

Section 16473

PROGRAMMABLE LOGIC CONTROLLERS, SCADA INTERFACE
PANELS AND PANEL MOUNTED EQUIPMENT (WRF)

PART 1 GENERAL

1.01 SUMMARY

This section includes furnishing and installing a Programmable Logic Controller (PLC) at the Water Receiving Facilities (WRF) to control the operation of the Owner's Flow Control Valve. Portions of the Work under this Specification shall be provided, installed and tested by a Specialty Instrumentation Contractor (SIC) working for the Contractor. The SIC will be selected by the Owner. See paragraphs 3.03 and 3.04 of this Specification for responsibilities of the Contractor and SIC. Attachment A includes the detailed scope of work and the material and equipment to be provided by SIC.

1.02 MEASUREMENT AND PAYMENT

- A. No separate payment for Work performed under this Section. Include cost of same in Contract price bid for Work of which this is a component of.
- B. Refer to Section 01270 – "Measurement and Payment" for unit price procedures.
- C. A "CASH ALLOWANCE" pay item is included in Section 00300 – "BID" for the work to be performed by SIC.

1.03 REFERENCES

This specification references the following publications in their current editions. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

- A. ISA 5.4: Instrument Loop Diagrams
- B. National Electrical Code (NEC)
- C. National Electrical Manufacturers Association (NEMA)
- D. National Fire Protection Agency (NFPA)
- E. Underwriters Laboratories (UL)

1.04 SUBMITTALS

Submit the following in accordance with Section 01330 - "Submittal Procedures" and Section 01782 - "Operations and Maintenance Data."

- A. Upon completion of the installation submit record drawings including field checked wiring diagrams as required by the Contract Documents.
- B. Operation and Maintenance (O&M) Manuals: Submit O&M manuals and troubleshooting instructions

1.05 RELATED REQUIREMENTS

- A. Section 01330 - "Submittal Procedures
- B. Section 01782 - "Operations and Maintenance Data"
- C. Section 11303 – "Chemical Analyzers"
- D. Section 16051 – "Electrical Construction"
- E. Section 16060 – "Electrical Demolition"
- F. Section 16111 – "Conduit, Fittings, and Bodies"
- G. Section 16116 - Precast Electrical Manholes and Pull Boxes"
- H. Section 16195 – "Electrical Identification"
- I. Section 16196 - "Low Voltage AC Surge Protective Devices (SPDs)"
- J. Section 16402 - "Underground Duct Banks"
- K. Section 16463 – "Mini-Power Centers"
- L. Section 16486 – "Mechanical Equipment Manufacturer's Provided Control Panels (MEMs)"
- M. Technical Specification Section 13446 – Primary Instrument Devices

1.06 QUALITY ASSURANCE

Contractor shall be responsible for delivery of all Work as specified in this section.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Maintain materials and equipment in like-new condition, including the use of heat lamps and suitable coverings to prevent accumulation of excess condensation and construction dirt.

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- B. Protect materials and equipment from the weather, moisture, impact, corrosive liquids, gases, dust, and other agents that could cause damage

1.08 - 1.12 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. PLC Materials and /or Equipment to be provided by SIC are included in Attachment A at the end of this Specification.

2.03-2.04 NOT USED

PART 3 EXECUTION

3.01 GENERAL/MANUFACTURER(S)

Contractor shall install, calibrate, test, start-up, and place in satisfactory service the work required under this Specification.

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION, APPLICATION AND CONSTRUCTION BY THE CONTRACTOR

- A. The Contractor shall furnish and install field instrument devices and associated wiring from such devices to the SCADA Control Panel.
- B. The Contractor shall not connect the wiring between the Owner's SCADA Control Panel and field instrument devices.
- C. The Contractor shall be responsible for testing the wires to verify continuity.
- D. Contractor shall label each end of the wire using same labeling convention identified in the Plans.
- E. The Contractor shall furnish, install and connect all power and grounding wires as shown on the Plans.
- F. Contractor shall furnish and install concrete pad for mounting of SCADA panel as shown on Plans.

3.04 INSTALLATION APPLICATION AND CONSTRUCTION BY SIC

- A. The SIC shall provide the SCADA Control Panel including the inter-wiring, SCADA

PLC system, Remote Terminal Unit (RTU), input/output interface (I/O) items and related equipment.

- B. The SIC shall furnish and install the wireless cellular modem and antenna.
- C. The SIC shall be responsible for connecting the wiring between the Owner's SCADA Control Panel and the field instrument devices.
- D. The SIC shall provide directions, diagrams, and instructions detailing the assembly and installation of the SCADA Control Panel.
- E. The SIC shall assemble, mount, and install SCADA Control Panel.
- F. The SIC shall perform a point to point test of all signals transmitted from or received by the SCADA PLC. The Project Manager shall be advised 72 hours in advance so tests can be witnessed.

