9611 SE 36th Street
Mercer Island, WA 98040

Request for Proposal
(RFP #17-11)

City of Mercer Island Contracted Services for:

WATER AND SEWER CONTROL SYSTEM - HARDWARE/SOFTWARE

Release Date: November 21, 2017

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NOTICE INVITING PROPOSALS

RECEIPT OF PROPOSALS: Sealed proposals will be received at the City Clerk/Recorder's Office, City of Mercer Island, hereafter "City," located at 9611 SE 36th Street, Mercer Island, Washington, 98040, until **2:00 p.m., on December 15, 2017**, for the project titled WATER AND SEWER CONTROL SYSTEM - HARDWARE/SOFTWARE.

The City accepts no responsibility or liability for delays in delivery and will provide no accommodation to vendors who fail to check for addendums and submit inadequate or incorrect proposals.

ADDRESS AND MARKING OF PROPOSALS: The envelope enclosing the proposal shall be sealed, and delivered or mailed to the City.
Attention:
Brian McDaniel
CITY OF MERCER ISLAND
9611 SE 36th Street
Mercer Island, WA 98040

- The envelope shall be clearly marked with the name and address of the proposer and shall be labeled: RFP #17-11 WATER AND SEWER CONTROL SYSTEM - HARDWARE/SOFTWARE.

- Proposals, modifications, or corrections received after the closing time on the due date will be considered late and will not be opened.

- Proposals by fax or email will not be accepted.

Questions regarding this request for proposals (RFP) should be emailed to brian.mcdaniel@mercergov.org, no later than **December 4, 2017**. Unauthorized contact regarding this RFP with other City employees may result in disqualification. Any oral communications will be considered unofficial and non-binding. All questions received will be compiled, and responses will be sent to all proposers prior to the closing of bids.

Proposals must remain valid for a minimum of 365 days from the date of proposal opening.

OPENING OF PROPOSALS: Receipt and registration of proposals will be handled by the City.

If only one proposal is received in response to the RFP, the City may either make an award or—if the City chooses—re-solicit to obtain additional proposals.

DESCRIPTION OF WORK: This RFP is to solicit proposals to select and procure supervisory control system software and hardware for water and sewer. The control system shall include new supervisory control and data acquisition (SCADA) human-machine interface (HMI) software, programmable logic controller (PLC) hardware and software, operator interface terminal (OIT) hardware and software, training, and

technical on-call support. Procurement of hardware and software will be completed after design of the full control system upgrade is complete, which is anticipated to be in 2018.

Noteworthy elements of this proposal include:

- The City reserves the right to shortlist and/or request interview or demonstrations from selected proposers' hardware and software.
- The City will consider both initial and long-term costs in its analysis.
- Procurement and installation of the software and hardware will be completed later; this RFP is for HMI software, master and remote site PLCs, and panel-mounted OIT selection and future procurement only.

PRE-PROPOSAL MEETING: A mandatory (call-in or in-person) pre-proposal meeting will be held in the Cactus Room, Mercer Island City Hall (9611 SE 36th Street, Mercer Island, Washington) at 2:30 p.m. Pacific Standard Time (PST) on November 28, 2017. Call-in number: (602) 567-4030. Participant code: 4812164.

DELIVERY SCHEDULE: See the selection schedule on page B-14 for the project as outlined in Section B. Implementation of the new software and hardware is anticipated to be complete in 2018.

INSTRUCTIONS TO PROPOSERS

CITY
City of Mercer Island
9611 SE 36th Street
Mercer Island, WA 98040
206.275.7812
Project Manager: Brian McDaniel
(brian.mcdaniel@mercergov.org)

ENGINEER
Brown and Caldwell
701 Pike Street, Suite 1200
Seattle, WA 98101
206.624.0100
Project Manager: Michael Karl
(mkarl@brwncald.com)

CITY'S RIGHTS RESERVED: The City reserves the right to reject any or all proposals, to waive any informality in a proposal, to negotiate a modified proposal in accordance with state statute(s), and to make awards in the interest of the City. The City reserves the right to short list, conduct interviews, and have selected proposers provide a demonstration and presentation of their hardware and software.

FORM OF PROPOSAL: The proposal shall be made on the proposal schedules that are bound herein. The proposal schedules, along with the requested supporting information, shall be enclosed in a sealed envelope bearing the name of the proposer and project. The proposals must be submitted in the format outlined on Page B-4 of this RFP.

COPIES OF PROPOSAL: The proposer shall submit one original and two hard copies in an 8.5-inch by 11-inch format. The proposer shall also submit one copy in digital format (Portable Document Format [PDF] or Word .doc) on a Universal Serial Bus (USB) drive.

DELIVERY OF PROPOSAL: The proposal shall be received by the time and manner stipulated in the *Notice Inviting Proposals*. It is the proposer's sole responsibility to see that the proposal is received in proper time. The only acceptable evidence to establish time of receipt of proposals from the City is the time date stamp from the City office on the proposal envelope or other documentary evidence of receipt maintained by the City.

WITHDRAWAL OF PROPOSALS: Proposals shall be unconditionally accepted without alteration or correction, excepting that the proposer may—by means of written request, signed by the proposer or his properly authorized representative—withdraw his proposal. Such written request must be delivered to the place stipulated in the *Notice Inviting Proposals* for receipt of proposals prior to the scheduled closing time for receipt of proposals, as stipulated in the *Notice Inviting Proposals*.

MODIFICATIONS OF PROPOSALS: Unauthorized conditions, limitations, or provisions attached to a proposal may render it non-responsive and may cause its rejection. The

completed proposal forms shall be completed without alterations, or erasures. Proposers shall include in their submittals a list of all deviations and substitutions, and the associated change in prices—whether an increase or decrease—from their base prices. Oral, telephonic, telephone facsimile, or email proposals or modifications will not be considered.

DISCREPANCIES IN PROPOSALS: If there is more than one proposal item, the proposer shall furnish a price for all proposal items in the schedule; failure to do so may render the proposal non-responsive and subject to rejection. In the event there are unit price proposal items in a proposal schedule and the amount indicated for a unit price bid item does not equal the product of the unit price and quantity, the unit price shall govern and the amount will be corrected accordingly, and the proposer shall be bound by said correction. If there is more than one proposal item in a proposal schedule and the total indicated for the schedule does not agree with the sum of the prices proposed on the individual items, the prices proposed on the individual supplier shall be bound by said correction.

PUBLIC DISCLOSURE NOTICE: To protect the integrity of the contracting process, proposals will not be disclosed until after award and signing of all contracts that may result from this RFP.

Proposers should be aware that any records they submit to the City or that are used by the City—even if the proposers possess the records—may be public records under the Washington Public Records Act (Revised Code of Washington [RCW] 42.56). The City must promptly disclose public records upon request unless a statute exempts them from disclosure. Proposers should also be aware that if even a portion of a record is exempt from disclosure, generally the rest of the record must be disclosed. Exemptions, including those for trade secrets and valuable formula, are narrow and specific. Proposers should clearly mark any record that they believe is exempt from disclosure.

PROPOSERS EXAMINATION OF PROPOSAL DOCUMENTS

1. It is the responsibility of each proposer before submitting a proposal, to:

    a. Examine the proposal documents thoroughly

    b. Consider federal, state, and local laws and regulations that may affect cost, progress, performance, or furnishing the work

    c. Study and carefully correlate the proposer's observations with the proposal documents

    d. Notify the engineer of all conflicts, errors, or discrepancies in the proposal documents

INSTRUCTIONS TO PROPOSERS

QUANTITIES OF WORK:

1. The quantities of work or material stated in the proposal schedules are supplied only to give an indication of the general scope of work; the City does not expressly (or by implication) agree that the actual amount of work or material will correspond therewith. The City reserves the right, before or after award of the contract, to increase or decrease the quantities of any unit price item of the work by an amount deemed appropriate, or to omit portions of such work as may be deemed necessary or expedient without a change in unit price. Such rights to revise and omit shall include the right to delete any proposal item in its entirety, or to add additional proposal items as deemed expedient and as negotiated prior to an award of contract.
2. The proposers shall not at any time after the submittal of a proposal make or have any claim for damages or anticipated profits or loss of profit or otherwise because of any difference between the quantities of work done and material furnished and those stated in said unit price items of the proposal.

DISQUALIFICATION OF PROPOSERS: If there is any reason for believing that collusion exists among the proposers, all proposals will be rejected. Any proposal received from a proposer that is—at the time of submitting its proposal or prior to receipt of award of a contract—debarred by or otherwise ineligible to receive funds from any U.S. Government agency, any agency of the State of Washington, any local public body of the State of Washington, or any state of the United States, shall be rejected. Should any notice of debarment, suspension, ineligibility, or exclusion be received by the proposer, the proposer will notify the City.

ETHICS: The City expects the proposer and City employees to act ethically.

Fair Dealing. The proposer warrants that its proposal is submitted and entered without collusion on the part of the proposer with any person or firm, without fraud, and in good faith. The proposer also warrants that no gratuities; in the form of entertainment, gifts, or otherwise; were, or will be offered or given by the proposer; or any agent or representative of the proposer to any officer or employee of City with a view toward securing a recommendation of award or subsequent contract or for securing more favorable treatment with respect to making a recommendation of award.

Conflict of Interest. The proposer warrants that it presently has no interest and shall not acquire any interest, direct or indirect, that will conflict in any manner or degree with the performance of services required under the contract resulting from this RFP. The proposer also warrants that to the best of its knowledge, no officer, agent, or employee of the City who shall participate in any decision relating to this RFP and the resulting contract currently has, or will have in the future, a personal or pecuniary interest in the proposer's business.

Participation/Proposer Preparation. The proposer may not use the consultation or assistance of any person, firm, or company, that/who has participated in whole or in part in the writing of these specifications or the scope of work, for the preparation of its offer or in the management of its business if awarded the contract resulting from this RFP.

Debarment or Ineligibility Compliance. By submitting its offer in response to this RFP, the proposer certifies that it has not been debarred or otherwise found ineligible to receive funds by any agency of the federal government, the State of Washington, any local public body of the State of Washington, or any state of the United States.

STANDARD CONTRACT TERMS AND CONDITIONS. Any contract resulting from this RFP will include, but not be limited to, the City's standard terms and conditions. The term of the contract will be for 2 years; however, the contract may be terminated by either party in advance of the specific termination date based upon the termination terms and conditions included in the standard terms and conditions. In addition, the City may extend the contract if agreeable to both parties.

It is the intention of the City to issue a contract to the company whose proposal is deemed to be the most advantageous and in the best interest of the City. However, the City reserves the right to reject all proposals and does not guarantee any award based on this RFP.

RECORD KEEPING AND AUDIT RIGHTS. The selected proposer shall be responsible for maintaining accurate accounting records for all services provided herein, and shall retain all records for a period of at least 3 years following termination of the contract. Upon reasonable notice and during normal business hours, the City or any of its duly authorized representatives shall have access to, and the right to audit, any records or other documents pertaining to the contract. The City's audit rights shall extend throughout the term of the contract and for a period of at least 3 years thereafter.

PROPOSAL FORMAT

Proposers that desire to be considered to provide the services outlined in this RFP should submit **NO MORE THAN 15 PAGES** (single-sided and no smaller than 11-point font). The following sections are not included in the 15-page limit:

- One-page cover sheet
- Technical specification response Tables 1, 2, 3, and 4 in Appendix A
- Technical support and staffing table
- System installation references
- Receipt acknowledgment of any addenda
- Product information and datasheets for software, PLCs, and OITs
- Non-collusion affidavit

INSTRUCTIONS TO PROPOSERS

These instructions were developed to aid in response development. All proposals are to be organized into the following sections and sequence to provide a structured format so that reviewers can systematically evaluate responses. Each copy of the response package must include all the sections in the order indicated, and shall be clearly labeled. Attachments should be clearly referenced and identified to facilitate the review process. Each response shall include:

1. Cover Sheet

The *General Information* form on the next page is designed to serve as the cover sheet. Do not attach cover letters, title pages, or blank sheets ahead of this form, or substitute letterhead paper. ***This form must be signed by a person authorized to make proposals and enter into contract negotiations on behalf of your agency. Failure to submit this form could result in your proposal being deemed non-responsive.***

INSTRUCTIONS TO PROPOSERS

City of Mercer Island
WATER AND SEWER CONTROL SYSTEM - HARDWARE/SOFTWARE

General Information

This form must be signed by a person authorized to make proposals and enter into contract negotiations on behalf of your company. To be considered for this project, the submittals must be completed in accordance with this RFP and this cover sheet must be attached.
Failure to submit this form will result in your proposal being deemed non-responsive.

