

PUMP STATIONS/SCADA UPGRADE PROJECT

WOODRIDGE LAKE SEWER DISTRICT

OCTOBER 15, 2012



Following is the project background, together with our proposed scope of services, schedule, fee and assumptions for the Pump Stations/SCADA Upgrade Project for the Woodridge Lake Sewer District (WLSLD) in Goshen, Connecticut. The WLSLD seeks funding for this project through CT-DEEP's CWF Pump Stations set-aside 2% loan program.

BACKGROUND

Woodard & Curran evaluated pump station features and needs as part of Task 5 of the Wastewater Facilities Plan, including: (1) communications with the pump stations; (2) pump station controllers; (3) data collection and reporting; (4) remote monitoring and control; and (5) flow measurement at the pump stations. Based on our evaluation, which is summarized in the attached Memorandum to CT-DEEP, dated August 31, 2012, we developed a summary of the following current limitations and needs:

- **Autodialers:** Each pump station has a telephone line connected to an autodialer which dials out high wetwell conditions and loss of station power alarms to designated phone numbers. These land line phone connections have proven unreliable, resulting in operations staff missing alarm conditions that could have been addressed earlier.
- **Pump Controllers:** Currently, all of the pump stations within the WLSLD collection system are equipped with Pribusin PCS-400 pump microcontrollers. The Pribusin microcontrollers utilize a propriety platform, which cannot be customized, and they are limited in their ability to provide process information to a SCADA system.
- **Centralized Monitoring:** The existing pump stations and WPCF do not have a centralized system for control, data collection and reporting. Currently, all operations and permit-required data is collected by hand, and there are no automated means to monitor or record this data; either at the WPCF or at the pump stations.
- **Flow Measurement:** Pump Stations 1, 2, 3, 5, 7, and 8 do not have a direct means of flow measurement. Pump Station 6 and the WPCF Pump Station have clamp-on ultrasonic flow meters located on the discharge piping in the below-grade drywells.
- **Emergency Connections:** All of the submersible pumping stations are equipped with generator quick connects and manual transfer switches that allow the staff to provide temporary emergency power utilizing a portable generator. Pump Station 6 and the Plant Pump Station have permanent emergency generators. However, Pump Station 6 and the Plant Pump Station have close-coupled motors below grade which make them vulnerable to failure resulting from station flooding. In the event of system failure, there are no means for connecting a bypass pump to the force main at either of these stations.

PROPOSED PROJECT SUMMARY

Based on our Task 5 evaluation, we developed recommendations that: (1) are critical for I/I management; (2) improve reliability; and (3) foster emergency readiness. Following is the basis of design for the improvements associated with the Pump Stations/SCADA Upgrade Project:

- **Flow Monitoring:** Provide magnetic flow meters to the internal/drywell discharge force mains at Pump Station 6 and the Plant Pump Station; Add continuous wetwell level trending capabilities at Pump Stations 1, 2, 3, 5, 7 and 8. The flow monitoring improvements will allow the WLSLD to more accurately monitor flows and I/I trends in each subarea over a much longer period than otherwise

possible with temporary flow monitoring programs. The ability to adjust wetwell level settings will also improve the District's ability to manage flows between pump stations during high flow events, decreasing simultaneous peak flows, thus improving pumping efficiencies and better managing utility costs.



