ITEM IX - DUPLEX SUBMERSIBLE NON-CLOG SUCTION LIFT AND GRINDER, SEWAGE PUMPING STATIONS AND PIPING

9.01 Scope

(a) Sewage pumping stations shall consist a minimum of 2 sewage pumps (min. 5 HP each), each capable of pumping the peak design flow, and associated controls, piping and structures.

Design Basis: Each pump must have the necessary characteristics and be properly selected and designed to perform under operating conditions shown on the pump station drawings. Specific operating conditions shown on the Plans or specified in the Special Conditions or the Specifications will be as follows:

- Capacity (GPM)
- Total Dynamic Head (feet)
- Minimum Pump Efficiency (percent)
- Maximum Sphere passage (Inches)
- Maximum Motor Horsepower
- Motor voltage/Phase/Hertz
- Minimum Service Factor

Pumps provided, including the spare pump and motor, shall be delivered pre-adjusted to meet the specified conditions.

(b) Preparation and grading of site and excavation; concrete and steel reinforcement; valves and piping; grassing and planting, miscellaneous metal work; and painting shall conform to the requirements of MSD’s Standard Specifications.

(c) The Pump Station site shall be 2 feet (min.) above the 100 year flood elevation.

9.02 General

(a) Pumps, piping and other equipment shall be new and unused, designed for the service intended, and shall be suitable for installation and efficient operation within the space and under the conditions shown on the Plans and specified herein. All equipment shall be properly protected so that no damage or deterioration will occur during shipment or storage.
(b) All structural steel work shall comply with the requirements of the American Institute of Steel Construction Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.

(c) The CONTRACTOR shall furnish the services of a competent engineering representative of the manufacturer of the pumps to inspect their installation and supervise initial operation. Upon completion of such supervision, the manufacturer's representative shall provide the ENGINEER a signed certificate which states that the pumps have been checked; that they perform satisfactorily; and that they meet the requirements of the Specifications. This certificate shall show the name of the pump manufacturer and the name of the company or firm by which the representative is employed.

(d) The CONTRACTOR shall furnish the services of a competent engineering representative or the manufacturer of the standby generator to inspect the installation and supervise the initial start-up and operation. A complete 4 hour (min.), 100 percent load test shall be conducted during the start up. Load test shall be at rated generator load. Upon completion of standby generator startup, the manufacturer’s representative shall provide the ENGINEER a signed certificate which states that the generator has been checked; that it performed satisfactorily; and that it meets the requirements of the Specifications. This certificate shall show the name of the generator manufacturer and the name of the company or firm by which the representative is employed.

(e) The CONTRACTOR shall furnish to the ENGINEER 3 copies of drawings of equipment to be furnished; foundation plans, number and position of all anchor bolts, manufacturer's specifications, descriptive literature, complete electrical data and control diagrams, and operating and maintenance instructions. Three copies of performance curves shall also be furnished for the pumping equipment, showing the condition point, shut-off head, the impeller diameter, the pump speed, and the horsepower. Descriptive literature and operating and maintenance instructions shall be furnished at the same time equipment drawings are furnished. This material shall be furnished in suitable binders.

9.03 **Spare Parts**

The manufacturer shall furnish a complete set of spare parts to include at least the following: One complete pump and motor assembly including corded cap, one flange guide, and one complete mechanical seal.
9.04 Warranties

The pumps shall be warranted to be free from defects in workmanship, design, and materials for a period of 1 year under normal use, operations, and service.

The pump seals shall be warranted for a minimum of 5 years from the date of shipment. Should the seals fail within the first year, the manufacturer shall be obligated, upon notification, to furnish new seals, without charge to the DISTRICT. The cost of replacement seals thereafter will be on a pro-rated basis as follows:

<table>
<thead>
<tr>
<th>Months After Shipment</th>
<th>Percentage of New Seal Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-18</td>
<td>0%</td>
</tr>
<tr>
<td>19-31</td>
<td>25%</td>
</tr>
<tr>
<td>32-45</td>
<td>50%</td>
</tr>
<tr>
<td>46-60</td>
<td>75%</td>
</tr>
</tbody>
</table>

9.05 Submittals

(a) Submittals for Plan Review shall include detailed drawings as specified herein and design calculations. Design calculations shall include flow calculations, pump cycle time calculations, pump on/off and alarm level, anti-flotation calculations, and system curve showing operating point, efficiency, and required brake horsepower.
Section VI – Technical Specifications

(b) The Design Submittal Checklist shall include but not necessarily be limited to the following items. The Engineer of record shall check and sign the checklist.

_____ 1. 12 foot wide access road, with 2 foot shoulders and adequately designed ditches.
_____ 2. Turn-around outside the gate, as specified.
_____ 3. Access road, turn-around and site paved, including 2 feet outside perimeter fence, and are adequately drained.
_____ 4. Site layout provides 5 feet (min.) clearance between perimeter fence and equipment.
_____ 5. Wet well is properly sized for 4 – 8 cycles per hour at design flow.
_____ 6. Wet well is designed to resist buoyant force, if applicable.
_____ 7. The pumps are the most efficient available among acceptable manufacturers.
_____ 8. Pipe and valves and fittings meet MSD specifications.
_____ 9. All mounting hardware, flange bolts and hardware mounting bolts are stainless steel.
_____10. Guide rails and lifting cable or chain and cable hanger are stainless steel.
_____11. All ductile iron pipe is minimum Class 350.
_____12. All exposed piping, valves, and fittings shall be flanged. Pipe shall be flanged with threaded flanges. Bolt on, or adapter flanges are not acceptable.
_____13. Influent manhole with only one penetration into the wet well.
_____14. The wet well and valve vault hatches are of adequate size for equipment removal.
_____15. Valve vault hatches are of adequate size for entry, valve operation, and force main bypass connection.
_____16. 1500 lb. (min.) electric winch hoist is provided with 115 volt weatherproof electrical outlet within 8 feet, with adequate footing.
_____17. All power and control panels are housed in stainless steel NEMA 4x enclosures.
_____18. The support structure for power and control panels is stainless steel channel sections.
_____19. The site layout provides adequate clearance between the wet well and control panels and wet well and generator.
_____20. Adequate area lighting is provided.
_____21. Adequate enclosure fence is provided.
_____22. The wet well has a DI screened vent.
_____23. The force main drawings include a plan and profile view with maximum scales of 1” = 10’ vertical and 1” = 50’ horizontal.
_____24. Pump Station site is above 100 year flood elevation.
_____25. One harnessed flange dismantling joint shall be provided on each pump discharge line in the valve vault.

Engineer of Record __________________________ Date __________________________ (SEAL)

ITEM VI – DUPLEX SUBMERSIBLE NON-CLOG SUCTION LIFT AND GRINDER SEWAGE PUMPING STATIONS AND PIPING

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Rev 2 10
(c) Shop Drawing Submittal List (provide 3 copies for MSD plus number of copies needed for DISTRICT, CONTRACTOR and Engineer of Record).