Authorized Official (Signature)	Date
Print Name of Authorized Official	Title of Authorized Official
Company Name	Contact Person
Address	District, State, Zip
Phone Number	Fax Number
Email Address	Federal Tax ID Number

NOTE: It is the sole responsibility of the supplier to learn of addenda, if any. Such information may be obtained at the City's procurement website (https://www.mercergov.org/RFP.asp); however, the sole responsibility for obtaining and learning of addenda belongs to the proposer. The City accepts no responsibility or liability and will provide no accommodation to proposers that fail to check for addenda and submit inadequate or incorrect responses.

2. Project Understanding and Proposed Product Description

The proposer shall provide a concise statement of its understanding of this project's objectives, constraints, and critical issues. Discuss any issues that the proposer believes to be particularly relevant in the implementation of its control system hardware and software, which includes HMI software and PLC/OIT hardware/software.

The proposer shall provide the product description of the proposed control system hardware/software to meet the technical specifications (Appendix A).

3. Business History and Technology Road Map

HMI Software and PLC/OIT Manufacturer(s)

The proposer shall provide an overview history of the proposed HMI software application, HMI software application manufacturer, PLC/OIT hardware/software, and PLC/OIT manufacturer. Identify the following within the overview:

- Business longevity, in years, of marketing and supporting HMI software and PLC/OIT hardware/software
- Historical evidence and plan for supporting the longevity of HMI/PLC/OIT technology
- Product manufacturer's end of life cycle general policy guidelines. Include:
    - How much notice is provided on the affected product's end-of-sale date and/or the last day when the affected product can be ordered in terms of months
    - Technical assistance availability in terms of hours per day, days per week, period of years from the end-of-sale date for hardware and operating system (OS) software
    - Spares or replacement parts for hardware availability in terms of period of years from the end-of-sale date
    - How software will be supported for bug fixes, maintenance releases, work arounds, or patches, and for how long in terms of years from the end-of-sale date
    - What the end-user needs to ensure support through the end-of-life transition period
    - How cyber security software and firmware updates and policy and procedures are documented, distributed, and recommended for maintaining a secure control system environment
- Compatibility of proposed HMI software with proposed PLC and OIT manufacturer; preference is for proposed HMI/PLC/OIT combination to be of the same manufacturer
- Yearly sales
- Number of installed water distribution and sewer collection systems within the United States
- Number of companies with certified support developers within the United States; provide reference information for a minimum of three companies

- Sales and support organization overview
- Critical third-party application development partnerships or alliances
- Additional end-user reference information as appropriate

SCADA System HMI Software and PLC/OIT Vendor(s)

The City understands that in most cases, SCADA system HMI software applications and PLC/OIT are marketed and supported by regional suppliers and distributors. The proposer shall provide a description of its business relationship with the manufacturer(s) of the SCADA system HMI software and the PLC/OIT it is proposing for use on this project.

The proposer shall provide a summary of its business history. Identify the following within the overview:

- Location
- Business longevity in years of marketing and supporting HMI system software
- Number of years marketing and supporting the proposed HMI system software and PLC/OIT
- Number of sales staff (if a staff person provides sales and support, count that person as half)
- Number and level of training/certification of software support staff capable of supporting the proposed SCADA system HMI software and PLC/OIT (if a staff person provides sales and support, count that person as half)

4. Proposed Training Program

SCADA System HMI Software

The proposer shall propose a baseline recommended training program to the City. This baseline recommended training should (at minimum) address general maintenance, administration, Historian client usage, reporting, and development training. Training should be broken into segments covering operator, developer, and support/administrative training. Minimum requirements include 4 days on site at City location, to support up to 14 attendees.

The proposer shall also describe the various types of training available to the City. This includes onsite training; virtual training programs; and local, regional, and national training programs. The City reserves the right to video record, obtain, and distribute all training materials from onsite training for the sole purpose of training additional staff members. Training materials will not be distributed outside of the City's organization.

PLC Hardware

The proposer shall propose a baseline recommended training program to the City. This baseline recommended training should (at minimum) address product components/hardware, and include:

- Power-up and power-down of hardware

- Description of status and trouble indication lights
- Definition and identification of fault and trouble codes
- Installation, removal, and replacement of components/hardware parts
- Certification that the component is properly networked and that the network is active
- 4 hours of classroom training to the City's personnel

PLC Software

The proposer shall propose a baseline recommended training program to the City. This baseline recommended training should include, at minimum:

- Opening, navigating, editing, saving, exporting, uploading, and downloading an application program
- Overview of the application programming on configuration of controller, configuration of communication, and the functions being implemented
- Viewing application program online and troubleshooting, editing hot and editing offline
- Computer requirements to run the development software
- How to implement the software patches provided by the manufacturer
- Where and how to get technical support
- 4 hours of classroom training to the City's personnel

Operator Interface Terminal

The proposer shall propose a baseline recommended training program to the City. This baseline recommended training should include, at minimum:

- Opening, navigating, editing, saving, exporting, uploading, and downloading an application program/graphics
- Use of each graphical interface display and the underlying control logic associated with each control and monitoring function, as well as the use of all system utilities
- Logging in, and setting user passwords
- Computer requirements to run the development software
- How to implement the software patches provided by the manufacturer
- 4 hours of classroom training to the City's personnel

5. Control System Hardware and Software Specifications

The proposer shall identify its products' ability to comply with the requirements and functionality as specified in technology specifications of this RFP. Specification response tables have been prepared for the proposer's use, and can be found in Appendix A. An electronic copy of these tables will be provided to proposers upon request.

The proposer shall prepare a written response in tabular form to the requirements listed in the Appendix A. The response shall give a "compliant," "exception," or "not compliant" answer for each specification numbered

paragraph and associated lettered sub-paragraph. A compliant answer can be made only if the proposed product can provide the specified function without the addition of external program applications, or internal programming or scripting. With the exception answer, provide a brief description (i.e., additional software package required, custom programming required, applications scripting required) to comply with the specification. If a specification requirement cannot be met by the proposed product, the proposer shall mark that item as not compliant.

The proposer shall also provide a written description of how the proposed software will be packaged and licensed to the City. Provide a network block diagram illustrating how the proposed system will function for the City.

The proposer shall include supporting technical information with the proposal, verifying the conformance with technical specifications contained herein, with respect to each item specified (Appendix A). This information shall be sufficiently detailed to allow thorough review and evaluation of the proposed software, and shall serve as one criterion for evaluation of the proposer's proposal. The supporting documents shall not exceed 20 pages. Failure to comply with this requirement may render the proposal non-responsive and subject to rejection.

6. Technical Support and Staffing

The proposer shall describe its ability to provide technical support of its control system hardware and software physically within 200 miles of the Mercer Island, Washington, area and/or remotely. The proposer shall complete the table per the descriptions defined below for each product: HMI, PLC, and OIT. If the support models vary for software or hardware products, include details that address the support of each product.

Parameter	Technical Support Name	Technical Support Location	Available Support Services	Technical Credentials and Qualifications	Hours of Operation	Maximum Response Time	Technical Support Agreement
1st Support Level							
2nd Support Level							
3rd Support Level							

Technical Support Name

Identify the distributor or manufacturer representative's name that will provide technical support services for each support level.

Technical Support Location

Provide the location of the technical support office.

Available Support Services

Provide a detailed description of the support services available at this location. This includes—but is not limited to—software installation, software configuration, software development, database, communication, training, and warranty support services.

Technical Credentials and Qualifications

Describe the resources available at this technical support location and their technical credentials and qualifications related to the proposed control system hardware and software. Describe their proposed roles, lines of communication, and authority. The technical support staff identified shall have a minimum of 2 years of product support experience for the proposed control system hardware and software.

Hours of Operation

Describe the hours of operation of this technical support location. Define how your technical support service will provide 24-hour per day response to technical support requests in the appropriate support level.

Maximum Response Time

Define the maximum response time to be expected after a service support request has been initiated.

Technical Support Agreement

Identify whether the technical support associated with each support level is included in the support agreement defined in technical specifications Table 1 (Appendix A).

7. System Installation References

The proposer shall identify a minimum of three water distribution and/or sewer collection SCADA system HMI/PLC/OIT installations that are successfully operating the proposed control system hardware and software. The preference is for the references to have the proposed HMI/PLC/OIT combination installed for a distributed control system with a redundant SCADA system HMI telemetered with several remote terminal units (RTUs) or remote PLCs for a public or private utility. These referenced facility SCADA systems should have the same level of complexity as intended for this project. Provide the following information with these references:

- Reference contact name and telephone number
- Number of system facilities (e.g., wells, pump stations, treatment plants, miles of pipeline, total daily production, and number of sites)
- History of installations (e.g., year installed, version)
- Number of configured data points in the SCADA database
- Description of the SCADA system HMI hardware architecture
- Number and type of PLCs
- Number and type of OITs

- Number of SCADA servers
- Number of HMI workstations
- Communications network configuration, including the number of remote telemetry sites
- Number of custom process graphic displays

Provide detailed additional client references, if desired. References will be deemed of value only to the extent that they address the performance and experience of one or more of the specific personnel proposed for this project.

8. Fee Proposal

In a separate sealed envelope, the proposer shall submit a fee for Schedules A, B, and C by the date shown under the selection schedule on page B-14. The separate sealed envelope shall include one hard-copy and one copy in digital format (Portable Document Format [PDF] or Word .doc) on a Universal Serial Bus (USB). All fee submittals will be subject to negotiation during final contract negotiations.

Cost of Ownership Fee. Each proposer shall complete Schedules A, B, and C in the proposal schedules section, a detailed list for the system, ***and its associated unit costs*** including all software; licenses; drivers; options; etc. to meet the requirements defined in technical specifications and the Network Block Diagram (Appendix A).

If the proposer is proposing costs that change from one year to the next because of inflation or other factors, the proposer shall enter the annual inflation factor as a percentage (e.g., 3 percent). The price shall be valid for 5 years with a maximum escalation of 3 percent.

Note that the proposed costs refer to the cost to the City for each item listed.

Hardware shall not be included in pricing from the HMI software vendors. The proposer shall take into consideration the labor, material, rental, and any associated cost to perform any unit of work.

Provide a rate schedule and material list of available items that may benefit the City's overall control system replacement project to facilitate its future needs.

All necessary training materials including computers and software shall be supplied by the vendor for each training exercise and included in the cost. Should any training require travel, include all costs for travel, lodging, and meals for each attendee.

PROPOSAL EVALUATION

The City's choice of control system hardware and software will be made by a team of individuals evaluating the proposals, hereby referred to as the City's Selection Advisory Committee. The criteria that will be used for evaluating the proposals are described in detail above. The relative importance of the evaluation criteria that will be applied during the proposal review process is shown below. Each proposal will be evaluated on the following point-weighted scoring system.

Selection Criterion	Maximum Points
Project understanding, business history, and technology road map	15
HMI system software specifications	50
PLC/OIT system software/hardware specifications	35
Technical support and training, system installation references	30
Life-cycle cost/support cost: first 10-year period (Tables A-1, A-2, and C-1)	40
Cost: training and service support options (Tables B-1, B-2, and C-2)	10
Responses to security questions	20
MAXIMUM TOTAL POINTS POSSIBLE	200

Each criterion will be rated on a scale between zero and its maximum points, where zero indicates that no information was given in the proposal, and 1 is the lowest score based on available information, up to the maximum points identified for that criterion. All proposals will be evaluated based on the criteria found above.

The highest score for both cost criteria will be points awarded to the proposer that submits a responsive proposal with the lowest costs for each section. The cost and life-cycle cost criteria scores for proposers will be prorated in relation to the lowest proposer's costs (e.g., if a cost is 10 percent higher than the lowest cost, a score of 10 percent less than the points available will be awarded; if a cost is 20 percent higher than the lowest cost, a score of 20 percent less than the available points will be awarded, etc.). The life-cycle cost will be determined by calculating recurring costs discounted using net present value (NPV).

INSTRUCTIONS TO PROPOSERS

SELECTION METHOD: Award of a contract will be done in accordance with the City's procurement policy.

If a contract is awarded, it shall be awarded to the responsive and responsible proposer whose offer conforms to the RFP and will be most advantageous to the City as set forth in the evaluation criteria presented above. Award of this contract will not be based on price alone. Factors that will affect the final cost to, and the benefits to be derived by, the City will be considered using the criteria in both stages. The City Selection Advisory Committee's decision as to which supplier best meets the City's needs will be final.

The City reserves the right to analyze, examine, and interpret any offer for a period of 120 days after the hour and date specified for the receipt of offers. The City, in evaluating proposals, reserves the right to use any assistance deemed advisable, including City contractors and consultants.

The City requires the system to function for at least 10 years after installation, thus the recurring annual costs must be understood. Annual costs shall include: annual license renewal costs, any annual technical support agreements as defined in the technical specifications, and any other expected costs associated with normal system operation for a 10-year period (Appendix A).

