WYTHE COUNTY, VIRGINIA
REQUEST FOR PROPOSALS
SCADA SYSTEM SERVICES FOR UTILITIES

Wythe County, Virginia is seeking proposals from controls firms for on-call support services for the County's existing potable water utility Supervisory Control and Data Acquisition (SCADA) system. Services are anticipated to include on-call technical support, system troubleshooting, periodic on-site programming and miscellaneous support, installation of new Remote Telemetry Units (RTUs) to expand the system, and upgrade of existing facilities to expand functionality. The County intends to contract with one or more firms to provide these SCADA services on an "as-needed" basis. Contracts will be for an initial one year period with the option to extend annually for up to four additional years.

System Overview

The Wythe County SCADA system includes a master SCADA control station at the existing Fort Chiswell Wastewater Treatment Plant as well as remote telemetry units at six storage tanks, four booster stations, and two master meter/control valve sites. The system provides control of booster stations and control valves as well as monitoring, data logging, and trending of tank and meter sites. The original system was installed in 2013 and has been expanded in multiple stages. It is anticipated that the system will continue to be expanded over the next five years to include all major potable water facilities. The existing system primarily includes Allen-Bradley programmable logic controllers (PLCs) at the master site and remote facilities with Wonderware PC software system. Refer to Attachment B – "Typical SCADA System Specifications" for additional details.

Scope of Services

Services will be requested and performed on an as needed basis including, but not limited, to the following:

- PLC Programming & Troubleshooting
- PC SCADA Programming & Troubleshooting
- Control Panel Troubleshooting & Modifications
- Radio Telemetry Troubleshooting
- Master & Remote Telemetry Unit Troubleshooting & Upgrades
- New Remote Telemetry Unit Installation & Master System Integration

On-Call field service and support services will be performed at standard contract hourly rates plus material expenses. Installation of new control sites or major upgrades of existing facilities will be performed at fees negotiated prior to work.

Proposal Format and Content

Each interested firm must submit three (3) copies of sealed proposals at the location and time specified in this Request for Proposals.

Proposals shall the attached "SCADA Services Proposal Form" and may include a cover letter or additional information not to exceed five (5) additional pages.

Proposal Evaluation & Selection Procedure

Proposals will be evaluated under the following criteria:

1. Qualifications and experience of firm;
2. References from previous clients including satisfaction with system performance, reliability, and quality of service;
3. Service responsiveness.

The County's selection committee will review all proposals. The committee may conduct follow-up discussions/interviews with qualified firms, and reserves the right to select the firms it feels are most qualified based on the proposals. The County reserves the right to reject any and all proposals or waive any informality. The procurement of these services will comply with the Virginia Public Procurement Act. The County is an equal opportunity employer. Female and minority firms are encouraged to submit proposals.

Inquiries

All inquiries regarding this Request for Proposals shall be addressed to:

Russell N. Jackson, PE
Peed & Bortz, LLC
20 Midway Plaza Dr., Suite 100
Christiansburg, VA 24073
(540) 394-3214
rnjpublic@peed-bortz.com

Proposal Submittal

Proposal shall include completed Attachment A – "SCADA Services Proposal Form" and may include a cover letter or additional information not to exceed five (5) additional pages. Three (3) copies of the proposals described herein must be received in a sealed envelope clearly marked "Wythe County SCADA System Services" no later than 3:00 p.m. on Tuesday November 20, 2018. Proposals shall be addressed to:

Stephen D. Bear
County Administrator
340 South 6th Street
Wytheville, VA 24382

Attachment A - SCADA Services Proposal Form

The following form shall be completed by firms submitting proposals for Wythe County SCADA Services. Firms may provide a cover letter or additional information not to exceed five (5) additional pages. The Owner reserves the right to request additional information following proposal submission as deemed of assistance for proposal evaluation.

