POLB SCADA PROJECT STANDARDS

The Port of Long Beach has created a common set of monitoring, instrument, sensor and communications standards for the implementation and replacement of Sewer Lift and Stormwater Pump Stations. These standards are to assist the Port in completing its Supervisory Control and Data Acquisition (SCADA) system.

The SCADA system will enhance the Port's capabilities by receiving real-time information regarding pump, electrical, flow and other key pieces of information. This information will assist in emergency response, maintenance staff training, life-safety, spare parts inventory, predictive maintenance needs, historical data for sizing future stations and many other benefits.

This document is designed to provide the Engineer with the SCADA requirements associated with Sewer Lift and Stormwater Pump Stations. During the design process, the Engineer shall coordinate with the Port's SCADA team to determine the precise requirements. Those requirements will then be integrated into the final design. (Simply attaching this document to the final design document is *not* sufficient.)

In case of conflict between this document and finalized construction documents, the construction documents shall prevail.

Monitored / Provided:

Item	Notes
PLC health	All PLC (Programmable Logic Controller)
HOA Switch	H/O/A (Hand [manual]/Off/Auto), 1 per pump. Used to control the operation of the site. Shall provide 2 Digital inputs (hand / auto) to the SCADA system.
Auto Operation	During auto operation, the control of the site is accomplished using the wet well Level stations and the high-level float. The control of the pumps is determined by either the level stations or the float and a pump down timer. Under normal operation, the level stations control the operation of the pumps. If the high-level float is activated, all of the pumps shall turn on. Upon the high-level float deactivating, the pumps will remain on for a specified time delay. The time delay shall be field adjustable and shall be set based upon the time it takes to pump down the wet well from the high float position to the bottom of the wet well. In addition, two digital outputs from the SCADA system shall be wired into the hardwired logic. The SCADA system will not normally be used for control of the site, but will allow the operator to remotely start/stop the pumps if required.
Manual Operation (in Hand)	When pump is placed into hand position, only the electrical protection devices shall be engaged. No high or low limits shall constrain the operation of the pump, SCADA control, float control and Level control shall be deactivated in this mode of operation
Wet well level station (x2)	All level stations shall be provided with an ultrasonic sensor, and associated controller. Each controller shall be provided with 4 outputs: high/high, high, low, & sensor fail. The Wet well level stations shall be wired in parallel with a selector relay, controlled by the sensor fail output from the level station, to operate the pumps. Lead / Lag functionality between the high and high/high level switches from the level station, or a timer if the high-level float is activated (see below). The level-station failure output from both level stations shall be provided to the SCADA system as two digital outputs.
Dangerous gases	4 gases (LEL, O2, H2S, CO); recommended dangerous gas sensors are provided below. The Engineer shall provide justification for each sensor being required, provide the area of coverage for the sensor and the operational implications if the sensor fails during the operation of the site.
Oil in wet well	Stormwater stations only. Shall provide both a local indicator and a SCADA input.
Pump running, Pump fault, position of the HOA switch	Provide pump running, pump fault status, and position of the HOA switch for the pump as SCADA inputs for all pumps
AC current & voltage monitoring (Modbus TCP/IP), motor overload, phase fail, voltage imbalance (digital output).	For all motors: current overload, phase loss, voltage imbalance shall be integrated into the hardwired motor protection system. Once active, faults shall be latched, with a local manual reset or SCADA reset. Provide a local indicator light and output contact to the SCADA system

