

**SECTION 13431  
ELECTRICAL CONTROLS**

**PART 1 - GENERAL**

- SUMMARY
  - Work under this section includes furnishing and installation of controls and associated appurtenances for the lift station.
- RELATED WORK
  - Note Used
- REFERENCES
  - Use latest revision of all references
  - National Electric Code
- SUBMITTALS
  - Electrical control systems.
  - Electrical diagrams showing integration of all electrical and control components.
  - Outline dimensions and general arrangement drawings of each enclosure and panel board.
  - Pump control floats and mounting hardware.
  - Circuit Breakers and Starters
- SPECIAL SUBMITTAL REQUIREMENT
  - Submit all electrical system submittals ***within two weeks*** after award for approval by the project engineer. Submittals shall include the following information as a minimum:
    - Electrical schematics
    - Enclosure dimensional drawings
    - Manufacturer data sheet for all components
    - Complete bill of material
    - 1 year warranty certificate

- **WARRANTY**

- Provide a one (1) year warranty for parts and labor from date of acceptance by the project engineer guaranteeing that the control system and associated equipment shall be free from defects in design, materials, and workmanship.

## **PART 2 - PRODUCTS**

- **WIRING**

- Conform to the National Electrical Code, State, and local Electrical Standards.
- Provide properly sized solid copper wire with minimum 600V insulation.
- Color code control wiring minimum #16 AWG.

- **WIRING DUCT**

- Provide properly sized PVC wire duct for all wiring.

- **CONTROL SYSTEM**

- Provide standard products, UL labeled, automatic control equipment with proven field performance.
- The control panel shall be manufactured by an UL certified panel facility and shall meet all UL508A standards (Industrial control equipment). The panel shall be provided with a serialized UL508 label.
- Provide all new components, factory assembled, wired, tested, and covered by complete electrical drawings and instructions in order to assure proper system interconnections, reliability, and long-term operation.
- All materials to be furnished shall be the standard products of a manufacturer regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design.
- Wiring within panels and boxes shall be installed neatly without the use of excessive amounts of wire.
- Where circuits and terminals are provided for connection of wires by others, space and a clear path within the panel or box shall be provided by the control

manufacturer to allow the installation of these wires without disturbance of the control wiring.

- Adequately ground the electrical system.

- FLOAT SWITCHES

- The liquid level of each wet well shall be sensed by four (4) direct acting float switches. The system supplier shall furnish, install, and wire the float switches as shown on the drawings. Each switch shall be supplied with required cable length to allow level adjustment without entering the wet well. A float switch shall be provided for each of the following level switch points:
  - High Level Alarm
  - Lag Pump On
  - Lead Pump On
  - Common Pumps Off
- Float switches shall be designed to insure long life and reliable operation in both water and wastewater applications. Float switch body shall be constructed of high impact, corrosion resistant, foam ball measuring not less than 2.74" in diameter and 4.83" long.
- The float shall have a long life, high reliability, SPST (available as normally-open/orange or normally-closed/blue) internal switching mechanism. The switching mechanism shall employ sealed mercury contacts rated for 2 Amp at 30 VDC/125 VAC. A multi-stranded, two-conductor, 18 gauge, CPE jacketed cable SJOW (UL, CSA) cable shall be part of the assembly. The cable shall be made especially for heavy flexing service. The entire float switch assembly shall be suitable for use in liquids up to 140 degrees Fahrenheit/60 degrees Celsius.
- The float switches shall be mounted to a common stainless steel direct suspension mounting bracket. The bracket shall provide mounting and strain relief connectors. Individual weights with a cast-in-place cable slot shall provide drift free mounting. The float switches and accessories shall be as manufactured by Ohio Electric Control, Inc.

- JUNCTION BOXES

- Shall consist of a UL Type 4X Polycarbon tamper resistant U.L. approved enclosure.
- Seal off fittings shall be provided as part of the assembly. Sealing compound shall be provided and applied by the installing contractor.