- Pump Station Control: Provide programmable logic controllers (PLC), wiring and programming in the existing pump control panels to provide control and monitoring at each pump station location. New PLCs will utilize open architecture software which provides the ability to calculate pump station flow and customize the monitoring and control capabilities. The PLCs facilitate SCADA readiness, improve connectivity during alarm conditions, and foster more proactive maintenance and response measures by WLSO operations staff. Lightning protection and surge protection will be incorporated as part of the control panel upgrades which will improve reliability as the stations are reported to be prone to lightning strikes that result in loss of station functionality.
- Centralized Data Collection: Provide a central PLC controller (SCADA master) and hardware for the SCADA system located at the WPCF. The SCADA master will include computers and software for automated data collection, remote alarm notification and reporting. The data collected from the pump stations is displayed in real time in a graphical format that is easy to read and interpret. Alarms are displayed for the staff to review and determine the best course of action. The alarming capability will include station loss of power, wetwell high level, pump fault, pump fail to start, level transmitter failure, and other backup/redundancy functions to promote emergency readiness. Status points, process variables (flow, level, pump run status and runtimes, status of station power, alarms, etc.) and alarms are logged and available for trending. The SCADA software can be configured to modify/customize the control system in response to the changing conditions and operational needs.
- Report Generation: Include reporting software (XLReporter) for the SCADA system. This package can be configured to generate automatic reports of process variables and alarms. The reports can be utilized to trend flow rates, pumping cycles and times to allow WLSO to identify and address inefficiencies that may develop. In addition, manual lab data can be entered into the program to compare to readings received from online instruments. The software can generate reports for any specified period (daily, weekly, monthly, etc.) and can be formatted to be identical to regulatory agency reports to reduce the amount of staff time required for reporting.
- Remote Access Capability: Install hardware package at the WPCF to provide secure remote access into the SCADA system. The remote access system will allow staff to monitor and control the system as if they were sitting in front of the SCADA PC at the WPCF, which enhances their ability to respond quickly and effectively. This remote access capability is available from a PC, laptop, smartphone or tablet through the use of a software application and the appropriate security credentials.
- Pump Station Communications: Provide licensed frequency radio for communication from the WPCF site with the pump stations via a repeater site at the WLSO Clubhouse. Implementation of radio communication would include the installation of radio equipment at each of the pump station locations, the WPCF, and a repeater site located at the WLSO Clubhouse. Licensed Frequency Radio will be a more reliable system for pump station communication than the existing leased telephone line system. In addition, radio communication is integral to implementing a centralized SCADA system which inherently increases reliability through improved monitoring, alarming and data collection. A Radio Propagation Study has been completed to demonstrate the feasibility of licensed frequency radio communication between the sites in the collection and treatment system.
- By-Pass Connections to Enhance Emergency Readiness: Provide bypass pump headers and quick connect fittings in the drywells at Pump Station 6 and the Plant Pump Station. Installation of these bypasses (which is a typical pump station design practice) will improve emergency response

capabilities by providing the WLS D with a means for connecting a portable pump to the force main at each station to pump out the wetwells. The current configuration does not include a means for bypass which elevates the risk of SSOs from the pump stations.

SCOPE OF SERVICES



Woodard & Curran's scope of services is based on the Proposed Project Summary. Our Scope of Services is organized in the following manner:

1. **Flow Metering and Emergency Bypass Improvements:** We will provide design, bidding, construction administration, and construction observation services for the Flow Metering and Emergency Bypass Improvements. The proposed construction work, including providing the flow meters and emergency by-pass connections, will be performed by a General Contractor, selected through the public bidding process, who will Contract directly with the WLS D.
2. **SCADA Improvements:** We will provide design, furnishing, programing, integrating and starting up for the SCADA Improvements. We will subcontract directly with equipment manufacturers and licensed electricians to furnish and install the instrumentation, controls and SCADA equipment.

Task 1A – Design of the Flow Metering and Emergency Bypass Improvements:

- 1A-1. Attend kick-off meeting with WLS D to review project details including schedule and design preferences.
- 1A-2. Provide engineering services related to mechanical/piping to develop plans and specifications, as outlined in the Proposed Project Summary. This task includes preparation of bid documents for the Flow Metering and Emergency Bypass Improvements, which will be publically bid.
- 1A-3. Attend one additional progress meeting with WLS D during the design phase.
- 1A-4. Develop Opinion of Probable Construction Cost.

