SECTION 16925
SCADA SYSTEM APPLICATIONS PROGRAMMING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Application programming and configuration of existing Supervisory Control and Data Acquisition (SCADA) system located at the City of Davis Corporation Yard at 1515 5th Street for display of station parameters, alarms and reports.

B. The SCADA system shall provide a Human/Machine Interface (HMI) into the PLC-based control system. The SCADA system shall allow process data to be monitored, displayed, and stored. It shall also allow the control of automated equipment in accordance with operational state and user-authorization requirements.

C. Work includes all required programming and/or integration of the human-machine interface / supervisory control and data acquisition (HMI/SCADA) software, auto-dialer software, report generation software, historical database software, and other required hardware and software components to yield a complete and operational system.

D. Work includes configuring, programming, and implementing a Supervisory Control and Data Acquisition (SCADA) system to interface Programmable Logic Controllers (PLC) and other control devices to maintain, monitor, and control the process. This system will provide operator interface between Operators and the many control devices that are used to control and monitor the process.

1.02 RELATED SECTIONS

A. Section 16010 – Electrical

B. Section 16915 – PLC and OI Applications Programming

1.03 SUBMITTALS

A. Provide submittals per Section 16010-Electrical, SUBMITTAL AND DRAWING REQUIREMENTS.

B. Submit completed color screen print outs of the SCADA screens to be added or changed, including all menus. Submit one screen per sheet of paper.

C. Submit a list of all alarms identified by the system including descriptions as shown on the Alarm Summary screen.

D. Submit remote automatic alarm dialer voice script in a text version for review.

E. Submit a total of three (3) different report formats for review. Identify the report generation software and additional software utilized in creating and printing each report.

F. SCADA programmer's prior work experience and resume.

1.04 MODULARITY

A. Configuration shall be modular and capable of merging new changes into existing SCADA systems as applicable or as remote changes are necessary.

1.05 QUALITY ASSURANCE

A. SCADA programming and integration performed under this Section shall be by an integrator who has been regularly engaged in control integration of water and wastewater treatment systems.

B. The System Integrator's trained field representative shall have the following experience requirements:

1. Has programmed, setup, and configured similar sized control systems for the last two years with the System Integrator/Contractor awarded the project.

2. Has integrated similar SCADA systems into at least two water or wastewater treatment plant control systems using the same SCADA software (current or earlier versions) being used on this Project.

PART 2: PRODUCTS

2.01 SCADA APPLICATION SOFTWARE

A. Existing SCADA software is Intellution I-Fix v3.0 on Windows 2003 Server and communicates to existing Opto-22 PLCs over serial radio. Provide new communications driver for Ethernet communications over Ethernet radio and integrate it into the existing

B. Communications driver program for communications from SCADA to the Allen Bradley PLC at this station shall be Top Server AB PLCs Communications Suite OPC+IO Server covering the AB Control Logix and Compact Logix, PLC5, SLC, Micrologix processors – serial and Ethernet protocols.

C. Driver application software shall be compatible with the existing SCADA system software, hardware, operating system, and configuration. Modify existing system as required to install new equipment and software. Confirm compatibility early in project as to not delay this project. Owner will address any SCADA hardware or software problems as identified by System Integrator.

D. Provide software to meet the functions described in these Specifications. The functions include data acquisition, alarming, calculations, historical databasing and reporting, graphic trending, and supervisory control.

E. Report Generation

1. The existing reporting software allows users to build reports in Microsoft Excel and run the reports for any time frame. The software will retrieve data for the reports from SCADA software systems as well as SQL compliant databases. The software shall support connections to multiple data sources ("databases") simultaneously. The software shall include a server component for configuring a project specific configuration file.

2. The System Integrator shall configure automatic output to the following destinations for each report.

   a. Printer

   b. Excel Workbook (.xls) file

   When outputting to a Web Page or Excel Workbook file, the software shall be capable of generating unique files. The files shall be named in an increasing sort order according to date.