3.04 - 3.10 (NOT USED)

END OF SECTION

ATTACHMENT A

SIC's Scope of Work
(Includes Equipment Supplied, Duties of the SIC and Related Services)

PART 1 SCOPE OF WORK

1.01 SUMMARY

The requirements of this section apply to the Specialty Instrumentation Contractor (SIC) which includes the fabrication, software development, installation, test and startup of control panels, SCADA equipment and accompanying instrumentation as related to the municipal water and wastewater industry. The scope includes new construction and upgrades to existing facilities.

To insure consistency and provide maximum functionality in the design, the work performed shall be by a system integrator licensed with the Texas Board of Professional Engineers, be certified as a UL508A manufacturer and maintain an ISO9001 quality certification. Additionally, the SIC shall retain a design and service facility within a 100 miles radius of the project site. The SIC's service facility shall have a maximum response time of 24 hours for non-emergency conditions and a 4 hour response time for emergency situations.

The SIC shall employ key personnel encompassing the following knowledge areas; successful completion of ISA CCST Level I certification, minimum 10 years PLC/HMI/SCADA programming experience and a minimum of 10 years general instrumentation hardware configuration and testing. The SIC shall have continuous 10 year history with documented projects of active engagement in municipal water, wastewater projects of equal or greater complexity.

The SIC shall fabricate the necessary package for control and SCADA applications fully conforming to the project's specification and Plans as approved by the Engineer. The supplied equipment shall be in accordance with all applicable specification referenced standards. Associated system PLC and HMI shall be programmed by the SIC thus providing a fully functional site specific unit. The new equipment shall seamlessly interface with the Owner's existing SCADA communications and networking system.

SIC furnished and installed products and services include:

- Control System Hardware including PLC, HMI and applicable equipment as required to meet the project specification requirements for SCADA applications of the remote stations.

- Wireless Cellular Modem and antenna

- Final connections between field equipment and SCADA Control Panel
- SCADA software as required for site specific applications
- Operations and Maintenance Manuals for SCADA equipment
- “As Installed” System Drawings for SCADA equipment
- System Startup and testing of SCADA equipment
- Applicable Owner/Operator training

The SIC scope does not include conduit and wires required to link the field instrumentation to the SCADA Control Panels.

PART 2 MATERIALS AND EQUIPMENT

2.01 PLC MATERIALS AND/OR EQUIPMENT SHALL BE PROVIDED BY SIC AND SHALL CONFORM TO THE FOLLOWING:

A. Type:

Programmable controller of solid-state electronic design capable of accepting field inputs and producing analog and digital inputs or outputs; data acceptance and transfer to other PLCs; performing display, using floating point calculations.

1. Configuration:

Hardware, firm-ware, software, and communication, configuration as required for project requirements.

2. Communications Cabling:

SIC shall provide and install all required communication cable.

3. Communication Modem: SIC shall provide and install modem

4. Spare Parts:

In addition to spare parts listed in other sections, SIC shall provide one card for each type of device used including CPU, Power supply, and related items.

5. Equipment Manuals:

SIC shall provide three complete hard copy sets of all equipment manuals, as well as an electronic copy in “PDF” format.

6. Performance and Features to be complied by SIC:
 - a. PLC shall be capable of employing plug-in (replaceable) input and output modules (I/O) with provisions for expansion to add 25 percent more I/O modules in the future.
 - b. Program Memory shall be nonvolatile and shall provide a minimum of 64K 16 BIT words or as required by each application. CPU shall be capable of accepting floating point values and process calculation.
 - c. Unit shall be capable of reprogramming either on-line or off-line but only when the key lock switch is in the “program” position.
 - d. Volatile memories shall be protected by long life backup battery with self-check or low battery visual indication.
 - e. Power supplies, I/O cards, CPU’s, racks, and related components shall be interchangeable for all sites.
 - f. All PLC and RTU racks shall operate from an 115V AC, 60 Hz power supply.

7. Display:

SIC shall provide a compact monochrome display (5.7” or bigger) with the PLC.

8. UPS Unit:

SIC shall provide an uninterruptible power supply (UPS). Locate the UPS unit with the PLC and RTU. Connect the output of the UPS to the SCADA Interface Panel Enclosure for full capacity output at 120V. Connect input power to the UPS from the field power supply. UPS input voltage to be 120V single phase and size UPS as required plus 50 percent capacity.

B. SCADA Interface Panel General Requirements shall conform to the following by SIC:

1. Furnish and install the panels.
2. The panels shall be the free standing type, complete with CPU, field devices, instruments, pushbuttons, indicating lights, nameplates, UPS, Air conditioner (A/C) and related equipment.
3. The construction and wiring shall be in accordance with this Section and applicable Plans. The Plans will specify the arrangement of instruments to be mounted on the front, rear, and sides of the panels.