Shop drawing submittals shall include but not necessarily be limited to the following materials and equipment:

<table>
<thead>
<tr>
<th>Material/Equipment</th>
<th>Material/Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump Station Wet Well</td>
<td>Main Circuit Breaker</td>
</tr>
<tr>
<td>Pumps</td>
<td>Fused Disconnect</td>
</tr>
<tr>
<td>Foundation Plan</td>
<td>Transfer Switch</td>
</tr>
<tr>
<td>Buildings</td>
<td>Disconnect Switch</td>
</tr>
<tr>
<td>Equipment Enclosures</td>
<td>Ultrasonic Level Control</td>
</tr>
<tr>
<td>Odor Control System</td>
<td>Conduit Seals</td>
</tr>
<tr>
<td>Wet Well Hatch</td>
<td>Electrical Conduits</td>
</tr>
<tr>
<td>DI Flanged Piping</td>
<td>Air/Vacuum Valves</td>
</tr>
<tr>
<td>Backup Elec. Generator</td>
<td>SS Structural Supports</td>
</tr>
<tr>
<td>DI Gasket Pipe</td>
<td>Pump Hoist</td>
</tr>
<tr>
<td>Force Main Pipe</td>
<td>Access Hatches</td>
</tr>
<tr>
<td>DI Fittings</td>
<td>Drain Piping w/Flap Valve</td>
</tr>
<tr>
<td>SS Bolts and Fasteners</td>
<td>FM Bypass Connection, 4” male</td>
</tr>
<tr>
<td>Pipe Paint</td>
<td>Yard Hydrant</td>
</tr>
<tr>
<td>Screened Vents</td>
<td>RP Backflow Preventor</td>
</tr>
<tr>
<td>Check Valves</td>
<td>Water Meter</td>
</tr>
<tr>
<td>External Swing Arm</td>
<td>Ladders</td>
</tr>
<tr>
<td>Gate Valves</td>
<td>Pump Control Panel</td>
</tr>
<tr>
<td>Plug Valves</td>
<td>Pump Hoist</td>
</tr>
<tr>
<td>Valve Vault</td>
<td>Telemetry Panel</td>
</tr>
<tr>
<td>Vault Hatches</td>
<td>Service Disconnect</td>
</tr>
<tr>
<td>Chain Link Fencing &amp; Gate</td>
<td>Electrical Wiring</td>
</tr>
<tr>
<td>Heated Enclosure for BFP</td>
<td>Wire Trough</td>
</tr>
<tr>
<td>Transfer Switch</td>
<td>Area Light and Pole</td>
</tr>
<tr>
<td>Electrical Control Schematic</td>
<td>SCADA System</td>
</tr>
<tr>
<td>Harnessed Dismantling Joint</td>
<td></td>
</tr>
</tbody>
</table>

(d) Operation and Maintenance Manuals

The CONTRACTOR shall furnish 3 complete sets of operation and maintenance (O&M) manuals, organized in a three-ring binder or suitable binders. The O&M manual shall also be provided on a CD or DVD, and shall include the following items, as installed:

1. Detailed pump drawings and parts list.
2. Pump system curve showing operating point, shut-off head, pump speed, efficiency, horsepower, and impeller diameter.
3. Manufacturer’s specifications and descriptive literature, and regular maintenance schedules for all equipment.

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4. Supplier’s name, address, phone number, and fax number for all materials and equipment.

5. Wiring diagrams for all control and electrical panels. Diagrams shall show wiring added to interface with other panels and equipment. These diagrams shall also note conduits with numbering so wires can be traced. When relays are noted, they shall be identified as to location in the equipment.

6. The pump station manufacturer shall supply 3 complete sets of comprehensive written instructions to enable an operator to properly operate and maintain the equipment supplied. Content of the instructions shall assume the operator is familiar with pumps, motors, piping and valves but that he has not previously operated and/or maintained the exact equipment supplied.

7. The instructions shall be prepared as a system manual applicable solely to the pump station equipment and related devices supplied by the manufacturer, as specified herein. Instructions for any equipment for which the manufacturer has not supplied, but has made mounting or other provisions, shall also be provided.

8. The instructions shall include, but not be limited to, the following:

   (a) Descriptions of, and operating instructions for, each major component of the complete pump package as supplied.

   (b) Instructions on operation of the pumps and pump controls in all intended modes of operation.

   (c) Instructions for all adjustments which must be performed at initial startup of pump equipment, adjustments required after the replacement of liquid level control system components, and adjustments as required in the course of preventative maintenance as specified by the manufacturer.

   (d) Service instructions for major components not manufactured by the pump station manufacturer, but supplied by him in accordance with the Specifications. In such case, the literature supplied by the actual manufacturer shall be incorporated as an appendix.

   (e) Electrical schematic diagram of the pump station as supplied, prepared in accordance with industry standards. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control and alarm system circuits, and interconnections among these circuits. Wire numbers shall be shown on the schematic. Schematic diagrams for individual components, not normally repairable by the station operator, need not be included and details for such parts shall not be substituted for an overall system schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.

   (f) Layout drawing of the pump station as supplied, prepared in accordance with good commercial practice, showing the location of all pumps, motors,
Section VI – Technical Specifications

valves and piping.

(g) Operation and maintenance instructions shall be specific to the equipment supplied in accordance with these Specifications. Instruction manuals applicable to many different configurations of pump stations, and which require the operator to selectively read portions of the manual will not be acceptable. Operation and maintenance instructions which are limited to a collection of product literature without addressing overall pump station operation and maintenance will not be acceptable.

(h) Complete operation and maintenance manuals for emergency power generation system.

9.06 Public Utility Accounts For Pump Stations

The CONTRACTOR or Development Owner shall set up the accounts for all applicable utilities providing service to the pump station site, i.e. water, power, natural gas. The accounts shall be set up in the Development Owner's name and later transferred to the DISTRICT’s name. In either case the Development Owner shall be responsible for payment of all utility bills until such time that the DISTRICT takes ownership of the pump station. The Development Owner shall provide verification that all accounts are in good standing at time of transfer of ownership to the DISTRICT.

9.07 Submersible Non-Clog Sewage Pumps

(a) Submersible non-clog sewage pumps shall be capable of handling raw, unscreened sewage and passing 3-inch diameter solids. The discharge connection elbows shall be permanently installed in the wet well along with the discharge piping. The pumps shall be automatically connected to the discharge connection elbows when lowered into place and shall be easily removed for inspection and service. Installation and removal of pumps shall not require personnel to enter the wet well. Sealing of the pump units to discharge connections shall be accomplished by linear downward motion of the pumps. The pump, with its appurtenances and cable, shall be capable of continuous submergence in water to depths of 231 feet without leakage.

(b) Each of the two submersible sewage pumps shall have the capacity, minimum efficiency, and motor size specified in the Special Conditions or on the Plans. The maximum pump motor speed shall be 1,800 rpm. Motors shall be suitable for 460 volt, 60 Hz, 3-phase operation.

(c) Pumps, motors, pump discharge connections, discharge elbows, guide rails, float switches and electrical cable, and pump guides shall be designed for Class 1,
Groups C and D, Division 1, hazardous locations, as defined by the National Electrical Code and shall be so certified by an independent laboratory.

(d) All bolts, machine screws, nuts, lockwashers, and other hardware used in the assembly of discharge elbows, guide rails, pump guides, hoist chains, float cable connectors, and access frames and covers shall be of stainless steel.

(e) Pumps shall be constructed of cast iron which complies with the requirements of ASTM Specification A48, Class 30. All pump openings and passages, including impellers, shall be of adequate size to pass spheres at least three inches in diameter and trash of stringy material which commonly occurs in sanitary sewage. Impellers shall be the enclosed or open type having a minimum number of vanes and shall be of cast iron construction, dynamically balanced. Stainless steel impeller wearing rings with mating stainless steel case wearing rings shall be provided on the inboard side of open impellers. Impellers shall be mounted in the stainless steel motor shaft. An oil chamber and two mechanical seals shall seal the motor from the pump liquid. Moisture detection probes shall be mounted in the oil chamber which are interlocked with the motor to shut down the pump and turn on a warning light on the motor control center when moisture is present in the oil chamber. Thermistors mounted in the bottom of the stator housing may be used instead of the moisture detection probes. Mechanical seals shall consist of upper and lower seals. Upper seals shall have ceramic stationary faces and carbon rotating faces with stainless steel springs. Lower seals shall have tungsten carbide stationary and rotating faces with stainless steel springs. Discharge connections shall have contact surfaces of non-sparking materials. Discharge elbows shall be of cast iron with integral bases for anchoring and supporting pumps and piping. Flanges shall conform to the requirements of ANSI/AWWA Specification C110. The metal contact surfaces shall be of non-sparking materials. Pump guides shall be stainless steel. The entire pump units shall be designed for Class 1, Groups C and D, Division 1, hazardous locations, as defined by the National Electrical Code and shall be so certified by an independent laboratory, so that forced wet well ventilation and redundant cut-off switches are not required. A welded, stainless steel chain of adequate size shall be permanently attached to each pump. Provisions shall be made for attaching the upper end of each chain to the wet well access frame and cover.