- Terminal Blocks shall be provided in the junction box to insure sound electrical integrity of the electrical connections. Terminals shall be provided for pump motor power leads, all pump sensor leads (moisture, overtemperature) and float switches.

- REMOTE MONITORING SYSTEM

## **SPECIFICATION FOR WIRELESS MONITORING AND CONTROL SYSTEM WITH INTERNET BASED DATA ACCESS**

### **PART ONE - GENERAL**

#### 1.01 DESCRIPTION

- A. Furnish and install a factory wireless data cellular based communication system for the purpose of monitoring and controlling various equipment operations. The supplier of the communication system shall be responsible for coordination required to insure equipment compatibility. The communication system shall be provided complete, in place, as shown on the Drawings, specified herein and needed for a complete, proper installation.
- B. Summary of PART TWO - PRODUCTS
  - Subsection 2.01: General
  - Subsection 2.02: Monitoring and Control System
  - Subsection 2.03: RTU Locations
  - Subsection 2.04: Monitoring Input Points Defined
  - Subsection 2.05: Other Materials
- C. Related work:
  - Documents affecting work of this Section include, but are not necessarily limited to General Conditions, Supplementary Conditions, and sections in Division 1 of these Specifications.
  - Section 16000: Electrical
  - Section 11310: Sewage Pumps

## 1.02 QUALITY ASSURANCE

## 1.03 SUBMITTALS AND SUBSTITUTIONS

- A. Comply with pertinent provisions of Section 01340.
- B. The following product data shall be submitted in accordance with the approved Construction Schedule required in Section 01310 of these Specifications:
- Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades;
  - Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work;
  - Test data required elsewhere in this Section.
- C. Upon completion of this Portion of the Work, and as a condition of its acceptance, deliver to the Engineer three copies of an operation and maintenance manual compiled in accordance with the provisions of Section 01730 of these Specifications.

## 1.04 PRODUCT HANDLING

- A. General: Comply with pertinent provisions of Section 01640

## 1.05 EQUIPMENT COMPATIBILITY

- A. The Contractor shall be responsible for coordinating the instrumentation equipment, communication equipment and other related equipment so that all elements are compatible and form a complete working system. Shop drawing submittals shall include sufficient information regarding component compatibility to demonstrate compliance with this requirement.

## **PART TWO - PRODUCTS**

### 2.01 GENERAL

- A. **Qualifications of Manufacturers** Products used in the work of this Section shall be produced by manufacturers regularly engaged in the manufacture of similar items and with a history of satisfactory production acceptable to the Engineer.
- The submitting Company shall provide evidence of, and warrant compliance with, substantially all below listed requirements.

- The submitting Company shall have been in business providing remote facility monitoring and control services through the data side of the cellular system to the water distribution / wastewater collection industry or a substantially similar industry for at least six years.
- The submitting Company shall be the actual manufacturer and operator, or a duly authorized and trained agent of the manufacturing company or a combination of both, who will actually provide, maintain, and warranty the proposed system.
- The Manufacturing Company of the field equipment shall also be the provider of all monitoring related services associated with the field equipment and all ongoing service agreements will be with the actual company providing the monitoring service, not a subcontractor or agent.
- The submitting company shall have a primary central monitoring and control center and a fully redundant, physically separate, backup-computer monitoring center. Either center shall have the capability of operating all the remote monitoring and control field RTU's.
- The submitting Company shall offer and provide 24 X 7 technical support.

**B. Qualifications of Manufacturers Representative**

1. The Engineer has worked with the following representative/distributor/vendor in the development of the Specifications for this equipment. This person is identified solely as a potential convenience with no intended or implied restriction, recommendation, endorsement, etc.: XXXXXXXXXXXXXXXXXXXX
2. Subject to the "or equal" provisions of the Contract Documents, the Engineer has \_\_\_\_\_ determined \_\_\_\_\_ that \_\_\_\_\_  


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could supply the products specified in this Section.

