowable Leakage = \( \frac{(D)(L)(PY)}{133,200} \)
Where: 
\[ D = \text{nominal diameter of the pipe in inches} \]
\[ L = \text{length of pipe in feet} \]
\[ PY = \text{square root of test pressure during the leakage test in pounds per square inch} \]

Calibrated test equipment shall be on site to verify the loss of water during the testing period.

B. Tapping Sleeves

All force main tapping sleeves shall be hydrostatically pressure tested in accordance with the latest revision of AWWA C-600. The test shall be conducted at 150 psi for a period of two (2) hours. No loss of pressure is allowed.

C. Procedures

1. Each section of pipe between valves, between the tapping sleeve and the pipe, and/or the valve and the tapping sleeve shall be slowly filled with water from a safe source, and the specified test pressure shall be applied by means of a water pump in a manner satisfactory to the District. In the case of testing a pipe where valves do not exist, the contractor shall plug the end of the line as approved in writing by the District. The pump, pipe, and/or tapping sleeve connections, gauge, and all necessary apparatus shall be furnished by the contractor and shall be approved in writing by the District prior to conducting any test. All necessary pipe taps for testing shall be made by the contractor as approved in writing by the District. The District may request testing of isolated portions between valves within the test section if a portion of that main has critical components such as multiple fittings at an extreme deflection. The contractor shall be responsible for the removal of all pipe taps installed for this purpose upon completion of the test as approved in writing by the District.

2. Pressure testing shall be measured from sample points and/or blow-off assemblies for force main pressure tests. The Utility Operator shall witness all tapping sleeves and force main pressure tests.

2.4.3.5 Installation of Pump Station

2.4.3.5.1 Responsibilities

A. Coordination of work: The contractor shall be responsible for the satisfactory coordination of the standard lift station construction with other construction and activities in the area. Delays in work resulting from lack of such harmony shall not in any way be a cause for extra compensation by any of the parties.

B. Notice to Residents: The contractor shall be responsible for notifying affected residents by the means of door hangers, mailings and/or all other appropriate means to alert residents at various times of the different phases of the construction of the...
standard lift station. The notifications shall indicate the various work activities that
the contractor will be performing on their street and what they can expect as far as
service outages, disruption of traffic, access inconvenience, unusual odors and other
activities affecting residents.

C. Licenses and Permits: The contractor shall be responsible for obtaining all licenses,
permits, authorizations, approvals, access agreements, consent from
utilities/persons/organizations upon whose property is impacted, written releases of
responsibility and all other required documents.

D. Work Access: The access to the Site is shown on the Contract Documents. Additional
accessibility to the site, as deemed necessary by the contractor beyond what is shown
on the Engineering Drawings, shall be the responsibility of the contractor, and all
expenses associated with work site additional accessibility shall be taken into
consideration as part of the contractor's bid unit prices. Written releases from the
property owner impacted by additional accessibility obtained by the contractor shall
be provided to the District.

E. Clearance of Blockages or Obstructions in the Sanitary Sewer System: The contractor
shall be responsible for clearance of blockages or obstructions in the sanitary sewer
system created by the contractor’s construction methods.

F. Location and Exposure of Manholes: The contractor shall expose only those sanitary
sewer structures necessary to perform the Work as shown on the Engineering
Drawings.

G. Existing Utility Operations: The Utility Operator shall shut down or manually operate
all existing systems necessary for performance of the Work. The contractor shall
submit a request to the Utility Operator for shut down or operational changes a
minimum of 24 hours in advance.

H. By-Pass Operations: The contractor shall be responsible for continuous maintenance
of flow of all existing utilities at the project site, unless otherwise agreed to by the
Utility Operator.

I. Water Access: The contractor shall be responsible for obtaining water access
necessary for performance of Work under the Contract from designated fire hydrants
at the site of work or other suitable designated sources.

J. Disposal: The contractor shall clean up and dispose of all waste materials from
construction activities including all materials removed from the sanitary sewer
system in conformance with all laws, regulations and standard practices.