(f) Submersible pump motors shall be designed for Class 1, Groups C and D, Division 1, hazardous locations as defined by the National Electrical Code and shall be so certified by an independent laboratory. Motors shall be explosion proof, squirrel cage induction type housed in an oil-filled cast iron watertight enclosure. The enclosure shall be sealed by O-rings and shall have rabbet joints with a large overlap. Cable leads shall be epoxy sealed. The motor shaft extension shall be stainless steel, impervious to the liquid and waste materials being pumped. All external hardware including motor nameplates shall be made of stainless steel. Motors shall be NEMA Design B: insulation shall be Special
ITEM VI – DUPLEX SUBMERSIBLE NON-CLOG SUCTION LIFT AND GRINDER SEWAGE PUMPING STATIONS AND PIPING

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Class F rated for continuous duty in 40°C liquids; shall have a 1.15 service factor; shall be equipped with winding thermostats; shall be capable of operating for 15 minutes in air at nameplate horsepower, and shall be capable of 15 starts per hour. The pumps shall be furnished with power and control cords of sufficient length to connect to the motor control center. The pump motors shall be sized so that they will not be overloaded at their rated capacity at any point on the pump performance curve.

(g) The pump shall have a durable, attached nameplate to confirm that it is built in accordance with the Specification as to HP, voltage, phase and hertz.

(h) Submersible sewage pumps shall be manufactured by the DISTRICT’s preferred vendors: Gorman-Rupp, Flygt, or Fairbanks Morse. 30 HP or greater pumps shall be reviewed on an individual basis.

9.08 Submersible Grinder Sewage Pumps

(a) Each pump shall be of the sealed submersible type. The pump volute, motor and seal housing shall be high quality gray cast iron, ASTM A-48, Class 30. All external mating parts shall be machined and Buna N Rubber O-ring sealed on a beveled edge. Gaskets shall not be acceptable. All fasteners exposed to the pumped liquids shall be 300 series stainless steel. The discharge connection elbows shall be permanently installed in the wet well along with the discharge piping. The pumps shall be automatically connected to the discharge connection elbows when lowered into place and shall be easily removed for inspection and service. Installation and removal of pumps shall not require personnel to enter the wet well. Sealing of the pump units to discharge connections shall be accomplished by linear downward motion of the pumps. The pump, with its appurtenances and cable, shall be capable of continuous submersion in water to depths of 231 feet without leakage.

(b) Each of the two submersible grinder sewage pumps shall have the capacity, minimum efficiency, and motor size specified in the Special Conditions or on the Plans. The maximum pump motor speed shall be 1,800 rpm. Motors shall be suitable for 230/460 volt, 60 Hz, 3-phase operation.

(c) Pumps, motors, pump discharge connections, discharge elbows, guide rails, float switches and electrical cable, and pump guides shall be designed for Class 1, Groups C and D, Division 1, hazardous locations, as defined by the National Electrical Code and shall be so certified by an independent laboratory.

(d) All bolts, machine screws, nuts, lockwashers, and other hardware and fasteners used in the assembly of discharge elbows, guide rails, pump guides, hoist chains, and float cable connectors shall be of stainless steel.
(e) Pumps shall be constructed of cast iron which complies with the requirements of ASTM Specification A48, Class 30. An oil chamber and two mechanical seals shall seal the motor from the pump liquid. Moisture detection probes shall be mounted in the oil chamber which are interlocked with the motor to shut down the pump and turn on a warning light on the motor control center when moisture is present in the oil chamber.

(f) An upper radial bearing and a lower thrust bearing shall be required. These shall be permanently lubricated by the dielectric oil which fills the motor housing.

(g) The shaft shall be machined from solid 416 stainless steel and be a design which is of large diameter with minimum overhand to reduce shaft deflection and prolong bearing life.

(h) A rotor and stator in the motor housing shall be separated and protected from the pumped liquid by an oil filled seal housing incorporating two type 21 carbon ceramic mechanical seals mounted in tandem. This seal housing shall be equipped with 2 moisture sensing probes installed between the seals, and the sensing of moisture in the seal chamber shall be automatic, continuous, and not require the pump be stopped or removed from the wet well. The sensor probes shall be electrically isolated, with a resistor between each probe to eliminate grounding to the casing.

(i) Impeller shall be a bronze multi-vane, semi-open, non-overloading design. They can either be factory or field trimmed to meet specific performance conditions. Impellers shall be hydraulically and statically balanced at the factory, and machined for threading on to the pump shaft. Wear or field trimming shall not deter the factory balance.

(j) The combination centrifugal pump impeller and grinder unit shall be attached to the common motor and pump shaft made of 416 stainless steel. The grinder unit shall be on the suction side of the pump impeller and discharge directly into the impeller inlet leaving no exposed shaft to permit packing of ground solids. The grinder shall consist of 2 stages. The cutting action of the second stage shall be perpendicular to the plane of the first cut for better control of the particle size. The grinder shall be capable of grinding all materials found in normal domestic sewage, including plastics, rubber, sanitary napkins, disposable diapers, and wooden articles into a finely ground slurry with particle dimensions no greater than ¼ inch. Both stationary and rotating cutters shall be made of 440C stainless steel hardened to Rockwell 60C and ground to close tolerance.

(k) The upper (axial) cutter and stationary cutter ring shall be reversible to provide new cutting edges to double life. The stationary cutter ring shall be a slip fit into the suction opening of the volute and held in place by three 300 series stainless steel screws and a retaining ring. The lower (radial) cutter shall macerate the
solids against the I.D. of the cutter ring and extrude them through the slots of the
cutter ring. The upper (axial) cutter shall cut off the extrusions, as they emerge
from the slots of the cutter ring to eliminate any roping effect which may occur in
single stage cutting action. The upper (axial) cutter shall fit over the hub of the
impeller and the lower (radial) cutter shall be slip fit and secured by means of peg
and hold and rotate simultaneously with the rotation of the shaft and impeller.

The grinding mechanism shall be locked to the shaft by a 300 series stainless steel
countersunk washer in conjunction with a 300 series stainless steel flat head cap
screw threaded into the end of the shaft.

1. A pump shall be painted after assembly, but before testing, with a lead free air
dried enamel. The paint shall be applied in one coat, with a minimum mil
thickness of 3 to 4 mils.

2. The pump shall have a durable, attached nameplate to confirm that it is built in
accordance with the specification as to HP, voltage, phase and hertz.

3. The entire pump units shall be designed for Class 1, Groups C and D, Division 1,
hazardous locations, as defined by the National Electrical Code and shall be so
certified by an independent laboratory, so that forced wet well ventilation and
redundant cut-off switches are not required. A welded, stainless steel chain of
adequate size shall be permanently attached to each pump. Provisions shall be
made for attaching the upper end of each chain to the wet well access frame and
cover.