3. A user interface shall be provided to allow users to place functions into an Excel Workbook in order to build reports. These functions will return data for the specified time frame. The following functions shall be supported:

   a. Average

   b. Count

   c. First and/or date/time stamp

   d. Last and/or date/time stamp

   e. List and/or date/time stamp

   f. Maximum and/or date/time stamp

   g. Minimum and/or date/time stamp

   h. Sum

4. The software shall provide Tag Functions that return the following attributes for tags. These attributes shall be retrieved from the project configuration file:

a. TagName
b. Description
c. Engineering Units
d. Type
e. Table Name
f. Column Name
g. Database Name
h. Group Name

5. Provide minimum 2 reports with up to 10 variables per report shall be generated. Reports shall include all analog variables (min, max and average), equipment run hours, flow totalization, alarm history, and chemical feed parameters.

6. Report Periods

a. Daily (12am to 12am)
b. Monthly (beginning to end of month)
c. Yearly (January 1st to December 31st)

F. Remote Alarm / Event Notification

1. SCADA alarm Dialer shall notify individuals via communication link once an alarm or event occurs. Each alarm or event shall have a station identification, alarm description, instructions and present values.

2. Call-in menu support for station present values, acknowledge alarms, and change analog and/or discrete tag values.

3. Automatically escalate notification to next notification path if alarm is not acknowledged within a specified time. Provide on-call operator phone number menus for easy change and re-assign.

4. Send alphanumeric text and/or e-mail messages as selected in configuration.

5. Existing SCADA alarm/event notification software shall be Wonderware, SCADAlarm or approved equal.

G. Existing report generation software is WorkSmart Automation, ReportBuilder.

PART 3: EXECUTION

3.01 SOFTWARE DEVELOPMENT

A. The programming, setup and configuration of the SCADA system shall be done by the System Integrator.

1. Each and every system, subsystem, automated device, and package equipment shall be fully automated to the extent possible and as defined in this and other sections.

2. Each system shall have graphical screens displaying the process, alarms, setpoints, trends and other controls.

B. Before beginning SCADA application software development, meet with the Owner for a four-hour Design Meeting at the Owner's facility.

1. Ensure that the Contractor Project Manager, System Integrator SCADA software programmer, Owner's Representative & Owner are in attendance.

2. Discuss SCADA format and setup requirements to ensure that parties involved have a clear understanding of the Contract requirements. This discussion is to cover graphic screen layout, color conventions, text display menu system, communications, etc.

3.02 SCADA CONFIGURATION

A. General

1. The Programmable Logic Controller(s) within the system shall perform all process control. The SCADA system shall not perform any control or function that would, on its own, change the way a controlling device (PLC or dedicated controller) controls the process. All commands must be initiated by an Operator and not be the programming of the SCADA system. All Timers, Totalizers, Counters, or any other control function devices will be implemented in the PLC.

2. The SCADA system shall have a Visual Basic script programmed to forward the Elevated tank level and a sequential counter to the East Area Tank PLC to allow the remote system to operate on Elevated tank level. See section 16915 for further details.

B. Communications

1. The SCADA shall monitor for communications and shall post an alarm if a PLC fails to respond to message queries.

2. The SCADA system shall track a ratio of completed message to missed messages in a 100 entry shift register. Therefore, the communications integrity to each station will be displayed as a percentage of completed messages. Show message integrity percentage on SCADA overview screen.

3. The SCADA system shall re-transmit data from one PLC/RTU to another for the purposes as described in this section and Section 16915, PLC &OI Applications Programming.

C. Graphic Screens:

1. Model screens after the P&IDs as shown in the contract drawings. If existing sites are similar, the new screens shall be similar in look and functionality as the existing screens.

2. Display all analog values on the graphic screens with bar graph, symbols, and analog readout along with its associated alarm setpoints arranged next to bargraph in ascending order (i.e. low alarm setpoints at bottom and high alarm setpoints near the top).

3. Graphic screen(s) shall display station main parameters in process flow format similar to that shown on the P&ID diagrams.

4. Setup control parameter screen listing all setpoint registers. All settable values shall be changeable from the graphic screens permitted with the appropriate password.