SELECTION SCHEDULE. The following schedule will be used for selection of the control system hardware and software vendor, subject to City modification:

November 21:	Advertise RFP
November 28:	Pre-proposal meeting
December 4:	Questions due
December 8:	Responses to questions
December 15:	Proposals due
January 3–5:	Interviews
January 12:	Selection of proposal on or about this date

*Note that the City reserves the right to adjust this schedule at its sole discretion.

Disclaimer. The City is not responsible for any costs associated with the preparation and submission of proposals, including any costs by the proposer or its agents incurred as part of any requested HMI software demonstration(s), HMI and PLC/OIT vendor presentation(s), and contract negotiation process.

Non-responsive Submittal. Attempts to circumvent the process by submitting qualification/technical information in the fee proposal shall cause the proposal to be considered non-responsive, and may cause it to be excluded from the review process.

An award of contract will be made to a responsive and responsible proposer(s) whose proposal(s) comply with all the requirements prescribed, or with such changes negotiated and approved by the City.

PROPOSAL FORM

PROPOSAL TO: CITY OF MERCER ISLAND

The undersigned proposer hereby proposes to furnish all labor, services, material, equipment, tools, supplies, utilities, and all other items and facilities necessary to perform all work required under technical specifications (Appendix A) and the proposal schedules of the City's proposal documents titled: *WATER AND SEWER CONTROL SYSTEM - HARDWARE/SOFTWARE* in accordance with the intent of the proposal documents, including the specifications and all addenda issued by said City prior to opening of the proposals.

The undersigned proposer acknowledges receipt of the following addenda:

Number	Date Received

DELIVERY TIME. If an award of contract is made, the City desires the work to be complete 90 days after the contract award and notice to proceed. Proposers should outline their proposed schedules in their proposals. This includes—but is not limited to—software delivery, support agreements, and training schedules.

Alternate delivery schedules, if offered, should be clearly noted in the proposal.

PROPOSAL CONDITIONS. The proposed price shall cover all products specified in this RFP, and shall be valid for a period of 365 days. The City reserves the right to award any/all of the proposal schedules singly or in combination. The City reserves the right to negotiate with the preferred proposer for modifications in scope.

NOTICE OF AWARD

To:

Re: WATER AND SEWER CONTROL SYSTEM - HARDWARE/SOFTWARE

You are hereby notified that the City has accepted your proposal for the above referenced project in the amount of $_____.

Furnish the required WATER AND SEWER CONTROL SYSTEM – HARDWARE/SOFTWARE vendor, performance bond, payment bond, and certificates of insurance within 10 calendar days from the date of this notice to you. An acknowledged copy of this notice of award, together with all future correspondence regarding this project, shall be sent to the City's project manager: Brian McDaniel.

When the agreement is provided, sign and return it within 10 calendar days from receipt of the agreement.

Dated this day of _____, 2018.

_____
Brian McDaniel
City of Mercer Island, Utilities Operations Manager

ACCEPTANCE OF NOTICE

Receipt of the above notice of award is hereby acknowledged by:

_____

This day of _____, 2018.

Signature:_____

Printed Name:_____

Title: _____

PROPOSAL CHECKLIST

The submittal package shall include the following pages:

- **Cover sheet (General Information Form)**
- **The narrative not exceeding 15 single-sided pages responding to evaluation criteria 2 through 4 outlined in Stage 1 proposal format.**
- **Technical specification response Tables 1, 2, 3, and 4 in Appendix A**
- **Proposed network block diagram**
- **Technical support and staffing table**
- **System installation references**
- **Example contract and amendment**
- **Acknowledgment of addenda**
- **Proposal form(s)**

Fee Proposal

- **Schedule A**
- **Schedule B**
- **Schedule C**

During this RFP process, questions may be raised by potential proposers that justify written clarification. If this occurs, formal addenda to the RFP will be distributed to all registered RFP recipients. Each proposer will then be required to provide, as an attachment to the proposal, a written acknowledgment of receipt of the addenda.

PROPOSAL SCHEDULES

SCHEDULE A

Table A-1: SCADA HMI Software Licenses

System Licenses	Minimum Requirement	Quantity	Unit	Unit Price	Total Price
Redundant servers	1	1	Pair	$ -	$ -
Device tags	10,000	1	Lot	$ -	$ -
Displays	100	1	Lot	$ -	$ -
Historian tags	5,000	1	Lot	$ -	$ -
View-only licenses	View	2	Each	$ -	$ -
Concurrent thin client HMI nodes	With data analysis tools	5	User	$ -	$ -
Concurrent thick client HMI nodes	With data analysis tools	2	Device	$ -	$ -
Alarm notification licenses	1 redundant with cellular modems and unlimited alarms	1	Pair	$ -	$ -
Concurrent development	License to support 1 developer	1	Lot	$ -	$ -
					$ -

Table A-2: HMI Software Support Cost Options

Support Description	Minimum Requirement	Quantity	Unit	Unit Price	Total Price
1-year technical support	24-hour, 365-day support, software patches and upgrades	1	Lump sum	$ -	$ -
5-year technical support	24-hour, 365-day support, software patches and upgrades	1	Lump sum	$ -	$ -
10-year technical support	24-hour, 365-day support, software patches and upgrades	1	Lump sum	$ -	$ -
5-year technical support	Standard business hours (9:00 a.m.–5:00 p.m. PST) support, software patches and upgrades	1	Lump sum	$ -	$ -
					$ -

Subtotal	$ -
Delivery charges	$ -
Grand total	$ -

PROPOSAL SCHEDULES

SCHEDULE B

Table B-1: Training Costs

One-time Costs	Minimum Requirement	Quantity	Unit	Unit Price	Total Price
HMI training	Minimum 4 days, on site, up to 14 attendees	1	Session	$ -	$ -
PLC training	Minimum 1 day, on site, up to 14 attendees	1	Session	$ -	$ -
OIT training	Minimum 0.5 day, on site, up to 14 attendees	1	Session	$ -	$ -
					$ -

Table B-2: Support Services Options

Support Description	Minimum Requirement	Quantity	Unit	Unit Price	Total Price
Network administration	Onsite support, excluding travel costs	1	Daily rate	$ -	$ -
Integration assistance	Onsite support, excluding travel costs	1	Daily rate	$ -	$ -
Training	Onsite support, excluding travel costs	1	Daily rate	$ -	$ -

PROPOSAL SCHEDULES

SCHEDULE C

Table C-1: PLC/OIT Hardware

One-time Costs	Minimum Requirement	Quantity	Unit	Unit Price	Total Price
OITs	Minimum 10-inch display, panel-mounted with OIT software and a minimum of 500 device tags	20	Each	$ -	$ -
PLCs	Appendix A: Technical Specifications	24	Each	$ -	$ -

Table C-2: Hardware Support Cost Options

Support Description	Minimum Requirement	Quantity	Unit	Unit Price	Total Price
1-year hardware technical support	24-hour, 365-day support, software patches and upgrades	1	Lump sum	$ -	$ -
5-year hardware technical support	24-hour, 365-day support, software patches and upgrades	1	Lump sum	$ -	$ -
10-year hardware technical support	24-hour, 365-day support, software patches and upgrades	1	Lump sum	$ -	$ -
5-year hardware technical support	Standard business hours (9:00 a.m.–5:00 p.m. PST) support, software patches and upgrades	1	Lump sum	$ -	$ -

APPENDIX A

TECHNICAL SPECIFICATIONS

PROJECT BACKGROUND

The City of Mercer Island (City) water system comprises two storage reservoirs, an emergency groundwater well, two booster pump stations, and pressure-reducing valves (PRVs) throughout the distribution system. The City receives its potable water supply from Seattle Public Utilities (SPU) through a metering connection and control valve on the northeastern side of the city. The sewer collection system comprises 17 pump stations that flow to King County for treatment.

The City has a variety of supervisory control and data acquisition (SCADA) and telemetry equipment varying in age and condition that is used to monitor and control the City's water and sewer system components. The sewer telemetry system remotely monitors the sewer pump stations and utilizes a General Electric (GE) CIMPLICITY system with Schneider Electric controllers. The water utility SCADA system is a WinCC system with primarily Siemens controllers. Currently, the SCADA and telemetry systems operate independently, and neither system is meeting the City's needs.

The City has a main site with two master controllers that communicate via leased circuits and fiber on the water side, and leased circuits and cellular on the sewer side. There are 5 remote water sites (e.g., main inlet control valve, pump station, reservoirs, and 2 pressure monitoring stations) and 17 sewer pump stations that communicate with the system via remote telemetry. The City's facilities are located throughout the City of Mercer Island, including approximately 1,000 physical input/output (I/O) points and two workstation computers.

To expand the functionality and reliability of the existing system, the City has determined that it will replace the current SCADA and telemetry system. The new system will be a unified control system with standard hardware and software throughout the city. Two redundant control centers will communicate to remote sites over primarily cellular communications. Building on the foundation of the new control system, the City's vision includes leveraging the benefits of a smart utility in the future.

SCOPE OF WORK

The proposer shall demonstrate that their company is able to provide the City with a SCADA system human-machine interface (HMI) software package and programmable logic controller (PLC)/operator interface terminal (OIT) hardware and software package with the technology and services needed to implement the City's current SCADA system HMI software, and meet the City's SCADA upgrade project goals and needs. The master planning document is currently in development, and will not be available at the time of this request for proposals (RFP) being released. The goals and requirements resulting from the SCADA Master Plan project will be reviewed during the pre-proposal meeting.

The intent of this RFP is two-fold. First, it is for the City to determine which available control system technologies are in line with its SCADA Master Plan project goals for

system redundancy, security, and reliability; and have the capability to provide a high level of functionality in controlling and monitoring the City's water distribution and sewer collection systems. Second, it is to provide the City with information to evaluate each proposal based on specific criteria including costs, which will allow the City to establish a contract with a selected control system vendor for the purchase of HMI/PLC/OIT technology and associated services.

Qualified vendors must have the capability to:

1. **Supply control system software: HMI, PLC, and OIT**
   The vendor shall be able to provide all the required software applications and licenses to the City, to provide the specified control system software functionalities that are in line with its project goals.

2. **Supply control system hardware: PLC and OIT**
   The vendor shall be able to provide the required hardware to the City, to provide the specified PLC and OIT functionalities that are in line with its project goals.

3. **Provide control system training**
   The vendor shall provide a comprehensive training program for City staff on the design, operation, configuration, and maintenance of both the software and hardware. The training will include instruction on all system configuration functions and procedures.

   The vendor shall prepare training materials that describe (through text and illustrations) all the system software and hardware functions. All training materials shall be provided to the City in electronic and hard copy format. Training shall be conducted at the City's facilities, or the vendor shall include the cost of travel expenses—including meals—for each attendee.

4. **Provide software and hardware maintenance and technical support**
   The vendor shall provide ongoing maintenance support for the software and hardware specified. At a minimum, the vendor shall provide a subscription to a comprehensive support and upgrade service for a minimum of 5 years with the option to purchase an additional 5 years of support (for a total of 10 years). This service will provide 24-hour per day, 7-day per week system support, and all software upgrades as they are released.

APPENDIX A

The proposer shall indicate how its software and hardware package meets the following technology specifications by completing Tables 1, 2, and 3 attached in Appendix A of this RFP, following the directions for completing the table.