4. Submersible pump motors shall be designed for Class 1, Groups C and D,
Division 1, hazardous locations as defined by the National Electrical Code and
shall be so certified by an independent laboratory. Motors shall be explosion
proof, squirrel cage induction type housed in an oil-filled cast iron watertight
enclosure. The enclosure shall be sealed by O-rings and shall have rabbet joints
with a large overlap. Cable leads shall be epoxy sealed. The motor shaft
extension shall be stainless steel, impervious to the liquid and waste materials
being pumped. All external hardware including motor nameplates shall be made
of stainless steel. Motors shall be NEMA Design B: insulation shall be Special
Class F rated for continuous duty in 40˚C liquids; shall have a 1.15 service factor;
shall be equipped with winding thermostats; shall be capable of operating for 15
minutes in air at nameplate horsepower, and shall be capable of 15 starts per hour.
The pumps shall be furnished with power and control cords of sufficient length to
connect to the motor control center. The pump motors shall be sized so that they
will not be overloaded at their rated capacity at any point on the pump
performance curve.

5. Electrical power cord shall be water resistant 600V, 60Deg.C, UL and/or CSA
approved and applied dependant on amp draw for size. The power cable entry
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into the cord cap assembly shall first be made with a compression fitting. Each individual lead shall be stripped down to bare wire, at staggered intervals, and each strand shall be individually separated. This area of the cord cap shall then be fitted with an epoxy compound potting which will prevent water contamination to gain entry even in the event of wicking or capillary attraction. The power cord leads shall then be connected to the motor leads with extra heavy connectors having brass inserts with a screwed wire to wire connection. There shall be an additional epoxy compound potting area separating the motor housing from the cord cap assembly. The cord cap assembly where bolted to the connection box assembly shall be sealed with a Buna N Rubber O-ring on a beveled edge to assure proper sealing.

(q) The stator, rotor and bearings shall be mounted in a sealed submersible type housing. The stator windings shall have Class F insulation (155 Deg. C. or 311 Deg. F.), and a dielectric oil filled motor, NEMA B design (3 phase), NEMA L design (single phase). The pump and motor shall be specifically designed so that they may be operated partially dry or completely submerged in the liquid being pumped. Stators shall be securely held in place with a removable end ring and threaded fasteners so they may be easily removed in the field, and must be capable of being repaired or rewound by a local motor service station. No special tools shall be required for pump and motor disassembly. Pump shall be equipped with heat sensors. The heat sensors shall be a low-resistance, bi-metal disc that is temperature sensitive, and shall be mounted directly in the stator and sized to open at 120 Deg. C. or 130 Deg. C. and automatically reset at 30-35 Deg. C. differential. The sensor shall be connected in series with the motor starter coil so that the starter is tripped if a heat sensor opens. The motor starter shall be equipped with overload heaters so all normal overloads are protected by external heater block.

(r) Submersible grinder sewage pumps shall be manufactured by Hydro-O-Matic Pump Division, Flygt, Myers, or Fairbanks Morse.

9.09 Horizontal Self-Priming Centrifugal Suction Lift Pumps

These pumps will be reviewed on a case-by-case basis.

9.10 Emergency Power Generator

An emergency power generator shall be provided at the station that is adequate to continuously operate all equipment at the site. It shall be powered by natural gas (public) or diesel. If natural gas is not available, a diesel powered generator shall be installed with a fuel tank sized for 72 hour (min.) operation. The fuel tank shall be full at the time of acceptance by the DISTRICT. The generator shall have at least 5 feet clearance in all directions. A service disconnect shall be provided between the generator and power source. Detail drawings must show pad,
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anchoring, and all details needed to evaluate acceptability. Detailed manufacturer’s information shall be provided. The generator shall be programmed to automatically start and run for one hour each week at a time to be determined by the DISTRICT. The generator shall be equipped with an automatic transfer switch, battery charger, computer cable, and computer software.

9.11 Guide Rails

Guide rails shall be of stainless steel which shall be attached to the access frame and cover by stainless steel brackets and anchors. The guide rail support shall be adjusted so that optimum vertical alignment can be obtained.

9.12 Access Frame and Cover

(a) The wet well and valve pit access frames and covers shall be double door hatches of all aluminum diamond plate construction reinforced for a 300 psi live load. The frames shall be extruded and have 316 S.S. hinges and 316 S.S. tamper resistant bolts/locknuts. The frame shall be cast into the concrete tops of the wet well and valve pit properly placed to facilitate removal of pumps and valves. They shall be of the sizes shown on the Plans or selected by the pump manufacturer. In no case shall access doors be less than that necessary to service valves and fittings within the pit. Entrance shall be by a removable key or post/staple for a padlock. A handle on the inside shall permit inside door opening. Submit detail drawing.

(b) Door leaves shall be ¼-inch thick aluminum diamond plate reinforced for a 300 psi live load. The frame shall be extruded aluminum trough section with an integral anchor flange on all 4 sides. The frame shall include an EPDM odor reduction gasket that reduces the amount of odor that escapes from below the door and a 1 ½-inch threaded drain coupling. The floor access door shall be equipped with a flush drop handle that does not protrude above the cover, and 316 stainless steel hold open arms with red vinyl grips that automatically lock the covers in the 90 degree open position. The door shall have 316 stainless steel hinges and 316 stainless steel tamper resistant bolts/locknuts. A staple for a padlock shall be supplied for security. An adhesive backed vinyl material that protects the product during shipping and installation shall cover the entire top of the frame and cover. Installation shall be in accordance with the manufacturer’s attached instructions. The door shall be manufactured and assembled in the United States. Manufacturer shall guarantee the door against defects, materials and workmanship for a period of 10 years. The floor access door shall be Model TPD as manufactured by U.S. Fabrication, Inc.

9.13 Motor Control Center

(a) The motor control center shall control the operation of all pumps. The motor
control center shall contain starters for each pump, pump alternation and level sensing circuits, alarm circuits, and control devices as specified and as required. The motor control center shall also contain a 15 amp, 120 volt duplex receptacle.

(b) Each pump starter shall be combination magnetic full voltage circuit breaker type with magnetic trip circuit breaker and thermal overload elements in each phase. The circuit breaker and overload elements shall be selected and set for the nameplate characteristics of the motor furnished and not "typical" values. The starter shall be UL listed for use on a system with available fault current of at least 22,000 amperes. A service disconnect must be provided between the generator and the power source.

(c) The alarm circuits shall activate an audible alarm signal, a flashing alarm light on top of the motor control center, and the SCADA Telemetry. Silence and test pushbuttons shall be provided for the alarm circuits. Alarm shall be activated by the failure of either pump, moisture in pump oil chamber, pump motor over temperature, high-water and low water. Circuits as recommended by the submersible motor manufacturer shall be used to sense moisture in the oil chamber. Detection of moisture or motor over-temperature shall cause the motor to be taken out of service which shall be restarted by only manual means.

(d) Control circuits shall operate at 120 volts from a fused control transformer. Devices for each motor shall include a hand-off-automatic selector switch, an elapsed time meter, and a current transformer driven ammeter. A phase failure/phase reversal relay shall be furnished to remove all pumps from service. The relay shall operate its voltage if any phase drops below 85 percent of nominal voltage. Drop out point shall be adjustable over a range of at least 80 to 95 percent of nominal. Pump operation which is interrupted because of power failure shall re-start automatically upon power restoration. Pilot lights shall be furnished to indicate phase failure, high water, and moisture seal failure.

(1) Indicating lights shall be furnished for the following functions for each pump:

- High Temperature Shutdown
- Running
- Automatic
- Manual
- Seal Failure

(2) Elapsed Time Indicators: Six digit elapsed time indicators (non-reset type) shall be connected to each motor starter to indicate the total running time of each pump in "hours" and "tenths of hours".