**2.02 MONITORING AND CONTROL SYSTEM**

**A. Microprocessor Based Field RTU**

- Data Cellular Radio
  - The Remote Terminal Unit (RTU) shall incorporate a radio that utilizes the data side of any cellular system to transmit the data and alarms monitored, as well as receive manual or automated control commands.
  - Cellular radios from all cellular carriers shall be able to mount in the same mounting port on the motherboard and consequently be interchangeable in no more than 10 minutes.
- Enclosure Options

The RTU shall be offered in at least the following three enclosure options:

  - NEMA1 with battery inside the enclosure
  - NEMA1 "FlatPak" with a depth of less than 1.5 inches so it is able to fit between the inner and outer door of a double door control panel.
  - NEMA4X with the battery inside and which has front door and top "sun shades" to reduce internal temperatures when placed in the sun.
- Microprocessor Feature Updates

Microprocessor features like data transmission rates shall be able to be adjusted through the cellular system without any site visits necessary.

- RTU Inputs and Outputs M110 and M800 models
  - RTU shall have eight (8) digital inputs. These eight (8) inputs must have end of line resistor supervision, or similar supervision, that can detect normal alarm trip inputs and detect input wiring disconnection/shorting as a distinctly different signal and report.
  - RTU shall have an optional expansion board of an additional eight (8) digital inputs
  - The digital inputs shall be user selectable as normally open (NO) or normally closed (NC).
  - In M110 models at least three of the RTU digital inputs must be capable of being programmed to record and report pump run times in one minute increments or less as indicated by a relay opening and closing. If only two pumps are monitored then the unit shall also be capable of recording and reporting simultaneous pump run times. In M800 Models eight of the RTU digital inputs on main board must be capable of being programmed to record and report pump run times in one minute increments or less as indicated by a relay opening and closing. If only two pumps are monitored then the unit shall also be capable of recording and reporting simultaneous pump run times.
  - RTU shall have built-in alarms for input wiring fault, AC failure, communication failure and low battery detection.
  - RTU shall have two (2) analog inputs measuring 4-20mA or 1-5 VDC at 10 bit resolution with four (4) alarm thresholds per input.
  - RTU shall have an optional expansion board of an additional four (4) analog inputs
  - RTU shall have an optional expansion board of an additional eight (8) digital inputs
  - RTU shall have an optional expansion board of an additional two (2) analog outputs.
  - RTU shall have an optional expansion board of two (2) pulse counter inputs
  - RTU shall have an electronic key reader input to monitor on-site personnel. The RTU shall utilize an audible tone to verify key reading. Each key in the system shall provide unique identification of the key holder when they are on site vs. "someone" is on site.
  - RTU shall have three (3) digital normally open or closed output relays rated at ½ ampere@ 120VAC
  
- Status LED's on Motherboard
  - LED's above each digital input shall visually display the status of the digital input
  - Radio signal strength shall be displayed by at least 8 LED's in 5db increments between -75db and -110db to facilitate accurate antenna placement
  - Operational and diagnostic status of at least 8 criteria shall be displayed by individual LED's.
  
- Power Requirements

- The RTU shall be powered by 12 volts AC and have a built in battery backup capable of keeping the RTU powered for 30 hours in case of primary AC failure.
- All terminations inside the RTU enclosure shall be low voltage AC or DC (28 volts or less).