K. Secure Storage Area: The contractor shall find secure storage areas of a size adequate
to accommodate the required vehicles, equipment and materials for the period of
performance of the Contract. The Utility Operator will not provide any space or place
to store materials.
L. Maintenance of Traffic: The Contractor shall be responsible for all maintenance of traffic and obtaining approval of a Maintenance of Traffic (MOT) Plan from the District for work within a District right-of-way and from the Charlotte County Community Development Engineering Department (CCCDED) for work within the right-of-way of any County Road and from FDOT for work within the right-of-way of any state road.

M. Working hours: The contractor shall carry out work in accordance with local ordinance and not to cause any unreasonable nuisance to affected residents. Under emergency conditions, this limitation may be waived by the consent of the District.

2.4.3.5.2 Execution

A. The contractor shall prepare the standard lift station site for construction. This shall include the establishing of maintenance of traffic, surveying, site clearing, installation of silt fence, exposure of existing underground utilities, and notification of residences that may be impacted by the construction. The standard lift station wet well and concrete cover and slab, valves, piping, pump/motor assemblies and rails, MCC, water service(s), electrical wiring/conduit, pad, fencing and gates, access panel and frame, driveway/culverts, optional equipment, and accessories shall be installed in accordance with the Contract Documents.

B. Installation shall be made by skilled and licensed technicians and coordinated with other trades as necessary.

C. The standard lift station receives wastewater flows continuously at varying rates and the level of the flow in the wet well is monitored by liquid level sensors. The wet well liquid level sensors shall be suspended at various levels in the wet well and transmit the level of the wastewater in the wet well directly to the MCC. The level sensors shall be set for the following conditions in coordination with the Utility Operator:

1. Pump off
2. Pump on
3. Lag pump on
4. High liquid level alarm

D. The MCC is an integrated system. The contractor shall furnish and install the MCC as one complete package to include all equipment and appurtenances regardless of the manufacturer and shall be responsible for the MCC to perform as a fully integrated operable system.

The MCC shall be designed to provide the following functions:

1. Turns pump off
2. Turns pump on
3. Turns lag pump on
4. Provides for alternate pumps operation
5. Activates the audio and visual alarms in the event of high liquid wet well levels
6. Activates the battery backup high liquid level alarm in event of power loss and resets the alarm when the power is restored
7. Allows for the manual connection to a portable generator
8. Provides phase monitoring and protection
9. Monitor and indicates pump seal failures

E. If a telemetry control unit is required, the applicable MCC functions shall be transferred to the telemetry control unit/programmable logic computer to control as outlined in the telemetry control unit section.

F. The telemetry control unit and lift station remote terminal unit (LS RTU) shall be designed to provide the following functions:

1. Monitor and Control Points

   The following points shall be monitored by the LS RTU. On, Off, or Fault condition shall be indicated locally at the LS RTU and remotely at any SCADA Workstation Computer. Any monitoring point shall have the capability of being configured as an alarm in the SCADA software. Any unused monitor points listed, i.e., there is no 3rd pump, shall be capable of being used to monitor other discrete devices.

   a) Pump 1 Status
   b) Pump 1 Start Fault
   c) Pump 1 Stop Fault
   d) Pump 2 Status
   e) Pump 2 Start Fault
   f) Pump 2 Stop Fault
   g) Pump 3 Status
   h) Pump 3 Start Fault
   i) Pump 3 Stop Fault
   j) Pump 1 HOA in HAND
   k) Pump 1 HOA in AUTO
   l) Pump 1 HOA in OFF
   m) Pump 2 HOA in HAND
   n) Pump 2 HOA in AUTO
   o) Pump 2 HOA in OFF
   p) Pump 3 HOA in HAND
   q) Pump 3 HOA in AUTO
   r) Pump 3 HOA in OFF
s) Low Well Level Float
t) Off Well Level Float
u) Lead Well Level Float
v) Lag Well Level Float
w) Lag2 Well Level Float
x) High Well Level Float
y) Float Sequence Fault
z) Well Level Transducer (4-20 mA)
   aa) Well Level Transducer Input Fault
   bb) Water Pressure Transducer (4-20 mA)
   cc) Water Pressure Transducer Input Fault
dd) Auxiliary Discrete Input (discrete or pulse)
e) Phase Voltage Fault
   ff) Phase Sequence Fault
   gg) Phase AB Voltage
   hh) Phase AC Voltage
   ii) RTU Memory Fault
   jj) AC Power Fault
   kk) DC Bias Voltage Fault
   ll) Alarm Silence Button
   mm) Alarm Horn Status
   nn) Alarm Light Status

