SECTION 33 32 16.15

MEDIUM SIZED LIFT STATIONS

PART 1: GENERAL

1.01 SCOPE

A. This Section contains the requirements for a fully operational duplex submersible sewage pump station. Medium sized lift stations typically vary between 7.5 hp and 25 hp and have a maximum design flow capacity of 700 GPM.

1.02 SUBMITTALS

A. Conform to requirements of Section 01 33 00 - Submittals.

B. Provide complete factory testing for pumps to be furnished for this project as specified by the Hydraulic Institute. Include a full performance curve from shutoff to runout.

C. Submit manufacturer's data and details of the following items for approval:

1. Shop drawings and material certification(s) for the following:
   a. Submersible pumps with piping, connections, and setting plan.
   b. Valve assemblies showing clear opening sizes, opening directions, and setting details.
   c. Base settings plans for hydraulic drive units, crane, generator, automatic transfer switch, and other equipment to be installed stand alone.
   d. Construction details, including reinforcement, jointing methods, materials, and dimensions.
   e. Wet well showing installed equipment.
   f. All proposed electrical materials.
2. Equipment manufacturer's cut sheets and specifications. Contractor shall highlight where manufacturer's specifications are different from items specified in this section.
3. Materials to be used for pipe wall penetrations.
4. Materials and procedures for corrosion-resistant liner and coatings.
5. Plugs to be used for hydrostatic testing.
6. Provide precast wet well and manhole base sections with precast fillets or benches if available. If field installation of fillets or benches is necessary, provide Manufacturer's data for pre-mix (bag) concrete used for fillets and

benches.

D. Signed and sealed submittal drawings by a Professional Engineer licensed in the State where the project is being completed.

E. Complete design calculations computing discharge capacity, system head curve, wet well volumes, float and transducer elevations, and anti-floatation requirements.

F. Maintenance materials (spare parts) – Provide one complete set of the manufacturer's recommended spare parts for each pump. Provide 100% spare fuses, 100% spare alarm lights lamps, one (1) spare motor starter coil, and one (1) spare control transformer for control panel. Package each part individually or in sets of moisture proof containers or wrappings clearly labeled with part name and manufacturer's part/stock number. Provide any special tools required for equipment maintenance.

G. Provide separate control diagram with each line numbered and relay contacts indicated and written description of control sequence.

1.03 QUALITY OF EQUIPMENT

A. Equipment and appurtenances shall be designed for and constructed of materials for the conditions of exposure and of such strength to withstand all stresses which may occur during testing, installation, and all conditions of normal operation.

B. Exposed surfaces shall be finished in appearance. All exposed welds shall be ground smooth and the corners of structure shapes shall be rounded or chamfered for personnel protection.

C. All machinery and equipment shall comply in all respects with the provisions of the Occupational Safety and Health Act of 1970, and other applicable Federal, State and local laws & regulations.

1.04 FIELD SERVICES

A. Contractor shall provide the services of a manufacturer's representative experienced in the installation and operation of the pumping station supplied under this specification for not less than one 8-hour workday on-site for each of the following: 1) installation inspection, 2) start-up and performance testing, and 3) instructing AW's operating personnel.

PART 2: PRODUCTS

2.01 SEWAGE PUMPS

A. The sewage pumps shall be heavy duty submersible pumping units, complete with motor and submersible rated power and control cables. The pumps shall be field serviceable, with cast iron pump case and motor housing, integral stainless steel motor and pump shaft, and stainless steel fasteners. For serviceability and parts availability all pumps shall be standard catalog submersible pumping products.

B. Each phase of the motor shall contain a bimetallic temperature monitor in the upper portion of the stator windings. These thermal switches shall be connected in series and set to open at 140°C +/- 5°C. They shall be connected to the control panel, and used in conjunction with, and supplemental to, external motor overload protection.

C. Pumps shall each be supplied with Type 316 stainless steel guide rail system with integrated discharge elbow and stainless steel lifting chain.

D. Power and control cable(s) shall be sized in accordance with NEC standards.

E. Bi-metallic temperature switches shall be provided for the upper and lower bearings, and RTD type temperature measuring devices for the motor winding and bearings.

F. Pumps shall be rated for operating conditions as shown on the Drawings.

G. Energy efficient pumps that utilize premium efficiency motors shall be provided for all lift stations.

2.02 MOTORS

A. All motors shall be provided with thrust and radial bearings rated for L-10 life of 17,500 hours to carry the entire load which may be imposed upon it under all operating conditions. All motors shall be of nationally known American manufacturers and manufactured with standard frames. All motors shall be mounted using manufacturer's standard bolt hole pattern. No additional holes shall be made in the motor mounting. The stator, rotor and bearings shall be mounted in a sealed submersible type housing. The stator windings shall have Class F insulation and a dielectric oil filled motor, NEMA L design.