## B. Communication Links

- Communication System
  - Wireless communication links shall be through the data side of the cellular system. The voice side of the cellular system and satellite based links are not acceptable.
- Cellular Carriers
  - The submitting company shall have direct relationships with the cellular companies and shall not use third parties to affect data transport through the cellular companies.
  - The RTU will have interchangeable data cellular radios that will communicate through third generation GPRS (ATT), CDMA (Verizon) or iDEN (Nextel) to maximize the likelihood of reliable communication.
  - If a GPRS (ATT) radio is used, the submitting company shall have PTCRB approval from ATT to use the radio, contract and product acceptance with ATT. If an iDEN radio is used the submitting company shall be have certified partner status, contract and product acceptance with Sprint/ Nextel.
  - The Customer will not have or have to purchase cellular data contracts direct with the carrier(s).
- Security Protocols
  - All the cellular radios shall all make continuous, secure socket connections (SSL) from the radio, through the cellular system, to the submitting company's servers and web pages.
  - The RTU shall utilize a transmission scheme that encrypts the transmitted data utilizing a 128 bit encryption method that meets or exceeds the advanced encryption standard (AES). The 128 bit AES encryption shall be at all stages of data transfer and storage
  - The cellular radios shall all have private IP addresses
  - The submitting company shall have established multiple, private gateways through the cellular system, completely behind firewalls, with at least one of the cellular providers.
- Data Transmission Rates M110 and M800
  - All alarms regardless of unit type will be transmitted immediately upon occurrence; delays can be added by the customer at the RTU or the supplier's website.
  - The RTU shall either transmit non-alarm data updates every hour on M110 models or continuously transmit all digital state changes on an as occurs basis; analog and pulse inputs will be transmitted at least once every two minutes on M800 models. The customer may choose to utilize either type of RTU at any proposed site.
  - The RTU will have an effective, continuous, transfer rate of at least 19,200 baud.
- Communication Link Structure and Performance Criteria



- The communication link structure shall be a secure socket connection from the RTU through the cellular system to the supplier's servers, and it shall be a continuous connection, 24 x 7, 365.
- Receipt of all data sent from the RTU to the server center shall be acknowledged by the server center back to the RTU in real time for every data packet sent. Such structure is called end-to-end data acknowledgement.
- The secure socket connection shall be from the RTU through the cellular system direct to the system supplier; no third parties shall receive the data from the cellular carrier and then pass it to the system supplier.
- The above mentioned secure socket connection shall be monitored for end-to-end uptime with interruptions as small as 15 seconds being captured.
- Both end-to-end uptime and the number of times the link was disconnected/reconnected shall be reported for each RTU continuously with daily summary statistics posted on the customer website. All the end-to-end uptime history of each RTU shall be available on the customer web site from when it first powered up to the present. Weekly management summaries of each RTUs end-to-end uptime shall be automatically emailed to the customer.

### C. Centralized Server Centers: Hardware and Software Requirements

- Server Center Physical Structure
  - The server center housing shall be able to withstand a direct hit from at least a F-3 tornado and continue operations.
  - The server center housing shall have at least six (6) separate and redundant, on-site power generating facilities to backup the local utility power such that there can be stand-alone operation of the center for at least 24 hours.
  - Entrance to the facility shall be controlled by armed guards at all entrances 24x7x365
- Server Center Redundancy Structure
  - The server center shall house the manufacturers completely redundant and hot linked:
    - Servers
    - Interconnects
    - Databases
    - Power supplies
    - Inbound cellular connections
    - Outbound internet hubs and providers
- Database Structure
  - All data from the RTU's shall be held for customer access forever.
  - All databases shall be backed up and archived daily

- The databases shall be capable of interfacing and transferring, on a continuous basis, all RTU data to an OPC compliant database for access by other OPC compliant HMI software packages.
  - Client side OPC software will run as an executable or NT service.
  - Client side OPC software will, on a user definable interval, establish a socket connection to static IP address(s) at providers' server center.
  - OPC software shall retrieve all changed OPC tag values and close the socket. OPC software shall be set up so as customers OPC computers firewalls may be programmed to only allow Internet traffic to/from the designated service providers IP addresses and port numbers.
  - OPC software will allow for multiple customer OPC software packages to establish, concurrently, OPC connections so as to provide for redundant HMI database operation at customers locations.
  - Customer's firewalls will not be programmed to accept socket connections.

- System Security

- All data links shall be behind firewalls, 128 bit encrypted and never accessible, addressable or viewable via the general public Internet, Private IP's are required, pooled public IP's will not be accepted.