1. Year firm was established (or year firm began providing control/SCADA services, if later). _____
2. Total number of employees. _____
3. Number of field service staff. _____
4. Typical response time for troubleshooting/repair field service requests (days). _____
5. Guaranteed response time for troubleshooting/repair field service requests, if applicable. _____
6. References

   A. Reference #1

      Customer: _____

      Location (Town or County): _____

      Number of System Sites (RTU/MTU): _____

      PLC Hardware Type: _____

      PC Software System (if applicable): _____

      Contact: _____

      Title: _____

      Telephone Number: _____

   B. Reference #2

      Customer: _____

      Location (Town or County): _____

      Number of System Sites (RTU/MTU): _____

      PLC Hardware Type: _____

      PC Software System (if applicable): _____

      Contact: _____

      Title: _____

      Telephone Number: _____

C. Reference #3

Customer: _____

Location (Town or County): _____

Number of System Sites (RTU/MTU): _____

PLC Hardware Type: _____

PC Software System (if applicable): _____

Contact: _____

Title: _____

Telephone Number: _____

7. Proposed Standard Rates (Rates may be revised at time of annual contract renewals).

Hourly Field Service (Not including Travel) $_____ / hour

Minimum Field Service Charge (Including Travel) $_____ / daily trip

Telephone Support (if applicable) $_____ / hour

8. Non-Binding Site Installation Estimates. (Refer to "Typical SCADA System Specifications" for scope of typical site installations. Exact scope of any proposed future installations will be defined and Quotes/Proposals requested at that time.)

Water Storage Tank RTU $_____

Master Meter/ Control Valve RTU $_____

Booster Station RTU $_____

The undersigned hereby authorizes and requests any person, firm or Corporation to furnish any information requested by the Owner or Peed & Bortz in evaluation of the submitted proposal:

Company: _____

By: _____

Title: _____

Date: _____

ATTACHMENT B - TYPICAL SCADA SYSTEM SPECIFICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. General: This document provides information on the existing Wythe County potable water utility Synchronous Control and Data Acquisition (SCADA) system and typical requirements for new facilities. Exact equipment and performance requirements of specific future installations would be determined on a case by case basis. Typical work for new installations would include design, documentation, assembly, installation, field testing, startup, training, and final documentation for project controls and additions to the County's SCADA System. Major components of this system generally include the software modifications, materials, equipment, and installation required to implement a integrate new sites within the system and any associated panel or field equipment modifications.

1.2 GENERAL REQUIREMENTS

A. Electrical: All wiring shall be in complete conformance with the National Electric Code, state, local and NEMA electrical standards. All incoming and outgoing wires shall be connected to numbered terminal blocks and all wiring neatly tied and fastened to chassis as required. For ease of servicing and maintenance, all wiring shall be color coded and uniquely numbered. The wire color code and number shall be clearly shown on the drawings, with each wire's color and number indicated.

1.3 QUALITY ASSURANCE

A. General: The controls provider shall be responsible for and shall provide for the design, supply, delivery, installation, certification, calibration and adjustment, software configuration, testing and startup, owner training, warranty and routine future field services for new installations and modifications to the existing County system.

B. Standard Products: In order to achieve standardization for appearance, operation, maintenance, spare parts and manufacturer's service, to the greatest extent practical, like items of equipment provided hereunder shall be the end products of the same manufacturer.

1.4 SUBMITTALS

A. Hardware Submittals: Before any components are fabricated, and/or integrated into assemblies or shipped to the job site, furnish to the Owner for their review copies of submittal documents. Submittals shall include full details, shop drawings, catalog cuts, and such other descriptive matter and documentation as may be required to fully describe the equipment and to demonstrate its conformity to these specifications. Specifically, submittals shall include the following materials:

1. Block diagram and operational description of the system showing all major components and their interconnections and interrelationships. Label each diagram and specify all external power and communications interfaces. Required documentation sets shall be furnished in bound hardcopy and final documentation shall also be provided in electronic format on CD.
2. Drawings of equipment to be supplied shall include, as a minimum: overall dimension details for each panel, console, etc., including internal and external arrangements and door mounted operator

devices with nameplate designations. Wiring diagrams of equipment including field device connections shall be included and specific installation/wiring requirements identified.

3. Operational Description shall include the principal functions/capabilities of each personal computer (PC) and PLC as provided and configured /programmed. Included shall be a description of system communications.
4. Provide a detailed Bill of Materials along with descriptive literature identifying component name, manufacturer, model number, and quantity supplied.

1.5 OPERATION AND MAINTENANCE MANUALS AND SOFTWARE

A. General: Provide complete hard-covered, ring bound, loose-leaf O&M manuals as well as one digital copy for all new facilities. In addition to "as-built" system drawings, the manuals shall include internal wiring diagrams and operating and maintenance literature for all components provided.