Motor locked rotor NEMA code shall be H or better for motors less than 15 HP and shall be G or better for motors 15 HP and above.

B. Each motor shall have two (2) tandem mounted mechanical seals, the lower one outside the motor and protecting the upper one which shall be in an oil-filled chamber. The lower, primary seal shall consist of one stationary silicon carbide or tungsten carbide ring and one positively driven (rotating) silicon carbide or tungsten carbide ring. The upper seal between the oil and motor housing shall consist of one stationary stainless steel or tungsten carbide ring and one positively driven (rotating) carbon ring. Each interface shall be held in place by its own independent spring system.

Moisture detector probes in the oil-filled seal chamber shall be connected to an alarm indicating the presence of moisture in the seal chamber. Thermal overload protectors shall be imbedded in the motor windings and connected to the control to disconnect the motor in the event of overheating.

C. Each motor shall be equipped with heavily jacketed submersible cables of the length required to reach the junction panel adjacent to the control panel without splices or strain and allowing a minimum of 4 feet of slack. Short cables will be rejected.

D. All motors shall be sized according to the information shown on the Drawings.

2.03 LIFTING CHAINS

A. Chains for attachment to below grade equipment shall be a minimum of 7/32" 316 stainless steel having a working load limit of 1200 lb. The chain weight shall be 41.1 lb/100 ft. The working load rating of the lifting system shall be a minimum of 50% greater than the pump weight. Lifting chain shall be provided with sufficient length to reach from pumps to wet well cover, with an additional 3' of slack provided.

2.04 LIFTING DEVICE

A. Provide crane as indicated on plans. Units shall be rated at not less than 150% lifting capacity at maximum boom extension for the weight of the proposed pumps. The crane shall be capable of 360° rotation.

2.05 CHECK VALVES

A. Provide each pump with a swing check valve. Provide outside lever and weight. Valve shall provide positive control to prevent water hammer from valve closure.

2.06 GATE VALVES

A. Provide each pump with a gate valve or eccentric plug valve. Valve shall have a rising stem and flanged ends.

2.07 COUPLING SYSTEM (GUIDE RAIL)

A. A guide rail system shall be furnished and installed for each pump designed to operate under the expected head and flow conditions. The system shall be designed such that the pumps can be easily removed from the wet well without entering the well or disconnecting piping.

B. The system shall consist of a 90-degree discharge elbow with support leg, stationary base support, slide rail pump assembly, dual stainless steel guide rails, upper, lower and intermediate stainless steel guide rail supports, and stainless steel lifting yoke, cable and eyes. The foot-mounted discharge elbow and adapter shall conform to ASTM A48 Class 25 or 30 grey iron.

C. The stationary base shall be constructed of ductile iron, integrally cast. The slide face shall be constructed of Class 35 cast iron. The coupling shall incorporate a self-energizing gasket to provide positive sealing under all conditions. All bolts, nuts, screws, and miscellaneous accessories not otherwise noted shall be Type 316 stainless steel.

D. The guide rail system shall be a standard product of the pump manufacturer.

2.08 ALUMINUM ACCESS DOORS

A. Door leaf shall be minimum ¼" aluminum pattern plate reinforced to withstand H-20 loading. Frame shall be ¼" aluminum with an anchor flange around the perimeter. Doors shall be equipped with heavy forged brass or stainless steel hinges, stainless steel pins, and an automatic hold-open arm with release handle. Provide a staple for padlock and an aluminum lifting handle. The lifting handle shall recess into the door when not in use. Hardware shall be cadmium plated and factory finish. The frame shall be mill finish with bituminous coating applied to exterior channels where they come in contact with the frame. Doors shall be hinged as shown in the Drawings. Where opposite opening doors are indicated, safety chains shall be provided. Door assemblies shall meet OSHA requirements. On all door leafs with any dimension greater than 36 inches, supply compression springs to assist opening.

B. Provide safety grate option and keyed locks for all access hatches. Provide master access keys in accordance with AW's requirements. Two of each key shall be provided and keys shall be tagged for lock location. Safety grating shall be manufactured with 1" square molded fiberglass or steel and be capable of supporting 300 lbs/SF

2.09 CONCRETE WET WELL SECTIONS AND VALVE VAULT

A. Provide precast wet well sections and related components conforming to ASTM C478. Provide base riser section with fillets or benches precast into the structures unless unavailable from the precaster. Mark date of manufacture and name or trademark of manufacturer on inside of barrel. Riser sections shall have dimensions and orientation of pipe cut-outs as shown on the Drawings. Flat slab top section shall have cut-outs for the access hatch frames. No ladder is permitted in the wet well.