Item	Notes
Main breaker Shunt trip	Used to allow operations the ability to shut the site down. Provide a manual pushbutton at the site to force a shunt trip, and an output to allow the SCADA system to do a remote trip of the site. Shunt Trip **shall not** be hardwired into the protection system. Shunt trip coil shall be 24 VDC
Ground Fault	One per plant, used for monitoring ground fault. Output from Ground fault detector shall be via a local indicator light and output contact to the SCADA system.
Motor vibration sensor	Measure & sensor fail - non-submersible => 25 HP; output provided to SCADA system as 4-20 ma input and digital input indicating sensor failure.
Motor vibration switch	Auto safety off & sensor fail - non-submersible => 25 HP; connect into the protection system; shall be latched, require either SCADA or manual reset. Provide a local indicator light and output contact to the SCADA system
Motor high temp switch	All motors: connect into the protection system; shall be latched, require either SCADA or manual reset. Provide a local indicator light and output contact to the SCADA system. Circuit shall be fail-safe, broken wire indicates high temperature.
Pump seal leak detection	Submersible pump motors: connect into the protection system; shall be latched, require either SCADA or manual reset. Provide a local indicator light and output contact to the SCADA system
Flowmeters	as required. Shall be magnetic flow type meters with local flow gauge and 4-20 ma output. Engineer shall specify the requirement for the sensor.
pump over pressure switch	Engineer shall specify the over pressure switch and a block / bleed valving to allow testing of the switch without removal. Provide a local indicator light and output contact to the SCADA system. Implement with a hardwired time delay relay, which shall (i) connect into the protection system, (ii) be latched, and (iii) require either SCADA or local manual reset.
Intrusion	All panels, hatches, doors. Each input shall be wired individually to the SCADA system and shall be fail safe (broken wire indicates door open).
Blower low flow switch	All stations with ventilation blowers; Provide a local indicator light and output contact to the SCADA system. Blower low flow switch specifications to be provided by the Engineer.
Flooding	All stations with dry wells. Engineer shall determine and describe action to be takin if flooding occurs.
Control panel UPS	DC UPS power with the following digital outputs: 1) power supply failure, 2) loss of AC power, 3) low battery, panel power failure. All SCADA components shall be DC powered, with redundant DC power supplies rated at less than 30 maximum-volt output, and backed up with external AGM batteries, which shall be field replaceable (not a proprietary battery) and not integrated into the manufacture's DC UPS. Batteries shall be replaceable without shutting down DC UPS. Redundant DC power supplies shall be DIN mounted and external to the DC UPS controller. DC UPS shall provide nominal 24 VDC output. DC power shall be used for the PLC, sensors, communications, and control logic. Shall operate for a minimum of 48 hours on batteries (engineer to show calculation).

Item	Notes
Generators – Permanent	**Automatic Transfer Switch (ATS)**: 1) shall provide the following digital outputs: A) generator power available, B) Utility power available, C) ATS in Utility power position, D) ATS in generator power position, E) ATS in pre-transfer (this is used to allow PLC to turn off pumps before transferring back from Generator power to Utility power). 2) provide via Modbus TCP/IP Ethernet: A) 3 phase voltages and Currents (into the system). 3) shall accept the following digital inputs: A) generator test (this shall cause the ATS to: i) start the generator, ii) assert the pretransfer output, iii) transfer from utility power to generator power, iv) drop pretransfer output. ATS will remain in this mode until the test is de-asserted, at which time the same process as described above shall be executed. 4) ATS shall not require an internal DC battery. 5) for sites with ATS the Ground fault detection equipment shall be installed on the load side of the ATS to allow ground fault monitoring of both the generator and normal power sources. **Generator**: Generator shall provide the following digital outputs: A) generator running B) generator fault (this shall be true for the following conditions: (i) generator not in automatic, (ii) Main generator breaker open, (iii) one of sensors is preventing the generator from running) C) low fuel (calibrated to notify when there is less than 4 hours of fuel remaining) D) low oil pressure E) low battery F) high water temp G) fuel leak H) Generator not in automatic. Generator shall provide the following Analog outputs (4-20 ma): A) Oil temperature B) Fuel tank level (range as either # gallons (0 to max gals = 4-20 ma), or % full (0-100% full = 4-20 ma) C) Battery voltage (0 – max voltage = 4-20 ma) D) Generator water temperature. (0 to max temp (F) =4-20ma) Generator shall provide the following digital inputs: A) Generator start B) Generator main breaker shunt trip (24 VDC coil)
Generators – Portable	**Manual Transfer Switch (MTS):** Shall provide the following digital inputs: A) in Utility power position, B) in emergency power position. **Portable Generator**: Remote start capability.

Item	Notes
Generator – Aux fuel tank	4-20 ma Analog value indicating Fuel level, low fuel (digital input), fuel leak (digital input). Used for permanent generator installations

Devices

Provide the following SCADA devices, or approved equivalents. During the Engineering process the Engineer shall select from the list of components listed below. The Engineer shall validate that the specified equipment is still available during the design phase of the project and if not, provide recommended substitutions. The Engineer shall have the option to present substitutions for the below-listed equipment must identify to the Port of Long Beach, who will review and provide acceptance.

Three of the devices listed below (the PLC, ultrasonic measurement system, and the radio) are specialty items and are sole sourced. Substitutions are not permitted, and equivalents will not be approved.

Other equipment is acceptable to be substituted. Currently the Port uses Schneider VFDs, and AB or Schneider soft starters. Would prefer Modbus TCP/IP interfaces and configuration software that is provided by the vendor at no cost.