The submitted literature shall be in sufficient detail to facilitate the operation, removal, installation, programming and configuration, adjustment, calibration, testing, and maintenance of each component and/or instrument.

Operation and Maintenance manuals shall include copies of all PLC programs written to accomplish the monitoring and control functions specified. Programs shall be updated after startup is complete, with the fully commented program(s) licensed to and provided to the Owner on compact disk (CD). Two (2) copies shall be provided.

All software and tools required for configuring and programming RTU's, PLC's, and SCADA software shall be provided and licensed to Owner. All custom programing shall be licensed to Owner for their use on existing facilities and base for future expansion of system.

The contents of the O&M manuals shall include the following sections:

1. System Hardware/Installation
2. System Software
3. Operation
4. Maintenance and Troubleshooting

PART 2 - PRODUCTS

2.1 GENERAL

A. General: The functions and features specified herewith are typical requirements of standard control site installations. Specific requirements of individual sites may vary and would be determined for any proposed future installation prior to a Request for Quote. In some cases, the specifications may allow the accomplishing of certain functions by means of more than one hardware/firmware/software approach. Any approach that is proposed shall equal or exceed all functional, operational, convenience and maintenance aspects of the one described. Major equipment, component and software items may be specified in advance; however, the controls provider shall include all appurtenant items necessary to achieve the required operation.

B. System Overview: The Wythe County SCADA system includes a master SCADA control station at the existing Fort Chiswell Wastewater Treatment Plant as well as remote telemetry units at six tanks, four booster stations, and two master meter/control valve sites. The system provides control of indicated

booster stations and control valves as well as monitoring, data logging, and trending of tank and meter sites. The system was designed for future expansion to a complete County-wide system, expected to be implemented in phases over approximately the next few years.

2.2 CENTRAL MONITORING AND CONTROL STATION

A. Existing System Overview: A PLC panel and SCADA computer is installed at the County's Fort Chiswell Wastewater Treatment Plant and serves as a central monitoring and control station./ Master Telemetry Unit (MTU). The SCADA PC operates Wonderware 2012 Development Studio with 3,000 tag capacity. The existing central monitoring station receives and transmits all inputs and outputs described at all remote sites. PC Software provides remote monitoring, data logging, and trending of meter flows, tank levels, and pump run times. SCADA software also includes reporting and trending within software as well as ability to export standard reports to Excel worksheets. The system is accessible via password protected internet access and provides automated alarm notification and acknowledgement via telephone and email communication. System provides automated backup of recorded data.

B. SCADA PC Screens: The SCADA PC software includes the following existing screens which will shall be updated to include any new additional remote sites.

1. Map Overview Screen
    a. Area wide overview with GIS or dynamic Google Maps (or similar) base mapping showing major roads and corporate boundaries. Base mapping shall include water system linework from County provided shape files which shall be updatable by Owner
    b. Tank Levels depicted graphically and numerically as water depth and/or percent full.
    c. Booster pump station status including Run, Fail, Idle condition
    d. Control valve status as Open or Closed Condition
    e. Selectable navigation to screen for any site providing full site details.
    f. Indication of signal failure to any site
2. Pump Station (Transfer Pumping)
    a. Remote run and stop operation of each pump
    b. Run and fault indication for each pump
    c. Station discharge flow rate
    d. Total daily discharge flow
3. Booster Station (Variable Speed Constant Pressure Boosting)
    a. Pump Run Status (Each Pump)
    b. Pump Enabled Status (Each Pump)
    c. Pump Alarm Status (Each Pump)
    d. Discharge Pressure Setpoint
    e. Discharge Pressure
    f. Suction Pressure
    g. System Operation Mode (Auto/Manual)
    h. System Reset Required
    i. System Reset Request
    j. General Alarm
    k. Discharge Flow Rate
4. Control Valve
    a. Remote open and close operation of valve
    b. Additional information as indicated for master meter screens

5. Tank Sites
   a. Numerical display of current level
   b. Graphical indicator of current level
   c. Graphical display of 24 hour historical tank levels.
   d. High and low level alarm setpoints
   e. Pump on and off or control valve open and close level setpoints for applicable sites
6. Master Meters
   a. Total daily flow
   b. Current flow rate
   c. Graphical display of 24 hour historical flows
   d. Numerical display of previous seven day total flows
7. Historical Data Screen
   a. Configurable graphical display of any individual or multiple selected monitored or calculated values
   b. Report Generation
8. Alarm Configuration Screen (may be provided in add-on software package)
   a. Configuration of alarms which initiate notification
   b. Configuration of notification email addresses and telephone numbers