ITEM VI – DUPLEX SUBMERSIBLE NON-CLOG SUCTION LIFT AND GRINDER SEWAGE PUMPING STATIONS AND PIPING

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(3) **Equipment Marking:** A permanent corrosion resistant name plate shall be attached to the control and include the following information:

- Equipment serial number
- Supply voltage, phase and frequency
- Current rating of the minimum main conductor
- Electrical wiring diagram number
- Motor horsepower and full load current
- Motor overload heater element
- Motor circuit breaker trip current rating
- Name and location of equipment manufacturer

(e) The motor control center shall be assembled in a stainless steel NEMA 4 enclosure suitable for mounting on the support structure. Enclosure shall feature a hinged outer door with key operated cylinder lock and a hinged inner door containing all control devices. All breakers, overload resets, etc. shall be operable without opening the inner door. All control devices shall be identified with an engraved laminated nameplate permanently attached. Internal wiring shall be permanently identified with wire and terminal number and shall be grouped and tied to present a neat appearance. The complete motor control center shall be suitable for use on the voltage shown for the pump motors elsewhere in these Specifications and shall comply with all requirements of the National Electrical Code or any state or local codes or ordinances. The support structure shall be made of stainless steel and approved by the DISTRICT.

### 9.14 SCADA Telemetry System

(a) The SCADA telemetry system shall be supplied by a reputable company experienced in installation of SCADA Systems. The DISTRICT’s Electrical Maintenance Manager shall approve the company doing this work.

(b) A high speed internet connection (cable or Digital Subscriber Line) shall be provided to the Pump Station site for communication. Downstream speed shall be a minimum of 1.5 Megabits per second (Mbps), upstream speed shall be a minimum of 384 Kbps.

(c) A modem shall be provided, and programmed for the Pump Station controls to communicate with the SCADA telemetry system. The modem shall be rated for outdoor exposure and conditions.

(d) The alarm and input/output signals communicating with the DISTRICT’s SCADA system shall be as follows:
### Alarm Matrix:

<table>
<thead>
<tr>
<th>ALARM</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility Power Failure</td>
<td>Utility power has failed.</td>
</tr>
<tr>
<td>UPS Battery Low</td>
<td>UPS battery voltage is too low.</td>
</tr>
<tr>
<td>Generator Status</td>
<td>Generator is running or stopped.</td>
</tr>
<tr>
<td>Wet Well Level High</td>
<td>Wet well level is high.</td>
</tr>
<tr>
<td>PH High</td>
<td>PH level is too high.</td>
</tr>
<tr>
<td>Flow High Alarm</td>
<td>Flow level is too high.</td>
</tr>
<tr>
<td>Generator Fault</td>
<td>Generator has a failure.</td>
</tr>
<tr>
<td>Pump 1 Failure</td>
<td>Pump 1 failure (overload or seal failure or over temperature).</td>
</tr>
<tr>
<td>Pump 2 Failure</td>
<td>Pump 2 failure (overload or seal failure or over temperature).</td>
</tr>
<tr>
<td>Generator Low Fuel Level</td>
<td>Generator fuel level is low.</td>
</tr>
<tr>
<td>PLC Reporting Error</td>
<td>Not currently used.</td>
</tr>
<tr>
<td>Communication Failure</td>
<td>Usage has changed, now being determined by the Control Center.</td>
</tr>
<tr>
<td>Low Fuel Level</td>
<td>Generator fuel level is too low.</td>
</tr>
<tr>
<td>Unassigned</td>
<td>Future use.</td>
</tr>
<tr>
<td>Unassigned</td>
<td>Future use.</td>
</tr>
<tr>
<td>Unassigned</td>
<td>Future use.</td>
</tr>
</tbody>
</table>

### Definition of Alarms

1. **Utility Power Failure**  
   This alarm is used to signal the SCADA system that the utility power has failed.  
   This is read from the Automation Transfer Switch (ATS) when it is in the utility position.

2. **UPS Battery Low**  
   This alarm is used to signal the SCADA system that the UPS battery is too low.  
   This is read from a relay on the UPS.

3. **Generator Status**  
   This alarm is used to signal the SCADA system that the station generator is running.  
   This alarm shall be read from the generator.

4. **Wet Well Level High**  
   This alarm is used to signal the SCADA system that the station wet well level is too high.  
   It shall be read from the ultrasonic level indicator and the backup float switch.
5. **Generator Fault**
   This alarm is used to signal the SCADA system that the station generator has a failure and can not be started automatically. The signal shall be read from the generator control panel.

6. **Pump 1 Failure**
   This alarm is used to signal the SCADA system that the pump has failed. It shall be read from the overload, seal failure or over temperature input on the PLC.

7. **Pump 2 Failure**
   This alarm is used to signal the SCADA system that the Number 2 pump has failed. It has the same conditions as the Number 1 pump.

8. **Low Fuel Level**
   This alarm is used to signal the SCADA system that the generator has a low fuel condition. This alarm is read from the generator.

9. **PLC Reporting Error**
   This alarm is used to signal the SCADA system that the PLC has an error. This alarm is read from the PLC.

10. **Unassigned Alarm**
    On all stations there shall be at least 3 unassigned alarms allocated for future upgrades.

11. **Sigma Communication Failure**
    This alarm is used to signal the SCADA system that there is a Sigma communication failure at the station.

**Station PLC Input and Output Requirements:**

The system shall provide adequate inputs and outputs for each site with sufficient spares for future addition of equipment. The following table identifies required I/O:
### Section VI – Technical Specifications

#### ITEM VI – DUPLEX SUBMERSIBLE NON-CLOG SUCTION LIFT AND GRINDER SEWAGE PUMPING STATIONS AND PIPING

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<table>
<thead>
<tr>
<th>INPUT</th>
<th>STATE</th>
<th>PURPOSE</th>
<th>USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPS on Utility</td>
<td>Utility / Battery</td>
<td>Utility Power Failure Alarm</td>
<td>Use at all sites.</td>
</tr>
<tr>
<td>UPS Battery Low</td>
<td>OK / Low</td>
<td>UPS Battery Low Alarm</td>
<td>Use at all sites.</td>
</tr>
<tr>
<td>Door Switch</td>
<td>Open / Closed</td>
<td>Door Open Alarm</td>
<td></td>
</tr>
<tr>
<td>Automatic Transfer Switch Utility Position</td>
<td>Open / Closed</td>
<td>ATS Status</td>
<td>Use at all sites.</td>
</tr>
<tr>
<td>Automatic Transfer Switch Generator Position</td>
<td>Open / Closed</td>
<td>ATS Status</td>
<td>Use at all sites.</td>
</tr>
<tr>
<td>Generator Status</td>
<td>Running / Stopped</td>
<td>Generator Status</td>
<td>Use at all sites.</td>
</tr>
<tr>
<td>Generator Fault</td>
<td>OK / Fault</td>
<td>Generator Failure</td>
<td></td>
</tr>
<tr>
<td>Wet Well Level High</td>
<td>OK / High</td>
<td>Wet Well High Alarm</td>
<td>Use at all sites.</td>
</tr>
<tr>
<td>Pump 1 Status</td>
<td>Running / Stopped</td>
<td>Pump 1 Failure</td>
<td>Use at all sites.</td>
</tr>
<tr>
<td>Pump 2 Status</td>
<td>Running / Stopped</td>
<td>Pump 2 Failure</td>
<td>Use at all sites.</td>
</tr>
<tr>
<td>Pump 1 Overload</td>
<td>OK / Overload</td>
<td>Pump 1 Failure</td>
<td>Use at all sites.</td>
</tr>
<tr>
<td>Pump 2 Overload</td>
<td>OK / Overload</td>
<td>Pump 2 Failure</td>
<td>Use at all sites.</td>
</tr>
<tr>
<td>Pump 1 Seal</td>
<td>OK / Seal Failure</td>
<td>Pump 1 Failure</td>
<td>Used when available.</td>
</tr>
<tr>
<td>Pump 2 Seal</td>
<td>OK / Seal Failure</td>
<td>Pump 2 Failure</td>
<td>Used when available.</td>
</tr>
<tr>
<td>Pump 1 Over Temperature</td>
<td>OK / Over Temperature</td>
<td>Pump 1 Failure</td>
<td>Used when available.</td>
</tr>
<tr>
<td>Pump 2 Over Temperature</td>
<td>OK / Over Temperature</td>
<td>Pump 2 Failure</td>
<td>Used when available.</td>
</tr>
<tr>
<td>Pump 1 Hand / Auto</td>
<td>Hand / Auto</td>
<td>Pump 1 Status</td>
<td>Used when available.</td>
</tr>
<tr>
<td>Pump 2 Hand / Auto</td>
<td>Hand / Auto</td>
<td>Pump 2 Status</td>
<td>Used when available.</td>
</tr>
<tr>
<td>Generator Fuel Level Low</td>
<td>OK / Low Fuel</td>
<td>Generator Low Fuel Alarm</td>
<td>Used when available.</td>
</tr>
</tbody>
</table>

### Telemetry Use by SCADA

The items listed below shall be displayed on the MSD SCADA system.

