SECTION 02750

WASTEWATER LIFT STATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work under this section includes, but is not limited to, furnishing and installing a duplex submersible lift station as indicated on the project drawings and herein specified, as necessary for proper and complete performance.

1.02 REFERENCES

A. Publications listed below form part of this specification to extent referenced in the text by basic designation only. Consult latest edition of publication unless otherwise noted.

1. American National Std. Institute (ANSI) / American Water Works Assoc. (AWWA)

    a. ANSI B16.1 Cast iron pipe flanges and flanged fittings.

    b. ANSI/AWWA C115/A21.51Cast/ductile iron pipe with threaded flanges.

    c. ANSI 253.1 Safety Color Code for Marking Physical Hazards.

    d. ANSI B40.1 Gages, Pressure and Vacuum.

    e. AWWA C508 Single Swing Check Valves.

2. American Society for Testing and Materials (ASTM)

    a. ASTM A48 Gray Iron Castings.

    b. ASTM A126 Valves, Flanges, and Pipe Fittings.

    c. ASTM A307 Carbon Steel Bolts and Studs.

    d. ASTM A36 Structural Steel.

3. Institute of Electrical and Electronics Engineers (IEEE)

   a. ANSI/IEEE Std 100 Standard Dictionary of Electrical Terms.

   b. ANSI/IEEE Std 112 Test Procedure for Polyphase Induction Motors.

   c. IEEE Std 242 Protection of Industrial and Control Power Systems.

4. National Electric Code (NEC) / National Electrical Manufacturers Assoc. (NEMA)

   a. NEC National Electric Code.

   b. NEC 701 National Electric Code article 701.

   c. NEMA Std MG1 Motors and Generators.

5. Miscellaneous References

   a. Ten-State Standards Recommended Standards for Sewage Works.

   b. Hydraulic Institute Std for Centrifugal, Rotary and Reciprocating Pumps.

   c. NMTBA and JIC Std. National Machine Tool Builders Association and Joint Industrial Council Standards

   d. ISO 9001 International Organization for Standardization.

1.03 SUBMITTALS

A. Product Data

1. Prior to fabrication, pump and control panel manufacturer shall submit three (3) copies and an electronic copy of submittal data for review and approval.

2. Submittal shall include shop drawings, electrical ladder logic drawings, and support data as follows: Catalog cuts sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor and

shaft drive data, pump characteristic curves showing the design duty point capacity (GPM), head (FT), and hydraulic brake horsepower (BHP). Electrical components used in the motor branch and liquid level control shall be fully described.

B. Shop drawings shall provide layout of mechanical equipment and anchor bolt locations for equipment base plate. The electrical ladder logic drawings shall illustrate motor branch and liquid level control circuits to extent necessary to validate function and integration of circuits to form a complete working system.

C. Operation & Maintenance Manuals

1. Installation shall be in accordance with written instructions provided by the pump manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping and valves, but lack experience with the exact equipment supplied.

2. Provide a minimum of three hard copies and one electronic copy of all O&M manuals. Documentation shall be specific to the pumps and control panels supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:

a. Functional description of each major component, complete with operating instructions.

b. Instructions for operating pumps and pump controls in all modes of operation.

c. Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.

d. Support data for commercially available components not produced by the station manufacturer, but

supplied in accordance with the specifications, shall be supported by literature from the prime manufacturer and incorporated as appendices.

e. Electrical schematic diagram of the pump station circuits shall be in accordance with NFPA70. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the station operator, need not be included. 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. Mechanical layout drawing of the pump station and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, valves and piping.

3. Operation and maintenance instructions which rely on vendor cut-sheets and literature which include general configurations, or require operating personnel to selectively read portions of the manual shall not be acceptable. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications.

1.04 QUALITY ASSURANCE

A. Components including the pumps, motors, and controls will be tested as a complete working system at the manufacturer's facility. Tests shall be conducted in accordance with Hydraulic Institute Standards at the specified head, capacity, rated speed and horsepower. Factory operational test shall duplicate actual performance anticipated for the complete pumps.