4. Unless otherwise specified on applicable Plans, all panels shall be of the fully enclosed type designed for use with high-density instrumentation mounting.
5. The instruments designated for rear-of-panel mounting shall be arranged within the panel according to respective Plans and in a manner to allow for ease of maintenance and adjustment.
6. Conductors running from the field to the panels shall be continuous without splices, except at approved junction boxes. The junction boxes shall have terminal blocks with 20 percent spare terminals. Special care shall be exercised to carry grounding lines through such junction boxes with the least possible resistance. Cables entering panels shall be multi-conductor. Conduit and multi-conductor cables entering panels shall be sealed to prevent the intrusion of gas and moisture.
7. The panels shall be completely fabricated and factory wired with all devices.
8. All components shall be mounted in a manner that shall permit servicing, adjustment, testing and removal without disconnecting, moving or removing any other component. Components mounted on the inside of panels shall be mounted on removable plates and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required otherwise by the manufacturer to protect equipment from vibration. Component mounting shall be oriented in accordance with the internal components and shall be identified with suitable plastic or metal engraved tags attached with drive pins adjacent to (not on) each component. Tags shall identify each component in accordance with the Plans and Specifications.
9. All exterior panel mounted equipment shall be installed with suitable gaskets, faceplates, etc. required to maintain the NEMA rating of the panel.
10. All panels shall be supplied with suitable nameplates which identify the panel and individual devices, as required.

C. Panel Materials and Construction:

1. Panels shall be constructed of Type 316 stainless steel with angle or channel bracing. Fabricate each panel from a 12-gauge minimum sheet. Panel fronts shall be fabricated from a single piece of sheet steel. Interior and side panels, and subpanels shall be minimum 12-gauge steel painted white. Panel shall be free from scale or any blemish which would mar the finish. Panels shall be suitable for installation in NEMA Type 4X environments.
2. Structure and Enclosure:

- a. Panels shall be of continuous welded construction. Provide angle stiffeners as required on the back of the panel face to prevent panel deflection under instrument loading or operation. Internally the panels shall be supplied with a structural steel framework for instrument support purposes and panel bracing. The internal framework shall permit panel lifting without racking or distortion. Provide removable lifting rings designed to facilitate simple, safe rigging and lifting of the control panels during installation. Plugs shall be provided and shall unobtrusively fill the panel lifting ring holes when substituted for the lifting rings after installation is complete.
- b. Each panel shall be provided with full height, fully gasketed access doors. Doors shall be provided with a three-point latch, and heavy duty locking handle. Access doors shall be conveniently arranged and sized such that they extend no further than 24 inches beyond the panel when opened to the 90-degree position. Front and side access doors shall be as shown on the Plans. Panel access doors shall be provided with full length, continuous, piano type, steel hinges with stainless steel pins.
- c. The panels, including component parts, shall be constructed and assembled in a thoroughly workmanlike manner and shall be free from sharp edges and welding flaws. Wiring shall be free from kinks and sharp bends and shall be routed for easy access to other components for maintenance and inspection purposes.

D. Temperature Control:

1. Outdoor panels shall be provided with closed loop air conditioner coolers to present temperature build up due to electrical devices or solar gain.
2. The internal temperature of all panels shall be regulated so as to not exceed 100 degrees Fahrenheit. Under no circumstances shall the panel cooling equipment compromise the NEMA rating of the panel.
3. All enclosures shall be provided with a thermostatically controlled strip heater to reduce condensation.
4. All enclosures shall be fully insulated with insulation board

E. Corrosion Control:

Panels shall be protected from internal corrosion by the use of corrosion-inhibiting vapor capsules as manufactured by Northern Instruments Model Zerust VC; Hoffman Engineering Model A-HCI; or equal.

F. Control Panel - Internal Construction:

1. Internal Electrical Wiring:
 - a. Panel equipment shall be mounted and wired on or within the cabinet. Wiring shall comply with the National Electrical Code. Wiring within the panel shall be grouped together with harnesses or ducts and secured to the structure. Wiring shall be numbered in compliance with the numbering system used on the wiring/connection diagrams. Wiring and connection diagrams shall comply with ISA 5.4 and shall be submitted by the manufacturer as part of the shop drawings for review.
 - b. Power and low voltage DC signal wiring shall be routed in separate wire ways. Crossing of the two system wires shall be at right angles.
 - c. Power wire shall be 12 AWG Type THWN stranded and shall be insulated for not less than 600V unless specified otherwise. Conductors shall be of tinned copper construction. All interconnecting wiring, except for electronic circuits, shall be rated for not less than 90 degrees C.
 - d. Signal wire shall be 1 pair 16 AWG shielded. Conductors shall be of tinned copper construction.
 - e. Wire color shall be: Line Power - Black; Neutral or Common - White; AC Control - Red; DC Control - Blue; Equipment or Chassis Ground - Green; specified externally powered circuits - Orange. Graphic light wiring (24 volt maximum at the lamp socket) may be 22 AWG if properly fuse protected and terminated in a terminal block capable of accepting No. 14 AWG field wiring.
 - f. Wiring shall terminate at a master terminal board, rigid type and numbered. The master terminal board shall have a minimum of 25 percent spares.
 - g. Terminal blocks shall be arranged in vertical rows and separated into groups (Power, AC control, DC signal, and alarm).
 - h. Terminal blocks shall be barrier type (plastic barrier) with the appropriate voltage rating (600V minimum). Terminal strips shall be provided for the purpose of connecting all control and signal wiring. They shall be the raised channel mounted type as manufactured by Phoenix UX6N Type 3004 S24 and UK6, 3-HESI 304171, or equal.
 - i. Wiring trough for supporting internal wiring shall be plastic type with snap on covers. The side walls shall be open top type to permit wire changing without disconnecting. Trough shall be supported to the

