CITY OF FORT WAYNE MASTER UPDATED: 7/13/17

SECTION 33 32 19

Public Utility Wastewater Pumping Stations

NTS: This specification is to be used when replacing pumps and controls at existing pump stations or when constructing new pump stations. Verbiage in this specification is based upon the following assumptions: 1) duplex submersible pump stations; 2) 3 phase power required; 3) City standard equipment and materials to be used; 4) redo telemetry.

1. GENERAL
   1. GENERAL
      1. The Contractor shall furnish and install one automatic pumping station complete with all needed equipment installed in a structure as shown on the Contract Drawings.

NTS: Edit Paragraph B. to suit project.

* + 1. The principal items of equipment shall include two submersible, non-clog pumps; valves; piping; control panel with circuit breakers, and automatic pumping level controls, re-establishing existing telemetry and all wiring.
    2. Codes, specifications, and standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise specified. Where used in these specifications, the following acronyms shall represent:
       1. ANSI - American National Standards Institute.
       2. ASTM - American Society for Testing & Materials.
       3. HI - Hydraulic Institute.
       4. NEMA - National Electric Manufacturer's Association.

NTS: Section 1.2 is to be included if project is bid on unit price basis. Section to be deleted or revised if project is to be bid on lump sum basis.

* 1. MEASUREMENT AND PAYMENT

NTS: Adjust Paragraph A.1. below for additional work item numbers as needed.

* + 1. Lift Station (Mechanical)
       1. Work Item Number and Title

**33 32 19-A: Lift Station (Mechanical)**

NTS: Review paragraph 2 below and edit to suit project.

* + - 1. The Contractor shall provide all labor, materials, and equipment, both temporary and permanent associated with: removal and replacement of the existing pumps; valves; and piping. Additionally this item includes bypass pumping; salvage of existing pumps and controls; disposal of existing valves; communication systems installation and adjustment; testing, to include systems demonstrations, start-up services and instruction; adjustment of utilities; and site restoration.

NTS: Delete Paragraph 3 if not salvaging equipment. Also give options of what to salvage (ex. pumps, valves, controls).

* + - 1. The Contractor shall salvage pumps and controls and deliver to the Water Pollution Control Plant Warehouse at 2601 Dwenger Avenue, Fort Wayne, IN.
      2. Payment under this Item shall be on a lump sum basis.
  1. QUALITY ASSURANCE
     1. The pumps shall be heavy duty, electric submersible, centrifugal non-clog units designed for handling raw, unscreened sewage and wastewater. The pumps shall be capable of operating in a liquid temperature up to 104 degrees F.
     2. The pumps and motor shall be suitable for continuous operation at full nameplate load while the motor is completely submerged, partially submerged or totally non-submerged.
     3. The pump, mechanical seals and motor units provided shall be from the same manufacturer.
     4. The pumping unit manufacturer shall test each pump for mechanical and electrical correctness.
     5. Perform field tests specified in this Section.
     6. All control panels shall be designed and constructed to UL 508A standards. All control panels shall be UL 508A listed. Control panels shall be made available to the Owner and Engineer during factory testing.
  2. SUBMITTALS
     1. Standard submittal data for pump approval must consist of:
        1. Manufacturer's Certificate of compliance certifying compliance with the referenced specifications and standards.
        2. Shop drawings with performance data and physical characteristics.
           1. Certified performance total dynamic head, capacity, brake horse power, efficiency, and required net positive suction head curves for each pump supplied.
        3. Manufacturer's installation instructions.
        4. Manufacturer's operation and maintenance material and manuals.
        5. Certified copies of test reports.
        6. Pump outline drawing.
        7. Station drawing for accessories
        8. Warranty Information
        9. Electrical:
           1. Submit all electrical requirements for each piece of equipment including voltage, phase, and load data.
           2. Submit a drawing showing the electrical enclosure placement within the pump station. Placement must be approved by the Engineer prior to installation.
           3. Provide interior and exterior layouts of control panels where applicable. Layouts shall be to scale and a bill of material shall be included.
           4. Provide interior and exterior layouts of power panels where applicable. Layouts shall be to scale and a bill of material shall be included.
           5. Submit information on all pilot and control components. This includes but is not limited to: pilot lights, relays, push buttons, and timers.
           6. Provide wiring and interconnection diagrams for each piece of equipment. For example, submitting one diagram for all screening equipment is not acceptable. Differentiate between panel and field wiring.
           7. “Typical” diagrams are not acceptable. Manufacturer’s standard diagrams may be submitted if they are made specific for this project by:

Showing all included options, special items, etcetera.