2. The following discrete control points shall be provided with the LS RTU. On or
   Off condition shall be indicated locally at the LS RTU and remotely at any
   SCADA Workstation Computer. Any unused control points listed, i.e., there is no
   3rd pump, shall be capable of being used as a general purpose discrete outputs.
   a) Pump 1 Control
   b) Pump 1 Disable
   c) Pump 2 Control
   d) Pump 2 Disable
   e) Pump 3 Control
   f) Pump 3 Disable
   g) Total Station Disable
   h) Alarm Horn Control
   i) Alarm Horn Disable
   j) Alarm Light Control
   k) Alarm Light Disable
   l) Auxiliary Output
   m) Auxiliary Output Override
   n) Auxiliary Output Disable

G. Installation of Lift Station Remote Terminal Unit (LS RTU)

18) Install and place into operation a complete and new LS RTU at the site. This work
    shall include the networking, all interconnecting wiring, conduit, and circuitry
    necessary to provide the owner with a fully operable LS RTU.
19) All associated fiber optic infrastructure, fiber to network converters, and network switchgear shall be supplied. This hardware local to the site shall be mounted in pump control panel and connected to the LS RTU.

20) Include the services of a factory trained, qualified representative of the equipment manufacturer to inspect the complete equipment installation to assure that it’s installed in accordance with the manufacturer’s recommendations, make all adjustments necessary to place the system into trouble-free operation.

21) All workmanship utilized in the manufacture and installation of this system shall be of the highest quality and performed in a manner consistent with all accepted industry practices.

22) The existing Hyper SCADA Server shall be modified to incorporate a new HMI graphical screen for the LS RTU. The graphical screen shall be consistent with existing LS RTU screens.

23) The existing Symphony program shall be modified to incorporate the coordinated pump and flow management of the new LS RTU.

24) The manufacturer shall warrant all hardware and software provided against all defects in material and workmanship for a period of one year. The TCU001-IP shall carry an additional 2-year return-to-factory warranty. The TCU001-IP warranty shall also cover damage due to lightning and surge over the entire three-year period.

H. The manufacturer shall offer full factory support of the installed system through the use of factory employees. Service representatives who are not direct employees of the manufacturer, or who are not specifically trained in the service of the owner’s existing SCADA System shall be unacceptable. The customer shall have 24/7/365 access to service personnel.

I. The contractor shall coordinate the work of all the sub-contractors, suppliers, manufacturers, etc. for the complete installation, integration, interconnection, testing, calibration, and startup of the instruments, sensors, controls, and related accessories.

J. The contractor shall provide for all temporary utilities and services required for his operations including but not limited to electrical power, water, sanitary facilities, etc. The contractor shall furnish, install, and maintain all temporary utilities and services during the contract period including removal and restoration of disturbed areas upon completion of the Work. Such facilities shall comply with regulations and requirements of the National Electrical Code, OSHA, Florida Power and Light, and applicable Federal, State, and Local codes, rules, regulations.

K. The contractor shall be prepared to maintain wastewater flow as a part of his operations and provide all pumps, piping, and other equipment to accomplish this task, perform all construction, obtain all permits, pay all costs, and perform complete restoration of all existing facilities to equal or better condition to the satisfaction of the District.

L. Grounding rods shall be provided to adequately and independently ground the MCC, standby generator, telemetry control unit, and odor control in accordance with the Contract Documents. A grounding loop with a single ground rod may be substituted if approved in writing by the District.
M. The contractor shall connect the biofilter unit to the lift station water supply in accordance with the Engineering Drawings.