Task 1B – Public Bidding of the Flow Metering and Emergency Bypass Improvements:

- 1B-1. Prepare and submit the advertisement for bidders for publication in a local newspaper and the Dodge Report. Copies of the bidding documents will be reproduced and distributed to bidders. We will obtain up-to-date Connecticut Prevailing Wage Rates for inclusion in the bidding documents.
- 1B-2. Prepare and distribute up to 15 sets of bidding documents.
- 1B-3. Attend pre-bid meeting at the WLS D to review the proposed project with prospective bidders.
- 1B-4. Respond to questions/comments during the bidding period and issue addenda.
- 1B-5. Attend the bid opening.
- 1B-6. Tabulate, review and analyze bid results.
- 1B-7. Investigate and evaluate the qualifications and credentials of the lowest qualified bidder.
- 1B-8. Make recommendation to the WLS D as to the lowest qualified bidder and as to the Award of the Construction Contract.



Task 1C – Construction Administration of the Flow Metering and Emergency Bypass Improvements:

- 1C-1. Coordinate and attend pre-construction meeting with WLSL and Contractor.
- 1C-2. Receive/review/process shop drawings for the materials and components of the construction.
- 1C-3. Review/process recommended periodic payments to the Contractor for completed work.
- 1C-4. Review/process/recommend contractor requests for change orders or other claims related to the work.
- 1C-5. Provide advice to WLSL during construction.
- 1C-6. Respond to Contractor questions (requests for information) during construction.
- 1C-7. Prepare record plans based on our site visits, as-builts provided by the Contractor, and WLSL staff input.

Task 1D – Construction Observation of Flow Metering and Emergency Bypass Improvements:

- 1D-1. Provide part-time, periodic construction observation services. Our proposed budget is based on four (4) part-time field visits, up to four hours each, during the anticipated 4-week active construction period.

Task 2 – Furnish, Install, Program, Integrate and Startup SCADA Improvements:

- 2-1. Attend SCADA kick-off meeting with WLSL to review project details including schedule and design preferences.
- 2-2. Prepare Basis of Design (BOD) Report to define the major system features that will be included in the SCADA Project, review BOD report with WLSL, and confirm project intent before finalizing SCADA design.
- 2-3. Provide engineering services related to electrical/SCADA engineering services and instrumentation to develop plans and specifications, as outlined in the Proposed Project Summary.
- 2-4. Attend two additional progress meetings with Town to review the BOD and final design phases.
- 2-5. Develop Opinion of Probable Construction Cost at the conclusion of the final BOD report.
- 2-6. Furnish and install the radio communications equipment, programmable PLC hardware, new level instrumentation and personal computers (PCs) and software.
- 2-7. Program the PLC hardware at the project locations based upon Control Narratives, I/O requirements, and alarm requirements developed for each site in coordination with WLSL staff. The control panel drawings will be used to accurately assign the I/O in the programs, and the control narratives will be used as the basis for the functionality for each project location.
- 2-8. Develop pump station monitoring screens for the two (2) SCADA PCs (referred to as Human Machine Interfaces or HMIs), as well as Panelview screens for all stations provided with Panelviews (referred to as Operator Interface Terminals or OITs). The HMI configuration shall consist of: main SCADA system overview screen; wastewater remote station screens (total of 8); communication status screen, depicting the state of the communication between each remote site and the radio master location; and historical collection and trend displays. The OIT screens shall



consist of: alarm summary screen; and station summary screen (up to 2 per station for the 8 stations).