B. The manufacturer’s technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the equipment as described in Part 3 of this section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in manufacturer's packaging and store per manufacturer's instructions.

1.06 PROJECT/SITE CONDITIONS

A. Pumps will be installed within the wet well as shown on the drawings.

1.07 MANUFACTURER'S WARRANTY

A. The pump manufacturer shall warrant all equipment to be of quality construction, free of defects in material and workmanship. Pumps and other equipment, apparatus, and parts furnished by the pump manufacturer shall be warranted for five years from the date of start-up, with a minimum of 18 months of 100% coverage from manufacturer defects and workmanship. The warranty shall be in printed form and apply to all similar units.

B. Components failing to perform as specified by the engineer, or as represented by the manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Contractor shall furnish and install a submersible duplex pump station, including a pre-cast concrete wetwell and valve vault per the construction drawings. The wastewater pump station shall include all necessary ductile iron piping, fitting, valves, and appurtenances as shown on the drawings, and as needed for a complete installation. Included with the two (2) submersible wastewater pumps shall be a radar level sensor, manufactured by Vega or approved equal, a float control backup system, pump control panel including soft starters or VFD's, electrical power feed, and necessary conduit, wiring, etc. Pumps and control panel shall be supplied by a single manufacturer.

B. Wet Well

1. The wet well shall be constructed of precast reinforced concrete sections conforming to ASTM C-478, type II 4,000 psi with absorption not exceeding 6%. A 12-inch anti-flotation collar shall be provided with the base of the wetwell structure. The footing shall be concrete, placed on a dry compacted subgrade. The wetwell shall be constructed to the dimensions shown on the drawings.

2. The access hatch in the top slab of the wet well shall be sized appropriately for the selected pumps as detailed on the construction drawings, and shall have a minimum live load capacity of 300 pounds per square foot. The frame shall be complete with hinged and hasp-equipped cover, upper guide holders, chain holders and stainless steel cable holder. Frame shall be securely mounted directly above the pumps. The door shall be torsion bar loaded for ease of lifting and shall have safety locking handle in open position. Fastening hardware used inside the wet well shall be stainless steel. Interior shall be spray applied with OBIC Armor 1000 aromatic polyurea coating by CTR Coatings or approved equal by the Owner.

3. The Contractor shall furnish and install guide rails for each pump, to permit the raising and lowering of the pump. Guide bars shall be 316 stainless steel and of adequate length and strength to extend from the lower guide holders on the pump discharge connection to the upper guide holder mounted on the access frame. Guide rails shall be installed plumb with stainless steel intermediate supports as required by the Engineer.

4. All conduit entering the lift station should be sealed air tight at the wet well and at the control panel. Once above grade, these conduits shall also have an air gap immediately below the control panel. Conduit shall be sealed air tight on either side of the air gap.

5. All piping and fittings within a wet well from the pump base to the valve pit shall have an epoxy prime exterior.

6. All exposed metal piping and fittings shall receive TNEMEC, or approved equal, protective coatings with a minimum of

4.0 to 6.0 mils of Series 1028 coating system. The finish coat shall be resistant to oil mist exposure, solvent contact, and salt spray. The factory finish shall allow for over-coating and touch up after final installation.

C. Valve Vault

1. Valve vault shall be constructed of precast reinforced concrete sections conforming to ASTM C-478, type II 4,000 psi with absorption not exceeding 6%. The footing shall be concrete placed on a dry, compacted sub grade. The valve vault shall be constructed to the dimensions shown on the drawings. The access hatch in the top slab of the valve vault shall be sized as shown on the construction drawings, with a minimum live load capacity of 300 pounds per square foot as detailed on the construction drawings. The hatch shall include 1/4" (inch) tread plate, flush type lock with inside spoon handle. Frame shall be securely mounted directly above the valves. The door shall be torsion bar loaded for ease of lifting and shall have safety locking handle in open position. Fastening hardware used inside the valve pit shall be stainless steel.