Unused options or features shall be crossed out or deleted.

Identify the drawing with project name, equipment name, and tag number.

NTS: Include item h for stations that have a MultiSmart unit. Otherwise delete this line item.

* + - * 1. Provided the MultiSmart product sticker information. Minimum information to be included is the Serial No, Password, and Site Code.
    1. Standard submittal data for plug and check valve approval must consist of:
       1. Shop Drawings
       2. Product Data
    2. Operation and Maintenance Manuals
       1. The Contractor shall submit operation and maintenance manuals for the pump equipment furnished hereunder.
       2. The Contractor shall submit operation and maintenance manuals for the plug and check valves furnished hereunder.
  1. PRODUCT DELIVERY, STORAGE, AND HANDLING
     1. The Contractor shall be responsible for the delivery, storage, and handling of products.
     2. Load and unload all pumps, motors, and appurtenances by hoists or skidding. Do not drop products. Do not skid or roll products on or against other products. Pad slings and hooks in such a manner to prevent damage to products.
     3. The pumps furnished shall be packaged in such a manner as to provide ample protection from damage during handling, shipment, and outdoor storage at the lift station site. All openings shall be capped with dustproof closures and all edges sealed or taped to provide a dust-tight closure.
     4. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

1. PRODUCTS
   1. PUMPS

NTS: Fill in blanks based on pump selected in design with manufacturer’s data.

* + 1. Requirements: The Contractor shall furnish and install two submersible non-clog wastewater pumps at the pump station and shall be as manufactured by Xylem Inc. with each pump having the following criteria:

Capacity gpm

Total Dynamic Head feet

Model

Impeller mm

Horsepower Hp

RPM rpm

NTS: At (-1-), (-2-), & (-3-) insert manufactures data. At (-4-) insert length of cable required based on location of control panel & wet well depth. At (-5-) insert chain length required based on wet well depth.

* + 1. Each pump shall be equipped with a submersible electric motor connected for operation on (-1-) volts, (-2-) phase, (-3-) hertz, with (-4-) feet of submersible cable suitable for submersible pump applications. Each pump shall be fitted with (-5-) feet of stainless steel chain. The working load of the lifting system shall be 50% greater than the pump unit weight.
    2. Pump Design - The pumps shall be automatically and firmly connected to the discharge connection, guided by 304 S.S. 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. No portion of the pump shall bear directly on the sump floor.
    3. Pump Construction- Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts and bolts shall be AISI type 316 stainless steel construction. All metal surfaces coming in contact with the pump, 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.
    4. Cable entry seal - 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 terminal board, which shall isolate the interior from foreign material gaining access through the pump top.
    5. 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 15 [30 for Premium Efficiency Motors] 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.

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. 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. The motor shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

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 cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

NTS: Optional paragraph – if using premium efficiency motor. Delete otherwise.

In addition to the features specified under paragraph F, above, the premium efficiency motor rotor shall have end rings and rotor bars constructed of copper. The premium efficiency motor shall meet the efficiency levels specified in the IEC standard 60034-30 for international efficiency, Class IE3.

NTS: Insert following paragraph if using Flygt SmartRun TM intelligent controls. Delete otherwise.

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 power cable shall be of a shielded design in which an overall tinned copper shield is included and each individual phase conductor is shielded with an aluminum coated foil wrap. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater. **This cable is required for use with Flygt SmartRun TM intelligent controls.**

* + 1. Bearings - The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep grove 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.
    2. Mechanical seal - 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 tungsten-carbide ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary tungsten-carbide seal ring and one positively driven rotating tungsten-carbide seal ring. 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. No system requiring a pressure differential to offset pressure and to affect sealing shall be used.