2.3 TANK CONTROL PANELS

A. Control panels shall be installed at new storage tanks to monitor tank level. Master SCADA controls shall also provide control of applicable control valves or transfer pump stations for tank fill control based on adjustable low and high level setpoints in the tank. For the purpose of control provider budgetary pricing, Tank Control Panel telemetry work shall be assumed to also include material furnishing and installation of galvanized steel electrical mounting rack, meter base, and 100 amp minimum 12 space panelboard. Telemetry shall be assumed to be via cellular data modem.

B. The proposed tank equipment shall be housed in a corrosion resistant welded NEMA Type 4 enclosure. Enclosures shall be fabricated from FRP or stainless steel. Units shall include a single gasketed front door. Full height hinges and door clamping hardware shall be included.

C. Inputs and Outputs: The RTU shall be capable of accepting a minimum of two local analog inputs (AI), ten digital inputs (DI), and six digital outputs (DO), with expansion capability for additional inputs and outputs. Initial inputs and outputs shall be as follows:

Description	Type	Source/ Output Location
Tank Level	AI-1	Level Sensor

D. Equipment shall operate from a source of 120 volts, 1 phase, and 60 Hz. Circuit breakers shall be quick-make, quick-break, thermal-magnetic, trip indicating. Single pole circuit breakers shall be UL listed as "Switching Breakers" at 120 Volts and shall carry the SWD marking.

E. All wiring shall be in complete conformance with the National Electric Code, state, local and NEMA electrical standards. All incoming and outgoing wires shall be connected to numbered terminal blocks and all wiring neatly tied and fastened to chassis as required. For ease of servicing and maintenance, all wiring shall be color coded and uniquely numbered. The wire color code and number shall be clearly shown on the drawings, with each wire's color and number indicated.

F. Surge protection shall be installed to protect electrical components in accordance with minimum International Society of Automation (ISA) standards. All analog signals coming from instrumentation to the control panel shall be protected with surge suppression. All digital input/output signals and instrumentation shall be protected by inline fuses. Transient voltage surge suppression (TVSS) shall be installed in the control panel. Insulation and grounding of suppressors shall be in conformance with manufacturers recommendations.

2.4 MASTER METER & CONTROL VALVE PANEL

A. The Control Valve Panel shall include a cellular data modem and SCADA meter interface unit (SMIU). Programmable control functionality shall be provided through either the SMUI or a separate RTU to communicate with the Master SCADA system and an applicable storage tank sites. Automatic valve operation shall be according to level setpoints from downstream tank(s). Control logic shall ensure that valve position will be maintained through momentary communication interruptions. Panel shall include relay contacts to energize 120V solenoid on control valve to open and supply system. Meter reading and computed flow rate shall also be provided through the SCADA system. Panel shall include HOA switch for valve and open/close indicator lights. For the purpose of control provider budgetary pricing, Control Panel telemetry work shall be assumed to also include material furnishing and installation of galvanized steel electrical mounting rack, meter base, and 100 amp minimum 12 space panelboard.

B. The equipment shall be housed in a padlockable stainless steel NEMA Type 4 enclosure. Enclosures shall include a single gasketed blind front door. Full height hinges and door clamping hardware shall be included. Indicator lights and selector switch shall be mounted on inner panel door.

C. Operational Control: The control panel shall communicate to read the discharge system tank level. Valve operation shall be based on low level valve open and high level valve close setpoints. Valve position shall be maintained through momentary communication losses. Panel shall also monitor master meter outputs and record and totalize daily flows.

D. Inputs and Outputs: The RTU shall be capable of accepting a minimum of two local analog inputs (AI), ten digital inputs (DI), and six digital outputs (DO), with expansion capability for additional inputs and outputs. Initial inputs and outputs shall be as follows:

Description	Type	Source/ Output Location
Control Valve Open Command	DO-1	Control Valve Solenoid

E. Meter Communication: Meter interface unit shall be connected to radio telemetry to transmit meter polled reading and instantaneous flow rate computed from time and volume sample readings.