- System Software

- The system software shall collect and display:
  - **Alarms including individuals accepting alarms,**
  - **RTU electronic key reads with user names, time of read, and site name**
  - **pump running status,**
  - **pump run times with historical graphs,**
  - **individual pump flow estimates,**
  - **automatic daily analysis of pump runtimes for abnormalities with automatic customer notification of such abnormalities,**
  - **pump starts with hourly analysis of excess pump starts with automatic notifications of excess pump starts,**
  - **minute-by-minute radio health checks with automatic notification of non-reporting or poorly reporting RTU's,**
  - **scaled and labeled pulse totalizations and if rainfall gauges are used, inter-day rainfall graphs and run time verses rain fall based on either rain gauges installed as part of the system or as run time verses a reporting airport rain gauge;**
  - **Performing and displaying volumetric inflow/outflow calculations from RTU supplied data for each pump cycle as they occur. Such volumetric calculations will utilize real-time pump start/stop data with simultaneously gathered level transducer data to perform the inflow/outflow and pump GPM calculations.**

- **Utilizing real-time data collection have the ability to based on digital input closure, open or close digital output relay on the same or another real-time unit (Intertie)**

#### D. Alarm System Structure and Software

- Alarm Delivery Formats
  - Alarms shall be delivered in the following formats:
    - Phone (voice call), fax, pager (numeric or alphanumeric (short alpha or long alpha format), text message, email, or any combination of the above simultaneously.
  - Alarms shall be able to be acknowledged by phone, text message, 2-way pager, email or on the customer web site.
  - Voice alarm acknowledgement shall be adjustable to be able to mimic the format of dialers.
  - Alarms will be called out on alarm and upon return to normal conditions.
    - Return to normal alarms can be adjusted to call the alarm callout group or a different callout group.
- Alarm Callout Formats
  - Alarm callout groups shall be able to be setup to automatically switch between callout groups at different hours of the day and/or different days of the week.
  - Alarm callout groups shall be able to have multiple teams within each group to easily facilitate rotation of teams of on-call personnel.
- Alarm Message Formats
  - All alarms shall have the alarm condition, time, alarm location and pump status at the time of the alarm in each message.
  - Alarm message format shall be adjustable to include just the above information when calling a phone where it is known who will answer the phone, or be adjustable to add an introductory message asking for a specific person when calling a phone where it is not known who will answer the phone (like a home phone).
  - Alarms shall be able to be delivered individually or be able to be grouped into one message so that multiple, simultaneous alarms (like AC Fail at multiple sites) can be delivered and acknowledged in one phone call.
- Alarm Dispatch Logs
  - Each alarm shall have a full log of each notification attempt of that alarm documenting the following:
    - Date, time, and alarm condition
    - If each notification attempt was a success or failure and the reason for each failure if an attempt was a failure (like line busy, call dropped, etc)
    - A recording of each voice notification attempt so the specific reason for a notification failure can be known.
    - Date, time, and name of person who acknowledged the alarm.
- Voice Alarm Delivery Capacity
  - Manufacturer shall provide at least 20 outbound lines to deliver voice alarms so as not delay delivery of current alarms.

## E. REMOTE DATA ACCESS

- Remote Data Access Format
  - Data collected by the system shall be able to be remotely accessed by simple web browser. The system shall provide individual web pages for the User to access via any web browser.
  - To access the web pages, the User will have to enter a User Name and Password.
    - The User can set up any of three levels of access to the web pages:
      - Read only...can see but cannot make any changes
      - Read/Write...can see and can make changes
      - Read/Write/Control...can see, make changes and effect control functions, also add or remove logins/ passwords.
  - The system supplier will provide at least two separate web sites for each customer. One shall be designed to be viewed on a traditional laptop or desktop computer. The other shall be designed to be viewed on a web enabled cell phone or PDA. This web site will still have graphs showing trending of data, and will be designed to minimize the data sent so as to minimize the page loading times and size of the data plans necessary to view the site on a web enabled cell phone or PDA.
  - The system supplier will provide secure access through a specified phone without the need for web access (Voice SCADA). This will require login to system via numeric 5 digit code and must be set up in the system to an associated login for that site to a specific phone number to maintain site security.
  - In addition to the above web sites, if the User has Mission M800 Real-time RTUs, the User will be provided at no additional charge with a customizable software interface that will display real-time status and graphic trending of data collected by the M800 RTU.
    - The software will be downloadable from the Mission customer website.
    - The software will automatically update itself every time the User accesses the software.
    - The software will require NO programming to customize.
    - The software will be the Mission Real Time Viewer.
- Remote Access Security
  - In addition to the Username and Password structure described above, all access of the User web site shall be logged. Such logging data to included date, time and duration of access, User Name and Password of user to access the site and IP address of the accessing computer. The log will be accessible through the User web site
- Automated Administrative Reports and Alerts
  - **The User web site shall produce and automatically deliver weekly reports which summarize alarms and responses, pump runtimes and flow estimates, weekly end-to-end uptime percentages of each RTU, and all electronic key uses at the RTU sites.**