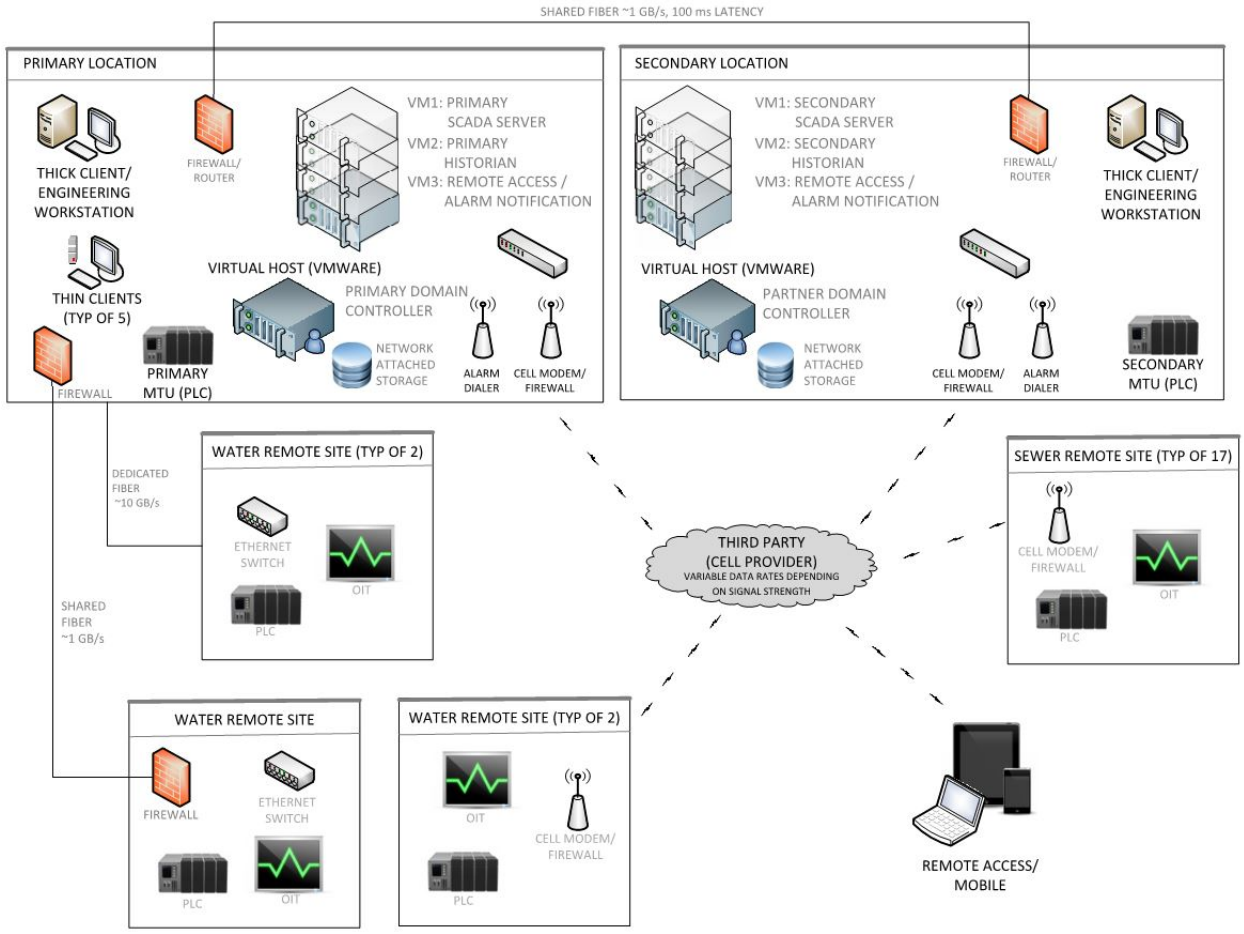
1.0 Project Overview

The project goal is to select a control system hardware and software package for the City. It is intended for the future control system to comprise remote sites for sewer pump stations and water distribution with master and slave PLCs and OITs for standalone automation being telemetered to HMI workstations to form an integrated SCADA system and smart utility system.

1.1 System Architecture

Figure 1 presents the conceptual architecture of the future SCADA system, including an operations center with a backup in a separate physical location. The vendor shall include with their proposal an equivalent document specific to their SCADA system and any recommendations for specific software, communication architecture, and specifics on the OS.

Figure 1. Basic system block diagram



1.2 General SCADA HMI Software Requirements

The SCADA software shall consist of an HMI system with support for a supervisory and process control real-time data acquisition alarm, and event management historical data collection report generation local or remote telemetry communications to PLCs and/or remote terminal units (RTUs) Internet/Intranet access and change control. The software shall be easy to use with an object-oriented graphics development environment, and shall have an open architecture. The software shall be compatible with Windows Desktop and multiple mobile OSs. The system shall have the built-in flexibility to permit easy configuration in accordance with specific end-user requirements, as well as quick and easy modification by the end user in the field.

The software shall consist of a suite of off-the-shelf modular components from a single software manufacturer that are tightly integrated together to perform all SCADA system functions. The suite shall contain an HMI for process visualization, real-time relational database for historical data collection, client tools for trending and reporting within the HMI and as standalone, and communication drivers for PLC/RTUs. The suite shall be scalable so that a small standalone application can easily be expanded into a large distributed control network with either single or redundant database servers, or redundant communication servers providing information to multiple workstation clients.

1.2.1 Platform Independent Scripting Support
The SCADA software shall offer extensibility by providing integrated support for object linking and embedding (OLE) and object linking and embedding controls (OCXs) technology. The SCADA software shall be a platform independent scripting tools container that supports methods, properties, and events of platform independent scripting tools objects. The support of platform independent scripting tools technology shall provide application developers with immediate access to hundreds of OCXs developed by dozens of independent software developers. Registering an OCX for use within an application system shall be an automatic process. Registered OCXs shall be displayed in a dialog box for adding/removing OCXs to/from the application. OCXs added to the application shall be contained within a dialog box to be quickly added to new and/or existing applications. At design time, the user is focused on selecting an OCX for placement mapping OCX properties, events, and methods to tag names and writing logic to control OCX behavior via OCX properties and methods.

1.2.2 Platform Independent Scripting Tools
The data analysis software shall provide platform independent scripting objects for the trend and query clients so that they may be imbedded into SCADA HMI, or any other platform independent scripting container. A

query client shall be included to allow the user to execute Structured Query Language (SQL) queries that return a result set from any SQL server database into a tabular data grid. The query platform independent scripting tool shall support multiple data server sources for simultaneous data display.

1.2.3 Alarm Management and Notification

Alarms shall be detected and reported by an alarm manager service. The alarm manager service shall support no less than 200 simultaneous alarm client displays. In the event of an alarm storm (i.e., hundreds or thousands of alarms detected within 1 second) the alarm manager service shall report, and the client shall display up to 1,000 new alarms within 10 seconds of detection.

The system shall be able to alarm system resources (central processing unit [CPU] utilization memory etc.).

Alarms shall be logged to a Microsoft SQL server or Microsoft database engine (MSDE). Alarm events to be recorded shall include alarm instantiation, alarm return-of-normal, and alarm acknowledgment. Items to be logged in addition to the alarm event shall include date and time of the alarm event, alarm group, alarm description, alarm data type (e.g., real/integer/Boolean), alarm type (e.g., lo-lo, lo-hi, hi-hi, receiver operating characteristic [ROC] deviation disc, etc.), operator name, and operator node of alarm acknowledgement and alarm priority.

An alarm purge service shall be provided to automatically purge and optionally archive alarms that are older than a user-defined period of days online.

Alarms may be printed to a locally connected or network printer. The alarms printed from a node may be filtered to all alarms, unacknowledged alarms only, acknowledged alarms only, alarms from a particular alarm group, group alarms from a particular priority, or alarms from multiple alarm providers. Also, would like to have the ability to filter alarms by dates and affected PLC.

It shall notify of operations and maintenance personal using alarm dialing (text-to-speech and pre-recorded messages), text, and email notification (either in software or third-party software to be included in purchase price), based upon areas and priorities. It shall also be able to notify operations based upon text-to-speech software with redundancy that matches the overall SCADA system software.

1.2.4 Alarm Management Functions

The operator shall be able to view current and historical alarm information from a full screen alarm summary display, or on a small scrolling region and the bottom of any display. The alarm information shall be displayed in chronological order with the most recent alarm at the top. The information capable of being displayed for each alarm shall include the time and date description, tag name, alarm state, alarm type (e.g., lo, lo-lo, hi, hi-hi, rate-of-change, etc.) value, acknowledging operator, acknowledging node, priority-level alarm, or process area group name and class.
It shall be possible for the operator to filter the alarm display based on priority-level alarm groups or process areas. In distributed network systems, alarms shall be viewed and acknowledged from any workstation, and the information shall be distributed to all clients. The alarm summary will be able to display the name of the operator and the node acknowledging the alarm.

It shall be possible to configure the system such that the operator is notified of an alarm no matter which display the operator is currently viewing. The notification shall include the option of a pop-up alarm display window, a flashing process symbol such as a process vessel, an alarm text message that is available on each display, or a dedicated alarm display window anywhere on the screen. A configurable audible signal shall be provided.

The alarm summary display shall provide the built-in horizontal and vertical scroll bars to page through alarms. The display of these scroll bars shall be user-configurable.

The alarm summary display shall allow for dynamic resizing of the column widths by simply selecting a column line and dragging it to set the column width.

The alarm display shall support up to eight different combinations of colors based on the priority of the alarm and whether it is acknowledged or unacknowledged. The colors shall be user-selectable via configuration from 256 colors.

The system shall provide a method of notifying the user when a new alarm has occurred. The alarm display object shall automatically scroll to a new alarm when the user has scrolled down the alarm list from the top.
The alarm display shall retrieve alarm information by submitting an alarm query to the alarm server. The alarm query shall allow specification of a priority range alarm, acknowledge state alarm group, alarm history, or summary. Combinations of the parameters can be specified for the query to produce selected results.

The operator shall be able to create new alarm queries at runtime and save the queries for reuse.

The operator shall be able to select and acknowledge alarms individually by group or remote site. The operator shall also be able to acknowledge only those alarms visible in the display, only those selected, only the most recent alarm, or all alarms in the system. The alarm display shall allow alarms to be selected by clicking on them with the mouse at runtime. The operator shall be able to suppress alarms on the local display. Suppressing alarms on one operator interface shall not affect the display of alarms on another operator interface. Un-suppressing previously suppressed alarms shall be via simple mouse click.

The operator shall be able to select an alarm from the alarm summary display, and the system shall switch to the corresponding screen of the section of the control system where the alarm originated.

It shall be possible to inform the operator of an alarm condition via an audible tone, pop-up display, or any combination of animation types on the screen.

1.2.5 Alarm Redundancy

The system shall provide (for alarm handling) standby application objects that become active upon failure of execution of active objects or failure to communicate with the active objects. Separate configuration of alarms in standby objects is not required. As with application, redundancy objects are allocated to a primary manager object that—in turn—ensures that contained standby objects are created and deployed as standby for alarm handling.

1.2.6 Alarm Summary/Alarm History Object

Alarms shall be displayed by configuring a user-defined alarm summary object that may be placed by itself or along with other objects in a window. The object can be sized and then double-clicked to launch a configuration dialog.

Default alarm object configurations shall be displayed with the option to change any configuration parameter for runtime viewing.

The alarm configuration shall include parameters with check boxes to select and enable/disable how the alarms appear at runtime.

Alarms shall be color-coded per the state and priority of the alarm, including an acknowledged alarm, unacknowledged alarm, and an alarm that has returned to normal—but is not yet acknowledged.

The user shall be able to choose from 256 different colors to display each of these alarm states. The alarm display object shall also support event display, with the color used for events also being one of the 256 different colors.

1.2.7 Application Log Files

Application log files shall reside on the local hard drive for a user-defined number of days. Each network node shall maintain an independent log file for the applications that are unique to each node. A new log file will be created and archived daily per the user-specified time and location. The viewer shall support color distinctions for different threads, processes, or programs. The log file viewer shall support viewing remote node application log files.

1.2.8 Application Redundancy/SCADA System Failover

The SCADA system software shall provide redundancy for all functions within a normal SCADA controls environment. The specific components that require redundancy within the SCADA system are (1) application object/application object hosting PLC/RTU communications alarm logging, (2) reporting (i.e., remote notification), and (3) logging historical process data. In redundant configuration, there shall be a primary and backup system object that manages contained primary and backup objects. The system shall execute and synchronize active objects with standby objects. In the event of detection of any failure in active object execution or communication with the active object, standby objects shall begin executing and communicating within the system. This redundancy must support offsite backup.

Configuration of application redundancy shall be configured through a graphical user interface that does not require any scripting.

1.2.9 Audit Trail

The development environment shall provide an audit trail of check out/check in and revision history for each template or application object that includes a user identifier (ID), time and date stamp, and a detailed summary of the changes made.

Any runtime changes to a configured variable shall provide an audit trail of user ID, full user name, previous value, and new value. Attributes configured for verification shall provide an audit trail of user ID, full user name, verifier username, full user name, previous value, and new value.

1.2.10 Communications Architecture

The runtime environment shall be based on distributed peer-to-peer system architecture. It shall be possible to scale the architecture from a single self-contained node to more than 50 nodes. The architecture shall

contain a multi-computer model that is a single distributed namespace in the runtime environment, and does not require replication of data from one node to another.

Application objects and their attributes shall be accessible by the objects' hierarchical names or globally unique tag names.

The architecture shall allow for remote redeployment of application objects and associated programs without reloading software.

The architecture shall allow centralized administration and control of the runtime state of the distributed system.

The architecture shall operate in real time and be able to handle millisecond transaction and event speeds.

The architecture shall be able to monitor and respond to high volumes of asynchronous data and event messages at a rate of thousands of messages per second. It shall be able to support a minimum of 5,000 I/Os and 50 nodes.

Application objects shall have the ability to connect to any I/O server utilizing the Dynamic Data Exchange (DDE), DDE-Net, and Open Platform Communications (OPC) protocols. I/O shall be defined as any input and/or output variable including individual data acquisition points and any variable parameter generated for exchange between objects in the system. At a minimum, the data types supported shall be Boolean float string, internationalized string integer (e.g., 8-, 16-, and 32-bit signed and unsigned), time, and elapsed time.