- subpanel by using stainless steel screws. Trough shall not be bonded to the panel with glue or adhesives.
- j. Wire connectors shall be the hook fork type with insulated barrel for crimp type compression connection to the wire.
 - k. Each wire shall be provided with a numbered heat shrink tubing identification markers at both ends and the numbering shall be destination type. Identification markers shall be pre-typed. Handwritten markers or paper markers will not be permitted.
 - l. Direct interlock wiring between equipment will not be allowed. Only one side of a terminal block row shall be used for internal wiring. The field wiring side of the terminal shall not be within 6-in of the side panel or adjacent terminal.
 - m. Wiring troughs shall not be filled to more than 60 percent visible fill. Wiring trough covers shall be match marked to identify placement. If component identification is shown on covers for visibility, the ID shall also appear on the mounting sub-panel.
 - n. Each panel shall have a single tube, fluorescent light fixture, 15 Watt in size, mounted internally to the ceiling of the panel. Light fixture shall be switched and shall be complete with the lamp.
 - o. Each panel shall have a specification grade duplex convenience GFCI receptacle mounted internally within a stamped steel device box with appropriate cover.
 - p. Each panel shall be provided with plugmold raceway with one outlet for each instrument plus 20 percent excess for future use for instrument power.
 - q. Each panel shall be provided with an isolated copper grounding bus for all signal shield ground connections. Shield grounding shall be in accordance with the instrumentation manufacturer's recommendations.
 - r. Each panel shall be provided with a separate copper power grounding bus in accordance with the requirements of the National Electrical Code.
 - s. Each panel, where applicable, shall be provided with analog signal isolation (I/I) where analog signals are sent from one panel or console to another.
 - t. Each panel shall be provided with surge suppression protection (electrical transients) for connections between AC power systems and

electrical and electronic equipment. Surge suppressor grounding shall be accordance with the manufacturer's recommendations.

- u. All wiring to hand switches and the like which are live circuits independent of the panel's normal circuit breaker protection shall be clearly identified as such.
2. Relays required for properly completing the control function shall be provided. For example, pilot lights (both "ON" and "OFF") will receive a single pair of wires for both conditions. As a result, a relay is required to provide inputs to both pilot lights. Relays shall have red LED indicators which illuminate upon coil energization.
 3. These relays shall be mounted in their respective panel and shall be clearly identified as being live circuits independent of the panel's normal circuit breaker protection.
 4. Nameplates shall be provided for equipment. The nameplates shall be approximately 1-in x 3-in constructed of black and white laminated, phenolic material having engraved Helvetica letters approximately 1/4-in high, extending through the black face into the white layer. Nameplates shall be beveled and attached to panels by self-tapping stainless steel screws. Adhesive bonded or glued on name plates shall not be accepted.
 5. Drawing storage pockets shall be provided on the inside of each panel. Its size shall be sufficient to hold all of the Plans required to service the equipment.
 6. Hinged doors shall have continuous hinges of stainless steel construction and three-point latching system with lock. Provide padlocks for each local panel and all keyed alike. All hinged doors shall be gasketed.
 7. Panels shall be factory tested prior to shipment. Field installation shall consist only of setting the panel in place and making necessary electrical and conduit connections.
 8. Components shall be mounted in a manner that shall permit servicing, adjustment, testing and removal without disconnecting, moving or removing any other component.
 9. Components shall be mounted on plates on the inside of panels in such a manner that allows for removal of the components without removal of the plate. Components shall not be mounted directly to the enclosure.
 10. Internal components shall be identified with suitable plastic engraved name plates attached with stainless steel drive pins adjacent to (not on) each component identifying the component.