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 motor shall be able to operate dry without damage while pumping under load. Seal lubricant shall be FDA Approved, non-toxic.

* + 1. Pump shaft - Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. The pump shaft shall be of 431 Stainless Steel.

NTS: Delete impeller types that are not applicable to project.

* + 1. Impeller (Type N) - The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, semi-open, multi-vain, backswept, non-clog design. The impeller vane leading edges shall be mechanically self-cleaned upon each rotation as they pass across a spiral groove located on the volute suction which shall keep them clear of debris, maintaining an unobstructed leading edge. The impeller(s) vanes shall have screw-shaped leading edges that are hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in waste water. The screw shape of the impeller inlet shall provide an inducing effect for the handling of sludge and rag-laden wastewater. Impellers shall be locked to the shaft and held by an impeller bolt.
    2. Impeller (Type C) – The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, double shrouded non-clogging design having a long through let without acute turns. The impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Whenever possible, a full vane, not vortex, impeller shall be used for maximum hydraulic efficiency; thus, reducing operating costs. Impeller(s) shall be, retained with an Allen head bolt and shall be capable of passing a minimum 3 inch diameter solid.
    3. Impeller (Adaptive) – The impeller shall be cast of ASTM A-48, Class 35B gray iron, dynamically balanced, semi-open, multi-vane, back-swept, non-clog design. The impeller vane leading edges shall be mechanically self-cleaned upon each rotation as they pass across a spiral groove located on a replaceable insert ring. The impeller shall have vanes hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in waste water. The screw shape of the impeller inlet shall provide an inducing effect for the handling of sludge and rag-laden wastewater. The impeller shall be capable of momentarily moving axially upwards a distance of 15mm/0.6-in. to allow larger debris to pass through and immediately return to normal operating position.

NTS: If using Type “N” or adaptive impeller, delete paragraph on wear rings and volute.

* + 1. Wear Rings – A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a brass, or nitrile rubber coated steel ring insert that is drive fitted to the volute inlet.
    2. Volute – Pump volute(s) shall be single-piece grey cast iron, Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified.

NTS: Delete following paragraph on volute bottom/insert ring if “C” or adaptive impeller is being used.

* + 1. Volute Bottom/Insert Ring (Type – N) – The pump volute shall be of A48 Class 35B gray cast iron and shall have (an) integral spiral shaped cast groove(s) at the suction of the volute. The internal volute bottom or insert ring shall provide effective sealing between the pump volute and the multi-vane, semi-open impeller. The sharp spiral groove(s) shall provide the shearing edge(s) across which each impeller vane leading edge shall cross during its rotation in order to remain unobstructed. The clearance between the internal volute bottom and the impeller leading edges shall be adjustable.

NTS: Delete following paragraph on volute/suction cover if type “N” or type “C” impellers are being used.

* + 1. Volute/Suction Cover (Type – Adaptive) – The pump volute shall be a single piece gray 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 suction cover insert ring in which are cast spiral-shaped, sharp edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall have a guide pin integral to the casting and shall be cast of ASTM A-48, Class 35B gray iron and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

Protection - All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. At 260 degrees F, the thermal switches shall open, stop the motor and activate an alarm. A leakage sensor shall be provided 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 125o C (260o F) shall not be allowed.

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 the control panel.

* 1. LEVEL INSTRUMENTATION

NTS: Level sensor selection shall be reviewed with Owners maintenance staff. Consider multipoint probe, radar, ultrasonic, and pressure.

* + 1. Level sensors: Provide a multi-point float stick and a submersible continuous level sensor to measure water depth in the wet well. Install as indicated on the drawings.  The multi-point float stick shall serve as the primary level sensor.

NTS: At (-1-) insert required cable length based on wet well depth and control panel location.

* + - 1. Continuous Level Sensors: MultiTrode® model MTPT with mounting bracket, (-1-) feet of cable, intrinsic safety barrier, and other items as required.

NTS: At (-1-) insert required probe length based upon wet well depth, designed operating range, and manufacturer’s data. At (-2-) insert required cable length based on wet well depth and control panel location. This should match paragraph 2.2.A.1 above. Standard lengths are 33’ or 100’.

