Section 16900

Systems Integration

PART 1: General

1.1 *Summary* – This Section includes the following:

1.1.1 The System Integrators shall be responsible for integrating the furnished equipment, material, and software into a fully operational control system.

1.1.2 The System Integrator shall work directly for the Contractor.

1.1.3 The Systems Integrator shall be responsible for supplying the following products and services:

1.1.3.1 Field Instruments

1.1.3.2 Control Panel

1.1.3.3 All Components within Control Panel, as indicated on drawings.

1.1.3.4 All SCADA / HMI programming updates to interface new Lift Station into the overall SCADA / HMI system

1.1.3.5 All CAT 5e patch cables

1.1.3.6 All miscellaneous items required for a fully operational control system integrated with the Owner's existing SCADA / HMI system

1.1.4 The Contractor shall be responsible for supplying the following products and services:

1.1.4.1 Coordinating with the Electrical Utility Company for providing service to the site location

1.1.4.2 Coordinating the location of the Electrical Equipment and Control Panel, and installing it

1.1.4.3 Coordinate installation requirements with the Systems Integrator

1.1.4.4 Installing all field instruments

1.1.4.5 Providing all conduit and conductors associated with a complete and operational control system

1.1.5 The System Integrators shall provide all software for this project, to be installed by the Integrator. This software shall include but not be limited to the following:

1.1.5.1 PLC code

1.1.5.2 HMI screens

1.1.6 The Systems Integrator shall provide the following drawings for the control and electrical system (Each of these drawings shall be submitted and approved as a shop drawing):

1.1.6.1 Block interconnection drawings for the control system and associated electrical equipment (including connections to process control panels).

1.1.6.2 Point to Point wiring diagrams for all equipment connected to the control system.

1.1.6.3 Control Panel Drawing for any panel being built by the Integrator.

1.1.6.4 Equipment specification sheets.

1.1.6.5 Flow charts and control narratives for all control system logic to be approved by the Owner prior to implementation.

1.1.7 The Systems Integrator shall provide the following Operation and Maintenance Manuals for the control system (Each of these shall be custom written by the Integrator. In addition, each manual shall be submitted and approved as a shop drawing.):

1.1.7.1 Control System Operations Manual

1.1.7.2 Control System Maintenance Manual

1.1.7.3 Laminated Trouble Shooting Guides for both the Operators and the Maintenance Staff

1.1.8 The Contractor shall furnish and install all wiring, piping, conduits and necessary mounting and accessory equipment to provide a complete and fully operational instrumentation and control system.

1.2 *System Integrator Qualifications* –

1.2.1 *General* –

1.2.1.1 The following is a pre-approved list for Systems Integrators to be used for the project:

1.2.1.1.1 Automation Control Service, LLC.

1.2.1.1.2 Revere Control Systems.

1.2.1.1.3 Custom Control Solutions.

1.2.1.1.4 Elemech, Inc.

1.2.1.2 Systems Integrators wanting pre-approval shall submit documentation indicating they meet the requirements of this specification to the Owner for review and approval. Pre-approval written acceptance from the Owner shall be in writing and shall be turned in and attached with bid documentation forms.

1.2.1.3 The Integrator shall be engaged full time in the design and manufacturer of PLC based control systems. The Integrator shall have documented experience in the municipal water and wastewater market.

1.2.1.4 The Control Systems Integrator shall maintain a service representative within 100 driving miles of the project site.

1.2.1.5 The control system Integrator shall have a panel shop located at their main facility and shall be able to obtain a UL listing for control panels.

1.2.1.6 The System Integrators shall perform a factory acceptance test for the control system at their local office, and notify the Owner of such time so the Owner has the opportunity to attend. During this test, the Systems Integrator shall demonstrate the complete operation of the control system including any field I/O and network connections. The test shall also have actual dynamic loads provided for each Across-the-Line Starter circuit connected to the control system.

1.2.2 *Project Staffing* –

1.2.2.1 *Project Manager* –

1.2.2.1.1 The Project Manager shall be a registered Professional Engineer licensed in the State of Florida and shall oversee all aspects of the control system project.

1.2.2.1.2 The Project Manager shall have documented experience in the design and construction management of instrumentation / control and electrical systems. This experience shall include emergency power systems, variable frequency drive systems, harmonic correction, voltage drop and load flow analysis, breaker coordination, motor starters, conduit & conductor installation, and PLC / HMI programming.

1.2.2.1.3 The Project Manager shall be the primary contact for the Owner and Engineer.

1.2.2.1.4 The Project Manager or his designee shall be on site during the start-up and testing period for the proposed control system.

1.2.2.2 *Programmers* – All Programmers shall at a minimum have five (5) years of experience in PLC / SCADA / HMI programming.

1.2.3 *Service Technicians* –

1.2.3.1 All Service Technicians shall have a minimum of five (5) years of experience in electrical maintenance.

1.2.3.2 All Service Technicians shall have a minimum of two (2) years of experience in PLC /SCADA / HMI systems.

1.2.3.3 All Service Technicians shall have experience troubleshooting: motor starters, PLC, SCADA, and HMI systems.

1.2.3.4 Service Technicians shall have proficiency in using the following equipment: volt meters, oscilloscopes, PLC programming software, HMI configuration tools

1.3 *PLC / HMI Programming* –

1.3.1 All PLC code shall be written in "Function Block" and "Ladder Logic" style. The System Integrator may use "Ladder Logic" for simple logic functions with the Owner's approval prior to programming.

1.3.2 All PLC / HMI code shall be supplied to the Owner with fully descriptive comments. All HMI code shall be supplied to the Owner with fully descriptive screen and tag data.