F. Equipment shall operate from a source of 120 volts, 1 phase, and 60 Hz. Circuit breakers shall be quick-make, quick-break, thermal-magnetic, trip indicating. Single pole circuit breakers shall be UL listed as "Switching Breakers" at 120 Volts and shall carry the SWD marking.

G. All wiring shall be in complete conformance with the National Electric Code, state, local and NEMA electrical standards. All incoming and outgoing wires shall be connected to numbered terminal blocks and all wiring neatly tied and fastened to chassis as required. For ease of servicing and maintenance, all wiring shall be color coded and uniquely numbered. The wire color code and number shall be clearly shown on the drawings, with each wire's color and number indicated.

H. Surge protection shall be installed to protect electrical components in accordance with minimum International Society of Automation (ISA) standards. All digital input/output signals and instrumentation shall be protected by inline fuses. Transient voltage surge suppression (TVSS) shall be installed in the

control panel. Insulation and grounding of suppressors shall be in conformance with manufacturers recommendations.

2.5 BOOSTER STATION CONTROL PANELS

A. Control panels shall be installed at the booster station to monitor the booster pump system and provide alarm acknowledgement and setpoint interface control. For the purpose of control provider budgetary pricing, power electric service and suitable power circuit shall be assumed to already be available at the booster station. Control Panel shall be assumed to be wall mounted within the station. Telemetry shall be assumed to be via cellular data modem.

B. The proposed equipment shall be housed in a corrosion resistant welded NEMA Type 4 enclosure. Enclosures shall be fabricated from FRP or stainless steel. Units shall include a single gasketed front door. Full height hinges and door clamping hardware shall be included.

C. Inputs and Outputs: The RTU shall be capable of accepting a minimum of two local analog inputs (AI), ten digital inputs (DI), and six digital outputs (DO), with expansion capability for additional inputs and outputs. Initial inputs and outputs shall be as follows:

Description	Type	Source/ Output Location
Booster System Common Alarm	DI-1	Booster Station Control Panel
Mag Meter Pulse Flow Increment	DI-2	Mag Meter Transmitter
Booster System Discharge Flow	AI-1	Mag Meter Transmitter

D. Booster System Monitoring: The RTU shall communicate to the Booster System Control Panel via Ethernet to provide monitoring or pump and system status, allow adjustment of system setpoints and allow remote system reset.

The SCADA system shall provide monitoring only of the following booster system status items:

1. Pump Run Status (Each of Three Pumps)
2. Pump Enabled Status (Each of Three Pumps)
3. Pump Alarm Status (Each of Three Pumps)
4. Discharge Pressure
5. Suction Pressure
6. System Reset Required
7. General Alarm

The SCADA system shall also provide monitoring and adjustment of the following:

1. Discharge Pressure Setpoint
2. System Operation Mode (Auto/Manual)
3. System Reset Request

Totalized and instantaneous flow measurements shall also be provided through the SCADA system.

2.6 COMPONENT SPECIFICATIONS

A. Control Panels: Control panel enclosures shall be NEMA Type 4. Unless otherwise specified, enclosures shall be fabricated from FRP or stainless steel. Units shall include a single gasketted front door. Full

height hinges, locking hasp and door clamping hardware shall be included. All enclosures shall be UL listed.

Unless otherwise indicated, controls shall operate from a source of 120 volts, 1 phase, 60 Hz. All controls shall be protected from lightning or other transient voltages by a power arrestor. All power supplies required for operation shall be provided. Power supplies shall be sized to have a minimum of 40% spare capacity providing increased reliability and allowing for the addition of future equipment. Isolators shall be provided on all analog inputs for surge suppression. Enclosure shall have a heater for condensation protection.

All wiring shall be in complete conformance with the National Electric Code, state, local and NEMA electrical standards. All incoming and outgoing wires shall be connected to numbered terminal blocks and all wiring neatly tied and fastened to chassis as required. For ease of servicing and maintenance, all wiring shall be color coded and uniquely numbered. The wire color code and number shall be clearly shown on the drawings, with each wire's color and number indicated.

Relays shall be plug-in relays with contacts rated 5 amperes at 120 volts AC and clear polycarbonate covers. Relays shall be similar to square D RS14, Class 8501 general purpose relays with screw terminal sockets mounted in a NEMA 1 enclosure.