* + - 1. Multi-point float stick: MultiTrode® probe , nominal (-1-) inches long (10 switch points), (-2-) feet of cable, mounting brackets, intrinsic safety barrier, and other items as required.
      2. Provide a Tension Clamp for each cable as manufactured by Rutenbeck part AKL-801.
    1. Level transmitter: Provide a continuous monitoring level sensor to measure water depth in the wet well. Install as indicated on the drawings.  The 4-20mA level transmitter shall serve as the secondary level sensor.

NTS: Coordinate with City Utilities Engineering on selection of controls section 2.3 (-A-) or 2.3 (-B-).

* 1. (-A-) ELECTRICAL, CONTROL, AND CONTROL PANEL REQUIREMENTS

NTS: Depending on what type of power is available at the site, will affect some of the items in the specifications.  At (-1-) include existing systems to be re-used. Examples include telemetry equipment, flow meters, etc.

* + 1. It is important to retain all equipment associated with the following systems: (-1-) as this will be reused. If there are any concerns with size, condition, etc. of existing control panel, it is the responsibility of the contractor to bring to owners attention. It shall be the Contractor’s responsibility to provide a complete working system while following all code requirements.

NTS: Enclosure should consider a cooling unit for VFD applications. If a cooling unit is to be specified, verify model number selected is appropriate for enclosure size

* + 1. Enclosures
       1. The interior of the enclosure shall be provided with properly sized industrial grade corrosion inhibitors.
       2. The enclosure shall be provided with thermostatically controlled, properly sized condensate heater.  The heater shall be mounted on the lower portion of the enclosure internal panel.
       3. Furnish a door limit switch actuated panel LED light.
       4. Include a door intrusion alarm.
       5. Integrate a red 30mm oil and water tight alarm light on the exterior hinge side of the enclosure.
       6. Wire duct shall be installed as a wire way. Wire way shall be min 4” (100mm) in height and be filled to max 50% capacity.
       7. Conduit entry into the enclosure originating from the wet well, shall be sealed with explosion-proof conduit seals to prevent moisture and gas vapors from entering the enclosure.
       8. Install all wiring within the enclosure plastic wiring ducts. Separate DC and AC signals with separate wire ducts or routing.
       9. Terminate all wiring at terminal blocks. Splices are not permitted.
       10. Include reference sheet in an archival quality acid-free sheet protector. It shall list initial pump set points, float stick set points, wet well elevations and Modbus slave address. Include level controller ‘zero’ elevation. All elevations are to be based on USGS NAVD1988 Datum.

NTS: Include item #11 for stations that have a MultiSmart unit. Otherwise delete this line item.

* + - 1. Adhere the MultiSmart product sticker to the back of the inner panel next to the MultiSmart unit. This sticker is provided by the manufacture and contains the following information: Serial No, Password, and Site Code.
      2. All telemetry equipment shall be included in the main control panel.
      3. Enclosure shall be NEMA 4X stainless steel, continuous hinge with 3-point latch. Manufactured by Hoffman, Saginaw, or Engineer approved equal.
      4. Provide adequately sized uninterruptable power supply (UPS) in control panel. UPS shall be din-rail mounted, designed to operate in temperatures down to -14° F, manufactured by Phoenix Contact or Engineer approved equal.
      5. Enclosure shall include appropriate heat shield for outdoor installations. Shield shall be provided by the enclosure manufacturer.
    1. POWER
       1. The incoming pump power wiring shall be terminated at distribution lugs and shall be provided with voltage surge arresters to protect all equipment mounted within the enclosure from switching surges and lightning induced surges.
          1. Locate surge arresters in such a manner as to facilitate inspection and future replacement of damaged units. Comply with UL 1449 and ANSI C62.41 Standards.
       2. Power within the panel shall be distributed further through thermal magnetic circuit breakers and motor circuit protectors, which shall be accessible from the front of the swing-out panel without opening the swing-out panel. Provide the following:
          1. A motor circuit protector for each pump.
          2. A circuit breaker for control transformer
          3. Circuit breakers shall have minimum interrupting rating of 22kAIC
          4. Separate incoming terminals for control circuit panel control power, pressure transducer power supply and telemetry transceiver.
          5. Provide Mains voltage monitoring to the control panel.