2. All exposed metal piping and fittings shall receive TNEMEC, or approved equal, protective coatings with a minimum of 4.0 to 6.0 mils of Series 1028 coating system. The finish coat shall be resistant to oil mist exposure, solvent contact, and salt spray. The factory finish shall allow for over-coating and touch up after final installation.

3. Drain line from the valve vault shall discharge back to the wetwell structure and include a duck bill check valve.

D. Plug Valves

All plug valves shall be of the non-lubricated, eccentric type conforming to AWWA C517 with resilient faced plugs, and Class 125 ANSI flanges. Valves to 20” size shall be round port or have a port area equivalent to 100% of full pipe area and all valves 24” and larger shall be 100% port area. Valve body and bonnet shall be made from ASTM A536 Grade 65-45-12 ductile iron or ASTM A126 Class B cast iron, internally and externally coated with 6-mil epoxy. Valve seats shall have a welded-in overlay of high nickel content on all surfaces contacting the plug face. Valves shall have permanently lubricated, stainless steel bearings in the upper

and lower plug stem journals. All valves shall have bolted bonnets and adjustable compression packing or self-adjusting U-cup packing that can be replaced without removing the bonnet. All exposed nuts, bolts, springs, and washers shall be zinc plated. O-ring seals are not acceptable.

E. Check Valves

1. Check valves shall be of cushioned swing check type and shall meet the materials requirements of AWWA specification C508. The valve shall be cast iron body, bronze mounted, single-seated for non-shock working pressure of 175 psi.

2. The valve shall be so constructed that by simply unbolting and lifting off the cover, the internal working parts may easily be removed and replaced without removing the valve from the line. Check valves shall be suitable for mounting in horizontal lines or vertical lines when water flow is up. Check valves should close without any hammering action.

F. Surge Relief Valve

1. Surge relief valves shall be provided where surge analysis, static pressure conditions, or force main operating characteristics indicate the potential for excessive transient pressures, or at the discretion of GBPW.

2. The valve shall be appropriately sized based on the working pressures of the proposed pump station.

3. Provide a cast-iron body valve, to be normally closed, opening only when system pressures exceed the spring adjustment setting. Spring settings to be determined by the design engineer.

4. Surge relief valves to be manufactured by Ross Valve, or approved equal.

5. A shut-off valve shall be installed underneath the surge relief valve in the vault to allow for the removal of the surge relief valve without interrupting pump service.

G. Air Release Valves

1. Provide air release valves at all high points or positive to negative grade changes along the forcemain route to prevent air locking or areas of entrapped air in the pipeline.

2. Provide ARI Model D-025, short version, with written five (5) year warranty, isolation valve, SSTL quick disconnect, SSTL Sch. 40 pipe/nipples, and connected with a service saddle/corporation stop.

3. Provide body made of reinforced nylon with corrosion resistant polymer and stainless-steel operating parts.

H. Pressure Gauge

1. Each pump shall be equipped with a glycerin-filled pressure gauge to monitor discharge pressures. Gauges shall be a minimum of four (4) inches in diameter.

2. Pressure gauge ranges shall be selected based on the operating conditions of the pump station. Gauge accuracy shall be within 0.5% of the total scale range. Provide diaphragm isolators on all gauges so that their materials of construction are resistant to wastewater. Pressure shall be transmitted to the gauge by a locked in and sealed fluid such as ethylene glycol or silicone oil. Elastomer shall be Butyl or Neoprene. The pressure gauge will be installed in the valve pit upstream of the plug valves. The installation shall include a ½-inch tap with a stainless-steel nipple and ball valve for isolation.

I. Equipment acceptance shall be contingent upon the pumps ability to run continuously at full speed for periods up to twenty-four hours. A demonstration may be required by the engineer.