B. Provide precast valve vault and related components conforming to ASTM C 478. The valve pit shall be provided with a flat slab top section with cut-out for the access hatch and frame. No ladder is permitted within the valve vault. Provide ventilation in the valve vault if the pit depth exceeds 5 feet. Valve vaults shall be furnished with a sump and sump pump, or approved equal, to allow for drainage.

C. In more temperate climates, AW permits the use of welded steel grating for top sections of valve vaults with prior approval from the AW Project Manager. Welded steel grating shall be manufactured from ASTM A-1011 carbon steel. Standard welded grating shall be manufactured with bearing bars spaced at 1-3/16" on center and cross bars at 4" on center. Valve vaults shall be furnished with a sump and sump pump, or approved equal, to allow for drainage.

2.10 SEWAGE GRINDER

A. Furnish hardware for mounting and retrieval from the wet well, retrieval chain and basket screen for use in place of the grinder when the grinder unit is removed from the wet well. Provide hydraulic drive power pack and associated hoses and connections as required, and as recommended by the manufacturer for this

application. Cutters shall be as recommended by the manufacturer for this installation.

2.11 YARD HYDRANT

A. Yard hydrant shall be bronze, self draining, non freezing, self closing compression type. Provide vacuum breaker adapter for hose connection. Size adapter on AW recommendation.

B. Primary interior operating parts shall be brass and removable from yard hydrant without excavation.

C. Yard hydrants shall be set in 4 cubic feet of crushed stone to allow for proper drainage. AWWA recommendations shall be followed when installing the yard hydrant.

D. Backflow prevention devices shall be installed on the yard hydrant service line in accordance with State and local regulations.

2.12 INSTRUMENTATION

A. Controls – The control logic shall provide for the operation of the lead pump under normal conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the lag pump will automatically start to handle the increased flow. As the liquid level decreases, the pumps will shut off at the elevations shown on the Drawings. In the event of a malfunction or a flow that exceeds the capacity of the pumps, a high level light and audible alarm will be activated to indicate alarm conditions. Pumps shall alternate as lead and lag pumps on a continuous basis..

B. Control panel shall be provided as part of pump station package with manufacturer unit source responsibility. Base panel shall include all circuitry to control pumps including contacts, microprocessor, starters, circuit breakers, etc. Manufacturer shall be responsible for sizing of all components. Panels shall include the following:

1. Ground fault receptacle with circuit breaker.
2. Reduced voltage starters with under voltage release and overload coils for each phase (each pump).
3. NEMA starters
4. Local/remote dry contacts for alarms specified elsewhere
5. Sequential, selectable alternator
6. Lightning arrestor
7. Elapsed time meter for each pump, non-resettable
8. Time delay between pumps.
9. H-O-A switches for each pump
10. Contacts for two mercury switch level control floats and one pressure transducer

11. Auxiliary heater
12. Pump failure with dry contact.
13. Generator interlock
14. Phase loss monitor.

B. Pressure transducer and floats
1. Contractor shall provide both a pressure level transducer and float system. Pumps shall be controlled via pressure transducer with level floats utilized as a back-up system.
2. Provide stainless steel float hanger brackets.

C. Alarm system
1. If a control building is required, the control building shall have an intrusion alarm system integrated with the existing local alarm systems. The alarm system for the lift station will integrate the station alarms identified below, if possible. The alarms shall connect to the SCADA RTU to be provided with the pump control panel.
2. Pump run status
3. High wet well level
4. Station power failure
5. Low wet well level
6. Loss of phase (if three phase power)
7. Generator start failure
8. Grinder high water
9. Grinder motor fault
10. Others as determined by AW during design

D. Flow Monitor
1. Provide flow monitor, or meter where determined by the AW project manager, and/or as indicated on the Drawings. Flow monitor shall provide 1% accuracy totalized flow independent of fluid viscosity, density and temperature, unaffected by most solids contained in fluids.
2. Flow monitor shall include the following features:
   a) Standard size DIN enclosure for easy installation

b) Alphanumeric display for easy-to-read and easy-to-understand data
c) Clear plastic splash proof cover to protect the display, keyboard, RS-232 connector and PC Card slot
d) Seven digital inputs: three pumps and four user inputs
e) Two digital outputs (open collector) for alarms
f) Two analog outputs proportional to outflow and inflow for telemetry system, or sampler or chart recorder
g) RS-232 serial port for fast and easy access
h) Optional eight analog inputs: 4-20 ma, 0-5 VDC DIP switch-selectable (pressure, temperature, level, etc.)
i) Optional built-in 2400 baud auto-answer modem

Standby Power

C. Where determined by the AW Project Manager, the lift station shall be furnished with a standby generator. Purchase of the generator shall be coordinated with AW

2.13 ELECTRICAL SPLICE JUNCTION BOX

A. The electrical splice j-box shall be located in an easily accessible location adjacent to the wet well, shall provide easy access for inspection and servicing, and be of corrosion resistant materials. Junction boxes are not permitted to be located on top of the wet well. The electrical splice box shall be UL approved for wet locations.