- **The web site shall be capable of sending two (2) different categories of notifications, Alarms and Alerts. Alarms are for conditions that the User decides they want to be notified immediately about. Alerts are conditions that need attention, but are not so time sensitive that they cannot wait till the next morning.**
  - **The Alarms callout list and the Alert callout list shall be able to be separate and distinctly different.**
- The User web site shall analyze daily pump run times at compared to a moving 30 day average of that pumps most recent runtimes and automatically Alert the User is the pump runs outside the normal runtime variation pattern.
- The User web site shall analyze hourly pump runtimes and automatically compare it to two (2) User set thresholds. If the Alert threshold is exceeded, an Alert will be sent the following morning. If the Alarm threshold is exceeded, an alarm will send immediately.
- The User web site shall send an Alert the first morning that units are in Communications fail even though Alarms have been sent at the time the RTUs went off-line. Such Alerts are a reminder to Management that they still have units that are off line.

2.03 RTU LOCATIONS

- A. RTUs shall be located at XXXXXXXXXXXXXXXXXXXXXXXXX
- B. RTUs at each location shall be furnished with an omnidirectional antenna at grade plus 8ft.

2.04 MONITORING POINTS PER RTU

- A. The inputs to be monitored at sites \_\_\_\_\_ are as follows:

1. Digital inputs

- DI-1
- DI-2
- DI-3
- DI-4
- DI-5
- DI-6
- DI-7
- DI-8

Optional Digital Expansion Board below:

DI-9

DI-10

DI-11

DI-12

DI-13

DI-14

DI-15

DI-16

2. Analog inputs with four (4) hi/low threshold alarms

AI-1

AI-2

Optional Analog Expansion Board below:

AI-3

AI-4

AI-5

AI-6

4. Optional Pulse inputs

P-1

P-2

5. Relay Outputs

R-1

R-2

R-3

B. Additional Site Inputs Follow Same Format As Above

## 2.05 OTHER MATERIALS

- Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

## **PART THREE - EXECUTION**

### 3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

### 3.02 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.
- B. Additional coordination with the supplier's information here.

### 3.03 INSTALLATION

- A. Install the work of this Section in strict accordance with the manufacturer's recommendations and shop drawings as approved by the Engineer.
- B. Upon completion of the installation, carefully inspect each component and verify that all items have been installed in their proper location, adequately anchored, and adjusted to achieve optimum operation.
  - If required, the contractor shall adjust the antenna placement or elevation to obtain consistent, stable operation of the system.
- C. Delineate timing of RTU installation and commissioning.

### 3.04 SERVICE

- A. Demonstrate to the Owner's operation and maintenance personnel the proper methods for operating and maintaining the equipment, and the contents of the operation and maintenance manual required to be submitted under Article 1.03 in this Section.
- B. The Contractor shall furnish to the Owner, through the Engineer, a written report prepared by the instrumentation equipment manufacturer's field service technician certifying that:
  - the equipment has been properly installed in accordance with manufacturer's recommendations;

2. the equipment check out and initial start-up activities have been completed in accordance with manufacturer's recommendations and under the technician's supervision;
  3. Antenna placement has been optimized
  4. The equipment is free from any undue stress imposed by connecting conduit or anchor bolts;
  5. The equipment operates satisfactorily and in compliance with the requirements of this Section.
- C. If applicable, delineate whether or not the Contractor shall include with his bid, the on-site services of the instrumentation equipment manufacturer's field service technician, and for what period. This service shall be for the purpose of instruction of plant personnel and testing of the system.