G. Miscellaneous Panel Components:

1. Pilot Type Indicating Lights:

- a. The miniature lamp for the pilot lights or CMC lighted pushbuttons shall be rated at 14V or 28V for 12V or 24V systems, respectively. The lamps shall be LED based lamps visible from 4.5 meters, with a lamp life of 100,000 hours plus. LED lamps shall be as manufactured by Ledtronics, Inc. or equal.

(1) Type:

Heavy duty oil-tight type which utilizes a low voltage lamp

b. Functional/Performance:

- (1) Units shall be provided with low voltage lamps suitable for the voltage supplied. Lights supplied with 120V AC power shall have integral reduced voltage transformers.

- (2) Lamps shall be replaceable from the front of the unit.

c. Physical:

- (1) Lens color shall be as indicated on the instrument device schedule. Lens shall be approximately 1-1/4-in diameter.

- (2) Provide legend faceplates engraved to indicate the required function of each device.

- (3) Units shall be rated NEMA 13 for indoor panels. Units located outdoors or indicated to be weatherproof shall be rated NEMA 4X.

2. Rotary Hand Switches and Push Buttons:

- a. Rotary selector switches shall be heavy duty oil resistant, with the number of poles and number of positions as required. Switches shall have a selector handle, stainless steel escutcheon plate, and be of the maintained or momentary contact type, as required, and rated for 10 amperes at 120V AC. The switches required for "electronic duty" shall have low, stable, contact resistance and gold contacts. Provide bridging contacts where required. The selector switches shall have lighted sections.

- b. Pushbuttons shall be heavy-duty, oil-tight, with momentary contacts. Switches shall be supplied with the number of poles required for the

application, a stainless steel escutcheon plate, and contacts rated for 10 amperes at 120 AC.

(1) Type:

Control devices shall be heavy duty oil-tight type with stackable contact blocks.

(2) Functional/Performance:

Provide contact arrangement and switching action as required for the control system specified.

c. Physical:

(1) For 120V AC service provide contacts rated 10 amps at 120V AC, for 24V DC service provide silver sliding contacts rated 5 amps at 125V DC, for electronic (millivolt/milliamp) switching provide contacts rated 1 amp at 28V DC.

(2) Push buttons shall have flush type operators. Selector switches shall have knob or wing lever operators.

(3) Units shall be rated NEMA Type 13 for indoor service. Units located outdoors or indicated to be weatherproof shall be rated NEMA 4X.

(4) Provide legend plates denoting switch/push button position/function.

3. Industrial Relays and Time Delays

a. Type:

Industrial heavy duty relays.

b. Functional/Performance:

(1) Contact arrangement/function shall be as required to meet the control function specified.

(2) Contacts shall be rated at 10 amps continuous at 600V.

(3) Relays shall be provided with convertible contact blocks.

(4) Pneumatic time delay relays shall be used on time delays less than 180 seconds and shall be adjustable.

(5) Solid state time delay relays shall be used on time delays between 180 seconds and one-hour.

c. Options/Accessories Required:

Provide all mounting rails and other accessories that are required.

4. General Purpose Relays and Time Delays

a. Relays shall be double pole, double throw, octal plug in type with a transparent dust cover. The relay shall be equipped with a light to indicate when its coil is energized. The mechanical life of the relay shall be 100,000,000 operations minimum.

(1) Type:

Units shall be of the general purpose plug-in type.

(2) Functional/Performance:

a) Coil voltage shall match supply voltage.

b) Contact arrangement/function shall be as required to meet the specified control function.

(3) Mechanical life expectancy shall be in excess of 10 million.

(4) Duty cycle shall be rated for continuous operation.

(5) Units shall be provided with integral light to indicate relay is energized.

(6) Solid state time delays shall be provided with polarity protection (DC units) and transient protection.

(7) Time delay units shall be adjustable and available in ranges from .1 second to 4.5 hours.

b. Physical:

(1) For 120V AC service provide contacts rated 10 amps at 120V AC, for 24V DC service provide contacts rated 5 amps at 28V DC, for electronic (milliamp/ millivolt) switching applicator provide gold plated contacts rated for electronic service.

- (2) Relays shall be provided with dust and moisture resistant covers.
 - c. Accessories Required:
 - (1) Provide mounting sockets with pressure type terminal blocks rated 300 volt and 10 amps.
 - (2) Provide mounting rails/holders as required.
- 5. Signal Isolators/Boosters/Converters
 - a. Type:

Externally powered solid state electronic type. Loop powered devices are not acceptable.
 - b. Functional/Performance:
 - (1) Accuracy: within 0.15 percent.
 - (2) Inputs: Current, voltage, frequency, temperature, or resistance as required.
 - (3) Outputs: Current or voltage as required.
 - (4) Isolation: There shall be complete isolation between input Circuitry, output circuitry, and the power supply.
 - (5) Adjustments: Zero and span adjustment shall be provided.
 - (6) Protection: Provide RFI protection.
 - c. Physical:
 - d. Mounting: Suitable for m Accessories Required:

Mounting rack or general purpose enclosure as required.
- 6. Signal Selectors, Computation, and Conditioning Relays
 - a. Signal Selector. Computing module shall accept the number of input signals noted and produce an output signal which corresponds to the highest or lowest, as noted, input signal. Input or output accuracy shall be plus 0.25 percent or better, including linearity and repeatability.
 - (1) Type:

Solid state electronic type

- b. Functional/Performance:
 - (1) Inputs: 4-20 mA.
 - (2) Outputs : 4-20 mA.
 - (3) Protection: Provide RFI protection.
 - (4) Operation: The relay shall multiply, add, subtract, select, extract the square root, or perform the specified conditioning/computation function required. All inputs shall be able to be individually rescaled and biased as required.
 - (5) Isolation: All inputs, outputs, and power supplies shall be completely isolated.
 - (6) Accuracy: 0.35 percent of span.
 - (7) Adjustments: Multi-turn potentiometer for zero, span, scaling, and biasing.
- c. Physical:

Mounting: Suitable for mounting in an enclosure or instrument rack.
- d. Accessories:

Mounting rack or general purpose enclosure as required.

7. Control Devices

- a. Push-Button Switch and Selector Switch:

Heavy-duty, oil-tight construction rated for 600V AC, 10 amps continuous.
- b. Pilot Light:
 - (1) Push-to-test transformer type.
 - (2) Light to include a miniature bayonet base lamp designed for 6.3V AC with a minimum life of 20,000 hours.
- c. General Purpose Relay:

Plug-in type rated 240V AC, 10 amps continuous.

- d. Industrial Relay:

 Heavy-duty type with plug-in contact cartridges rated 600V AC,
 10 amps continuous.

- e. Time-Delay Relay:

 Solid state, plug-in type rated 600V AC, 10 amps continuous.

ABBREVIATIONS

Table 1: Abbreviations

	Definition		Definition
AE	Analyzer Element	LS	Level Switch
AI	Analyzer Indicator	LSH	Level Switch – High
AIT	Analyzer Indicator Transmitter	LSHH	Level Switch - High High
AS	Analyzer Switch	LSL	Level Switch – Low
ESVC	Electric Solenoid Valve – Close	LSLL	Level Switch - Low Low
ESVO	Electric Solenoid Valve – Open	NC	Normally Closed
EV	Electric Valve	NO	Normally Open
EVNH	Electric Valve – Ammonia	PAH	Pressure Alarm High
EVCL	Electric Valve – Chlorine	PAL	Pressure Alarm Low
FCV	Flow Control Valve	PG	Pressure Gauge
FE	Flow Element	PI	Pressure Indicator
FIC	Flow Indicator Controller	PIT	Pressure Indicator Transmitter
FM	Flow Meter	PRV	Pressure Relief Valve
FS	Flow Switch	PS	Pressure Switch
FSH	Flow Switch – High	SV	Solenoid Valve
FSL	Flow Switch – Low	TA	Temperature Alarm
FITQ	Flow Totalizer	TS	Temperature Switch
HIC	Hand Indicator Controller	XI	Valve Position Indicator
LAH	Level Alarm – High	XT	Valve Position Transmitter
LAL	Level Alarm – Low	WLA	Weight – Low
LI	Level Indicator	WI	Weight Indicator
LIT	Level Indicator Transmitter		

[NOTE: DESIGN ENGINEER IS TO VERIFY ABBREVIATIONS IN TABLE AS APPLICABLE TO THE SITE. THIS NOTE IS TO BE REMOVED BEFORE ISSUE FOR BID]

8. Owner’s Programmable Logic Controller (PLC)

NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY **PROGRAMMABLE**
 STANDARD SPECIFICATION **LOGIC CONTROLLERS, SCADA INTERFACE**
PANELS AND PANEL MOUNTED EQUIPMENT (WRF)

The PLC shall be capable of handling the Inputs listed in Table 2 from the equipment and instrumentation at the site and transmit that information to the main Owner Regional Control Facility (RCF) and/or be used internally to operate equipment located at the site. Based on inputs from the main RCF and in response to the programming of the PLC with respect to the inputs the PLC is receiving, the PLC will Output information to the equipment and instrumentation on the site. Table 3 provides a list of the Outputs that the PLC will send to the site. Optional connections and inputs that can be received or sent by the PLC can be found in Table 4.