Surge protection shall be installed to protect electrical components in accordance with minimum International Society of Automation (ISA) standards. All analog signals coming from instrumentation to the control panel shall be protected with surge suppression. All digital input/output signals and instrumentation shall be protected by inline fuses. Transient voltage surge suppression (TVSS) shall be installed in the control panel. Insulation and grounding of suppressors shall be in conformance with manufacturers recommendations.

B. PLC Control/Telemetry System: Each PLC panel shall have adequate memory and instruction sets required to make the unit perform all of the functions required by this specification. Units shall communicate with each other and with remote I/O panels via Modbus protocol.

All control signals, status signals, alarms, and process variable data shall be transmitted and received between the sites via the telemetry system. The system shall convert commands, alarms and variable analog data to digital blocks and transmit this information. The PLCs shall be capable of stand-alone control to maintain programmed logic.

Units shall be furnished completely configured and tested providing the specified communication, monitoring, display, input/output, annunciation, computational and other requirements for operation of the system. Any additional components required for operation, whether specifically referenced herein or not, shall be provided.

The PLC system shall be based on a scalable modular multi-use open architecture platform that can be efficiently applied to perform the necessary functions at each location. Each controller/telemetry unit shall be a modular hardware style PLC consisting of a CPU with adequate memory and instructions, power supply, local and remote input/output modules, communications ports, and all other components required to make the unit perform all of the functions required in this specification.

The PLC system shall support true system open architecture allowing full integration of other third party generic hardware/software devices. The architecture shall meet the requirements as herein defined and allow economical expansion of function and features based on new and evolving technologies.

1. Programmable Logic Controller (PLC): The PLC system shall be based on a robust, field proven, current technology hardware platform allowing utilization of the latest advances in technology and permitting the most open programming and communication architectures. The PLC system shall

be modular and scalable to be efficiently applied at each of the specified sites within the system. The PLC shall be manufactured by Allen-Bradley, in order to provide consistency with existing system hardware.

The PLC system shall include a real time of day time clock w/battery backup for time stamping of data log records and scheduling of periodic time of day based events. Clock shall not require reset after a site power failure has occurred.

The PLC shall store system parameters including, logic configuration, setpoints, time delays, alarm and event data, counters and totalizers, etc. in field programmable (FLASH) non-volatile memory. Sufficient non-volatile memory must be provided to protect at least 8,000 variables. The PLC shall also provide enough protected memory for time stamped data logging of up to 200,000 process values. This data shall be unaffected by power interruptions.

The PLC shall have enough processing power and working (DRAM) memory to enable high level programs such as Internet Web Servers to operate efficiently without affecting other simultaneous multitasking operations.

The PLC shall be furnished with a minimum of 6 communication ports with true multitasking and allow simultaneous support of all ports. Ports can be configured for local I/O, Operator Interface/display support, LAN/WAN, etc..

The PLC processor shall meet the following as a minimum:

a. CPU - True 32 Bit running at 50 MHz.

b. 16 MB - 32 bit Dynamic RAM

c. 8 MB FLASH

d. 512 KB Static RAM

e. 1 (One) Ethernet 10/100 BaseT port (RJ45)

f. 1 (One) RS-232 Serial Communications (115 KB PS)

g. 1 (One) Local I/O port

h. 1 (One) Display Serial Communications Port

The PLC shall not require any specialized tools for removal of the unit. System components including PLC, power supplies, etc. shall be DIN rail mounted. Terminations shall be via plug in connectors facilitating quick field replacement.

PLC's and associated I/O modules shall meet national and international safety standards including UL, CSA, CE, DNV and Zone 2 Rated. In addition to the safety standards PLC system components shall also meet IEEE-472 (ANSI C37.90) surge withstand and IEC68-2-6 Vibration standards.

The PLC shall operate from a 10-30 VDC power source. A battery and charger as previously specified shall be supplied to power the master & remote unit during 120 Volt service power outage conditions.

The PLC's shall have an operational temperature range of -40OC to 70OC (-40OF to 158OF) under relative humidity conditions of 5 to 95% non-condensing. Storage temperature range up to 85OC (185OF)

2. Software: The PLC shall have a high performance open source software architecture that utilizes a true multitasking operating system running a combination of standard and specially designed for water and wastewater application software modules. The system provided shall utilize an integrated system approach providing a comprehensive common configuration tool for all components within the system including I/O, Processor, Communications, and Operator Interface Display. The architecture shall permit all system components to be configured, simulated, tested and downloaded from one terminal to all system components. The operating system shall be multitasking and allow a minimum of two separate programs to run simultaneously without affecting each other.

