



October 30, 2017

City of Hollywood
Department of Public Utilities
P. O. Box 229045
Hollywood, FL 33022-9045

Attention: Steve Joseph, PE

Subject: Automation and SCADA Improvements for Optimization of the SRWWTP's Influent Distribution, Oxygenation Trains, RAS, Deep Injection Wells and WAS

Thank you for the opportunity to develop this scope of work (SOW) to support the City of Hollywood's (City) Department of Public Utilities with the development of automation and SCADA improvements for the optimization of the Southern Regional Wastewater Treatment Plant's (SRWWTP) unit processes. The SOW presented below comprises the tasks that should be performed, as part of Phase II, to optimize the operations of the Influent Distribution, Oxygenation Trains, RAS, Deep Injection Wells and WAS unit processes through automation and additional SCADA improvements.

BACKGROUND

The SRWWTP's Oxygenation, Chlorination, and Pumping Systems are comprised of several large and complex processes, including influent distribution and flow splitting, high purity oxygen aeration, oxygen generation plant, Return Activated Sludge (RAS) pump stations, chlorination facility, and effluent pumping. Most of this equipment is currently controlled manually by Operations professionals, as the existing SCADA system within the unit processes lacks the necessary level of automation to monitor and control the processes from a Human Machine Interface (HMI) in the control room. This lack of automation limits the level of efficiency that could be achieved during the operation of these unit processes. As a result, the City has identified as the operational efficiency goal of increasing the level of automation at these unit processes to allow for automatic or semi-automatic control from the HMI in the control room.

The SRWWTP is a wastewater treatment facility permitted at 55.5 MGD and includes an on-site oxygen generation facility for the operation of a pure oxygen-activated sludge process for treatment. The SRWWTP is divided into two sections, East and West, both of which are capable of operating independently. The Oxygenation, Chlorination, and Pumping Systems within the SRWWTP include an influent distribution box with appurtenances, an Oxygen Generation Plant, five oxygenation trains, eight clarifiers, four RAS pump stations, six chlorinators, three evaporators, two chlorine residual analyzers, and four effluent pumps (two effluent pumps with

two backup diesel pumps). These systems consist of the following seven Programmable Logic Controllers (PLCs):

- Siemens PLC – Oxygen Generation Plant
- PLC 3 – Chlorine Facility
- PLC 6 – Effluent Pump Station
- PLC 8 – RAS Pump Station 2
- PLC 10 – Influent Distribution Box and Oxygenation Trains
- PLC 15 – RAS Pump Station 4
- PLC 16 – Deep Injection Well Pump Station

The SCADA system within these processes that was part of the Phase I SOW completed in November 2017 included the Oxygen Generation Plant Siemens PLC, Chlorine Facility PLC 3, and Effluent Pump Station PLC 6.

The SCADA system within these processes that is part of Phase II for this SOW is comprised of the following:

Influent Distribution Box (PLC 10 I/O)

- Five internal slide gates that split flow to each of the five oxygenation trains.
- Five electric gate actuators, which are currently operated remotely, and have the potential to be automated to adjust the flow based on input from the existing flow meters.
- Odor control system located at the influent structure, including four recirculation pumps, three metering pumps, two chemical storage tanks, two 3-stage scrubber units, a blower, immersion heaters, a water softener, and various valves. The odor control system instrumentation includes several level indicators and analysis of hydrogen sulfide, pH, and oxidation/reduction potential (ORP).
- An air compressor system, including two air receiver tanks, two compressors, an air dryer unit, and various valves.

Oxygenation Trains (PLC 10 I/O)

- Five enclosed pure oxygen reactors.
- Four mixers at each pure oxygen reactor for a total of 20 mixers.

- Equipment and instrumentation, including flow meters, oxygen concentration sensors, solenoid valves, pressure indicators, alarms, blowers, and analysis for dissolved oxygen, combustible gas, and oxygen purity.
- Fifteen single loop controllers are used to control oxygen flow (three per train). The City requires the removal of the loop controllers and the control of oxygen flow included in the PLC programming.

RAS Pump Station 2 (PLC 8 I/O)

- Four RAS pumps with VFDs.
- Two valves.
- Instrumentation, including flow meters, pump discharge pressure indicators, and seal water pressure indicators.
- Two clarifiers
- The City requires a pump rotation sequence to be included in the programming for these RAS pumps.

RAS Pump Station 4 (PLC 15 I/O)

- Four RAS pumps with VFDs.
- Three valves.
- Two clarifiers.
- Instrumentation, including flow meters, pump discharge pressure indicators, seal water pressure indicators.
- The City requires a pump rotation sequence to be included in the programming for these RAS pumps.