J. The pump offered shall be the manufacturer's standard production model.

K. Install two (2) Flygt submersible non-clog wastewater pumps, or approved equal. Each pump shall be equipped with submersible electric motor connected for operation on 460 volts, 3-phase, 60 hertz service, with fifty (50) feet of submersible power cable suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and have P-MSHA approval. The pumps shall be supplied with a mating discharge connection

that matches the size of the pump discharge. Each pump shall be fitted with twenty (20) feet of lifting chain or stainless-steel cable. The working load of the lifting system shall be 50% greater than the pump unit weight.

2.2 PUMP DESIGN

A. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor.

2.3 GUIDE RAIL BASE ASSEMBLY

A. There shall be no need for personnel to enter the wet well to remove or reinstall the pumps. In a wet pit installation, the discharge base & elbow assembly shall be permanently installed in the wet well and connected to the discharge piping. In order to prevent binding or separation of the pump from the guide rail system, the pumps shall connect to the guide rail base automatically and firmly, guided by two 2-inch guide pipes extending from the base elbow to the top of the station. Systems using guide cable in lieu of rigid guide bars or pipes shall not be considered acceptable. The sliding guide bracket shall be a separate part of the pumping unit, capable of being attached to standard 4 inch ANSI class 125 or metric DN100 pump flanges, so that the pump mounting is non-proprietary, and any pump with a standard discharge flange can be mounted on the base assembly. Base or bracket assemblies with proprietary or non-standard flange dimensions shall not be considered acceptable.

B. Positive sealing of the pump flange/guide rail bracket to the discharge elbow shall be by metal to metal contact. No portion of the pump shall bear directly on the floor of the sump. The guide rail system shall be available in an optional non-sparking version.

2.4 PUMP CONSTRUCTION

A. Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. The lifting handle shall be of stainless steel. All

exposed nuts or bolts shall be AISI type 316 stainless steel construction. All metal surfaces coming into contact with wastewater, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

B. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or optional Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

C. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

2.5 COOLING SYSTEM

A. A water jacket is not required, unless adequate submergence depth of wastewater is unavailable, or it is determined that one may be required after owner review. Motors are sufficiently cooled by the surrounding environment or pumped media.

2.6 IMPELLER

A. The impeller shall be of Hard-Iron^{TM}, ASTM A-532 (Alloy lll A), 25% chrome cast iron, dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the impeller shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 6% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. A brass sleeve shall act as a friction clutch allowing for safe motor stoppage in the event of a solid object entering the cutting area without damaging the motor shaft. The Impeller shall be held by an impeller bolt.

2.7 PUMP VOLUTE/SUCTION COVER

A. The pump volute shall be a single piece grey cast iron, ASTM A-48, Class 35B, non- concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable volute cutting ring containing five spiral-shaped, sharp-edged grooves, five shearing pockets and five sets of cutting teeth. The spiral groove shall provide the relief path and sharp edges across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The internal volute bottom shall provide effective sealing between the multi-vane semi-open impeller and the volute. The cutting ring shall be cast of Hard-IronTM, ASTM A-532 (Alloy lll A), 25% chrome cast iron.

2.8 MOTOR

A. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of no less than 30 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber containing the terminal board, shall be hermetically sealed from the motor by an elastomer compression seal. Connection between the cable conductors and stator leads shall be made with threaded compression type binding posts permanently affixed to a terminal board. The motor and the pump shall be produced by the same manufacturer.

B. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

C. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

D. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out, unless approved by GBPW.

2.9 MECHANICAL SEALS

A. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating, corrosion and abrasion resistant tungsten- carbide ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating, corrosion and abrasion resistant tungsten-carbide seal ring.

B. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable. For special applications, other seal face materials shall be available.

C. The following seal types shall not be considered acceptable or equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double

mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.

D. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load.

E. Where a seal cavity is present in the seal chamber, the area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

F. Seal lubricant shall be non-hazardous.

2.10 PUMP SHAFT

A. Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The shaft shall be stainless steel – ASTM A479 S43100-T.