1.2.11 Communications Redundancy

The SCADA system shall monitor the status of communications to the communications server(s), and the status of the communication server to each PLC/RTU. In the event of a communications failure, the SCADA system shall transfer communications responsibility to a designated standby communications server.

1.2.12 Conditional Control and Data Change Logic

The system shall support configuration of objects that perform application control based upon a user-definable state of an object and attribute, or the result of an expression involving multiple object tag names/hierarchical names. This includes discrete object tag names/hierarchical names, on/off state alarm states (e.g., lo, lo-lo, hi, hi-hi), or equivalence to a specific value. It shall be possible to define condition logic scripts that execute once when the condition expression becomes true, once when the condition expression becomes false or while the condition is true, while

the condition is false at a user-definable rate of 500 milliseconds minimum, or when the value changes.

1.2.13 Data Compression

The database shall support high-speed data acquisition and efficient data compression. Data compression for the historical data collector shall not use any algorithms that do not allow for storage of the tag data at their scanned rates. The stored data records shall be able to recreate the process data in a loss-less format.

The historical data collector shall store string or text data. Each string may be up to 512 characters long. With each string value stored, a quality field shall be stored as well.

1.2.14 Database Summary System

The historical data collector shall provide user-configurable data summary tables for any analog tag name, and will automate the collection of aggregate historical information based on a declared event. The summary system shall support minimum, maximum, average, and summed calculation types for minute; hourly; daily; weekly; and monthly frequencies. The summary system shall store the tag name value type of calculation and frequency as defined for each tag name.

1.2.15 Defined Failure Events

The SCADA system shall detect the following events within the SCADA system and network objects:

- Communications failure to a single RTU/PLC
- Communications failure to multiple RTU/PLC(s)
- Communications failure to communications server
- Application logic failure
- Alarm printer failure (e.g., offline, out of paper)
- Alarm manager failure
- Historical data collector rate of collection deviation
- Low disk space on any historical data collector on the network

The SCADA system shall detect any or all the possible failures and allow client data recovery without operator intervention.

1.2.16 Development Environment Views

The development environment shall have the ability to view and configure the application from a plant model perspective.

The development environment shall have the ability to view and configure the application from an application object deployment perspective.

1.2.17 Disk Storage Management

The historical data collector shall not require specialized tools for disk storage management. It shall be possible to automatically archive (i.e., back up) and retrieve historical data files using standard Windows copy techniques. It shall be possible to retrieve select portions of archived data without retrieving all archived data. Retrieval of the archive data shall automatically place this data online and available for retrieval by the historical data collector.

Additionally, the historical data collector shall approach zero administration as nearly as possible. The historical data collector shall provide for a mechanism whereby current files on a disk drive that is nearly full will automatically be moved to a secondary device. The files and available space on the secondary drive shall be monitored as well, such that when a user-defined threshold is reached, the oldest files may be automatically deleted to preserve the integrity of the system. Historical files shall never be deleted from the primary storage device if an appropriate secondary device is configured.

1.2.18 Display Navigation

Operators shall interface to all process and SCADA activities through easily recognized pull-down or full-screen menus.

The system runtime software shall support operator access to multiple displays at one time, including split screens where the operator may view more than one process area at a time. In addition, the system shall support unlimited use of pop-up displays for additional help or diagnostic information.

The system runtime software shall support multiple monitors using commercially available multiple monitor graphics adaptor cards.
The operator shall have access to context-sensitive online help or instructions from any display at any time during operation of the system with a single keystroke or mouse click.

The operator shall be able to access displays via a pointing device and/or soft key menus with a choice of function keys, cursor control keys, or any single key on the keyboard. Display navigation shall not normally require the use of typing text commands into an alphanumeric keyboard. Supported pointing devices shall include a mouse, touch screen, light pen, or trackball.

The operator shall be able to easily identify which objects are selectable from any display by simply dragging the pointing device over the object. Displaying a halo around the object shall provide confirmation that an

object can be selected. Typical objects include process device symbols, (e.g., pump motors etc.) controller faceplates, buttons, switches, or sliders.

1.2.19 Dynamic Configuration and Bumpless Data Initialization

The historical data collector shall automatically begin acquiring tag data immediately after a tag configuration has been committed to the database. Adding a single, or multiple tags to an existing historical data collector database shall not affect the data acquisition of previously defined tag names. Client connections will not be affected during reconfiguration due to dynamic configuration. Additionally, there will be no loss of data for tags where data acquisition configuration is not changed. Tags that require a change in data acquisition configuration will lose data during the period of re-initialization.

1.2.20 Event Action

The historical data collector event detectors shall determine that an event has occurred, and trigger an associated action. Event detectors shall scan for events at the user-defined rate for each event. The user shall be able to select from any one of four actions when an event is detected. Event actions shall include: (1) execution of an SQL statement to perform an SQL query on the database, (2) taking a snapshot and recording the time stamp and values of one or more selected analog or discrete tags, (3) sending a Microsoft Exchange or Simple Mail Transfer Protocol (SMTP) email message to designated recipients, and (4) change the cyclic time and/or value delta storage rate for one or more analog tag names. The ability to modify the storage rate based on an event allows for fast logging of data to gather more valuable process data to assist in troubleshooting.

1.2.21 Event Configuration

Using a point-and-click approach, the system shall allow users to create/define event tag names and associate event tag names to event detectors and the resulting actions. The user shall be able to insert a time delay in milliseconds before the event action is triggered, and establish the priority of the event as normal or critical. It shall be possible to detect an event based on a scheduled time interval; a specific analog value crossing a threshold; or a discrete value from 0 to 1 (leading edge), 1 to 0 (trailing edge), or both. An event editor shall be provided to support complex SQL event detectors and event actions.

1.2.22 Event System Configuration

The historical data collector shall contain an event sub-system to monitor, record, and/or respond to process or system events, and to trigger some type of action when the event is detected. The event system shall detect an event occurrence using predefined and configurable criteria, historically log when an event occurs, and trigger designated configurable event actions based on the event detection. Event attributes shall be logged to

the database, will include the date and time that the event occurred, and will include the event criteria that were satisfied.

1.2.23 Warranty, Software Maintenance, and Technical Support

The software warranty shall begin when it has been installed and is in productive use. After the end of the warranty period, the user may continue to receive technical support via phone, email, or the technical support website. To ensure that the user always has access to the latest software releases, long-term warranty, and technical support, the vendor shall offer an extended support program for a fixed annual fee that entitles the user to receive software upgrades; priority telephone support; electronic support; electronic file download; newsletter; and tech support compact disc (CD).

The extended support program shall entitle the user to receive the latest SCADA system software releases and version upgrades as they become available. To ensure quality support for all users, all software licenses at the site must be maintained at the same version level.

1.2.24 Full Function Operator Workstation (HMI)

The SCADA system operator shall be able to execute all monitoring and supervisory control functions from the full-function operator workstation. Typical operator commands include modifying set points for control loops, alarm acknowledgment, set point adjustment auto/manual switching, on/off control of field devices, and taking points or devices on/off scan. The operator shall be able to access all SCADA tag name/hierarchical names or graphic displays from any workstation on the network without knowing which historical data collector or server the point or display resides on. The system software shall include an object-oriented color graphics display generator with full animation capabilities to provide users with a realistic visualization of the system process. All graphical editing operations shall be point-and-click—selecting icons from floating and docking toolbar pull-down menus or keyboard commands. It shall be possible to perform a functional test of any graphic display by switching to the runtime mode with a single mouse click. The graphics editor shall include a broad library of complex objects and process symbols, such as meters, pushbuttons, sliders, gauges, pumps, motors, tanks, valves, trends, alarms, and controller faceplates. All complex objects shall be scalable to any size, and may include animation links to provide dynamic response based on real-time data or user action.

The software shall be licensed to support any of the following OSs on appropriate hardware in any combination, as follows:

- Server workstation or desktop personal computer (PC) running Windows 10 (32 bit and 64 bit) or Windows 2016 server (32 bit and 64 bit) OS.
- Remote desktop services with diskless PCs running sessions served by Windows 2016 Remote Desktop Services.

1.2.25 General Purpose I/O Communications Server

General-purpose communication I/O servers shall be available for support of the current controllers in use, as well as Modbus RTU serial and Modbus Transmission Control Protocol (TCP) Ethernet. The PLC communication servers shall support interfaces via a direct serial local control network such as Data Highway Plus (DH+) and Modbus Plus, or via TCP/Internet Protocol (IP) Ethernet. There shall be support for several hundred various devices utilizing OPC protocol. An I/O server toolkit shall be available for third parties to develop custom I/O servers.

1.2.26 Graphical Objects

The graphics editor shall include a set of basic drawing tools to create simple or complex objects. Selecting an icon on the drawing toolbar shall easily create simple objects, which include lines, rectangles, polygons, ellipses, circles, and filled shapes or text. Any of these objects can be assigned various attributes, such as line color, fill color, size, and orientation, and can be made static or dynamic. Text objects shall be scalable and use true fonts in bold, italic, or underline. All objects shall be scalable and moved in any direction one pixel at a time, or dragged with a mouse.

The graphics editor shall support standard object manipulation functions, such as cut, copy, paste, and delete. Alignment tools shall be included to simplify proper object placement and arrangement. Align commands shall be included to align objects based on justification to the left, right, center, top, or bottom. Object commands shall also be included to space vertically and horizontally, move to back, move to front, rotate, or group and ungroup.

The graphics editor shall include a broad library of complex objects and process symbols, such as meters, pushbuttons, sliders, gauges, pumps, motors, tanks, valves, trends, alarms, controller faceplates, and bitmaps. All complex objects shall be scalable to any size, and may include animation links to provide dynamic responses based on real-time data or user action.

1.2.27 Graphics Display Development

The SCADA system software shall include an object-oriented color graphics display generator with full animation capabilities to provide users with a realistic visualization of the SCADA system process. All graphical

editing operations shall be point-and-click, selecting icons from floating and docking tool bars, pull-down menus, or keyboard commands. The development environment shall be able to run in a Remote Desktop Services session. The display editor shall include the following tools for display, drawing, linking, and animation.

1.2.28 Historical Data Acquisition and Retrieval

The historical data collector shall acquire data via automatic and manual methods. Automatic data acquisition shall be through industry-standard data transports. Data acquisition via DDE and OLE for process control (OPC) in addition to proprietary transports shall be supported. The method for retrieving data shall be SQL. It shall be possible to store data at one resolution, and query at another. Methods shall exist to query and retrieve data cyclically with millisecond resolution, no matter the storage mode. It shall be possible to query and retrieve data in delta with user-selected deadband criteria and millisecond resolution, no matter the storage mode. It shall be possible to query and retrieve evenly spaced data over long periods when the criterion is a row count, no matter the storage mode.

1.2.29 Historical Data Collection

Historical collection of data from SCADA objects shall be entered once at the time of configuration of those objects using the corresponding object editor in the SCADA system. The historical data collector shall automatically acquire the configuration parameters upon deployment of the configured application objects.

The SCADA system software shall provide a real-time relational database for long-term process data storage. The historical data collector shall store real-time and historical data for each analog, discrete, or string tag name. The historical data collector shall also store summary event alarm and configuration data. The database engine for the collector shall be based on a full licensed copy of Microsoft SQL Server, and support client/server architecture. The user shall not be required to know Microsoft SQL Server to install and implement the historical data collector. The historical data collector database shall acquire and store process data at full resolution. The historical data collector database shall include normalized extension tables for real-time data, and include a set of client tools for data analysis and reporting, such as those described in earlier sections. The historical data collector shall be able to run in a standalone mode without connection to, or configuration from, the SCADA system.

While there are always physical limiting factors such as disk space, there shall be no programmatic limit to the amount of data stored online. Additionally, there shall be no performance penalty for long-term data storage. There shall be no discernible difference in data retrieval speed

based on its age. For example, the retrieval of 2 hours of data stored 2 years prior shall be the same as 2 hours of data stored 1 day ago.

1.2.30 Historical Data Collector Interface to Other Relational Databases

The historical data collector shall utilize Microsoft's Data Transformation Services to simplify the transfer of historical process data with other SQL server databases like Microsoft SQL Server or Oracle. The historical data collector database shall include an OLE database provider so that any other SQL client can access the real-time or historical process data from the data historical data collector.

1.2.31 Historical Data Collector Redundancy

The system shall allow active object value historical data collection. Upon failure of execution of active primary objects, standby objects shall be activated and shall assume the task of providing data for historical collection. Separate configuration of historical collection for standby objects shall not be required. If the historical data collector is offline or unreachable, the engines servicing active objects shall store the historical data locally, and forward the buffered data to the historical data collector when the server is available. Primary and standby object engines shall synchronize any buffered historical data. If the historical data collector is offline or unreachable and the primary object engine fails, the failover engine shall assume the task of storing historical data locally, and forward the buffered data to the Historian when the server is available. There shall be no practical limit (other than disk space) as to the size of the locally stored historical data.