Deep Injection Well Pump Station (PLC 16 I/O)

- Three Deep Injection Well pumps, two constant speed pumps with soft starters and one pump with VFD.
- Three strainers with automated valves.
- Three pump seal water systems.
- Instrumentation, including flow meters, pump discharge pressure indicators, seal water pressure indicators.
- Two monitoring well pumps.

Additional information on Phases II is provided below.

Phase II – Influent Distribution Box and Oxygenation Trains (PLC 10), RAS Pump Station 2 (PLC 8), RAS Pump Station 4 (PLC 15), and Deep Injection Well Pump Station (PLC 16)

Task 100 – Data Gathering and Review and Field I/O List Verification

1. ***Data Gathering and Review.*** Black & Veatch will review existing Influent Distribution Box, Oxygenation Trains, RAS Pump Stations 2 and 3, and Deep Injection Well Pump Station PLC panels and field I/O documentation, PLC communications network drawings, and electrical diagrams of the process equipment provided by the ICE Manager to determine the configuration and functionality of the existing systems. As part of the review, Black & Veatch will export the iFix HMI tags and PLC I/O configuration program and compare this to the existing drawings.

A draft I/O list will be created based on the information provided by the City. The City has indicated that the existing drawings and programming applications are not as-built and will need to be field verified.

2. ***Field I/O List Verification.*** Black & Veatch will provide one engineer to field verify (for a maximum of four business days) the existing I/O in PLCs 8, 10, 15, and 16. Using the draft I/O list developed during Task 1, each field I/O signal terminated in the PLC panel will be identified and verified that it is working properly. The output of this effort will be an updated I/O list for each PLC. The City will provide one technician to assist the engineer during the I/O field verification.

Black & Veatch will coordinate with the ICE Manager to gain an understanding of the drawings, PLCs, field instrumentation and equipment. In addition, Black & Veatch will coordinate with the ICE Manager to update the existing SCADA system network architecture drawings to reflect current conditions. Black & Veatch will scan the City's existing PLC panel drawings to PDF, if not already in PDF format, and red-lined mark-ups of the PDFs will be provided as part of this work. No AutoCAD panel drawings will be created; however, may be provided as supplemental services to this SOW.

3. Following completion of the field investigations a working wrap-up meeting will be held with the ICE Manager and selected Operations staff to discuss findings, HMI and PLC standards and preferences, and identify outstanding issues.

Task 200 – Influent Distribution Box and Oxygenation Trains (PLC 10), RAS Pump Station 2 (PLC 8), RAS Pump Station 4 (PLC 15), and Deep Injection Well Pump Station (PLC 16) PLC and HMI Control Strategies

1. Operations Review. Black & Veatch will meet with the ICE Manager and selected Operations staff to coordinate access to equipment and review, from a control and automation perspective, the operating procedures for the Influent Distribution Box, Oxygenation Trains, RAS Pump Stations and Deep Injection Well Pump Station. A Black & Veatch instrumentation and controls engineer, process engineer, and operations specialist will visit the SRWWTP site for a maximum of two business days. The team will document the City's operational procedures and processes associated with start-up, operations, and shutdown of the Oxygenation Trains, RAS Pump Stations, and Deep Injection Well Pump Station.
2. Based on information gathered above, Black & Veatch will develop control strategies, pump standard operating procedures and, if necessary, update the I/O listing for the Influent Distribution Box, Oxygenation Trains, RAS Pump Stations, and Deep Injection Well Pump Station that will serve as the basis for the PLC and HMI programming efforts described in Task 300 below.
3. A draft of the control strategies and pump standard operating procedures will be provided to the ICE Manager for review and comment. After a two-week review period, comments will be incorporated and the final control strategies and pump standard operating procedures will be prepared.
4. The Influent Distribution Box, Oxygenation Trains, RAS Pump Stations, and Deep Injection Well Pump Station control strategies will utilize the PLC and HMI standards and conventions developed under the Sludge Process Control System Automation and SCADA Improvements Project and updated based on the work performed in Phase I. Black & Veatch will update the Standards and Conventions document to incorporate changes required for the Influent Distribution Box, Oxygenation Trains, RAS Pump Stations, and Deep Injection Well Pump Station.
5. Implementation of the control strategies in the PLC and HMI may require control system equipment and hardware changes such as new PLC processors, PLC input/output cards, new instrumentation, network hardware, and communication cable. As an appendix to the Influent Distribution Box, Oxygenation Trains, RAS Pump Stations, and Deep Injection Well Pump Station control strategies, Black & Veatch will prepare a brief narrative description of the control system equipment and hardware improvements that are required. The appendix will also include an updated SCADA system network architecture drawing including these improvements. Detailed connection diagrams, updated PLC panel drawings, P&IDs and construction specifications are not included as part of this SOW. The City will be responsible for

furnishing and installing new PLC equipment, instrumentation and network improvements identified prior to the commissioning of the programming improvements.