B. If a shaft material of lower quality than stainless steel – ASTM A479 S43100-T is used, a shaft sleeve of stainless steel – ASTM A479 S43100-T is used to protect the shaft material. However, shaft sleeves only protect the shaft around the lower mechanical seal. No protection is provided in the oil housing and above. Therefore, the use of stainless-steel sleeves will not be considered equal to stainless steel shafts.

2.11 BEARINGS

A. The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. **Single row lower bearings are not acceptable.** The minimum L_{10} bearing life shall be 50,000 hours at any usable portion of the pump curve.

2.12 CABLE ENTRY SEAL

A. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

2.13 FINISH

A. Pumps, piping, and exposed steel framework shall be cleaned prior to painting. Exposed surfaces to be coated with one coat gray wide range non-lift primer and one coat white acrylic alkyd wide range enamel. Paint shall be low VOC, alkyd based, high solids, semi-gloss white enamel for optimum illumination enhancement, incorporating rust inhibitive additives. The finish coat shall be 1.0 to 1.2 MIL dry film thickness (minimum), resistant to oil mist exposure, solvent contact, and salt spray. The factory finish shall allow for over-coating and touch up after final installation.

2.14 ELECTRICAL CONTROL COMPONENTS

A. The pump control panel shall be supplied by the pump manufacturer. The pump control panel will be tested as an integral unit by the pump manufacturer. The control panel shall also be tested with the pump system as a complete working system at the pump station manufacturer's facility.

B. For all motors 15 horsepower and greater, provide a reduced-voltage soft starter (RVSS) with the pump control panel. If variable frequency drives (VFDs) are proposed for the application, RVSS’s are not required.

C. Panel Enclosure

1. Electrical control equipment shall be mounted within a NEMA 4X stainless steel control enclosure with a single three-point stainless steel lockable latch. Door shall be

hinged and sealed with a neoprene gasket and equipped with captive closing hardware. Control components shall be mounted on a removable steel back panel secured to enclosure with collar studs.

2. All control devices and instruments shall be secured to the sub-plate with machine screws and lock washers. Mounting holes shall be drilled and tapped; self-tapping screws shall not be used to mount and component. All control devices shall be clearly labeled to indicate function.

3. Pump station controls shall conform to third party safety certification. The panel shall bear a serialized UL label listed for "Enclosed Industrial Control Panels". The enclosure, and all components mounted on the sub-panel or control cover shall conform to UL descriptions and procedures. All installation requiring penetration of the control panel shall be made in such a manner and with approved devices that will maintain the panels' NEMA 4X rating. All conduits entering the control panels or other enclosures from the wet well shall be sealed with gas-tight fittings (Myers type hubs).

C. Sub-Panel

1. Control sub-panel shall be 12-gauge steel with white enamel finish. Sub-panel shall have flanges on at least two sides. All mounting holes shall be drilled and tapped at the least 8/32" and parts mounted with stainless steel machine screws. Self-tapping screws will not be accepted.

2. Provide a removable inner swing door for each door of the enclosure. Inner swing doors must be 5052 grade aluminum having a minimum thickness of 0.125 inches. The door shall be adequately sized to enclose all panel- mounted components while having a vertical swing of a minimum of 90 degrees. Inner doors shall be held closed with a durable ¼-turn latch. The doors shall have a brushed high gloss luster. All inner door mounted components will be labeled with phenolic engraved nameplates.

D. Panel Components

1. Pump Circuit Breakers

a. Heavy-duty, thermal-magnetic molded case pump motor circuit breakers to be manufactured by Square

D Company or approved equal.

b. Pump breakers shall be accessible through inner door.

2. Control Transformer

a. A control circuit transformer shall be included to provide 115 VAC power to control components.

b. Fuses selected according to NEC requirements shall protect transformer primary and secondary. Fuse blocks shall be provided with lights for indication of a blown fuse.

c. Provide two 20 amp, 120v, 1P breakers to feed lights and remote monitoring system.

3. Surge Protective Device (SPD)

a. SPD with a minimum surge current rating of 40,000A shall be provided. The SPD shall have LED status indicator lights. It shall be manufactured by Square D Company or approved equal.