N. All wire ends shall be identified with wire markers at both ends.

O. All instrumentation wiring shall be shielded from a continuous source to destination and shall be grounded in accordance with the manufacture’s recommendation.

P. All bedding, backfill and compaction shall meet the requirements of District Standard details and the DCS.

Q. The instruments shall be calibrated by the manufacturer in accordance with the Contract Documents.

R. A calibration sticker noting the date, calibration data and the technician’s initials shall be affixed to the instrument. A calibration data sheet and log shall be prepared for the Utility Operator.

2.4.3.6 Pump Station Testing and Startup

A. The Contractor shall not initially energize the equipment without the written approval of the District.

B. After installation and calibration, the contractor shall functionally test the major equipment and electrical components to verify their compliance with the manufacturers recommended specifications and the Contract Documents.

C. The contractor shall not activate or turn on any equipment until each control circuit has been red-lined for completeness and functionality and safety interlocks are tested.

D. The contractor shall document site testing activities by written test procedures and a testing log shall be maintained at the project site or given to the Utility Operator.

E. Wet well and valve vault exfiltration test shall consist of plugging all inlets and outlets, filling the wet well or valve vault with water to the rim of the structure, and letting the water remain for 24 hours. The water level is returned to the top of the rim and let stand for two (2) hours. No leakage shall be allowed for the test to pass.

F. The system integrator/supplier shall provide equipment startup services for the project.

G. The system integrator/supplier shall be responsible for providing factory trained representatives for the startup of equipment requiring factory assistance during startup.

H. The system integrator/supplier shall coordinate with the Utility Operator to assist with the startup activities and provide necessary training of the Utility Operator in the operation and maintenance of the system.

I. Upon construction installation of Utility Operator maintained sewer lift stations, startup operations and testing shall be conducted prior to final acceptance and release of sewer flows under the supervision of the Utility Operator. At a minimum, a representative of the
pump supplier, a representative of the contractor, the Utility Operator, and a representative of the Engineer of Record will be present for startup testing.

J. Pump station startup reports shall be completed and signed off in entirety and provided to the District before a facility shall be accepted by the District.

The startup report shall include, but not be limited to, the following:
1. Name of project & lift station
2. Date & time of startup testing
3. Pump specifications and serial numbers
4. Control specifications and serial number
5. Controller specifications and liquid level sensor elevations
6. Resistance and meg-ohm reading results
7. Line voltage check results
8. Amperage at Load results
9. Pumps properly seated and check valves operate properly verification
10. Access cover specifications
11. Performance test results for each pump (GPM, TDH, shut off head reading, static head, PSI during test, total head, etc.)
12. Wet well diameter
13. Drawdown for 1 minute test
14. Witness names and respective company names

2.4.3.7 Spare Parts

For each lift station, the contractor shall provide on or before final inspection:

A. One impeller
B. One wearing ring or insert ring
C. Level switches, one additional float (normally open type) with 50-ft of cable.
D. Three Fuse, Rejection
E. One of each model of Fuse, Time-Delay
F. One Phase Monitor

G. Two of each model of Control Relay

2.4.3.8 Technical Parts

A. The contractor shall provide operation and maintenance data in the form of an instructional manual. The manual shall be in a three-ring binder and be arranged in sections and include a table of contents. The manual shall include appropriate drawings, schematics, pictures, sketches, specifications, flow diagrams, manufacturer’s documents, etc. required to operate and maintain the individual standard lift station functions and the overall standard lift station as a system.

B. Two (2) copies of the O&M manuals shall be made available to the District and the Utility Operator 30 days prior to the standard lift station start-up for review prior to start up. Upon District validation, the contractor shall provide two (2) hard copies and one electronic copy of the approved O&M manuals including copies of certified tests and inspection data.

2.4.4 ADDITIONAL SUBMITTALS

A. The contractor shall include the statement that the submittals have been reviewed and the materials meet District Specifications and/or Standard Details.

B. The required shop drawings for the work included under this Specification are listed in section “Required Shop Drawings”. The contractor shall submit four (4) signed copies of shop drawings for District review a minimum of 60 days prior to the start of construction for each particular item.