To provide for and insure multiple source support, the PLC system shall utilize industry standard programming language certified by the PLC open committee for all five languages supported by the IEC 61131-3 standard including; Sequential Function Chart, Ladder Diagram, Structured Text, Instruction List, and Function Block Diagram. All five languages must be included. Any one or a combination of the aforementioned programming languages can be used to implement the system strategy. The programming software must be Windows™ based and be able to operate on Windows 10 - 64 Bit operating systems.

PLC's provided under this specification shall be capable of performing the necessary logic to control the system as previously defined. These capabilities shall include, but not be limited to the following:

a. Discrete input/output
b. Analog input
c. Analog output
d. Timers
e. Pump Controller
f. Pump Alternation
g. Mathematical Function Blocks
h. Stage Blocks
i. Trending
j. Latch/unlatch relays
k. Counters
l. Comparators
m. Ladder logic
n. Flow Totalization/Integration
o. Intrusion Detection
p. Time of Day Control w/Lockout
q. Ramp Blocks
r. Data Logging

Communications between a PLC and any computer shall be accomplished using standard off-the-shelf drivers allowing use of standard Windows DDE and or OPC software drivers. The PLC system configuration software shall allow the MTU tag name data base to be exported to the computer HMI software providing continuity between PLC and HMI tag names and making future changes/upgrades more efficient and less prone to database tag name error. Communications between the PLC any link computer shall be via high speed communications port (RS-232 up to 115 Kbps) or Ethernet 10/100 BaseT (10/100 Mbps) in conjunction with a modem over the previously specified telemetry medium.

Each PLC shall have memory protected built in historical archiving/data logging of system alarms & events and process variables. Data logger shall be able to log data based on time or an event. PLC shall have enough memory allocated to allow 200,000 time and date stamped discrete and/or analog values to be archived. The historical archive shall allow the oldest data to roll off the system as memory is used keeping the 200,000 most current data points available. Process point time stamping frequency shall be selectable within the configuration software. It shall be possible for the archived data to be exported in CSV format allowing use with standard spreadsheet and data base software applications.

Each PLC shall have built in web server capability allowing system information to be stored in a format that allows for easy access and viewing with standard Windows™ based browser. Each unit shall be furnished with built in O & M data associated with its specific site including; as a minimum, basic system information, panel layouts, wiring diagrams, material lists w/part

numbers, and operational summary. This information shall be accessible locally or remotely.

3. I/O Systems: The PLC system shall have I/O resources to support a wide variety of applications without needing to depend upon alternate technologies to meet various system data requirements. Each PLC shall be supplied with the required I/O to meet the specified requirements and allow for a minimum of 100% spare capacity for future expansion. The PLC system shall be easily scaled from a standalone unit capable of supporting a minimum of 64 local, 64 remote I/O, and 64 Ethernet networked I/O points or one of 1284 RTU's with a total system data handling capability of 50,000 points.

   The PLC system shall support a wide variety of modular I/O with various configurations to permit the most efficient use of I/O hardware and panel space. I/O modules shall be available for local I/O (within control panel), remote I/O (RS-485 based distributed outside of the control panel) and Ethernet based I/O (Distributed I/O on high speed in plant network or wireless Ethernet). Each I/O module shall be DIN rail mounted, have compression wire type terminals capable of accepting 14 AWG wire, have wire identification markers and I/O wiring diagram. Each module shall include diagnostic LEDS indicating module operational and I/O status. Each I/O module shall be electrically isolated, meet IEEE-472 (ANSI C37.90) surge withstand certification, shall be removable under power and easily field replaced with a spare module requiring no software/hardware reconfiguration adjustments. Each module shall be safety keyed to insure proper installation. I/O modules shall permit installation and operation in hazardous locations as classified under UL, CSA Class 1, Div. 2, Groups A, B, C & D.

   a. Local I/O modules shall be connected to the PLC by a dedicated high speed serial communications port and shall allow local networking of I/O modules. Local I/O to PLC update time shall not exceed 150 mS.

   b. Ethernet I/O modules shall be connected to the PLC by on board Ethernet 10/100 BaseT connection port. Ethernet I/O modules shall support multiple communications including TCP/IP and Modbus ASCII and RTU allowing connection to any device supporting these protocols over standard Ethernet backplane.