PART 3: EXECUTION

3.01 PUMP STATION (GENERAL)

A. Conduct of operations

1. Contractor shall dispose of demolished or removed equipment and materials off site in an environmentally and legally manner on a daily basis. Products of demolition shall not be stored on site.

2. Maintain debris cleanup daily. Construction materials shall be located as designated by AW Project Manager.

3. Provide written and graphic information to describe operations for demolition work.

4. Protect existing equipment and facilities from damage. Replace damaged with new equipment and materials or repaired of the same as approved by

the AW Project Manager.

5. Provide traffic safety measures at all times

3.02 SITE WORK

A. Erosion control

1. Apply erosion control in accordance with Erosion and Sedimentation Control plan prepared by the Engineer.

2. Maintain construction entrance as required.

B. Soil backfill and compaction

1. Contractor shall backfill and compact soil around the wet well and valve vault. Soil shall be compacted in to 95 percent of maximum standard proctor density according to ASTM D698.

C. Provide a chain link fence in accordance with American Water Standard Details. The fence shall have a minimum height of 6 feet with three rows of strand barbed wire, or 8 feet with one row of strand barbed wire. The fence shall also be provided with separate vehicular and pedestrian gates.

D. Provide trees and shrubs surrounding the fence. Provide a plan indicating the type, size, spacing, and distance from the fence on the Drawings for approval by American Water.

E. Examination

1. Verify that lines and grades are correct.

2. Determine if subgrade, when scarified and recompacted, can be compacted to 95 percent of maximum standard proctor density according to ASTM D698 prior to placement of foundation material and base section.

3. When proper density is not reached, moisture condition subgrade until that density is reached or treat as unstable subgrade.

4. Maintain positive drainage of storm water. Provide erosion protection in accordance with standard specifications for State road and bridge construction. Provide stabilization of the worksite to prevent rutting and erosion. Store excavated material on site at the direction of AW.

F. Maintain construction entrance as required.

3.03 SETTING EQUIPMENT

A. EQUIPMENT

1. Set equipment plumb and level. Install in strict accordance with written instructions from the manufacturer. Use anchor bolts, grout leveling and and/or isolation pads as required by the equipment manufacturer. Provide anchor bolts and other ancillary materials necessary for an installation in compliance with manufacturer's requirements.

B. PIPE

1. Furnish support as required by the manufacturer and as shown on the drawings. Provide end restraint where pipe may be subject to movement when under pressure. Mechanical joint fittings shall be furnished with restraint devices. Test pipe in accordance with AW requirements.

C. PUMPS

1. Provide isolation fittings for intake and discharge, fittings directly installed on the pump joint connections. No stress from piping shall be transmitted to the pump connections.

3.04 FOUNDATIONS

A. Minimum compaction requirements for soils acting as foundations shall be 95% maximum Standard Proctor to a depth of 12 inches below the structure. Moisture content range of the soil shall be plus or minus 2% optimum.

3.05 TESTING

A. Provide copies of manufacturer's factory test results on equipment and materials provided. Notify AW within 24 hours of any site testing to be conducted

B. The following equipment shall be tested after installation with a manufacturer's representative present to verify compliance with recommended testing protocol. Copies of test reports shall be furnished to AW. Provide copies of manufacturer's recommended site testing procedures not less than 48 hours prior to testing of equipment.

1. Pumps
   a. Pumps shall be tested for rotation direction, one-minute pump down and amperage draw during pump down.
   b. Record results and submit to owner.
   c. Exercise removal facilities using crane and hoist. Removal shall not present binding or tracking problems.

2. Control Panel
   a. Control panel shall be tested for each function provided to verify proper operation.
   b. Verify proper interface with SCADA and coordinate with SCADA requirements.

3. Crane
   a. Verify rotation and lifting capacity through exercise testing each capacity.

4. Grinder
   a. Test for torque and grinding capacity using manufacturer's recommended testing procedures.

b. Verify absence of hydraulic oil leaks. Replace defective materials with new.
c. Exercise removal facilities using crane and hoist. Removal shall not present binding or tracking problems.

5. Pipe:
   a. Pipe shall be tested in accordance with relevant AW Specification sections.
   b. Repair or otherwise correct leaks.

C. Clean Up and Touch Up
1. Repair marred painted surfaces of equipment with paint recommended by the manufacturer for that purpose. Remove debris of construction from the site daily and dispose of in a legal manner.

END OF SECTION 33 32 16.15