Devices at All Stations:

PLC Components	Make/Model
PLC & I/O **(Sole Sourced Item)**	CompactLogix 1769 series PLC 1769-L33ER CompactLogix 2MB Enet Controller 1769-PB4 1769 Compact I/O Power Supply 1769-IQ32 Compact 24V DC sink/source input module 1769-OB32 Compact solid-state 24V DC source output module 1769-IF8 Compact voltage/current analog input module 1769-ECR or 1769-ECF Right / Left End Cap
All cabinets Shall be NEMA 4X (large are stainless 316, small are polyester). Outdoor enclosures housing the PLC / Communications equipment shall be free standing single door enclosures which will allow the ability to add Heat shield.	Hoffman or equal
Floor Stand	If Required; Hoffman or equal

Sensors and Instruments

Sensors and Instruments	Make/Model
HOA switch	Allen-Bradley 800T-J2B or equal
Bypass key switch	Allen-Bradley 800T-H48A or equal
Ultrasonic level transducer, 2 per station	Siemens XPS-10 or XPS-15F
Ultrasonic level transmitter (mounted in control panel), 2 per station **(Sole Sourced Item)**	Siemens HydroRanger 200 HMI
Float switches	Contegra LS SPDT or equal

Sensors and Instruments	Make/Model
4-channel gas monitoring – LEL, CO, H2S, O2	Honeywell SPXCDULNFX
Green, amber, red LED lamps and horn	Eaton or equal
Vibration switch	Murphy VS2-EX or equal
Vibration transmitter	
Pressure switch	United Electric 10-C-11-M511
Pressure transmitter	Rosemount 2051CGXA02A1AS5E5Q4 or equal
Flow meter (xx is for sizing)	Schneider Electric IMT31A-44546001100003 w/ 95XXA-A513X11100000000
AC current transmitter, Phase-loss monitor, motor protection relay	Little Fuse 777 motor protection with Modbus TCP/IP Ethernet
Thermal flow switch	Magnetrol TD2-7D00-030 w/ TEC-A110-002
Hatch limit switch	Square D 9007 CR53B2
Intrusion switch	Hoffman ALFSWD or equal
15 inch graphical display	Maple Systems cMT3152X or approved equal
Panel lighting	Generic LED lighting
120V Receptacles	Generic
Ground fault detector	Little Fuse 777.
Main breaker shunt trip	Need to install a shut trip on the main trip.

Communications

Communications	Make/Model
Cellular radio, network switch and firewall **(Sole Sourced Item)**	Digi TX64 5G
20’ hollow metal antenna tube & mount minimum diameter of 1 ½ “	Generic
Cellular directional antenna	Generic (Sprint, ATT and Verizon data)

Specific to Stormwater Stations:

Item	Make/Model
Slick Sleuth Oil Spill Monitor	InterOcean SS320 series

Other Requirements:

The Engineer shall specify the following within the drawings and specifications:

1. All field wire shall be terminated onto termination blocks prior to wiring the PLC.
    a. All digital inputs shall be 24 VDC.
    b. Any filed digital or analog Input wiring shall be protected such that a short of any field wire to earth ground shall not impact any part of the control system other than the individual signal associated with the field wire.
    c. All field PLC I/O cables shall be separated into separate conduits; digital inputs, Analog input\outputs, digital outputs.
    d. Field I/O wiring shall be a minimum of 16 gauge wire.
2. All field pressure sensors shall be specified to include bleed / block valving to allow for calibration, removal of the sensor without disabling the operation of the equipment.
3. Pressure Switch:
    a. A high discharge pressure switch shall be installed for each pump between the pump and the check valve to disable the pumps.
        i Shall be installed with appropriate diaphragm seals to isolate the switch from process fluids and isolating ball valves to enable easy maintenance and replacement of switch.
        ii Shall have NEMA 4X enclosures with setpoint and dead-band, adjustable via calibrated external reference dials and listed for use in Class 1, Division 2 locations.
        iii Shall have a repetitive accuracy of plus or minus 5 percent of the operating range and must withstand up to 150 percent of setpoint pressure.
    b. Set point must be adjustable over the operating pressure range identified in the drawings with a differential adjustment span of 20 to 40 percent of the range of the switch.
4. Mechanical Contactor, Soft Starter, VFDs.
    a. During the design phase of the project, all sites shall be evaluated to use VFD's to minimize wear and tear on the motors. The Engineer shall do a calculation to determine that type of contactors should be used.
    b. Mechanical Contactors should be used any time the motors are low horsepower and are below the requirements for soft starter by the electric utility.
    c. Engineer shall validate that the design ensures that the lock rotor will not impact the operation of the emergency generator.
    d. Lead / Lag pump rotation shall be implemented on a weekly or monthly basis. During float operation, the control of the wet well should be accomplished by use of one high-level float and timers.
        i If emergency high-level float control is activated the site should be designed to allow all of the pumps to come on.

ii If there are external constraints that will not support this type of design, the Design Engineer shall identify this during the first submittal.

All station requirements should be confirmed with the Port's Director of Maintenance.