* + - 1. Provide a transformer to obtain 120 Volts AC power.
         1. Transformer shall be high efficiency type, with 105 º C temperature class, extra regulation and low losses.
         2. Size transformer to feed all 120 Volts AC within the enclosure +20%. Minimum size of the transformer shall be 1.0 KVA.
      2. Distribute 120 Volt AC power through single pole, circuit breakers as shown on the single line diagram, which shall have minimum interrupting rating of 10,000 Amperes. Provide a circuit breaker for each of the following items:
         1. Motor control circuit.
         2. Panel light and thermostatically controlled enclosure heater described above.
         3. Convenience GFI receptacle.
         4. Additional as specified on single line diagram.
      3. Install a duplex convenience receptacle, which shall be accessible from the front of the swing out panel. Receptacles shall be 15 Ampere, GFI (Ground Fault Interrupting) types.
      4. Protect each starter power with magnetic only motor circuit protector. Motor circuit protectors shall be as follows:
         1. Size, voltage and configuration shall be as required.
         2. Provided with adjustable instantaneous trips.
         3. Minimum rating: 22kAIC (Amperes Interrupting Capacity).
      5. Provide each pump starter with the following:
         1. A minimum of two sets of normally open starter auxiliary contacts.
         2. A minimum of two sets of normally closed starter auxiliary contacts.
         3. One set of normally open auxiliary overload alarm contacts.
      6. Provide for each pump starter circuit breaker tripped auxiliary contact.
      7. For each pump provide the following
         1. Motor Thermal switch
         2. Leak sensor
         3. Current transformers for each phase
      8. Provide terminal blocks, which shall be grouped together, for remote control and monitoring wiring.
      9. Provide all electro mechanical relays as necessary to achieve the intended operation as described. Relays shall be plug-in ice-cube style, 3PDT or 4PDT, with manual operator and indicator light. Contacts shall be rated a minimum of 10 amps at 240 VAC.
      10. Manufacturers shall be as listed below. Products of other manufacturers assembled to provide all specified functions, including reliability equal to or exceeding that of the manufacturers listed above may be submitted for approval.
          1. Circuit breakers and motor circuit protectors shall be Square D or Eaton.
          2. Pilot and control devices shall be as manufactured by Allen-Bradley, or Square D.

NTS: This pump controller is only good for up to three pumps.  Additional modules may be needed for stations with on-site generators and/or magnetic flow meters.

* + 1. PUMP CONTROLLER
       1. Microprocessor based, intelligent pump controller with pre-configured pump control logic and fault handling. Pump Control and Monitoring Equipment shall be MultiTrode®, Inc. MultiSmart model MSM3MP.
       2. Provide pump control module and user interface model #IO-3PC (MultiTrode).
       3. Provide motor protection module, model #IO-3MP (MultiTrode).
       4. Standard functions: The pump controller shall be provided with pre-configured (default) parameters which are selectable via the user interface keypad, including:
          1. Set point adjustment for pump activation/deactivation and level alarms.
          2. Level device inputs: 4-20mA signal or (conductive) level probe.
          3. Redundant level device inputs.
          4. Selectable between charge (fill) & discharge (empty).
          5. Pump control of up to 3 pumps.
          6. Pump grouping and alternation.
          7. Station optimization including:

Maximum off time for any pump.

Maximum pumps to run simultaneously.

Maximum pump starts per hour.

Inter-pump start and stop delays.

Maximum run time for any pump.

Blocked pump detection.

* + - * 1. Well washer control functions.
        2. Well clean out (periodic pump down to off point).
        3. Alternate profiles of level set points (Conditional pump management).
        4. Data logger functions.
        5. 3-phase supply monitoring and supply protection including:

Under-voltage.

Over-voltage .

Phase fail.

Phase rotation.

Monitoring of dc supply, battery voltage, and internal temperature.

* + - * 1. Additional Functions (Firmware Enabled):

Over current and under current detection.

Ground / earth fault.

Insulation resistance testing for motor windings.

KVA, kW and power factor measurement.