#### 1.05 EQUIPMENT COMPATIBILITY

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  - The submitting Company shall have been in business providing remote facility monitoring and control services through the data side of the cellular system to the water distribution / wastewater collection industry or a substantially similar industry for at least six years.
  - The submitting Company shall be the actual manufacturer and operator, or a duly authorized and trained agent of the manufacturing company or a combination of both, who will actually provide, maintain, and warranty the proposed system.
  - The Manufacturing Company of the field equipment shall also be the provider of all monitoring related services associated with the field equipment and all ongoing service agreements will be with the actual company providing the monitoring service, not a subcontractor or agent.
  - The submitting company shall have a primary central monitoring and control center and a fully redundant, physically separate, backup-computer monitoring center. Either center shall have the capability of operating all the remote monitoring and control field RTU's.



- The submitting Company shall offer and provide 24 X 7 technical support.
  
- CONTROL PANEL ENCLOSURE AND COMPONENTS
  - Enclosure
    - Lockable UL Type 4X 304 stainless steel tamper resistant U.L. approved enclosure with a dead front on piano hinges and three point latching system.
    - The inside swing door shall be on a separate hinge system.
    - The exterior door shall have an engraved nameplate of the lift station.
    - The enclosure shall be mounted galvanized steel supports either encased in concrete or on a concrete pad with adequate surface area and depth to prevent over turning. The enclosure shall be installed a maximum of 60 inches above finished grade measured from the top of panel.
  - Lightning Arrestor: Provide a properly sized lightning arrestor connected to each leg after of the main circuit breaker and properly grounded as recommended by the manufacturer.
  - Main Circuit Breaker: Supply thermal magnetic molded case industrial type circuit breaker with a minimum interrupting rating of 10,000 amps to 240VAC. Each main circuit breaker shall be sized as required based on the actual load and per NEC requirements.
  - Power Terminal Block: Locate at the bottom of the enclosure to facilitate bottom conduit entry and to insure sound electrical integrity of the incoming power connections.
  - Circuit Breakers: Supply a thermal magnetic molded case circuit breaker to provide short circuit protection for each separate circuit as follows.
    - Circuit #1 – pump #1
    - Circuit #2 – pump #2
    - Circuit #3 - controls
    - Circuit #4 – receptacle, lights, other
  - GFI Receptacle: Provide a 120VAC, 15 amp, duplex GFI receptacle mounted in the enclosure inner door for operator convenience.

- Pump Starters: Provide IEC rated magnetic motor starters with manually resettable overload heaters sized to match the existing pump motors listed below:
  - Reset buttons - Provide inner door mounted overload reset push buttons for each pump.
  - Lights – Provide inner door mounted, red pilot lights to indicate an overload condition for each pump.
- Pump Controls: Provide a Hand-Off-Auto (H-O-A switch), 3 position, heavy duty type selector switch for each pump.
- Pump Running Lights: Provide door mounted, green pilot lights for each pump. The light shall be operated from a respective starter auxiliary contact to indicate a “pump running” condition.
- Pump Seal Failure: Provide inner door mounted, red pilot lights for each pump. The light shall be wired to indicate a “seal pump failure” condition.
- Running Time Meter: Provide three 120 VAC meters measuring hours and tenths of hours of operation up to 99999.9 hours.
  - Use one meter for each pump and a meter that will be energized whenever both pumps run at the same time.
  - Meter shall operate from the control voltage by an auxiliary contact on the motor starter.
- Duplex Pump Alternator
  - The Duplex Alternator shall be a solid-state Plug In Alternator, easily replaceable, that automatically controls two wastewater pumps. The Alternator shall be ALT-120-10S as manufactured by Ohio Electric Control, Inc. or approved equal.
  - A time delay will be provided to delay the Lag Pump Operation.
  - The Alternator shall include a three position selector switch for alternation or to select Pump 1 as Lead always or Pump 2 as Lead always.
- Alarm: Provide enclosure top mounted weatherproof alarm light with a red Lexan lens. Alarm light shall be activated during High Level alarm event and have a test button.