1.2.32 Historical Data Point Configuration

The historical data collector shall include a database editor to modify the parameters of any tag name without using the SCADA database editor as an option. It shall be possible to configure the data storage rate for each point based on a user-defined rate frequency (i.e., cyclic storage) or upon change (i.e., delta storage). Cyclic storage rates shall be configurable per point from 1 second, up to several hours. The historical data collector database shall support a 500-millisecond resolution for tag names that are configured with delta storage.

1.2.33 Historical Trend Viewing

The user shall be able to plot historical data for any tag name or groups of tag names in the database based any user-selected start and stop time. Two hairline cursors may be turned on and dragged across the trend area to provide the user with the exact value for each trended tag name at the point of intersection. The time span and value between the cursors shall also be displayed. It shall be possible to overlay data from different start/end times to compare the performance of equipment/compare the process for different time intervals. It shall be possible to overlay live

trends onto history traces to compare performance. The trend tool shall display statistical data for each trended analog tag name within the time frame selected. Statistical values shall include the minimum, maximum, average, and standard deviation. Icons or menu pull-down commands shall be available for analyzing the data, such as horizontal, vertical, or rubber band zooming; pan left or right; and zoom between the hairline cursors. It shall also be possible for the user to create text annotations anywhere on the trend. These annotations shall be visible from other workstations on the network with the same trend tool. It shall be possible to export the data in the trend area into an Excel (.XLS) file. Printing of the trends with all statistical data shall be supported.

1.2.34 HMI Application Control Logic

The SCADA system software shall include a scripting language that allows execution of commands and mathematical and logical operations based on specified system conditions or user actions. The scripting shall be easy to program using English-like statements, and shall not require any knowledge of any other programming logic. The user shall be able to edit or modify the logic scripts while the system is monitoring the process. Furthermore, it shall not be necessary to invoke any other application to compile the changes. The scripting language shall include selection boxes and pull-down menus to permit statements to be created without having to type tag names or specific commands. Buttons shall be available for easy selection of basic commands and operations such as if, then, else, else if, and, or, not, add, subtract, multiply, divide, equal to, not equal to, greater than, and less than. Additionally, there shall be a full library of more complex math and system script functions available. A validate button shall be included to ensure proper syntax and provide indication of errors to eliminate any problems at runtime. Online help for each script function shall include actual working examples that can be copied and pasted into the script editor.

1.2.35 HMI Application Logic Scripts

The system shall have the ability to execute user-defined logic scripts. Logic scripts shall be created in a statement-based programming environment. No compilers or linkers shall be required.

The system logic shall be able to automatically perform functions such as increase set points, totalize, and check the status of process set points to act.

The system logic shall be able to monitor the status of each tag name in the system and perform specific functions based on the type and status of an alarm condition. Alarm type may be lo, lo-lo, hi, hi-hi, deviation, or rate of change. Alarm status may be acknowledged or unacknowledged.

The system shall have the ability to perform application control turn on/off discrete points, show windows, download procedure, control processes (i.e., recipes), etc. This application logic shall also start and stop other application programs such as Excel, Word, and other applications like Crystal Reports.

1.2.36 HMI Application Manager

Each application shall include an application manager with a Windows Explorer-like browser to simplify management of windows (i.e., displays), scripts, tag names, alarms, and application documentation. A tag name cross-referencing index shall provide an efficient means of identifying where all tag names, links, and objects are used throughout all windows in the application.

1.2.37 HMI Data Change, Event Logging, and Window Logic

The system shall have the ability to execute system logic when the value of a tag name changes. The system shall have the ability to execute a Windows logic script upon a user-definable state of a tag name, or the result of an expression.

Any configured integer, floating point, Boolean, or string tag may also be configured as an event. The point shall be logged as an event any time its value changes.

Events shall be logged to Microsoft SQL Server or MSDE. Items to be logged in addition to the event itself shall include date and time of the event and event priority.

1.2.38 HMI Development Software Requirements

This section describes the engineering development requirements of all SCADA system software functions. All development and configuration shall persist in one or more common file or database repositories that provide a single point of configuration. Furthermore, there shall be a common naming convention for objects and tag names that is enforced by the development tools. The software shall be licensed to support any of the following OSs on appropriate hardware in any combination, as follows: Windows 10 Professional or Windows 2016 Server Remote Desktop Services with diskless PCs running sessions served by Windows Remote Desktop Services Server.

1.2.39 HMI Function Logic

The system shall support creating logic blocks and saving the logic as a function. These function scripts shall be able to run on a process thread independent of the HMI process. Function scripts shall run on a separate process thread, and not impact the performance of the HMI operations. Function scripts shall be able to be called from any of the logic types

defined in earlier sections, including a call from a function script to another function script.

1.2.40 HMI Keyboard Control Logic

The system shall have the ability to perform application control whenever a user presses a key on the keyboard. This includes whenever the key is pressed, released, or while the key is held down at a definable interval. The system will support any of the keys on a standard PC-compatible keyboard.

1.2.41 HTML Reporting Client Tool

A client tool shall be included that allows users to generate reports on any tag names. The client tool shall have a user interface that allows selection of tag names and previously created reports and report formats. The report tool shall allow you to set up, modify, and generate reports that present report data professionally and reliably. Types of information supported shall include historical and current data values, tag name configuration, information, graphs, statistics, annotations, event and summary information, and results from a query. Reports shall be generated based on data stored over a specified time frame in minutes, hours, days, weeks, or months. It shall also be possible to generate reports on demand by the user at runtime. Finished reports shall be formatted in HTML so that they can be viewed with a Web browser, stored on the server disk, or sent to a printer.

1.2.42 Import/Export Utility

The development environment shall include a utility to support, import, or export into a human-readable file format such as comma-separated file format (.CSV) or Excel (.XLS) for editing in a spreadsheet application such as Excel. It shall be possible to instantiate templates and application objects from the .CSV load by populating only the appropriate columns in the spreadsheet that are required for instantiation/configuration of the desired objects.

1.2.43 Logging Operator Actions

All operator actions shall be logged to an event logger. The event logger shall keep track of each new operator log on, log off, set point change, or device control.

Each event log shall record the date, time, operator logged in, and the type of action taken (e.g., set point change, state change, etc.).

1.2.44 Manual Data, Out-of-Sequence Data, and Superseded Data

The historical data collector shall support manual data, out-of-sequence data, and superseded data. Manually entered data such as lab data and out-of-sequence data (e.g., batched history data from an RTU) shall be

treated by the retrieval engine as if it were stored automatically. Any collected data may be superseded by manually inserting the correct data value and a flag denoting that the previous data have been superseded. The original data shall not—and cannot—be modified or destroyed. An SQL client tool may request original data, superseded data, or both. Manual data, out-of-sequence data, and superseded data shall be inserted into the Historian via an SQL insert statement or in bulk via .CSV file. Only users with proper login credentials shall be allowed to manually insert or modify data.

All stored data shall contain data quality attributes. The primary data quality attribute shall reflect data quality as defined in OLE for process control (OPC). Additional quality attributes shall be used for initial data (e.g., startup flag) and superseded data.

1.2.45 Microsoft Excel Reporting Tool

Data analysis software shall be included that allows users to easily select tag names and historical values from the real-time or historical database via a browser, and then utilize them in a standard Excel spreadsheet for reporting or presentation to management. Selecting tag names shall be accomplished using drag-and-drop or point-and-click commands. Writing macros to retrieve data shall not be required. The tag values selected can be output to specific cells in the spreadsheet and processed as number data types. The user shall be able to select historical data for the most recent values, or go back and select any start or stop time as far back as the data are available. The historical data can be recalled at the granularity that it was stored, or in a selected number of data points over a period of time. The user shall be able to retrieve raw historical data or summarized data such as the minimum, maximum, or average over a predetermined time frame. Once they are in the spreadsheet updates to the current values shall be refreshed with a single mouse click.
The quality of the data shall be analyzed and displayed. The user shall be able to select if poor-quality data will be displayed or replaced with an interpolated value. The user shall be able to specify relative or absolute value choices.

1.2.46 Microsoft Word Reporting Tools

Data analysis software shall be included that allows users to easily select tag names from the real-time or historical database via a browser, and then utilize them in a standard Word document for reporting. Selecting tag names shall be accomplished using drag-and-drop or point-and-click commands. Writing macros shall not be required to retrieve the data. The tag names selected can be output to specific values or arrays using standard Word tables. The user shall have the choice of selecting real-time absolute relative or configurable base dates and times. The user shall be able to retrieve raw historical data; summarized data, such as the

minimum, maximum, or average over a predetermined time frame; or data stored in the historical data collector. The user shall be able to select if poor-quality data are to be displayed or replaced with an interpolated value.

1.2.47 Multi-Protocol Communications Gateway Server

A utility shall exist to translate DDE to OPC and OPC to DDE protocol to support legacy or third-party servers. The gateway shall allow an in-process DDE conversation on one computer to be OPC on another computer without the use of Net-DDE or Distributed Component Object Model (DCOM) as a transport. This utility shall operate under Windows 10 Professional or Windows 2016 Server OS.

1.2.48 Multi-User Development Environment

The development environment shall provide a simultaneous multi-user development environment where users are subject to security permissions based on individual system-wide roles.

1.2.49 Object and Code Reuse

The development environment shall promote code reuse through standard templates that may be customized to create new object instances.

1.2.50 Object Animation

The color of an object can use any one of up to 256 colors, 128 standard colors, and up to 128 user-defined colors. A user-defined color palette can be created, exported, and imported. The color palette shall be based on 16.7 million colors. The system will also support the user choosing transparent colors for all graphical objects and backgrounds.

A percentage of fill for up, down, left, or right object directions can be based on a tag or hierarchical name.

An object may blink based upon any Boolean expression alarm event or upon a designated group of alarms. The blink shall be adjustable to slow, medium, or fast.

Each object shall have a visibility attribute option, allowing for visibility of the object based upon the status of a discrete point alarm or operator security level.

The system shall support object animation via re-sizing, moving, and/or rotating based upon a change in a tag or hierarchical name.

Objects shall be animated based upon any user-defined criteria made up of tag names or variables in the system. This includes the use of

expressions containing mathematical functions and the status of analog and discrete values in the system.

The graphics editor shall allow object layering to activate specific objects based upon conditions in the process.

Graphics development tools shall allow object placement via a snap-to-grid feature with configurable grid spacing.

Graphics development tools shall support an undo/redo feature with a configurable number of levels and command displays.

The system shall support a library of self-rendering objects that change visual properties based on dialog box entries made during development. For example, consider a standard set point loader object that has a graduated scale and a default range of 0 to 100. Dialog box entries shall allow changes to the range of the set point loader, the number of major and minor divisions on the scale, and the text font used for labels. The object shall then redraw itself with new number of tick marks, new spacing, new labels, and new font.

The system shall support the import of .DXF files (AutoCAD) with the drawing elements imported as native objects. It shall be possible to animate these objects using the full set of object animation properties as specified in earlier sections.

The graphics editor shall also allow the user to import drawings and images in bitmap (.BMP) and Joint Photographic Experts Group (.JPEG) file format.

The graphics development environment shall support copying single or multiple animated graphic objects and symbols. Immediate substitution of tag names for the duplicated object shall be possible without leaving the graphics editor.

The graphics development environment shall support copying single or multiple animated graphic objects and symbols from one window or display to another, retaining all the animation characteristics, links, and attributes. This function will eliminate duplication of effort. In addition, it shall be possible to import windows from another application in this same fashion.

The user shall be able to add tag or hierarchical names to an object while building a display without exiting the graphics editor.

Online context-sensitive help shall support display building. Users shall be able to access immediate help on all configuration subjects by pressing a single function key.

The user shall be able to define graphic screens while the system is monitoring the process.

1.2.51 Object Model

The development environment shall will utilize the concept of application objects. These objects may represent real-world devices, such as proportional-integral-derivative (PID) loops, motors, pumps, valves, etc.; or informational objects such as external database readers and writers; and eXtensible Markup Language (XML) readers and writers etc. Application objects shall closely model the physical representation of plant equipment and devices, and will not be bound to a separate data tag database topology. This shall include the ability to create complex multi-variable data objects.

1.2.52 Operator Security

The operator workstation shall use the security model defined by the configuration database.

The software shall use data-level security, where the ability to modify a set point or other value is determined in the configuration database. Any changes to the data level security model shall be seen by all operator stations without any modifications to the operator stations.

The security system shall be capable of disabling access to all Windows controls (e.g., file menu, close, minimize, etc.) and keyboard commands (Ctrl-Esc, Alt-Tab, and Ctrl-Alt-Delete).

1.2.53 Priority Telephone Support

The extended support program shall include priority telephone support 24 hours per day. A technical support engineer who has been certified by the software vendor based on a certified support testing program shall provide telephone support. A person (not an automated line) shall provide unlimited telephone support when calling during normal business hours. A voice-mail technical support system shall be acceptable only outside of normal business hours. A support engineer shall return voice mail a minimum of 2 hours after leaving a message with the voicemail system.