Task 300 – Influent Distribution Box and Oxygenation Trains (PLC 10), RAS Pump Station 2 (PLC 8), RAS Pump Station 4 (PLC 15), and Deep Injection Well Pump Station (PLC 16) PLC and HMI Programming

1. Black & Veatch will re-program PLCs 8, 10, 15, and 16 based on the control strategies and pump standard operating procedures developed in Task 200.
2. Black & Veatch will provide new iFix graphic displays for the Influent Distribution Box, Oxygenation Trains, RAS Pump Stations, and Deep Injection Well Pump Station based on the control strategies developed in Task 300.
3. Black & Veatch will utilize iFix historian tools to map existing tag names to the new standard tag names to retain access existing historical data.
4. Programming will include tagging updates to existing trends.
5. Programming will be based on the final I/O list developed in Task 100. An additional update to the I/O list requiring changes to the programming or iFix may be provided as a supplemental service to this scope of work.
6. Reports development will not be part of the programming SOW. If desired by the City, reports development may be provided as supplemental services.

Task 400 – Influent Distribution Box and Oxygenation Trains (PLC 10), RAS Pump Station 2 (PLC 8), RAS Pump Station 4 (PLC 15), and Deep Injection Well Pump Station (PLC 16) PLC and HMI Commissioning

1. PLC and HMI Commissioning will not commence until the City has installed any Influent Distribution Box, Oxygenation Trains, RAS Pump Stations and Deep Injection Well Pump Station equipment, hardware and/or instrumentation improvements necessary to implement the automation control strategies identified in Task 300, as necessary to implement the automation control strategies.
2. Black & Veatch, in a coordinated effort with City ICE staff, will download the PLC programs developed in Task 300 and commission the I/O, database, graphic screens and control logic on a system by system basis, as defined herein.
3. City ICE staff will assist in loop checks, testing, startup and commissioning activities.
4. Commissioning activities will include final documentation and correction of punch list items.

5. The level of effort for the Commissioning activities is based on the following:
 - a. Fifteen business days for PLC 10, including HMI displays.
 - b. Ten business days for PLCs 8, 15, and 16 including HMI displays.

Task 500 – RAS Pump Station 1 Programming and Commissioning (PLC 7)

The new RAS pump standard operating procedures and control strategies developed as part of Tasks 300 above will also be programmed and tested for RAS Pump Station 1 in PLC 7, which was updated in the Sludge Process Control System Automation and SCADA Improvements Project.

Task 600 – WAS Pump VFD Commissioning (PLC 7)

As part of the Sludge Process Control System Automation and SCADA Improvements Project, Black & Veatch completed the programming of the WAS pump VFDs but did not test the programming and commissioning since the VFDs were not in place by the completion of the project. Black & Veatch will perform I/O checkout and testing of the new WAS VFDs and WAS auto logic.

Task 700 – Operations Staff Training

Black & Veatch will provide an operations specialist to develop and conduct system training sessions for the City's O&M staff. The training sessions will focus on the system design, control and automation concepts for the SCADA system and treatment processes, as identified in the SOW. Two sessions, of up to two hours each, will be provided for each major process system. Training will be provided as follows:

1. A training document will be prepared and distributed for each session. The document will be comprised of a PowerPoint, control information topics, and drawings. An electronic version (PDF) of the PowerPoint presentation will also be provided.
2. Training will include a discussion of the principles of operation, process troubleshooting, and trending.
3. Training will be conducted at the SRWWTP site.

Hands-on-training will be provided with individual operators while on site during the training. A Black & Veatch operations specialist will be available to work with Operations staff at the workstation in the control room to assist operators in understanding the new automation and control system.

Level of effort on site is two business days for HMI & PLC training of City Operations and Maintenance staff.