1. **Wet Well Level**
   The station wet well level shall be displayed on the SCADA system, in feet.
2. **Pump Run Time**

The station pump(s) run time(s) shall be displayed on the SCADA system. The reading is normally returned to SCADA in minutes. The run time(s) shall be displayed on SCADA in total run time **hours** and shall be maintained until reset from the SCADA system.

9.15 **Liquid Level Controls**

(a) Level control in the wet well shall be “Milltronics Hydro Ranger Ultrasonic” level controller. Controls shall provide for automatic alternation of the pumps after each pump run cycle. Controls shall allow for lead/lag operation of the pumps. Failure of the duty pump shall cause the standby pump to run.

(b) One backup float switch shall be provided for the high water alarm and shall be sealed within a polyurethane ball. A weight shall be provided for the float switch. A single stainless steel bracket shall hold the float switch. Float switches and electrical cable shall be certified by an independent laboratory for Class 1, Groups C and D, Division 1, hazardous locations, as defined by the National Electrical Code. Float switches shall be furnished with sufficient cord to connect to the motor control center and to allow for adjustment.

9.16 **Electrical Wiring**

(a) The electrical wiring shall consist of a service pole, service entrance, service disconnect, main breaker, power wiring to pump control panel, power and control wiring to the pumps, grounding system and metering provisions as required by the electric utility. All wiring shall comply with requirements of the National Electrical Code, any state or local codes or ordinances, and the electric utility company. All materials shall be listed by Underwriters Laboratories and shall be new and delivered to the job in its original cartons. All exposed conduits shall be stainless steel minimum, 3/4 inch trade size, meeting UL and ANSI standards. All power and control conductors shall be Class B stranded copper. Power conductors shall be minimum number 12 AWG Type RHH-RHW-USE meeting ICEA Standard S-68-516 or S-66-524. Control conductors shall be minimum No. 14 AWG Type THHN. Ground conductors shall be medium soft drawn, stranded copper meeting ASTM Standard B-8. Connectors and terminals shall be solderless compression or pressure type cast connectors. Below grade ground connections shall be exothermically welded. All wiring shall be run in conduit except pump power and control cords within the wet well. All conduits from the wet well to the control panel must be stainless steel and buried at least 18 inches deep. All conduit ends must be sealed watertight in the wet well and at the electrical box. Conduit seals shall be installed above and below the wire trough.

(b) The service pole shall be treated pine, minimum class 4, with at least 20 percent of its length set in earth and firmly tamped. Height, location, and setting depth
shall be as required by the electric utility. Metal poles will be approved on a case-by-case basis.

(c) The main breaker shall be an enclosed circuit thermal-magnetic breaker, 3 pole, and 600 volt, labeled as suitable for service equipment. The service shall be protected with a three pole secondary lightning arrestor connected directly to the grounding system.

(d) All wiring methods and materials within the wet well shall comply with code requirements for Class I, Division I, Group C and D areas. Pump power and control cords shall be run from the wet well to the pump control panel underground in conduit at least 18 inches deep. Conduit shall be sealed around the cord inside the wet well in such a manner that the cord and seal may be removed from the conduit system when the pump must be removed for repair.

(e) The grounding system shall consist of bare copper conductors, minimum No. 2 AWG, bonding together the wet well reinforcing steel, the pump rails, metallic piping, the utility company neutral conductor, and a driven ¾ inch x 10 foot copper clad ground rod at the service pole. Grounding bushings shall be used at all conduit terminations in enclosures to insure ground continuity.

(f) The CONTRACTOR shall coordinate the installation with the electric utility. The CONTRACTOR shall furnish and/or install metering provisions as required by the utility, verify service voltage, and include in his bid any charges from the utility for providing service to the station.

(g) Electrical conduit shall be SCH 80 PVC below ground and on the light and SCADA pole. All other above ground conduit and penetrations into the wet well shall be stainless steel.

(h) The electric meter shall be located outside of the fenced area on an appropriate support structure in accordance with the requirements of the electric utility.

(i) Area lighting and hot box shall derive their power from the metered power supply for the station. Under no circumstances shall two accounts be allowed for a station such as a remote hot box installation.

(j) All electrical work and materials shall comply, as a minimum, with the National Electrical Code.

9.17 **Hoist**

(a) An electric motor driven winch hoist shall be provided and located to service both pumps and the valve vault. The hoist shall be a cable type having a fabricated steel support frame. It shall have a minimum capacity of 1,500 pounds. The
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cable end shall be fitted with a grab hook to properly connect to the lifting chain which is attached to the pump-motor combination. A 115 Volt outlet must be provided within 1 foot of the hoist.

9.18 Wet Well Structure

(a) The wet well structure shall consist of a precast concrete manhole or placed concrete of the type and size shown on the Plans. The precast manhole sections shall conform to the DISTRICT’s Manhole Specifications. The structure shall be level and all grout work shall be smooth with a steel trowel finish. Solid concrete fillets shall be poured to create a sump in which the pump sits. These fillets shall be in accordance with standard details as far as height and slope but shall be oriented in relation to the pump installation requirements.

9.19 Installation and Erection

(a) Pumps and other equipment shall be erected and installed by competent, skilled mechanics at the exact positions and elevations shown on the Plans.

(b) The CONTRACTOR shall furnish all necessary oil and grease for the operation of the equipment during the initial trial operation.

(c) Anchor bolts shall be type 304 stainless steel, accurately placed in the concrete foundations in their exact position and elevation by the use of templates, and all anchor bolt settings shall be carefully checked before concrete for the foundation is placed.

(d) All equipment and connecting piping shall be installed and supported in such manner that no load from the piping will be carried by the pumps.

(e) The CONTRACTOR shall properly grout each piece of equipment after it has been carefully aligned and leveled with steel wedges. The grout shall be poured so as to completely fill the space between the bottom of the base of the equipment and the top of the foundation. Grout shall be a non-shrinking type.

(f) After installation, the wet well shall be filled with clean water and allowed to stand for 24 hours (minimum) and then the water level shall be measured to determine if leakage has occurred. After satisfactory completion of the hydrostatic test of the wet well, a drawdown test and start-up shall be performed. A factory representative shall be on site for this test. Each pump shall be run through 3 drawdown cycles, measuring drawdown and timing the run to compute pumping rate. Clean water shall be used for the drawdown test. The controls shall be checked for operation in the automatic and manual operation modes. Float switches, if installed, shall be checked for proper elevations and operation. The SCADA system and alarms shall be programmed and checked for proper
9.20 **Sewage Pumping Station and Sewage Force Main Piping**

(a) All pipe materials shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs and other imperfections, and true to theoretical shapes and forms throughout. All materials shall be subject to the inspection of the ENGINEER at the Plant, trench, or other point of delivery, for the purpose of culling and rejecting materials, which do not conform to the requirements of the Specifications. Rejected materials shall be removed from the project site. Minimum force main pipe size shall be 2 inches. A copper tracer wire and plastic caution tape shall be buried above the full length of the force main, in accordance with the details.