1.2.54 Process Data Analysis Workstation

The SCADA system software shall include a set of easy-to-use client software tools for real-time and historical data analysis and system reports. This client analysis software may be used by engineering maintenance or supervisory personnel who need information from the

SCADA system, but do not require access to graphic displays. The client tools shall be able to access data from multiple historical data collectors on the SCADA system network. Users shall be required to log in with a password to access the database server. The user shall not have to know the location of the server on the network—only the name of the server. The data analysis software shall include tools for advanced trending analysis, X-Y plotting of tag names, and viewing of reports in spreadsheet or freeform format. All tools shall support full right mouse-click capability for quick menu selection of available functions. The client tools shall be available as a standalone program or as a platform independent scripting control for imbedding into the SCADA so that any full-function or view-only operator workstation may have the same capability or any user interface that supports the platform independent scripting tools.

1.2.55 Real-Time and Historical Trend Analysis Tool

A client tool shall be included that allows users to view any or all the tag names in either a trend chart or tabular format. The client tool shall have a user interface that allows for easy selection of tag names using an Explorer-like browser with a search filter to quickly find tag names in a historical data collector with thousands of points. The user shall be able to create folders for selected groups of tag names, and plot them individually or in groups by dragging them into the trend area. The user shall be able to save trend files for recall later. It shall be possible for the user to switch from real-time to the historical viewing mode using a simple check box. The user shall be able to toggle viewing trends either in the superimposed or the stacked mode. In the superimposed mode, all trends overlap and are in a single-scale range based on the largest vertical scale range in the group. In the stacked mode, each trend has its own vertical scale range. Trend plots shall automatically be scaled based on the widest vertical range of the tag name or optimized based on the maximum and minimum range within the selected time frame.

1.2.56 Real-Time Trend Viewing

The user shall be able to trend up to 256 different tag names in real time, including analog discrete string or event tag names within the same trend. The user shall pick tag names from the browser. The time span and vertical range of the trend shall be user-configurable at runtime. Standard time spans shall be configured for the last 5, 10, 30, or 60 minutes, or the last 24 or 8 hours. The user shall be able to adjust the range of the tag names in runtime.

1.2.57 Runtime Data Viewer

The runtime environment shall provide a utility to view the real-time status of any application object attribute.

1.2.58 Runtime and Development Security

The HMI software security function shall allow for creation of operator roles that can be assigned to security groups. Operator roles shall allow for assignment of configuration database permissions, and for runtime operational permissions and access to visualization of certain windows. At a minimum, runtime operational permissions shall control:

- Privilege to acknowledge an alarm in the runtime environment
- Privilege to modify configuration attributes that allow users to configure the attribute's value (i.e., a PLC register that defines a discrete input [DI])
- Privilege to modify operational attributes that allow users with operational permissions to do certain normal day-to-day tasks like changing set point output and control mode for a PID object or commanding a device object
- To open and view a process or application window
- The modification of tune attributes, which allows users to tune the attribute in the runtime environment (examples of tuning are attributes that adjust alarm set points and PID sensitivity)

Users assigned to operator roles shall inherit all parameters that were assigned to the role and security group.

Runtime changes to object values shall be subject to security authorization. Permissions that are configured using the development environment shall be automatically checked at runtime for authorization, including verification of identity and access permission related to the originator of the runtime change request.

Users shall log in before any change to any object attribute that has been constrained is allowed.

The runtime architecture shall conform to the object attribute security model defined in the configuration environment.

1.2.59 SCADA System Software Installation, Licenses, and Support

The SCADA software shall be easily installed from a single CD or a set of CDs (or USB drive) using a standard install program. During the installation procedure, the user shall be able to select the features and functions required for each workstation or server in the SCADA system. While loading the selected software, it shall be possible to redirect the location of software components. The SCADA software shall be licensed using software license files that can be easily restored to the system in case of hard drive failure. No hardware keys shall be required to run the software.

1.2.60 Standardized Database Tables

Setting up the database tables shall be automatically configured and require no database engineering. Data definitions including the creation of database objects such as tables, indexes, constraints, defaults, rules, stored procedures, triggers, and views shall follow a standard published and readily available database scheme.

This standard database schema shall outline the relationship between tables, table columns, keys, and indexes, and shall allow for third-party development of client applications. Database device sizes shall be dynamically allocated during database installation depending on the number of tag names to be stored within the historical data collector.

1.2.61 Template Derivation, Object Instantiation, and Inheritance

New templates shall be derived from an existing templates base (supplied by the software manufacturer) or user-defined. A template shall inherit the entire configuration of the parent object when generating a new template instance. Templates may contain other templates in a hierarchy. Templates may be derived from another template.

1.2.62 Remote Client Access Server Fail-Over

Remote client access thin clients, concurrent or dedicated, shall be capable of automatically failing over to a redundant remote client access server. No operator intervention shall be required. The system shall support execution of the visualization software and engineering development tools in remote client access sessions while enforcing the configured OS security model.

1.2.63 View-only Graphics Display Workstation

The SCADA system software shall support view-only graphics workstations for managers or supervisory personnel who wish to have access to all displays and trends, but do not have process control or alarm acknowledgement responsibilities. No modifications to the SCADA HMI configuration shall be required for this functionality. The view-only graphics display HMI shall be able to run in a Remote Desktop Services session.

1.2.64 Windows Service Support

The operator interface workstation shall be able to be run as a Windows service as opposed to an application. This provides Windows service capabilities for key HMI components, such as historical logging alarms and I/O communications. The service capabilities allow continuous operation through OS logons and logoffs, such as operator shift changes. All SCADA software shall support running as a Windows service so that, following a power failure or when the machine is turned on, an automatic

startup to the runtime mode will occur. This function ensures unmanned station startup without compromising OS security.

1.2.65 Integration with External Business Applications

The HMI software shall have the ability to integrate with the following applications. For future business applications, describe how the SCADA software integrates with each type of business application and provide examples of what has been done in the past.

Business Application	Software Vendor	Database
CMMS/EAM	Cityworks 15.1.3	MS SQL 2012
GIS	ArcGIS Server 10.5.1	MS SQL 2012
Utility billing	iCIS 3.0.3.7	MS SQL 2012
AMI	(Future)	

AMI = advanced metering infrastructure, CMMS = computerized maintenance management system, EAM = enterprise asset management, GIS = geographic information system

1.3 General PLC and OIT Requirements

1.3.1 Approvals and Operating Environment

PLCs shall be micro-processor-based, capable of receiving discrete and analog inputs (AIs) and—through programming—able to control discrete and analog output (AO) functions, perform data-handling operations, and communicate with external devices. PLCs shall meet the requirements of Underwriters Laboratories (UL) 508 devices, and shall be labeled. PLCs shall function properly at temperatures between 32 and 122 degrees Fahrenheit (°F) at 5 to 95 percent relative humidity non-condensing, and shall tolerate storage temperatures between -40°F and +140°F at 5 to 95 percent relative humidity non-condensing.

1.3.2 Modular PLC

PLCs shall be based on a modular, field-expandable design, allowing the system to be tailored to the process control application. The system shall be expandable using additional hardware and/or user software. As a minimum, the PLC shall include integrated power supply, CPU integrated Modbus and Ethernet communications, built-in I/O, and networkable to smart equipment over standard fieldbus (including Process Field Bus [PROFIBUS]). In addition, specify if Distributed Network Protocol (DNP3) or other secured and encrypted store- and forwards-based communication protocols are supported in Table 3.

PLCs shall provide redundancy for use as a master PLC, allowing the master PLC to poll, store, and forward data to remote PLCs. Redundancy shall not be required for the remote PLCs.

1.3.3 CPU Module

The CPU module shall be a self-contained, microprocessor-based unit that provides time of day, scanning, application (based on International Electrotechnical Commission [IEC] 61131-3 development logic) program execution, storage of application programs, storage of numerical values related to the application process and logic, I/O bus traffic control, peripheral and external device communications, and self-diagnostics.

1.3.4 Communications

The integrated communications options shall allow secure peer-to-peer communication with other PLCs, and shall allow the PLC to communicate with the OIT, central station, or HMI workstation. The PLC shall utilize the manufacturer's standard communication architecture and protocol, Ethernet architecture and protocol, or a combination of these. The communication port shall allow PLC programming to be done locally using a laptop computer, or from the central station or remote workstation. The PLCs shall be able to be used as standalone control systems for remote SCADA with telemetry communication networking. Communication

networking shall support proven methods using cellular, licensed radio, leased telephone lines, and direct fiber-optic cable (e.g., single-mode and multi-mode). Describe the communication, security, and authentication protocols supported between PLC and PLC and between HMI and PLC communication protocols in Table 3.

1.3.5 Power Supply

Power supply modules shall use alternating current (AC) power with a nominal voltage of 120 volts alternating current (VAC) ± 5 percent, or shall use direct current (DC) power with a nominal voltage of 24 volts direct current (VDC) ± 5 percent. The power supply module shall monitor the incoming line voltage level, and provide over-current and over-voltage protection. If the voltage level is detected as being out of range, the power supply module shall continue to provide power for an adequate amount of time to allow for a safe and orderly shutdown. Power supply shall be able to withstand a power loss for a minimum of 20 milliseconds while remaining in operation and providing adequate power to all connected modules.

Each power supply shall be provided with an on-off switch that is integral to the module. If the manufacturer's standard power supply module is not provided with an on-off switch, a miniature toggle-type switch shall be installed near the PLC, and shall be clearly labeled as to its function.

Provide power supply with an indicating light that illuminates when the module is operating properly.

1.3.6 I/O Modules

Modules shall be self-contained, microprocessor-based units that provide an interface to field devices. Each module shall contain visual indication to display the on-off status of individual inputs or outputs.

1.3.7 Program Storage/Memory Requirements

The CPU shall utilize the manufacturer's standard non-volatile memory for the OS and remote site data storage. The controller shall have electrically erasable, programmable, read-only memory (EEPROM) for storage of user programs and battery-backed random access memory (RAM) for application memory. The EEPROM shall be loadable using a laptop computer.

1.3.8 I/O Characteristics

Each controller shall allow for AI, AO, DI, discrete output (DO), and high-speed digital inputs. During normal operation, a malfunction in any I/O channel shall affect the operation of that channel only, and shall not affect the operation of the CPU or any other channel.

AI modules shall be available as 4–20 milliamperes (mA) VDC, isolated and non-isolated. DI modules shall be available as 12–24 VDC, high speed, sink and source. AO modules shall be available as 4–20 mA VDC, isolated. DO modules shall be available in 24 VDC, relay, sink, and source.

The number and type of inputs and outputs for the PLC shall vary by the site, and ranges from 20 to 100 total points. An example of the existing I/O distribution for two of the largest site point count is provided in the table below. The water site includes additional I/Os exchanged through a PROFIBUS network with existing variable-frequency drives (VFDs).

Site	AI	AO	DI	DO	Fieldbus
Water	16	8	16	40	PROFIBUS
Sewer	8	0	48	16	

1.3.9 Wiring Connections

Wiring connections shall be heavy-duty, self-lifting, pressure-type screw terminals to provide easy wire insertion and secure connections. The terminals shall accept two No. 14 American wire gauge (AWG) wires. A hinged protective cover shall be provided over the wiring connections. The cover shall have write-on areas to identify external circuits.

1.3.10 On-Off Switch

Each controller shall be provided with an integral on-off power switch. If the controller is not provided with a manufacturer's standard on-off switch, a miniature toggle-type switch shall be installed in the control panel near the controller, with its function clearly labeled.

1.3.11 Diagnostics

Each PLC shall have diagnostic routines implemented in firmware. The CPU shall continuously perform self-diagnostic routines that will provide information on the configuration and status of the CPU, memory, communications, and I/O. The diagnostic routines shall be regularly performed during normal system operation. A portion of the scan time of the controller shall be dedicated to performing these housekeeping functions. In addition, a more extensive diagnostic routine shall be performed at startup and during normal system shutdown. The CPU shall log I/O and system faults in fault tables that shall be accessible for display. When a fault affects I/O or communications modules, the CPU shall shut down only the hardware affected and continue operation by utilizing the healthy system components. All faults shall be annunciated at the central station. Diagnostic software shall be useable in conjunction with the portable tester.

1.3.12 Accuracy

Controllers shall have an accuracy of ± 0.25 percent of input span.