WORK TO BE PERFORMED BY THE CITY

1. The City will provide PLC panel and field I/O documentation, PLC communications network drawings, and electrical diagrams of the process equipment.
2. The City will provide one technician to assist the field engineer during the I/O field verification.
3. The City's ICE Manager will review the control strategies and standard operating procedures developed and provide comments to Black & Veatch.
4. The City will be responsible for furnishing and installing all new PLC equipment, instrumentation and network improvements identified prior to the commissioning of the programming improvements.
5. PLC and HMI Commissioning will not commence until the City has installed any equipment, hardware and instrumentation improvements necessary to implement the automation control strategies.
6. City ICE staff will assist in loop checks, testing, startup and commissioning activities.
7. City will provide access to Oxygenation, Chlorination, and Pumping Systems equipment during commissioning and make temporary provisions including manual control, temporary wiring, temporary networks, etc., to maintain plant operations during commissioning.
8. City will make ICE staff available to participate in the operations training.

SUPPLEMENTAL SERVICES

The following items are not included in this SOW and can be provided as supplemental services to this Task Order.

1. Preparation of AutoCAD panel drawings.
2. Programming will be based on the final I/O lists developed. Additional programming or iFix as a result of additional updates to the final I/O list.
3. Additional updates to the final I/O list developed under this SOW.
4. Reports development.

PROJECT SCHEDULE

Black & Veatch will perform the services in accordance with the following schedule:

Task Series	Task Description	Schedule
PHASE II – Influent Distribution Box and Oxygenation Trains (PLC 10), RAS Pump Station 2 (PLC 8), RAS Pump Station 4, (PLC 15) and Deep Injection Well Pump Station (PLC 16)		
Task 100	Data Gathering and Review and Field I/O List Verification	To be completed 6 weeks after Kick-off Meeting
Task 200	Influent Distribution Box and Oxygenation Trains (PLC 10), RAS Pump Station 2 (PLC 8), RAS Pump Station 4 (PLC 15), and Deep Injection Well Pump Station (PLC 16) PLC and HMI Control Strategies	To be completed 6 weeks after Task 100
Task 300	Influent Distribution Box and Oxygenation Trains (PLC 10), RAS Pump Station 2 (PLC 8), RAS Pump Station 4 (PLC 15), and Deep Injection Well Pump Station (PLC 16) PLC and HMI Programming	To be Completed 16 weeks after Task 200
Task 400	Influent Distribution Box and Oxygenation Trains (PLC 10), RAS Pump Station 2 (PLC 8), RAS Pump Station 4 (PLC 15), and Deep Injection Well Pump Station (PLC 16) PLC and HMI Commissioning	To be Completed 11 weeks after Task 300
Task 500	RAS Pump Station 1 Programming and Commissioning (PLC 7)	To be completed 1 week after Task 400
Task 600	WAS Pump VFD Commissioning (PLC 7)	To be completed 1 week after Task 400
Task 700	Operations Staff Training	To be completed 2 weeks after Task 600
Total Project Duration		42 weeks

We estimate that project execution should not exceed 42 weeks. We will work closely with the City to minimize project duration and impact to SRWWTP operations as much as practical.

PROJECT COST

The level of effort for the described SOW is a lump sum amount of \$299,460, as detailed in the table below. Monthly invoices that will be submitted to the City based on project progress.

Task	Cost
PHASE II – Influent Distribution Box and Oxygenation Trains (PLC 10), RAS Pump Station 2 (PLC 8), RAS Pump Station 4 (PLC 15), and Deep Injection Well Pump Station (PLC 16)	
Task 100: Data Gathering, Review and Field I/O List Verification	\$30,375
Task 200: Influent Distribution Box and Oxygenation Trains (PLC 10), RAS Pump Station 2 (PLC 8), RAS Pump Station 4 (PLC 15), and Deep Injection Well Pump Station (PLC 16) PLC and HMI Control Strategies	\$47,990
Task 300: Influent Distribution Box and Oxygenation Trains (PLC 10), RAS Pump Station 2 (PLC 8), RAS Pump Station 4 (PLC 15), and Deep Injection Well Pump Station (PLC 16) PLC and HMI Programming	\$123,825

Task	Cost
Task 400: Influent Distribution Box and Oxygenation Trains (PLC 10), RAS Pump Station 2 (PLC 8), RAS Pump Station 4 (PLC 15), and Deep Injection Well Pump Station (PLC 16) PLC and HMI Commissioning	\$56,875
Task 500: RAS Pump Station 1 Programming and Commissioning (PLC 7)	\$15,890
Task 600: WAS Pump VFD Commissioning (PLC 7)	\$5,740
Task 700: Operations Staff Training	\$18,765
Total Phase II	\$299,460

We look forward to the opportunity to continue to assist the City with this innovative and important project. Please, feel free to contact me with any questions at (954) 465-6872.

Very truly yours,

BLACK & VEATCH CORPORATION



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Client Director

cc: Francois Domond, PE
Kellvy Angeles