5. Provide an alarm summary screen(s) listing all alarms. Flashing Alarm Indication. Acknowledge button to acknowledge alarms displayed.

6. All values shall be displayed with engineering units.

7. Analog values shall be displayed with the resolution as described above.

8. Display indicating a new alarm regardless of the screen currently displayed.

9. Menu screen with jump buttons to all screens.

10. Jump button displayed on all screens to go to a menu screen.

11. Jump button displayed on all screens to go to the last screen.

12. Provide the following graphic screens:

    a. Overviews of station/project refer to P&ID drawings – one per P&ID (minimum).
    b. Setpoint "pop-up" menus for each device to configure alarms.
    c. Control screen to allow configuration of operation per the control strategies.

d. Alarm configuration screen with setpoint listings and descriptions.
e. Totalization (flow and/or runtime) for all devices.
f. Trending screens for each analog device.
g. Alarm summary screens with acknowledge and reset.
h. Modifications to existing overview screen as applicable. (large overview showing multiple related stations and/or systems).
i. Configure drop down menus and "go-to" buttons for each new screen.

D. System Security

1. Emulate existing security protocols and apply to new screens as directed by City Staff.

3.03 TESTING

A. The SCADA system shall be tested with the PLC control systems as defined in other sections. The SCADA system shall be ready for testing at the Field Test. The SCADA application programmer shall be performing testing, making corrections and/or on stand-by during all testing. There shall be no time limit to perform such testing and completion will be as determined by the Owner's Representative.

B. Provide testing as specified in Section 16600 – FACTORY AND FIELD TESTING.

3.04 ADDITIONAL PROGRAMMER LABOR HOURS

A. The Contractor shall include in his bid price an additional 24 hours of SCADA application program configuration changes to be designated by the Owner's Representative or Owner during testing and start-up.

B. All SCADA application programming configuration changes shall be performed by the original programmer and shall be made in the presence of the Owner's Representative in the field. None of the hours shall be used for travel costs, overhead, etc., that are not related to programming changes.

3.05 MEDIUM

A. Provide SCADA applications programs on CD recordable disk media with each submittal. Clearly label CD with station name and contents. CD disk shall contain the following:

1. Tag name data tables.
2. Colored graphic screens.
3. These disks and all copyrights shall become the property of the Owner, for its use on this and future projects.

B. In addition, one (2) sets of CD-ROM diskettes of the application SCADA programs shall remain on site. All programs on the disks shall be updated each time the Contractor is called out to modify the programs.

C. Provide two (2) copies of as-installed SCADA application screens and tag name data tables printed with standard laser print 8 1/2" x 11" paper at end of project. Insert new print-outs into the Operations and Maintenance manuals. Provide number of copies as specified in 16010 Operations and Maintenance Instructions.

3.06 TRAINING

A. The SCADA programmer shall provide a minimum of 8 hours of training for 4 to 6 of the Owner's engineering, operations, and maintenance personnel. The training shall consist of the following minimum sessions:

1. 4 hours – SCADA Configuration and Maintenance Course shall include:

   a. Training in entering configuration mode and creating symbols, assigning references, editing tag database.
   b. Making data back-ups and creating a back-up schedule.
   c. Making SCADA configuration back-ups.

2. 4 hours – SCADA Operations Course shall include:

   a. Screen usage.
   b. Password heirarchary.
   c. Dos and Don'ts.
   d. Reports and file management.

3.07 WARRANTY

A. Troubleshoot and correct all program abnormalities, glitches and bugs uncovered during the warranty period. Provide phone and/or on-site support as required to correct problem(s).

B. Software support which shall be provided by the System Integrator:

1. Free technical SCADA software and hardware configuration phone support for a period of one year. SCADA phone support shall be provided directly from the person(s) that configured the SCADA System. Phone support shall be available between 8 a.m. and 4 p.m. Pacific Standard Time Monday through Friday.

2. The System Integrator shall correct any SCADA software configuration error that is discovered within the warranty period, at no additional cost to Owner.

****END OF SECTION****