- 2-9. Configure the automatic reporting in the XLReporter package to automatically collect information from the remote stations. Report formatting will follow regulatory agency formats, for ease of use and submission by operations personnel.
- 2-10. Configure alarm notification functionality utilizing WIN911 software installed on the SCADA PC located at the treatment plant based upon the alarm requirements for each site. Coordinate with operations personnel to determine the specific alarm notification protocol.
- 2-11. Provide an autodialer to act as a back means of remote alarm notification in the event of failure of the SCADA PC or the WIN911 software.
- 2-12. Perform Factory Acceptance Testing (FATs) on all the control panels at the panel fabricator's facility to ensure proper operation of the panels prior to delivery. FATs includes the following: confirming with the panel fabricator that power-up testing and internal wiring checkout has been completed prior to arrival onsite and receiving the documentation confirming this; inspection of the panel to ensure compliance with the design and review of the as-built drawings provided by the panel fabricator; and completing I/O checkout for all configured points
- 2-13. Subcontract with TCS Communications to furnish radio communications equipment and provide communication system startup and testing services for communication between all project locations and the HMI located at the treatment building, utilizing the repeater site at the 'clubhouse' building as necessary.
- 2-14. Provide onsite startup assistance. Startup assistance will include the following: I/O checkout of all configured points; control loop tuning; system debugging; verification of proper operation of the equipment and instruments at the project location based upon the Control Narrative (as described above); and verification of communication to the overall SCADA network and the remote HMI.
- 2-15. Produce an electronic Operations and Maintenance (O&M) manual for each project location and make available to view and print on the SCADA computer after completion of the project. One hard copy of the as-built Control Panel drawings will be provided and left at each remote site. The O&M manual will utilize the following format: Management Section; System Overview; Network Architecture Drawing; Operations Section; As-Built Control Panel Drawings (specific to each location) representing the final condition of the control panel after successful startup of the SCADA system; Controls Narrative of SCADA System (specific to each location); I/O List (specific to each location); Alarm List (specific to each location); Maintenance Section; Maintenance Information for SCADA System, including troubleshooting guidelines and a recommended spare parts list; A CD containing electronic copies of the PLC program, OIT screens, O&M manual files, and all related drawings
- 2-16. Provide on-the-job training during startup and four (4) hours of formal Operation training for operations personnel. Formal Operation training will include the use of HMI and OIT screens, control of equipment from the HMI, setpoint modification, alarm review and acknowledgement, and trend review.

SCHEDULE

The WLSD will request funding for this project from its residents at their October 27, 2012 District meeting. Pending approval by CT-DEEP through the CWF Pump Station Set-Aside and Authorization by WLSD, we plan to commence design-phase activities related to the Flow Metering and Emergency Bypass Improvements in November 2012, followed by bidding in Spring 2013, and construction during Summer/Fall

2013. We anticipate that design activities related to SCADA will commence in November 2012, followed by SCADA implementation in Spring 2013, with SCADA integration and completion by November 2013.

FEE



Following is the engineering services budget, by Task, for the Pump Stations/SCADA Upgrade Project. The proposed services will be completed, in accordance with the Terms and Conditions of the Wastewater Facilities Plan Agreement, on a Cost-Plus-Fixed-Fee basis, consistent with CT-DEEP's CWF requirements:

Task 1A: Design (Flow Meters/Bypass)	\$15,000
Task 1B: Bidding (Flow Meters/Bypass)	\$7,000
Task 1C: Construction Administration (Flow Meters/Bypass)	\$8,000
Task 1D: Construction Observation (Flow Meters/Bypass)	\$5,000
<u>Task 2: SCADA (Design, Components & Integration)</u>	<u>\$319,000</u>
Engineering/SCADA Services	\$354,000
<i>Placeholder for Construction of the Flow Meters/ Bypass Headers (Not In This Contract)</i>	<i>\$100,000</i>
Opinion of Total Probable Project Cost	\$454,000

Our opinion of probable cost for the Pump Stations/SCADA Upgrade Project is \$454,000, including proposed engineering services herein, anticipated construction activities, and contingency.

ASSUMPTIONS

Following is a summary of assumptions related to this Project:

1. Permitting is not included in our proposal, since none is anticipated.
2. Bid advertising costs for the Flow Metering and Emergency Bypass Improvements are not included in our proposal.
3. We will comply with CT-DEEP's CWF requirements for MBE/WBE participation through our sub-consultants for the SCADA work.
4. Although we included our opinion of probable cost for the construction phase of the Flow Metering and Emergency Bypass Improvements as an overall budget placeholder, the Construction Contract is not part of our proposal, as this work will be publicly bid and Contracted directly with WLSD.
5. We assume that all proposed electrical and SCADA work will occur within the existing pump control cabinets, and we did not include any costs for work outside the existing cabinets, including new stand-alone electrical cabinets.