(b) As particular specifications are cited, the designation shall be construed to refer to the latest revision.

(c) Exposed piping inside the wet well and valve vault shall be flanged joint, ductile iron. Stainless steel bolts shall be used on all flanged joints with anti-seize applied to threads. Flanged pipe shall be manufactured with threaded flanges. Bolt-on or adapter flanges are not acceptable.

(d) Ductile iron pipe with flanged joints shall conform to the requirements of ANSI/AWWA Specification C115/A21.15. Flanges shall conform to the requirements of ANSI/AWWA Specification C115/A21.15.

(e) Fittings for flanged ductile iron pipe shall be of ductile iron. Flanged fittings shall conform to the requirements of ANSI/AWWA Specification C110/A21.10 and shall be suitable for a water working pressure of 250 psi. Flanges shall conform to the requirements of ANSI/AWWA Specification C110/A21.10.

(f) Underground Sewage Force Main piping, inside the pumping station site, (generally inside the fenced area), shall be ductile iron pipe with gasketed, compression type joints, "slip-joints". Ductile iron pipe with slip joints shall conform to the requirements of ANSI/AWWA Specification C151/A21.51. The pipe shall be Class 350. Slip joints shall conform to the requirements of ANSI/AWWA Specification C111/A21.11. Minimum cover shall be 30 inches.

(g) Force Main piping outside the pump station site to the point of discharge may be either ductile iron as above specified or PVC, unless the pipe material is specifically called out on the Plans or in the Special Conditions of the Technical Specifications.

(h) Poly-Vinyl Chloride Pipe (PVC) shall comply with the requirements of ANSI/AWWA Specification C900, Class 200. The pipe shall bear the National
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Sanitation Foundation seal for potable water pipe. The pipe shall be of PVC Class 12454-B material, as specified in ASTM 1784. Joints shall be of push-on design, and shall utilize a rubber gasket which shall be designed to insure watertight joints at sustained pressures not less than the pressure class of the pipe. Joints shall be integral with the barrel of the pipe, and shall be manufactured as a homogeneous part of the barrel. No solvent welding or cements shall be used in manufacture of the pipe or construction of the pipe line. PVC shall be manufactured in 20-foot lengths. Fittings for PVC pipe shall be of mechanical joint ductile iron, and shall comply with the requirements of applicable sections of these Specifications.

(i) Potable water service for wash down shall be copper tubing from backflow preventor to hydrant and shall be soft annealed type K and shall comply with federal specifications WW-T-799.

9.21 Valves

(a) No valve or discharge piping shall be less than 3-inch nominal diameter unless approved otherwise by the ENGINEER. All valves shall be field adjustable for varying discharge heads, and shall have the full opening of the incoming and outgoing pipe diameter.

(b) Plug Valves

(1) Plug valves shall be provided and must allow either or both pumps to be isolated from the force main and the emergency discharge. Valve shall pass 3-inch spherical solids. The plug valve shall be non-lubricated, tapered type. Valve body shall be cast iron or semi-steel. The drip-tight shutoff plug shall be mounted in stainless steel bearings, and shall have a resilient facing bonded to the sealing surface. Valve shall be operated with a single lever actuator providing lift, turn, and reseat action. The lever shall have a locking device to hold the plug in the desired position.

(2) Plug valves shall be suitable for non-shock water working pressures of 200 psi in sizes 12 inches and smaller and 150 psi in sizes 14 to 36 inches. The valves shall provide drip-tight shutoff up to the full pressure rating of the valves in either direction.

(3) End connections shall be flanged inside the valve vault and mechanical joint if buried. In general, valves installed underground shall have mechanical joints and exposed valves shall be flanged. Flanged connections shall conform to the requirements of ANSI/AWWA Specification C110. Mechanical joint connections shall conform to the requirements of ANSI Specification A21.11.

(4) Operating means shall be by wrench or by worm-gear operator. Valves 6
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Item VI – Duplex Submersible Non-Clog Suction Lift and Grinder Sewage Pumping Stations and Piping

(c) Check Valves

(1) Each pump shall have a full flow swing check valve which passes 3-inch spherical solids. Body to be cast iron, class 30 with flanged ends. Design shall incorporate a cleanout port, external lever with spring, and replaceable valve seat of AISI 304 stainless steel. Valve clapper shall be of molded neoprene with low pressure sealing rings provided at seating surfaces. Hinge pin and external hinge arm shall be stainless steel supported on each end by brass bushings; the sealing bushing shall have double O-rings. Replacement of O-rings shall not require valve removal or access to interior of valve body. Water working pressure to be rated at 175 psi, 350 psi hydrostatic test pressure. Valves that prevent passage of a 3-inch spherical solid are not acceptable. Check valves shall be Stockham Figure # G931-LS (lever with spring) or pre-approved equal.

(2) Check valves shall be of the nominal pipe diameter shown on the Plans and shall be so designed that, when open, they will have a clear waterway section of not less than the full nominal inside diameter of the connecting pipe. Check valves shall be as manufactured by Mueller Co., M & H Valve & Fittings Co., American-Darling Valve, or pre-approved equal.

(d) Air/Vacuum Release Valves

(1) A combination air/vacuum valve shall be installed on the sewage force main at the locations shown on the Plans, or where directed by the ENGINEER. Generally an air/vacuum valve shall be installed at all high points, increased down slopes, decreased upward slopes, long ascents, long descents and at long horizontal runs. Air/Vacuum valves shall be Val-Matic model #VM-100-S or pre-approved equal. The valve body and tapping saddle shall be epoxy coated. The tapping saddle bands shall be stainless steel.

(2) The air/vacuum valve shall be a combination valve designed to exhaust large amounts of air during filling of the force main, to release small amounts of accumulated air during operation, and to admit large amounts
of air upon impending vacuum during draining.

(3) The valve shall be float operated and both the air/vacuum and air release functions shall be housed in a single body. The valve body and cover shall be of cast iron conforming to ASTM Specifications A126, Class B. All leverage mechanisms, parts and the spherical float shall be stainless steel, Grade 304. The large and small orifice seats shall be Buna-N and shall be renewable.

(4) The air/vacuum valve shall be supplied with flushing attachments to allow periodic flushing of sediment, grease, and solids. Flushing attachments shall consist of an inlet isolating valve, bronze blow-off and flushing valves, and a minimum of 5 feet of rubber hose with quick disconnects to allow connection to a source of clean flushing water.

(5) All air/vacuum valves shall be installed in a vented manhole, meeting the requirements of Item II of the Specifications. The manhole shall not have a base and shall have cut-outs for the sewage force main. The manhole shall be installed such that no load is applied to the pipe, and shall have 8-inch minimum washed stone in the bottom and up to the springline of the force main. The manhole shall be vented with both a stainless steel vent and a vented cover.

(e) Valve Boxes

(1) Each underground valve installed outside of buildings or structures shall be provided with a valve box to house and protect the valve. Valve boxes shall be made of cast iron, of the adjustable sliding type, with a shaft diameter of 5¼-inches. The base shall be round or oval. The box shall be provided with an extension section so that, when installed, the cover will be slightly above ground surface.

(2) Valve boxes shall be Figure 4905 as manufactured by Opelika Foundry Company, or comparable boxes as manufactured by the Mueller Company, John Bouchard & Sons, Company, or pre-approved equal.

9.22 Hydrostatic Testing of Sewer Force Main Pipe

(a) After pressure sewer pipe has been laid, backfilled, and the necessary concrete thrust blocks constructed, the pipe shall be subjected to a hydrostatic pressure of 100 psi for a minimum period of 2 hours.

(b) The pipe shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a pump connected to the pipe. The pump, pipe connection, gauges, meters, and other
apparatus required for the tests shall be furnished and installed by the CONTRACTOR.