C. For materials that the Contractor is requesting deviations from this Specification and/or Standard details, the Contractor shall submit in writing a minimum of 60 days prior to construction, documentation to justify approval of these materials by the District. The Contractor shall submit four (4) signed copies of the material submittals.

D. No fabrication/construction shall take place until the final shop drawings are reviewed by the District. Final approval is at the discretion of District.

2.4.4.1 By-Pass Operations

The contractor shall submit a by-pass plan to the District for review a minimum of 20 days prior to the start of by-pass operations.

2.4.4.2 Required Shop Drawings

A. Structure(s): The contractor shall provide shop drawings for the structure(s) certified by the manufacturer. The submittals shall include the specifics being proposed for the outside coatings, inside coatings of the wet well top, concrete and reinforcement, access hatch, structural loading, buoyance provisions, outside seam wrap, sealant between
structure sections, invert and clocking of piping, size and location of openings, water proof gaskets and any other appurtenances applicable to the structure(s).

B. Submersible Sewage Pumps: The contractor shall provide shop drawings for the submersible sewage pumps certified by the manufacturer. The submittals shall include at a minimum: pump characteristic curves showing capacity in GPM, NPSH, TDH, efficiency, pumping horsepower from 0 to 110 percent of design capacity, impeller type, discharge diameter, passible sphere size, design drawings, a written description of the interchangeability of rails and discharge between the supplied submersible sewage pump and all District acceptable manufacturers, and any other appurtenances applicable to the submersible sewage pumps. The shop drawings shall include certification data in the form of testing results indicating that all AWWA, state, federal, and engineering standards are met. If requested by the Utility Operator, the contractor shall provide certified factory pump performance test data in the form of Section 6 of ASME PTC 8.2.

C. MCC: The contractor shall provide shop drawings for the MCC. The shop drawings shall include schematics, manufacturer brochures, and test results for pump settings, all MCC components, all other electrical components and appurtenances applicable to the MCC. The shop drawings shall include certification data in the form of testing results indicating that all NEMA, UL, AWWA, state, federal, and engineering standards are met.

D. Standby Generator and ATS: The contractor shall provide shop drawings for the standby generator and ATS. The shop drawings shall include schematics, manufacturer brochures and test results for all standby generator and ATS components and appurtenances applicable to the proposed standby generator and ATS. The shop drawings shall include certification data in the form of testing results indicating that the contract requirements and all NEMA, UL, and engineering standards are met.

E. Odor Control: The odor control system shall be supplied by a manufacturer who has been regularly engaged in the design and manufacture of the equipment having a minimum of 5 years’ experience in its design, fabrication, and testing of odor control systems of the type specified. The equipment supplier shall provide a list of a minimum of 10 identical installations of the type specified that have been in operation for a minimum of 5 years. Other manufacturers shall demonstrate to the District its equipment is of equal quality of the manufacturer specifically named herein.

1. The contractor shall submit complete shop drawings for the odor control system, together with all piping, ductwork, valves, and control for review by the District. The shop drawings shall include schematics, manufacturer brochures, and test results for all odor control components and appurtenances applicable to the proposed odor control. The shop drawings shall include certification data in the form of testing results indicating that the contract requirements and all NEMA, UL, and engineering standards are met.

2. The contractor shall complete the “TBDs” in table “12” below for the odor control system being proposed based on the size of the wet well, influent flows, inlet, outlet, standard lift station operational temperatures and the estimated inlet H2S concentration in ppm. The design documents shall be provided by the manufacturer to the District certifying that the odor control system meets the contract requirements.
Table 12.

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<tr>
<th>Air Flow Rate, cfm</th>
<th>TBD</th>
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<tbody>
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<td>Estimated Inlet H2S Concentration, ppm</td>
<td>TBD</td>
</tr>
</tbody>
</table>

F. The contractor shall submit the following information for review before the equipment is fabricated:

1. Letters of Certification of Compliance of materials, equipment, etc.

2. Final certified drawings showing outline dimensions, foundation layout or information, and other pertinent dimensions.