* + - * 1. Calculated flow function.
        2. Input/Output Description.
      1. Available I/O types shall include:
         1. Digital inputs (voltage free, discrete input).
         2. Digital outputs (240V, 5A resistive).
         3. Analog inputs (10bit) (4-20ma).
         4. Analog outputs (10bit) (4-20ma).
         5. Standard (Configurable) Digital Inputs:

Seal/Leakage sensor.

PTC Thermistor or other over temp device.

PT100.

Xylem FLS Sensor.

Conductive probe (for liquid level sensing).

* + - * 1. Motor Protection & Monitoring Inputs:

Insulation resistance test (IRT) to 1000v, 1 phase per pump.

3-phase current monitoring.

3-phase supply monitoring.

Three (3) current transformers (CTs) shall be supplied and installed per pump. Each pump’s full load amps (FLA) are to be taken into consideration to obtain correct CT ratio.

* + - 1. User Interface:
      2. The field hardware shall include a user interface for operations and configuration. The display shall provide status of the pump station, control of pumps, resetting of faults and configuration of parameters.
         1. The following parameters shall be displayed on the main status screen:

Level.

Set points for alarms and pump start/stop.

Pump Running/Stopped.

Pump Available.

3-phase current for each motor Pump faults.

3-phase supply.

* + - * 1. Provide access to Faults, History, Information and Settings.
        2. The following information screens and parameters shall be available via the keypad:

Elapsed Time accumulators for each pump & the pump station.

Number of Starts accumulator for each pump & the pump station.

Flow values, either derived from calculations or via a flow meter, including inflow, pump flow rate, total volume.

Overflow information, including start time, duration, estimated volume.

Insulation resistance value for each motor.

Status of Inputs & Outputs.

NTS: Delete “13” if the site does not have a building. Additional points should be added for on-site generator and magnetic flow meters.

* + - * 1. In addition to previously listed points to be indicated by the system the following conditions shall also be indicated:

Communication Fail

Inflow Rate

Outflow Rate

Pump Run Status (all pumps)

Pump Failure (all pumps)

High Alarm

Medium Alarm

Power Failure

Control Power Failure

UPS Failure

Volume Today

Volume Yesterday

Wet Well Level

Wet Well High Level

Personnel At Station

* + - 1. The following control functions/devices shall be industrial grade oil tight and watertight types.  Each pump shall be provided with the following controls, which shall be visible from the front of the swing-out panel, with the enclosure door opened:
         1. Pump mode for each pump, (Hand/Off/Auto) – 22.5mm operator.
         2. Pump fault reset.
         3. Level alarm reset.
         4. An amber “FAIL” pilot light.
         5. An amber “SEAL FAILURE” pilot light.
         6. A red motor “RUN” pilot light.
         7. A green motor “OFF” pilot light.
         8. A “RESET” push button.
         9. A non-resettable elapsed time meter for each pump.
         10. A non-resettable elapsed time meter for when both pumps operate simultaneously.
    1. COMMUNICATIONS:

NTS: Radio telemetry communications SHALL BE COORDINATED with City Utilities Engineering for approval. The Owner currently has capability for 900MHz Licensed, 900MHz Spread Spectrum, and Verizon 4G Cellular.

* + - 1. Furnish and install a complete telemetry system which shall include antenna mountings, panels, and interfaces. All local codes relating to antenna height requirements, aircraft flight paths, and other pertinent issues must be adhered to. The system shall communicate with the Utility's SCADA system configured to coordinate with the Utility's system for remote communications.
      2. The pump controller shall include the following types of connection ports:
         1. Ethernet port up to 10Mbit/s.
         2. (3) RS232 ports up to 115kBit/s.

NTS: At (-1-) list telemetry equipment manufacturer or system name of equipment being re-installed. Delete paragraph if installing new equipment.

* + - 1. (-1-) telemetry equipment will remain and need to be reconnected. Consult Engineer with any related questions or connections.
      2. The communication protocols shall support MODBUS RTU and  DNP3

NTS: Owners radio telemetry system is maintained by the provider listed below. Coordination with the provider to be done through City Utilities Engineering. Propagation study shall be completed prior to selecting the communication method. Preferred methodology is to have propagation study done during design and when trees are in full foliage.