Table 2: Inputs from Water Receiving Facilities (WRF)

No. of Inputs	Input Description	WRF Instruments
1	Flow Control Valve (Valve Position)	XT 204 FOR FC 204
4	Flow Meter (Instantaneous Flow, Totalizer Flow, Flow Alarm – High & Flow Alarm - Low)	FE 204 & FITQ 204
1	Free Ammonia Analyzer (Levels) (First Sample Point)	AIT 302 & AE 302
1	Hot Box (Heater Operational)	TS 203
2	Hot Box (Temperature & Low Temperature Alarm)	TS 203
3	Pressure Transmitter (Inlet Pressure, Inlet Pressure High Pressure Alarm & Inlet Pressure Low Pressure Alarm)	PIT 205
3	Pressure Transmitter (Outlet Pressure, Outlet Pressure High Pressure Alarm & Outlet Pressure Low Pressure Alarm)	PIT 202
2	Differential Pressure Transmitter (Differential Pressure and Differential Pressure High Pressure Alarm)	PIT 201
1	Total Chlorine Analyzer (Levels) (First Sample Point)	AIT 304 & AE 304
3	WRF GST (Level, High Level Alarm & Low Level Alarm)	LIT 200 (NHCRWA)

[NOTE: DESIGN ENGINEER IS TO VERIFY INSTRUMENT NUMBERS IN TABLE AS APPLICABLE TO THE SITE. THIS NOTE IS TO BE REMOVED BEFORE ISSUE FOR BID]

Table 3: Outputs to Water Receiving Facilities (WRF)

No. of Outputs	Output Description	WRF Instruments
1	Surface Water Flow Inhibitor	
1	Flow Control Valve Position #1	ESVC 204A FOR FC 204
1	Flow Control Valve Position #2	ESVO 204B FOR FC 204
1	Flow Meter (Instantaneous Flow to Customer Control Panel)	FE 204 & FITQ 204

[NOTE: DESIGN ENGINEER IS TO VERIFY INSTRUMENT NUMBERS IN TABLE AS APPLICABLE TO THE SITE. THIS NOTE IS TO BE REMOVED BEFORE ISSUE FOR BID]

Table 4: Optional Connections & Inputs

No. of Signals	Output Description	WRF Instruments
3	WRF GST (Level, High Level Alarm & Low Level Alarm)	LS 201 (Customer)
1	Groundwater Flow Meter (Flow)	(Customer)
1	Groundwater Wells (Status)	(Customer)

[NOTE: DESIGN ENGINEER IS TO VERIFY INSTRUMENT NUMBERS IN TABLE AS APPLICABLE TO THE SITE. THIS NOTE IS TO BE REMOVED BEFORE ISSUE FOR BID]

9. Magnetic Flow Meter (MFM)

The MFM shall transmit the following signals to the PLC via "FE 204" and "FITQ 204":

- a. Flow Meter - Instantaneous Flow
- b. Flow Meter Totalizer Flow
- c. Flow Meter - High Flow Alarm
- d. Flow Meter - Low Flow Alarm

The flow readings will be used by the PLC to control the position of the CFCV, with input from the main RCF. The PLC will transmit all four signals identified above to the Owner RCF.

[NOTE: DESIGN ENGINEER IS TO VERIFY INSTRUMENT NUMBERS AS APPLICABLE TO THE SITE. THIS NOTE IS TO BE REMOVED BEFORE ISSUE FOR BID]

10. Ground Storage Tanks (GST)

The PLC will receive the following signals from the GSTs via "LIT 200":

- a. GST - Level
- b. GST - High Level Alarm
- c. GST - Low Level Alarm

The GST level readings will be used by the PLC to control the position of the CFCV, with input from the main RCF. The PLC will transmit all three signals identified above to the RCF.

Based on the settings in Table 5, the PLC will transmit an "OPEN" signal to the CFCV when the level reaches a designated "LOW-ON" level. If the GST level continues to drop to the designated "LOW-LOW-ON" level in Table 5, an "ON" signal will be sent to the Customer's Water Wells (via the Customer Control Panel). Once the Customer's Water Wells "OFF" level is reached, the PLC (through the Customer's Control Panel) will send an "OFF" command to the Customer's Water wells. Once the CFCV's "OFF" level is reached, the PLC will send a "CLOSE" command to the CFCV.

[NOTE: DESIGN ENGINEER IS TO VERIFY INSTRUMENT NUMBERS AS APPLICABLE TO THE SITE. THIS NOTE IS TO BE REMOVED BEFORE ISSUE FOR BID]

Table 5: GST Levels

Description	GST #1 (feet)	GST #2 (feet)
GST High Level Alarm		
NHCRWA CFCV "OPEN"		
Customer's Water Wells "ON"		
Customer's Water Wells "OFF"		
NHCRWA CFCV "CLOSE"		
GST Low Level Alarm		

[NOTE: DESIGN ENGINEER IS TO FILL IN TABLE WITH CORRECT LEVELS AS APPLICABLE TO THE SITE. THIS NOTE IS TO BE REMOVED BEFORE ISSUE FOR BID]

11. Inlet, Outlet and Differential Pressure Readings

The PLC will receive the following signals from the inlet, outlet, and differential pressure transmitters via "PIT 205," "PIT 202" and "DPIT 201":

- a. Inlet Pressure - Pressure Reading
- b. Inlet Pressure - Low Pressure Alarm
- c. Inlet Pressure - High Pressure Alarm
- d. Outlet Pressure - Pressure Reading
- e. Outlet Pressure - Low Pressure Alarm
- f. Outlet Pressure - High Pressure Alarm
- g. Differential Pressure - Pressure Reading
- h. Differential Pressure - High Pressure Alarm

The Pressure transmitter readings will be used by the PLC to control the position of the CFCV, with input from the main RCF. The PLC will transmit all eight signals identified above to the Owner RCF. Refer to Section F below for further discussion.