3. Field assembly drawings and/or diagrams.

4. Schematic and wiring diagrams of power, control, and piping systems with all devices, terminal, and wires uniquely numbered and clearly indicating between factory and field wiring. All field wiring shall be included for each diagram to describe all modes of operation of the system indicated. Where the integrated system requires interlocking and control and other components in normal operation, these components shall be included in the description of operation.

5. Drawings of system showing assemblies, arrangements, piping, electrical, mounting details, equipment outline dimensions, fitting size and location, motor data, operating weights of all equipment and sufficient information to allow the Utility Operator to check clearances, connections, and conformance with the specifications.

6. Renewal parts list with diagrammatic or cross-section drawing showing part identification. Material analysis or trades designation for each significant part shall be noted on parts lists or on a separate sheet.

7. Materials of construction of all equipment.

8. Control panel drawings shall indicate all equipment installed inside and outside of the panel including the location of all alarms (for biofilter); lamps; complete instrumentation; and control, logic and power wiring diagrams.

9. Electrical equipment rating and data sheets for all devices.

10. Design calculations certified by a Registered Professional Engineer with demonstrated experience in the design of these systems.

11. Pump data and performance curves showing flow, pressure, and horsepower (for biofilter)

12. Specifications, performance data, and calibration curves for exhaust fan and auxiliary components

G. Biofilter: Any manufacturer whose main business is Fiberglass Reinforced Plastic (FRP) manufacturing shall not be accepted as a supplier of the complete system.
H. Activated Carbon Adsorber: Any manufacturer whose main business is HDPE manufacturing shall not be accepted as a supplier of the complete system

2.4.4.2.1 Telemetry Control Unit

The contractor shall provide shop drawings for the telemetry control unit. The shop drawings shall include schematics, manufacturer brochures, and test results for pump settings, flood light, antenna, tower, all other telemetry control unit components and appurtenances applicable to the unit. The shop drawings shall include certification data in the form of testing results indicating that the contract requirements and all NEMA, UL, AWWA, state, federal, and engineering standards are met.

2.4.4.2.2 VFD

The contractor shall provide documentation with the material submittals on the experience of the VFD manufacturer and his interfacing with the submersible pump manufacturer. The contractor shall also submit a manufacturer’s statement that the variable frequency drive meets the requirements of Federal Communication Commission and IEEE. Adequate IC (inductance-capacitor) filters shall be provided as required to meet this criterion.

2.5 IRRIGATION

2.5.1 IRRIGATION DESIGN STANDARD

To improve the survivability of required landscaping, all cultivated landscape areas must be provided with an automatic irrigation system. All irrigation systems must be designed to eliminate the application of water to impervious areas, including roads, drives, and other vehicle areas. Required irrigation must also be designed to avoid impacts on existing native vegetation.

All developments within the Babcock Ranch Community Overlay zone shall comply with the Master Development Order, Incremental Development Order, BROD Land Development Regulations, Sierra Club Agreement, and SFWMD Water Use Permit 08-00122-W, as amended from time to time.

Irrigation Quality (IQ) water must be used for irrigation purposes. No potable water can be used for irrigation purposes. Wells can be used for agricultural uses only.

All developments must meet the Gold Standard of SFWMD’s Florida Water Star Certification Program.

All new developments that have required landscaping must be irrigated using an automatic irrigation system with controller set to conserve water. Moisture detection devices must be installed in all automatic sprinkler systems to override the sprinkler activation mechanism during periods of increased rainfall. Where existing irrigation systems are modified requiring the acquisition of an approval, automatic activation systems and overriding moisture detection devices must be installed.
A. The applicant shall construct, at its expense, all necessary on-site reuse facilities including pipes, pumps, valves, meters, controls, sensors, telemetry, storage lakes and/or tanks, retaining ponds, and spray or sprinkler facilities for irrigation with IQ water, and other equipment deemed necessary by the District for the proper and safe operation of the system.

B. The applicant shall construct, at its expense, all necessary transmission lines, pumping stations, and appurtenant improvements for transmitting IQ water from the Utility System to the applicant's site.