1.3.13 PLC Software

OS: Each PLC shall be provided with the manufacturer's standard OS software package. The PLC shall maintain a point database in its memory that includes all parameters, constraints, and the latest value or status of all points connected to the PLC. Execution of the PLC application programs shall use the data in memory resident files. The OS shall support a full complement of process control functions. It shall be possible to define these functions using a mix of function blocks, ladder logic diagrams, sequential function charts, and text programming. Programming methods and interactions shall be based on IEC 61131-3. A combination of the programming methods shall be possible within a single controller. The OS shall allow software loading locally or from the central station. It shall also support data entry and diagnostics using an operator interface panel attached directly to the PLC. Each PLC shall be able to operate in standalone mode:

- Startup: The PLC shall have startup software that causes automatic commencement of operation without human intervention, including startup of all connected I/O functions. A PLC shall be capable of having a restart program. The restart program would be based on detection of power failure at the PLC with the ability to include start time delays between successive commands to prevent demand surges or overload trips.
- Failure mode: Upon failure for any reason, each PLC shall be able to perform an orderly shutdown, and force all PLC outputs to a predetermined (i.e., failure mode) state, consistent with the failure modes shown and the associated control device.

1.3.14 Functions

The controller shall be able to scan inputs, control outputs, and read and write to its internal memory. The controller shall be able to periodically perform self-diagnostics to verify that it is functioning properly. The controller shall be able to support the following functions that would be developed in resident application logic:

- Analog monitoring: Measure and transmit all analog values including calculated analog points.
- Logic (virtual): Development of logic (virtual) points that are software points entered in a point database and are not directly associated with a physical I/O function. Logic (virtual) points can be analog or digital points created by calculation from any combination of digital and analog points, or other data having all the properties of real points—including alarms—without the associated hardware.

- State variables: If an analog point represents more than two (up to eight) specific states, each state is nameable. For example, a level sensor can be displayed at its measured engineering units plus a state variable with named states usable in programs or for display, such as low alarm, low, normal, high, high alarm.
- Analog totalization: Totalize analog points measuring flow rate and displayed as a daily total on an OIT and/or HMI.
- Trending: Trend any analog or calculated point in real time.
- Alarm processing: Support alarm processing for AI, DI, and fieldbus alarms for all real and virtual points connected to the PLC:
    - Digital alarms: Digital alarms are those abnormal conditions indicated by a DI's change of state
    - Analog alarms: Analog alarms are those conditions higher or lower than a defined value, as measured by an AI
- Constraints: Provide capability to define constraints in the resident application logic for control points, such as maximum starts (i.e., cycles) per hour, minimum off time, minimum on time, high limit (value in engineering units and operator-adjustable), and low limit (value in engineering units and operator-adjustable).
- Control sequences and control loops: Support the following control:
    - Proportional control, and proportional + integral control.
    - Two-position control for a two-state device by comparing a set point against a process variable and an established dead band.
    - Floating point control exercising control when an error signal exceeds a selected dead band, and maintaining control until the error is within the dead band limits.
    - Signal selection to allow selection of the highest or lowest analog value from a group of analog values as the basis of control, including the ability to cascade analog values so that large numbers of inputs can be reduced to one or two outputs.
    - Signal averaging to allow mathematical calculation of the average analog value from a group of analog values as the basis of control, including the ability to weight the individual analog values so that the function output can be biased (as necessary) to achieve proper control.

1.3.15 Resident Application Software

Provide the capability for resident application programs to be developed in conjunction with the HMI Graphical Object-Oriented Programming (GOOP) to achieve the sequences of operation, parameters, constraints, and interlocks necessary to provide control of the process systems connected to the control system. All application programs will be resident in the PLC and execute in the PLC, and will coordinate with each other, to ensure that conflicts or contentions remain unresolved:

- Program inputs and outputs: Provide capability to program inputs in a resident application program to calculate the required program outputs. Where specific program inputs are not available, a default value or virtual point appropriate for the equipment being controlled and the proposed sequence of operation will be provided to replace the missing input, thus allowing the application program to operate.
- Failure mode: In the event of a PLC failure, the controlled equipment will continue to function in failure mode.

1.3.16 OIT Requirements

OIT shall provide control and data acquisition with the site's PLC and the master PLC using color graphic screens with easy user-intuitive navigation. The equipment shall be the manufacturer's most current product. Products that are obsolete or are slated to be discontinued are not acceptable. The OIT manufacturer may be different from the PLC/RTU and master terminal unit (MTU) manufacturer. The OIT shall be compatible with the PLC/RTU and MTU provided.

Features shall include the following:

- Rugged panel-mounted terminal with options for both National Electrical Manufacturers Association (NEMA) 12 and 4X ratings and anti-glare view ability
- 10-inch thin-film-transistor (TFT) color, liquid crystal display (LCD) with resolution of 1,024 by 600 pixels minimum
- Function properly at temperatures between 32°F and 122°F at 5 to 95 percent relative humidity non-condensing, and tolerate storage temperatures between -40°F and +140°F at 5 to 95 percent relative humidity non-condensing

Programming software shall be standard development software offered by the OIT manufacturer, or the software may be the same as the HMI.

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TECHNICAL SPECIFICATION RESPONSE TABLES

TABLE 1. SCADA System Basic Requirements Table

SCADA system requirements: Vendor shall provide comments that address the compatibility of their product solution to Requirements and Notes of each Subject. Refer to the project overview in Section 1.1 and the system architecture as described in Section 1.2 of the minimum specifications for compatibility needs.		
Subject	**Requirements and Notes**	**Comments**
Server OS	Windows Server 2016 (redundant servers)	
Workstation OS	Windows 10 Professional (64-bit)	
Workstation Web browser	Microsoft Explorer 11 or later, Google Chrome V.62 or later, and Firefox V. 56 or later	
Historian OS	Windows Server 2016 (redundant historians)	
System security method	Integrated with Windows security	
System security	4+ access levels, 20+ logins (configurable hot)	
Antivirus software compatible	List supported software vendors	
Extended warranty: annual software maintenance, support and software upgrades	Provide pricing for 4 options, 1 with 1 year, 5 years, and 10 years of support with proposal (24/7/365 support), 1 with standard business hours (9:00 a.m.–5:00 p.m. PST) support	
Remote access capability	Web access Smartphone access	
OPC compliance	Describe	
GIS compatibility	Describe	
AMI compatibility	Describe	
Utility billing	Describe	
CMMS compatibility	Describe	
License Method, Updates, and Terms (include time period)	Describe	

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SCADA system requirements:

Vendor shall provide comments that address the compatibility of their product solution to Requirements and Notes of each Subject. Refer to the project overview in Section 1.1 and the system architecture as described in Section 1.2 of the minimum specifications for compatibility needs.

Subject	Requirements and Notes	Comments
Server requirements	Server class, hardware specifications, etc.	
HMI system architecture	Specify quantity, role of server, etc.	
Online backup management	Describe	
Database compatibility	Ability to automatically send all SCADA data or only select sets of SCADA data to a separate Microsoft SQL Server 2012 database	
Virtualization support	Support running SCADA servers on VMware vSphere Version 6.5 servers	
Active Directory Domain	Support adding all SCADA computers/servers to the City's Microsoft Active Directory Domain	
Active Directory Domain	Support using Active Directory Domain for SCADA system user authentication and role-based security groups	
Multi-factor authentication	Support for using multi-factor authentication to the SCADA system	
Local Windows account	Support running all SCADA software as a standard Windows user account (i.e., not an administrator account)	
Microsoft software updates	Support the installation of monthly Microsoft security updates to all SCADA computers and servers	
Mobile applications	List all mobile SCADA applications written for iOS and Android OSs, and briefly describe what features these applications provide	

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SCADA system requirements: Vendor shall provide comments that address the compatibility of their product solution to Requirements and Notes of each Subject. Refer to the project overview in Section 1.1 and the system architecture as described in Section 1.2 of the minimum specifications for compatibility needs.		
Subject	**Requirements and Notes**	**Comments**
Web applications	List all Web-based SCADA applications and briefly describe what features these applications provide	

TABLE 2. RFP Response Table: HMI

The response shall give a compliant, exception, or not compliant answer for each specification numbered paragraph and associated lettered sub-paragraph. A compliant answer can be made only if the proposed HMI software can provide the specified function without the addition of external program applications, or internal programming or scripting. With the exception answer, provide a brief description (i.e., additional software package required, custom programming required, applications scripting required) to comply with the specification. If a specification requirement cannot be met by the proposed HMI software, the proposer shall mark that item as not compliant.

Section 1.2.	Requirement	Response	Comments
1	Platform Independent Scripting Support		
2	Platform Independent Scripting Tools		
3	Alarm Management and notification		
4	Alarm management functions		
5	Alarm Redundancy		
6	Alarm Summary/Alarm History Object		
7	Application Log Files		
8	Application Redundancy/SCADA system fail-over		
9	Audit Trail		
10	Communications Architecture		
11	Communications Redundancy		
12	Conditional Control and Data Change Logic		
13	Data Compression		
14	Database Summary System		
15	Defined Failure Events		
16	Development Environment Views		
17	Disk Storage Management		
18	Display Navigation		

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Section 1.2.	Requirement	Response	Comments
19	Dynamic Configuration and Bumpless Data Initialization		
20	Event Action		
21	Event Configuration		
22	Event System Configuration		
23	Warranty, Software Maintenance, and Technical Support		
24	Full Function Operator Workstation (HMI)		
25	General Purpose I/O Communications Server		
26	Graphical Objects		
27	Graphics Display Development		
28	Historical Data Acquisition and Retrieval		
29	Historical Data Collection		
30	Historical Data Collector Interface to Other Relational Databases		
31	Historical Data Collector Redundancy		
32	Historical Data Point Configuration		
33	Historical Trend Viewing		
34	HMI Application Control Logic		
35	HMI Application Logic Scripts		
36	HMI Application Manager		
37	HMI Data Change, Event Logging, and Window Logic		
38	HMI Development Software Requirements		
39	HMI Function Logic		
40	HMI Keyboard Control Logic		

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Section 1.2.	Requirement	Response	Comments
41	HTML Reporting Client Tool		
42	Import/Export Utility		
43	Logging Operator Actions		
44	Manual Data, Out-of-Sequence Data, and Superseded Data		
45	Microsoft Excel Reporting Tool		
46	Microsoft Word Reporting Tools		
47	Multi-Protocol Communications Gateway Server		
48	Multi-User Development Environment		
49	Object and Code Reuse		
50	Object Animation		
51	Object Model		
52	Operator Security		
53	Priority Telephone Support		
54	Process Data Analysis Workstation		
55	Real-Time and Historical Trend Analysis Tool		
56	Real-Time Trend Viewing		
57	Runtime Data Viewer		
58	Runtime and Development Security		
59	SCADA System Software Installation, Licenses, and Support		
60	Standardized Database Tables		
61	Template Derivation, Object Instantiation, and Inheritance		
62	Remote Client Access Server Fail-Over		

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Section 1.2.	Requirement	Response	Comments
63	View-only Graphics Display Workstation		
64	Windows Service Support		
65	Integration with External Business Applications		

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TABLE 3. RFP Response Table: PLC/OIT

The response shall give a compliant, exception, or not compliant answer for each specification numbered paragraph and associated lettered sub-paragraph. A compliant answer can be made only if the proposed hardware or software product can provide the specified requirements without deviation. A compliant answer can be made only if the proposed hardware and software can provide the specified function without product modification. With the exception answer, provide a brief description (i.e. additional software package and/or hardware required, product customization required) to comply with the specification. If a specification requirement cannot be met by the proposed hardware and software, the proposer shall mark that item as not compliant.

Section 1.3.	Requirement	Response	Comments
1	Approvals and operating environment		
2	Modular PLC (include in the comments secured and encrypted data transfer protocols supported)		
3	CPU Module		
4	Communications (include in the comments the supported communication, security and authentication protocols)		
5	Power Supply		
6	I/O Modules		
7	Program Storage/Memory Requirements		
8	I/O characteristics		
9	Wiring Connections		
10	On-Off Switch		
11	Diagnostics		
12	Accuracy		
13	PLC Software		
14	Functions		
15	Resident Application Software		
16	OIT Requirements		

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TABLE 4. Security Questions

The proposer shall respond to the following questions in Table 4 regarding security for proposed control system software.

Number	Question	Response
1	What security standards or frameworks does your software/product comply with or undergo evaluations by?	
2	Describe the security training your software developers have been through.	
3	Do you have third-party vulnerability audits of your software/product? Are the reports made available to clients? Provide a copy of the most recent report.	
4	What is your vulnerability disclosure/notification procedure to clients when vulnerabilities are discovered?	
5	What is your patching and update procedure and cadence?	
6	If vulnerabilities are discovered by your clients, how do you prefer to be notified?	
7	Have you or any of your clients had a data breach or security incident because of a vulnerability in the software/product that you have proposed? If so, describe the support provided to your client.	
8	Are there any current known and unpatched vulnerabilities in the software/product that you have proposed?	
9	Do you have a formal security program/department in your organization? If so, describe it.	

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Number	Question	Response
10	What methods are employed to protect data, including authentication in the software/product you are proposing?	