C. SCADA Meter Interface Unit (SMIU): A SCADA Meter Interface Unit shall be provided at the master meter to perform protocol conversion between the flow meter register and the SCADA System. The SMIU shall contain two (2) flow meter ports that are capable of reading encoder-based flow meters, in conformance with AWWA Standard C707-05. The flow meter communication protocol(s) shall be recognized automatically by the SMIU, without user-intervention. At a minimum, the SMIU shall be compatible with the Hersey and Sensus AMR protocols. The SMIU shall automatically sample the flow meter(s) at pre-programmed intervals, and compute flow rate(s) based upon a delta-Volume/delta-Time finite difference calculation (fixed delta-Time or fixed delta-Volume). The SMIU shall be compatible with a radio-read interrogator attached in parallel to the target flow meter. Radio read filter shall be provided as required for proper interface to both systems.

   The SMIU shall contain an Ethernet port as well as one (1) RS-232C and one (1) RS-485 serial port. Serial ports shall support MODBUS/RTU and MODBUS/ASCII communication protocols. Ethernet port shall support MODBUS/TCP, MODBUS/UDP, and Ethernet/IP protocols.

   The SMIU shall be SCADAmetrics EtherMeter flow meter gateway, or approved equal.

D. Battery Back Up System: Included with each PLC and I/O station, and working in conjunction with the unit's DC power supply, shall be an intelligent battery backup system including battery health logic module, charger and sufficiently sized battery. Battery system shall provide full on-line protection, power conditioning, and a seamless switchover to battery upon detection of main DC power supply failure. Once main DC power is restored, the unit shall provide seamless switchback to normal DC power source and recharge the battery. Battery health logic module shall individually monitor main DC power supply, battery and converter voltages for low voltage conditions, and provide low voltage cutoff to protect battery from an unrecoverable depletion. An on board LED, or local Operator Interface (OI) if

provided shall locally indicate detection of an alarm condition. In addition to local indication, all battery health and voltage information shall be transmitted to the Master PLC for centralized monitoring and alarm detection. The unit shall be capable of providing one-half hour of battery backed operation for all Master Station equipment.

Battery system shall be of sufficient capacity to provide a minimum of two (2) hours of backup in the event of a failure of the main power source. To avoid battery damage and erroneous data transmissions when operating on battery, should the battery voltage drop below 10.8 V, the PLC shall be inhibited from operation. Recovery shall be automatic upon restoration of normal power. The intelligent battery backup system shall be able to source 5 Amps allowing operation of mission critical components including; sensors, local alarm, and communication equipment during a power failure condition.

2.7 INSTRUMENTATION

Level Transducer: Tank level shall be measured by a pressure transducer providing a 4-20 mA instrumentation signal. The transducer shall be of the solid state head pressure sensing type. The transducer housing shall be fabricated of type 316 stainless steel. The pressure shall be transmitted by an internal oil fill to a gauge pressure type variable capacitance transducer, which converts the pressure to a directly proportional electrical signal. The power supply to the transducer shall be 24VDC supplied by the radio transmitter. Pressure sensor shall have a range of minimum needed to measure full tank height. Sensor shall be installed with injection style sealing fitting to protect instrument from water intrusion. Sensor shall be installed on a sensing link connected to the tank drain line. A hose bibb shall be installed at the end of the sensing line for flushing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Equipment specified in this section shall be installed in accordance with the manufacturer's recommendations at the locations as shown on the plans.

B. Field Service: Provide experienced personnel to supervise, perform, and coordinate the installation, adjustment, testing, and startup of the system. The personnel shall be present on-site as required to effect a complete and operating system. All elements of the system shall be tested to demonstrate that the total system satisfies all of performance requirements. The controls provider shall provide all special testing materials and equipment required and shall coordinate and schedule all testing and startup work with the Owner. As a minimum, the testing shall include both a factory test and a field test.

C. Training: The training program shall educate operators, maintenance, and management personnel with the required levels of system familiarity to provide a common working knowledge concerning all significant aspects of the system being supplied.

END