[NOTE: DESIGN ENGINEER IS TO VERIFY INSTRUMENT NUMBERS AS APPLICABLE TO THE SITE. THIS NOTE IS TO BE REMOVED BEFORE ISSUE FOR BID]

12. Combination Flow Control Valve (CFCV)

The CFCV will transmit the following signals to the PLC via "XT 204" for "FC 204":

- a. Flow Control Valve - Valve Position

The PLC will send "OPEN" or "CLOSE" control signals to the CFCV's solenoids (ESVC 204A and ESVC 204B FOR FC 204) to control the flow of surface water at the WRF. The PLC will base these control signals on inputs from the RCF, the "Instantaneous Flow" reading from the MFM, the level in the GST, and the outlet pressure transmitter reading.

As discussed in Section D, if the water level in the GST reaches a designated low level the PLC will signal the CFCV solenoids to "OPEN" and allow surface water to flow into the GST. If the water

level in the GST continues to drop or remains constant, the PLC will send an “OPEN” signal to the CFCV solenoid to open the CFCV further to allow a greater flowrate to enter the GST unless the flow rate measured at MFM (FE 204) is at the maximum flow rate allowed by Owner. If the maximum flow rate is reached, the PLC will send an “ON” signal to the Customer’s water wells as described in Section D. The maximum flow rate allowable for this site is: gpm.

Once a designated high water level is reached in the GST, the PLC will signal the CFCV solenoids to “CLOSE”.

If the outlet pressure measured downstream of the Flow Control Valve Station (“PIT 202”) drops below a designated low point the water will not have enough pressure to enter the top of the GST. If this occurs the PLC will signal the CFCV to “CLOSE” partially to increase the inlet pressure in the line, which will in turn increase the outlet pressure in the line to allow water to flow up and into the GST.

[NOTE: DESIGN ENGINEER IS TO VERIFY INSTRUMENT NUMBERS AS APPLICABLE TO THE SITE. THIS NOTE IS TO BE REMOVED BEFORE ISSUE FOR BID]

13. Chloramination System

All of the chlorination and LAS systems will be controlled by the Customer's Control Panel. The only signals that will be sent to the PLC will be the following:

- a. Chlorine Analyzer #1 (via AIT 304 for AE 304) - Free Chlorine Level at First Sample Point
- b. Ammonia Analyzer #1 (via AIT 302 for AE 302) - Total Ammonia Level at First Sample Point

The PLC will transmit both signals identified above to the RCF.

[NOTE: DESIGN ENGINEER IS TO VERIFY INSTRUMENT NUMBERS AS APPLICABLE TO THE SITE. THIS NOTE IS TO BE REMOVED BEFORE ISSUE FOR BID]

14. Miscellaneous

Other signals to be received by the PLC are the signals to indicate if the hot box heater is operational, the temperature in the hot box, and a low temperature alarm. All of these signals are sent by the mechanical thermostat located in the hot box (“TS 203”). The thermostat will signal the heater to turn “ON” at a specified low temperature and “OFF” at a specified high temperature. The

thermostat will signal to the PLC whether the heater is “ON” or “OFF”, the actual temperature in the hot box, and will send an alarm if a designated low temperature is reached.

The PLC may also receive signals indicating the flow and status of the Customer’s groundwater wells. The Customer’s flow meter on the groundwater well discharge line can send a signal to the PLC containing the flow rate and the “ON/OFF” status of the well pump.

If requested by the Customer, the PLC may send the surface water flow rate measured at the Flow Meter Station (FE 204) to the Customer’s Control Panel. This signal is not required, but should be available to the Customer.

15. Customer Control Panel

[NOTE: DESIGN ENGINEER IS TO COMPLETE THIS SECTION AS APPLICABLE TO THE SITE AND CUSTOMER'S CONTROL SYSTEM. THE CUSTOMER CONTROL PANEL MUST INCLUDE A DISCUSSION OF THE CHEMICAL DOSING SYSTEM. DESIGN ENGINEER MAY PROVIDE A SEPARATE SPECIFICATION SECTION TO COVER THE CUSTOMER CONTROL PANEL. THIS NOTE IS TO BE REMOVED BEFORE ISSUE FOR BID.]

END OF SECTION