- Remote Monitoring System: Model M110 by Mission Communications, or approved equal. Fully integrated the remote monitoring system into the control panel assembly.
- Wiring Diagram: Provide an as-built wiring diagram laminated in plastic and a pouch on the interior of the panel door for storage.
- NAMEPLATES AND COMPONENTS TO BE ACCESSIBLE FROM OUTSIDE PANEL
  - Make accessible on the dead front panel all major components and sub-assemblies noted below. Identify these items as to function with laminated, engraved bakelite nameplates, laser screen laminated mylar nameplates, or approved equal.

<u>Device</u>	<u>Nameplate</u>
Circuit Breaker	Main Circuit Breaker
Circuit Breaker	Pump No. 1 Circuit Breaker
Circuit Breaker	Pump No. 2 Circuit Breaker
Circuit Breaker	Control Power Circuit Breaker
<u>Device</u>	<u>Nameplate</u>
Circuit Breaker	Convenience Receptacle Circuit Breaker
H-O-A Switch	Pump No. 1
H-O-A Switch	Pump No. 2
Pilot Light (green)	Pump No. 1 - Run
Pilot Light (green)	Pump No. 2 - Run
Pilot Light (red)	Pump No. 1 - Overload
Pilot Light (red)	Pump No. 2 – Overload
Pilot Light (red)	Pump No. 1 – Pump Seal Failure
Pilot Light (red)	Pump No. 2 – Pump Seal Failure
Reset Push Button	Pump No. 1 - Reset
Reset Push Button	Pump No. 2 - Reset
Alarm Test Button	Alarm Light Test
Counter	Pump No. 1 - Cycle Counter
Counter	Pump No. 2 - Cycle Counter
Counter	Pump No. 1 & 2- Cycle Counter
Meter	Pump No. 1 – Running Time Meter
Meter	Pump No. 2 – Running Time Meter
Meter	Pump No. 1 & 2 – Running Time Meter
Remote Monitoring System	RTU

### PART 3 - EXECUTION

- FLOAT INSTALLATION
  - Install float switches in the wet well per manufacturer's instructions.

- ENCLOSURE INSTALLATION
  - Provide all mounting, hardware and fixtures necessary to mount control panel as shown on the plans.
- WIRING INSTALLATION
  - Wire in accordance with the NEC.
  - Place all wiring, including the wiring between the lift station and control panel, in conduit.
  - Install float wires and pump wires in separate conduits.
  - Seal all conduits from the lift station to the junction box to prevent gases from entering the control panel.
  - Connect all newly installed components into existing panel and insure that all switches, lights, and meters function properly.
- START-UP/FIELD TESTING
  - Provide the services of a factory trained, qualified representative to inspect the completed installation, make adjustments necessary to place the system in trouble-free operation and instruct the operating personnel in the proper maintenance and operation of the equipment.
  - Perform start-up testing under field conditions.
  - Perform an operational test under field conditions during the project final inspection.
    1. Verify float system operation for pump #1, pump #2, and pump #1 and pump #2 in combination.
    2. Verify operation of pilot lights and alarm light.
    3. Verify pump alternation.
    4. Verify operation of HOA switches.
    5. Verify operation of selector switch.
    6. Verify operation of hour meters.
    7. Verify operation of GFI receptacle.
    8. Check setting of overload heaters on each motor starter.
  - Test and record voltages and amperages of each pump.
  - Perform pump test to verify operating capacity of each pump.

- Record hour meter readings and pump counters.
- Place system into complete operation.
- Provide written certification from the manufacturer to the project engineer that the installation is in accordance with the manufacturer's requirements and the warranty is validated.

**END OF SECTION**