(c) Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, air/vacuum release valves shall be in service.

(d) All exposed pipes, fittings, and joints shall be carefully examined as the force main is installed and during testing. All leakage in joints shall be completely stopped. Any cracked or defective pipes or fittings discovered in consequence of this pressure test, shall be removed and replaced by the CONTRACTOR with sound material in the manner herein before provided and the test shall be repeated until satisfactory to the ENGINEER.

9.23 Water Service to Sewage Pump Stations

(a) Water service to sewage pump station sites shall consist essentially of a water meter, meter yolk, corporation stop, meter box and cover, double check/reduced pressure backflow preventer, water service line, and yard hydrant.

(b) The method and type of tapping the existing water main, the meter, corporation stop, backflow preventer, meter box and couplings shall meet the requirements of the local water authority. The backflow preventer shall be installed above ground in a heated enclosure. See standard backflow preventer detail.

(c) The DISTRICT-maintained portions of water service pipe shall be copper tubing, or polyethylene of the size shown on the Plans.

(1) Copper tubing shall be soft and annealed Type K and shall comply with Federal Specification WW-T-799.

(2) Polyethylene pipe will be allowed in areas outside the fenced compound and under grass. Pipe shall be CTS (copper tubing size) and rated at 200 psi working pressure at 73˚ F. Pipe shall be manufactured with PE 3608 or PE 3710 to SDR 9 wall thickness. Materials and manufacture shall comply with ANSI NSF Standard 61 and meet the requirements of AWWA C 901. Joints shall be minimized. Transitions or couplings shall be compression type brass fittings incorporating a pipe insert and compression seal with integrated joint restraint.

9.24 Corrosion Protection for Exposed Steel or Pipe

(a) All metal surfaces, including pipe, fittings, and valves, which must be protected from weather or corrosion shall have a three part coating system such as Sherwin Williams Exterior Tank System, or approved equal. The surfaces to which the system is to be applied shall be prepared in accordance with the
manufacturer’s recommendations.

(b) The first part or application shall be a rust penetrating epoxy pre-primer (Sherwin Williams Macropoxy 920 Pre-Prime or approved equal). After cure, the intermediate coat or base coat (Sherwin Williams Macropoxy HS high solid epoxy or approved equal) shall be applied.

(c) The finish or top coat (High Gloss Sherwin Williams Acrolon 218 HS acrylic polyurethane or approved equal) shall be applied.

(d) Color for pump station piping shall be Sherwin Williams Item Number SW4001 Bolt Brown, or approved equal. Colors for applications other than force main piping shall be submitted to the ENGINEER for approval.

9.25 Sewage Pump Station Site Fencing

(a) Fabric

(1) The fabric shall be composed of 6 foot, 9-gauge galvanized steel wire helically wound to form a continuous chain link fabric having a 2-inch mesh. Top and bottom edges shall have a twisted and barbed finish. The fabric shall be manufactured in accordance with ASTM A-392.

(2) Fabric shall be hot-dipped galvanized after weaving to produce a zinc coating not less in weight than 2.0 ounces per square foot of uncoated wire surface.

(3) Wire in the fabric shall meet minimum breaking strength of 1,290 pounds after galvanizing.

(b) Line Posts

Line posts shall be 2 inches O.D. standard pipe weight 1.76 pounds per foot and hot galvanized (2 ounces per square foot). Posts to be spaced approximately 10 feet on centers and set a full 3 feet in concrete footings, which are crowned at the ground surface to shed water.

(c) End and Corner Posts

End and corner posts shall be standard hot galvanized (2 oz. per square foot) basic open hearth copper-bearing steel pipe 3 inches O.D. weighing 5.79 pounds per foot, for setting a full 3 feet deep in concrete footings, which are crowned at the ground surface to shed water.
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(d) **Gate Posts**

Gate posts shall be 4-inch diameter, Schedule 40, standard pipe weight 9.11 pounds per foot and concrete filled.

(e) **Top Rail**

Top rail shall be 1-5/8 O.D. standard pipe weighing 2.27 pounds per foot and hot galvanized (2 oz. per square foot) and shall be furnished in random lengths averaging not less than 20 feet, jointed with extra long pressed steel sleeves, hot galvanized, making a rigid connection but allowing for expansion and contraction.

(f) **End and Gate Post Tops**

End and gate post tops shall be galvanized malleable iron, drive fitting outside of post to exclude moisture.

(g) **Fabric ties**

Fabric ties for attaching fabric to line posts or top rail shall be aluminum strip or wire used on top rail every 24 inches and on line posts every 14 inches.

(h) **Barbed Wire**

The fabric shall be surmounted with 3 strands of barbed wire. Each strand shall consist of two No. 12-1/2 W&M gauge twisted copper-bearing steel line wires, Class 3, hot galvanized, with No. 14 W&M gauge, 4 point barbs spaced not more than 4 inches apart. The barbed wire shall be manufactured in accordance with ASTM A-121.

Barbed Wire Extensions: All intermediate, gate and corner posts shall be equipped with extension arms for supporting barbed wire. The base shall be malleable iron and the extension pressed steel hot galvanized after fabrication. Intermediate arm shall have provision for passing top rail and corner arm casting to have set screw.

(i) **Brace and Tension Bands**

Brace and tension bands shall be unclimbable beveled edge type with 3/8 inch diameter square shouldered aluminum carriage bolts, non-removable from outside fence.

(j) **Bracing**

All corner, gate and terminal posts shall be braced by means of 1-5/8 O.D.
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horizontal compression member, securely attached to terminal and to first line posts with malleable iron fittings, beveled edge bands, and truss braced from first line post to bottom of terminal by 1/2 inch rod and turnbuckle. Corner posts to be so braced in each direction.

(k) Tension Bars

Tension Bars for attaching fabric to terminal posts shall be 3/16 x 3/4 high carbon steel attached to terminal posts by means of beveled edge bands.

9.26 Signage

(a) A weather resistant sign shall be provided in accordance with the sign detail in the Specifications.

9.27 Access Road and Pump Station Site

(a) The pump station access road shall be 12 feet wide (min.) with 2 feet wide shoulders. Maximum centerline grade is 18% unless otherwise approved by the ENGINEER. The road shall be crowned and sloped ¼ inches per foot toward the shoulders. Road shoulders shall be sloped away from road at 5%. The road shall be finished with 8 inches (compacted depth) of ABC stone and 2 inches of SF or RSF 9.5B pavement, as per NCDOT Specifications. Ditches shall be designed and constructed in accordance with N.C. Erosion and Sedimentation Control Manual, latest edition.

(b) Cut slopes shall be sloped at 1 ½ : 1 (max.) Fill slopes shall be sloped at 2:1 (max.).

(c) A turn around shall be constructed adjacent to and outside the fence with a minimum turning radius of 20 feet and a minimum depth of 35 feet.

(d) The pump station site shall be designed such that a minimum 5 feet clearance is provided between the fence and the wet well, valve vault, poles, generator, control panels and any other above ground equipment. The access gate shall be 16 feet wide (min.)

(e) The pump station site, turnaround, and access road shall be paved as specified above. The pump station site shall be paved 2 feet outside the fence, and sloped ¼ inch per foot from the center outward.

(f) The pump station drawings shall include a grading plan showing existing and proposed contours on access road and pump station site, and a detailed site plan showing the location of the wet well, valve vaults, pump hoist, control panels,
fence, all underground piping and electrical conduits, light pole, scada equipment pole, and generator in sufficient detail for a surveyor to lay out the site.

9.28 Odor Control

(a) The DISTRICT will consider odor control systems on a case by case basis. If the developer or owner of a development wishes to install an odor control system at a pump station, they shall contact the DISTRICT to discuss the need and type of equipment. All equipment is subject to review and approval by the DISTRICT.