C. The water reuse capacity of the project shall be based on the projected irrigated area of the proposed development receiving IQ water at an annual average rate of one (1) inch per week and established by an engineering report from a licensed Florida Professional Engineer and approved in writing by the District.

D. Regardless of IQ water service availability in proximity to the property at the time of the service application, the applicant shall be required to install "dry lines" and associated appurtenant improvements for IQ water distribution and service to the project area. All design and construction standards for such work shall meet or exceed the District specifications.

E. Evaluation. For all new development projects, there shall be a requirement for evaluation of the incorporation of use of IQ water. This evaluation shall be in the form of an application to the District as part of the utility agreement. The District shall review the water reuse capacity of the project and determine if its incorporation into the IQ water system represents a beneficial use of the IQ water resource.

F. Mandatory connection. After consideration of the above evaluation, the director shall have the authority to require the development project to connect to the IQ water system and comply with this article. If so required, connection to the IQ water system shall be a condition precedent to receipt of potable water and wastewater service for the subject property.

G. Customers in designated service areas may connect to the IQ water system when service is available and upon submission of a proper application, including projection of use, and land application calculation plans showing proposed tie-in points, signed and sealed by a Florida licensed engineer and in compliance with all local municipality requirements. When service is available, all customers that connect to the IQ water system will be charged a monthly usage charge. These charges shall be established by resolution, which may be amended from time to time.

2.5.2 IRRIGATION HEADS

2.5.2.1 General Design

A. High Volume Irrigation shall not exceed 50% of the total irrigated area

B. If irrigation is used for landscape beds, micro-irrigation is used and is correctly installed

C. Irrigation zones for turf grass and landscape beds shall be separate
D. Irrigation areas less than 4 feet wide are irrigated with correctly designed and installed micro-irrigation

E. Sprinklers and emitters are located at a minimum two feet from structures

F. Irrigation system is free from leaks

G. Sprinklers in low-lying areas have check valves

2.5.2.2 Distribution Uniformity

A. Sprinklers rise above turf grass height.

B. A minimum of six-inch pop-up for spray heads and 4-inch pop-up for rotor heads.

C. Application occurs in proper spray patterns, minimizing overspray, and eliminating spray on impervious surfaces.

D. Pipes are sized to prevent velocities greater than five feet per second.

E. Application rates for all sprinklers and emitters within a zone are matched.

F. Pressure differential between the head closest to the valve and the farthest from the valve shall not exceed 10% of the lower pressured head.

G. Head spacing does not exceed 50% of the nozzle throw diameter.

2.5.2.3 Scheduling

A. A device with rain shut-off scheduling capacities is installed in an operable location and is functioning.

B. Items to be installed next to controller

   1. Controller Handbook/Operating instructions
   2. As-built zone diagram
   3. Specific zone application rates and maintenance run times
   4. Soil moisture sensor probe location, when applicable

C. Soil Moisture Sensor (SMS) with multiple SMS probes shall be correctly installed using approved burial grade connectors in the valve box and is correctly functioning.

D. Evapotranspiration, smart, or weather-based controller must be correctly installed, programmed and functioning.

E. Leak detection / flow-sensing system is installed by the Property Owner/builder or homeowner.

F. Innovative irrigation water conservation shall be used.
2.5.3 PUMP SUPPLY

A. All supplements to the reuse water supply for irrigation purposes shall conform to SFWMD Water Use Permit 08-00122-W, as amended from time to time.

B. The water source for irrigation will be from IQ water and ground water stored in a lake, then withdrawn and pumped through the irrigation infrastructure to service the individual property. All water supply sources shall be in accordance with the Babcock Ranch Community Irrigation Master Plan Phase II irrigation plan.

C. No potable water shall be used for irrigation.

2.5.4 MASTER PLAN UPDATE

The Babcock Ranch Community Irrigation Master Plan shall be updated as directed and at the discretion of the District. All submittals to update the Babcock Ranch Community Irrigation Master Plan shall be made during the Site Plan Review process at the expense of the Owner. Any required master plan updates shall include but is not limited to:

A. Update of irrigation demands for buildout conditions

B. Update of irrigation supply

C. Evaluation of future infrastructure needs