* + - 1. Propagation study completed during design will be provided to determine appropriate heights for antenna.   All telemetry work will be completed by:

J&K Communication

                                  222 Towerview Drive

                                 Columbia City, IN 46725

                                 Phone: 260-244-7975

NTS: Coordinate with City Utilities Engineering on selection of controls section 2.3 (-A-) or 2.3 (-B-).

2.3(-B-) ELECTRICAL, CONTROL, AND CONTROL PANEL REQUIREMENTS

NTS: Depending on what type of power is available at the site, will affect some of the items in the specifications.  At (-1-) include existing systems to be re-used. Examples include telemetry equipment, flow meters, etc.

* + 1. It is important to retain all equipment associated with the following systems: (-1-) as this will be reused. If there are any concerns with size, condition, etc. of existing control panel, it is the responsibility of the contractor to bring to owners attention. It shall be the Contractor’s responsibility to provide a complete working system while following all code requirements.
    2. Include reference sheet in an archival quality acid-free sheet protector. It shall list initial pump set points, float stick set points, wet well elevations and Modbus slave address. Include level controller ‘zero’ elevation. All elevations are to be based on USGS NAVD1988 Datum.
    3. ENCLOSURES
       1. Conduit entry into the enclosure originating from the wet well, shall be sealed with explosion-proof conduit seals to prevent moisture and gas vapors from entering the enclosure.
       2. Terminate all wiring at terminal blocks. Splices are not permitted.
       3. Enclosures shall be NEMA 4X stainless steel.
    4. POWER PANEL
       1. The incoming pump power wiring shall be terminated at distribution lugs and shall be provided with voltage surge arresters to protect all equipment mounted within the enclosure from switching surges and lightning induced surges.
          1. Locate surge arresters in such a manner as to facilitate inspection and future replacement of damaged units. Comply with UL 1449 and ANSI C62.41 Standards.
       2. Power within the panel shall be distributed further through thermal magnetic circuit breakers and motor circuit protectors, which shall be accessible from the front of the swing-out panel without opening the swing-out panel. Provide the following:
          1. A motor circuit protector for each pump.
          2. Circuit breakers shall have minimum interrupting rating of 22kAIC.
          3. Separate incoming terminals for control circuit panel control power, pressure transducer power supply and telemetry transceiver.
          4. Provide Mains voltage monitoring to the control panel.
       3. Provide a transformer to obtain 120 Volts AC power.
          1. Transformer shall be high efficiency type, with 105 º C temperature class, extra regulation and low losses.
          2. Size transformer to feed all 120 Volts AC within the enclosure +20%. Minimum size of the transformer shall be 1.0 KVA.
       4. Distribute 120 Volt AC power through single pole, circuit breakers as shown on the single line diagram, which shall have minimum interrupting rating of 10,000 Amperes.
       5. Protect each starter power with magnetic only motor circuit protector. Motor circuit protectors shall be as follows:
          1. Size, voltage and configuration shall be as required.
          2. Provided with adjustable instantaneous trips.
          3. Minimum rating: 25,000 AIC (Amperes Interrupting Capacity).
       6. Provide each pump starter with the following:
          1. A minimum of two sets of normally open starter auxiliary contacts.
          2. A minimum of two sets of normally closed starter auxiliary contacts.
          3. One set of normally open auxiliary overload alarm contacts.
       7. Provide for each pump starter circuit breaker tripped auxiliary contact.
       8. For each pump provide the following
          1. Motor Thermal switch
          2. Leak sensor
          3. Current transformers for each phase
       9. Provide one set of normally closed circuit breaker tripped auxiliary contacts.
       10. Circuit breakers and motor circuit protectors shall be Square D or Eaton.
       11. Pilot indicator lights shall be LED and manufactured by Square D.
    5. CONTROL PANEL
       1. Provide and furnish the Lift Station Low Voltage Control Panel per prints and Bill of Materials.
       2. Panel shall be built in a UL approved panel shop.

NTS: Incorporate the Lift Station Low Voltage Control Panel as appendix.  The control panel builders listed below have reviewed the prints and are familiar with Owner’s expectations.