4. Three Phase Voltage Monitor

a. A three phase voltage monitor shall be plug-in pin type as manufactured by Diversified Corporation or approved equal. It shall monitor:

1) Phase failure
2) Phase reversal
3) Low voltage (Brown outs)

5. Pump Protection

a. All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. At 125°C (260°F) the thermal switches shall open, stop the motor and activate an alarm.

A leakage sensor shall be available as an option to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and send an

alarm both local and/or remote. Use of voltage sensitive solid state sensors and trip temperature above 125°C (260°F) shall not be allowed.

b. The thermal switches and FLS shall be connected to a Mini CAS (Control and Status) monitoring unit. The Mini CAS shall be designed to be mounted in any control panel.

6. Pump control shall be accomplished via a radar level sensor, manufactured by Vega or approved equal, and a float backup system.

7. Control relays shall be plug-in blade type with indicator light. They shall be Square D type 4PDT or approved equal.

8. A time delay relay shall be provided to ensure that both pumps do not restart simultaneously in the event of a power loss. Timer shall be Idec type RTE or approved equal.

9. Power terminals and control terminals shall have minimum 1/4” flat head set screws. Terminals shall be mounted on din rail for easy field access.

E. Indication and Operator Interface

1. Each pump will have a three-position switch to select ‘Hand-Off-Automatic’ position.

2. Each pump shall have elapsed time meter mounted on the inner door. Meters shall be wired to each starter, six-digit, non-resettable, to indicate total run time in hours and tenths.

3. The following indicating lamps shall be provided:

a. Pump Running per pump (green)

b. Pump Overtemp per pump (red)

c. Pump Overload per pump (red)

d. Pump Seal Failure per pump (red)

4. Pushbuttons shall be provided for:

a. Alarm Horn Silence (externally mounted)

b. Reset Motor Overload per pump

5. All lights and switches shall be SKS type manufactured by Square D Company or approved equal.

6. All door-mounted components shall have engraved nameplates (Two-ply laminated plastic; black letters, white background).

F. Alarm System

1. A flashing LED beacon alarm light shall be installed at the panel and located as to be readily visible from the main road. Alarm light shall be approved for vapor tight top installation and shall have a red lexan globe.

2. A weatherproof alarm horn shall be mounted on the side of the enclosure. Horn shall have a minimum 87 DBA output. The horn silencer shall be mounted on the front of the inner door.

3. Alarm horn and light shall be on at high level.

4. SCADA connections shall be provided for all run and alarm signals.

G. Wiring and Labeling

1. Power wiring shall be properly sized MTW rated 90 degrees C. Control wiring shall be red #16 AWG, MTW, rated 90 degrees C. All panel wiring shall have polyester or vinyl-cloth numerically identified labels on each end to indicate wire number. Labels will be manufactured by Phoenix or approved equal. Wire will be neatly routed in the panel through polyester wire duct except from the backplate to the inner door, which shall be wrapped in a separate bundled harness for control.

2. A laminated “As-Built” wiring schematic shall be posted on the inside of the inner door. A data tag with panel and manufacturer information shall be provided on inside of enclosure door.

3. All panel mounted components including control and power terminal strips will be clearly labeled according to provided wiring diagram.

4. All UL labels shall be posted where required by 508A standards.

H. Rating

1. The control panel shall be UL listed and labeled as an industrial control panel under UL 508 procedures.

2.15 LIQUID LEVEL CONTROL

A. The liquid level control system shall be tied to the pump control panel. The liquid level control system shall be a radar level sensor, manufactured by Vega or approved equal, with four (4) pump control elevations as noted on the drawings and two (2) mechanical float type switches (secondary control) at the Pump Off and Alarm elevations as noted on the drawings.