1.3.3 The Integrator shall provide the Owner with a flow chart of all PLC code as well as a written algorithm of the codes functions.

1.3.4 The graphic standards to be used for all HMI equipment shall be coordinated with the Owner and the existing HMI system. All control panel screens will be custom.

1.3.5 The Systems Integrator shall provide the Owner with an I/O map of all process variables in the PLC.

1.3.6 All PLC code shall be the property of the Owner.

1.3.7 The Contractor shall provide three copies of all commented PLC, SCADA, and HMI, code/script/screen layouts to the Owner in electronic format prior to acceptance by the Owner. Any documentation not containing symbol information or comments will not be considered acceptable.

1.4 *Submittals* – Verification indicating compliance with the all aspects listed under the Systems Integrator Qualifications.

PART 2: Human-Machine Interface (HMI)

2.1 The Human-Machine Interface software for the SCADA HMI shall be based upon the existing installation, which shall be field verified. The Systems Integrator shall be responsible for providing all necessary licenses, drivers, and required network and software packages as required, for the configuration as detailed in the project plans. The Systems Integrator shall be required to provide the necessary HMI screens to monitor and control the equipment installed in this project. The Integrator shall be required to submit the proposed HMI screens to the Engineer and Owner for approval a minimum of one (1) week prior to the factory testing.

2.2 All alarms generated by equipment installed on the project shall be displayed in the alarm summary page. The Integrator shall coordinate with the Owner when configuring the system alarms and subsequent actions. The use of HMI alarm tags will not be allowed unless sufficient reason is submitted and approved.

PART 3: Execution

3.1 *Contractor's Responsibility* – The Contractor shall coordinate the System Integrators during construction, testing, start-up, calibration and acceptance of the instrumentation and control system. The Contractor is responsible for a complete and fully operational instrumentation and control system.

3.2 *General Installation* –

3.2.1 The instrumentation and control system, peripherals, and accessory equipment shall be installed in accordance with the equipment Manufacturer's instructions and located as shown on the Contract Drawings or as approved by the Owner and Engineer.

3.2.2 The Contractor shall coordinate the installation, placing and location of system components, their connections to the process components, panels, cabinets and devices, as required to complete the work subject to the Engineer's approval. The Contractor shall be responsible to insure that all field wiring for power and signal circuits between existing devices, the proposed control system are correctly done in accordance with best industry practice to insure a satisfactory functioning installation

3.3 *Test and Acceptance* – The Owner shall witness On-site Operability Tests, and have the option to have 1 representative present during the Factory Acceptance Tests.

3.4 *Installation* – All equipment and devices for the instrumentation and control system shall be installed in the locations shown on the drawings, in accordance with the Manufacturer's recommendations, and in compliance with the requirements of these specifications. Any alterations to equipment type and locations shall be indicated in the submittal package with a listed reason(s) as to why the change occurred.

3.5 *Field Acceptance Tests* –

3.5.1 No power shall be activated to any part of the instrumentation and control system until the Owner or Engineer receive a written certified statement by the system supplier that the installation is complete and ready for energizing. The Contractor is responsible for proper coordination and scheduling, and any damage to the instrumentation and control system.

3.5.2 After the installation is completed, the Contractor, through the System Integrator, shall test each component of the instrumentation and control system. After all systems are operating properly, the Contractor shall notify the Owner and demonstrate the full operation of the system. The Contractor shall make all necessary adjustments and correct or replace faulty equipment to the satisfaction of the Engineer.

3.5.3 The control system integrator shall be required to provide all test equipment necessary to test the control system and computer networks (radio) per industry standards.

3.6 *Field Calibration* –

3.6.1 All instrumentation and controls shall be calibrated in the presence of the Owner in accordance with the Manufacturer's instructions to the accuracy specified.

3.6.2 The Contractor shall provide field calibration as necessary until the project is considered Substantially Complete by the Engineer.

3.7 *Maintenance and Calibration Period* – During the first year of operation after substantial completion of the project, the Contractor shall provide maintenance and calibration services for the newly installed instrumentation and control systems. All maintenance and calibration activities shall conform to the Manufacturer's requirements and shall be provided by a certified technician. This work shall include all labor, tools, equipment, materials and all other expenses at no

additional cost to the Owner. Calibration and maintenance shall be performed a minimum of every 4 months.

3.8 *Start-Up Services* –

3.8.1 The System Integrator shall include 8 man-hours for start-up in their bids. These hours will be on the site hours and exclude travel.

3.8.1.1 Any hours not used for Start-up shall be used for Owner Directed Field Programming Changes.

3.8.1.2 Contractor and Integrator shall plan and be prepared for the start-up. Any additional hours required to complete the start-up shall not result additional compensation by the Owner.

3.8.2 Coordinate the start-up time and location with the Owner at least 1 week prior to scheduled start-up. Owner shall have the opportunity to have representation present during the entire start-up. In the event that the Owner chooses not have representation present for start-up, the Systems Integrator shall obtain written documentation from the Owner indicating they will not require representation during the start-up and it may proceed as scheduled. A copy of this written documentation shall be provided to the Contractor at least 1 day prior to start-up.

PART 4: As-Built Documentation

4.1 The Contractor shall coordinate with the Systems Integrators and provide the Owner with a complete set of AutoCAD 2013 control drawings for the project. These drawings shall include site electrical, control panel schematic/layout drawings, programming code, etc. The drawings shall indicate all wiring numbers.

4.2 The Systems Integrator shall provide detailed documentation of all computer code developed for this project. This documentation shall include but not be limited to: written descriptions, comments in PLC code, and HMI scripting. All software and code developed for this project shall be considered property of the Owner.

4.3 All As-Built documentation shall be provided in both paper and electronic formats