* + - * 1. Control Panel Builders:

Toric Engineering

Complete Controls

Shambaugh and Son

* 1. PIPE, VALVES, AND FITTINGS
     1. Furnish complete station piping, valve pit, check valves and plug valves.
     2. The discharge pipe and fittings shall be ductile iron Class 350. Inside pipe and fittings shall be flanged. Bell end pipes or fittings with mechanical joints shall be provided at or near the outside face of the station well. Piping shall be supported independent of the sewage flanges.

NTS: At (-1-) insert size of valve.

* + 1. All plug valves shall be lever operated. One lever shall be provided for each plug valve. All plug valves shall be size (-1-) Dezurik Style PEC eccentric plug valve with square nut actuator. The Indiana representative is B.L. Anderson (phone 765-463-1518).

NTS: At (-1-) insert size of valve. At (-2-) and (-3-) insert style of valves as it varies with size. Clow valves 2-12” are “Style 1106LW” and 14”-30” are “Style 159-02”. M&H valves 2-12” are “Style 159-02” and 14-36” are “Style 159-02A”.

* + 1. All check valves shall be iron body, bronze mounted, with outside lever and weight. Covers shall be bolted and ends flanged. Check valves shall be (-1-) inch swing type check valves as manufactured by Clow (-2-) or M & H (-3-) lever and weight.
    2. All metal piping other than cast or ductile iron and copper tubing shall be galvanized steel pipe. Guide rails and all interior miscellaneous metals, including bolts, shall be stainless steel.
    3. At joints contractor shall use EBAA Iron Works Megalug Series 1100 mechanical joint restraint for ductile iron pipe.

1. EXECUTION
   1. INSTALLATION
      1. All equipment shall be installed in accordance with these specifications, construction drawings and the manufacturer’s printed instructions.
      2. Inspect all equipment and appurtenances prior to installation of the Work. Promptly remove damaged or unsuitable products from the job site. Replace damaged or unsuitable products with new, undamaged and suitable products.
      3. All electrical work shall be done by a qualified licensed electrician and shall conform to the National Electric Code.

NTS: Fill in set points below if not providing a drawing with the same information. If a Drawing with this information is provided, delete this section. NAVD 88 Datum should be used for elevations. Distance between set points must conform with the size of 10-point probe specified in 2.2.A.2

* 1. SET POINTS
     1. The level sensing devices shall be installed and programmed to operate the pumps at the following set points:
        1. Pumps Off: Elevation \_\_\_.\_\_ or \_ feet above bottom of wet well
        2. Lead Pump On: Elevation \_\_\_.\_\_ or \_ feet above bottom of wet well
        3. Lag Pump On: Elevation \_\_\_.\_\_ or \_ feet above bottom of wet well
        4. High Water Alarm: Elevation \_\_\_.\_\_ or \_ feet above bottom of wet well
  2. TESTING
     1. Each pump shall be fully tested in accordance with manufacturer's written instructions. Certified copies of the test results shall be furnished with each pumping unit. Record the test voltage and amperage measurements.
     2. Refer to Section 01 75 11 “Checkout and Startup Procedures” for documentation requirements and checklists.
  3. WARRANTY
     1. The pump manufacturer shall warrant the pumps being supplied to the Owner against defects in workmanship and materials for a period of five years under normal use, operation, and service. In addition, the manufacturer shall replace certain parts which shall become defective through normal use and wear or a progressive schedule of cost for a period of five years; parts included are the mechanical seal, impeller, pump housing, wear ring, and ball bearings. The warranty shall be in published form and apply to all units.
     2. The manufacturer shall provide as part of his bid price the services of a factory trained representative for two separate days at the lift station to perform initial start-up of the pumping station and demonstrate satisfactory performance of each piece of equipment and instruct operating personnel in the operation and maintenance of the equipment.
        1. The site visits shall be held on two separate days for the primary and sole purposes of the startup and O&M instruction.
     3. All equipment supplied and installed under this item of the specifications shall meet the requirements of the Occupational Safety & Health Act of 1970.

NTS: Contact City Utilities Engineering for the Low Voltage Control Panel Drawing that needs to be coordinated with section 2.3 of this specification.

+ + END OF SECTION + +