B. Intrinsically safe relays shall be provided for all components of the level control system.

C. The high-water level alarm system shall be tied to remote telemetry unit to notify operating staff via cell phone.

D. When flow in the wet well reaches the lead pump level, the lead pump starts. If fluid recedes to the off level, the pump shuts off, if not, fluid will continue to rise until it reaches the lag pump level where the lag pump will begin to operate. Both pumps will operate until the fluid in the wet well returns to the off level where both pumps shut off. At each instance when the off level is activated, the alternator automatically reverses the sequence of pump operation allowing for equal usage of the pumps.

E. If level continues to rise to high level, alarm light will flash and horn will sound until alarm silence is pressed.

F. Control sequence shall be designed so that panel functions automatically again after a power failure and manual reset is not necessary. The control sequence shall also be designed to allow operation of the lead float as off and the lag float as lead in the event of off float failure.

2.16 CELLULAR MONITOR

A. Furnish a monitoring system capable of transmitting alarms and data over a cellular network. The monitor shall be enclosed within

the control panel in a NEMA 1 enclosure. The monitor shall be powered by 120 volts AC and have a built-in battery backup capable of keeping the RTU powered for 40 hours in case of primary AC failure. The monitor shall be capable of monitoring up to six (6) digital inputs.

B. The monitoring system shall consist of the following:
   1. SEL-3505-3 Real-Time Automation Controller
   2. SEL-3061 Cellular Router
   3. SEL-9322 15 VDC Power Supply

C. The monitoring system shall monitor the following inputs:

   1. Pump 1 Run
   2. Pump 2 Run
   3. Pump 1 Alarm
   4. Pump 2 Alarm
   5. High Level Alarm
   6. Power Failure Alarm (Generated internally)

D. Provide a 4-20 mA output from the radar level sensor to the RTU / SCADA system for continuous wetwell level monitoring.

E. Include omnidirectional antenna with 6’ cable.

F. Include one year of prepaid cellular service.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Pump system manufacturer shall provide written instruction for proper handling. Immediately after off-loading, contractor shall inspect complete pump station and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all station serial numbers and parts lists with shipping documentation. Notify the manufacturer’s representative of any unacceptable conditions noted with shipper.

3.02 PREPARATION

A. Construct pre-cast wet well, valve vault with lid/hatch, etc. as shown on drawings.

3.03 INSTALLATION

A. Install, level, and align pump station as indicated on project drawings. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.

B. Install pipe with supports and thrust blocks to prevent strain and vibration on pump station piping. Install and secure all service lines (level control, air release valve or pump drain lines) as required in wet well.

C. Check motor and control data plates for compatibility to site voltage. Install and test the station ground prior to connecting line voltage to station control panel.

D. Prior to applying electrical power to any motors or control equipment, check all wiring for tight connections. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up.

3.04 FIELD QUALITY CONTROL

A. Operational Test

1. Prior to acceptance by owner, an operational test of all pumps, drives, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.

2. After construction debris and foreign material has been removed from the wet well, contractor shall supply clear water volume adequate to operate station through several pumping cycles. Observe and record operation of pumps, suction and discharge gage readings, ampere draw, pump controls, and liquid level controls. Check calibration of all

instrumentation equipment, test manual control devices, and automatic control systems. Be alert to any undue noise, vibration or other operational problems.

B. Manufacturer's Start-up Services

1. Coordinate station start-up with manufacturer's technical representative. The representative or factory service technician will inspect the completed installation. The services of a qualified service engineer to check the installation, supervise start-up, operation, adjust all controls for optimum equipment operation, and instruct and train owners personnel in the proper and most efficient operation and maintenance of the system shall be provided by the manufacturer for a minimum of 2 site visits, or as required for complete installation and start-up.

3.05 CLEANING

A. Prior to acceptance, inspect interior and exterior of pump station for dirt, splashed material or damaged paint. Clean or repair accordingly. Remove from the job site all tools, surplus materials, scrap and debris.

B. Remove dirt, grime, marks, etc., from pumps.

3.06 PROTECTION

A. The pumps should be placed into service after a permit to operate is received for the pump station. If operation is delayed, pumps and components shall be stored and maintained per manufacturer's written instructions.