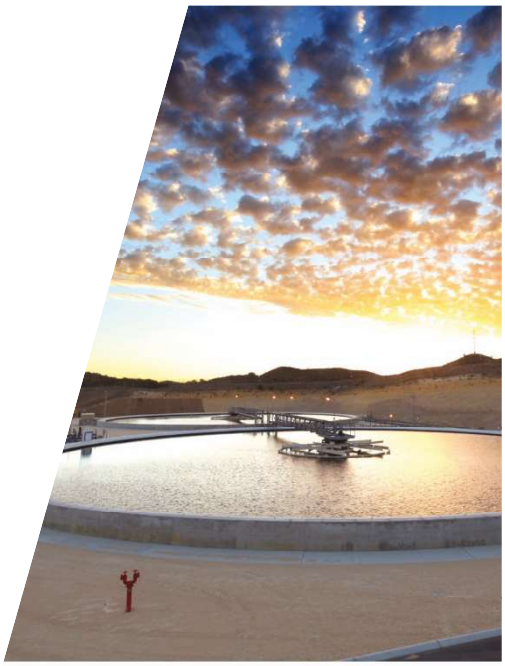


Control Logic Description and Process Narrative

Third Train and SPP Controls Upgrade

Sewage Processing Plant (SPP)
Center of Site
Bruce Power LP
Tiverton, ON









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1. General

1.1 Purpose and Organization

This document is a Process Narrative (PN) that will serve as a programming guide as well as a general operation and maintenance reference guide for the facility Operators of the Bruce Power LP Sewage Processing Plant (SPP). The SPP is located at the intersection of 19th Street and 40th Avenue and consists of building B18 as well as the plant treatment tanks and sludge storage lagoons. This intention of this document is to highlight the automatic control operations of the existing SPP PLC (Outpost 5 system), which will be migrated into the new SPP master PLC, as well as automatic control functions associated with the SPP Third Train (North Train). This document is intended to be a reference in conjunction with existing Bruce Power flow sheets, Outpost 5 PLC ladder logic, existing UV system PLC ladder logic, and details within the Bruce Power SPP Controls Upgrade design package as well as the Bruce Power SPP Third Train (North Train) Upgrade design package. Existing ladder logic for the SPP should be utilized as the primary source of information for integration of logic into the new SPP master PLC for existing SPP systems. The majority of existing treatment systems within SPP are manually controlled. Following execution of the Controls Upgrade, those systems, which are currently operated in a local/manual mode, will continue to operate in this manner.

1.2 Process Overview

As previously noted, the primary intention of this document is to detail the automatic control operations of the existing automatically controlled systems of the Bruce Power SPP as well as systems associated with the new SPP Third Train (North Train). The existing SPP includes influent flow equalization and raw wastewater pumping, influent comminution and screening, wastewater treatment chemical addition, east/west aeration tanks and blower systems, east/west final settling tanks and return activated sludge (RAS)/ waste activated sludge (WAS) pumping, east/west train aerobic digesters, east/west train unwatering sump, UV disinfection system, and MISA sampling system. The new Third Train (North Train) consists of North aeration tanks, North train blower systems, North final settling tanks and RAS/WAS pumping, North train aerobic digesters, and North train sludge wasting/decant sump.

1.2.1 Raw Wastewater Equalization and Pumping

Wastewater is conveyed to the SPP from pump stations across the Bruce Power Site. All pumped wastewater is conveyed to the SPP Equalization (EQ) Tank (TK-11). The SPP EQ tank buffers peak flows and allows for more consistent wastewater quality to be fed to the downstream treatment systems. The EQ tank provides approximately 540 cubic meters (m^3) and allows for 3-8 hours (approximately) of retention time. The EQ tank is mixed/aerated by means of coarse bubble diffuser headers connected to the existing SPP blower system. The level of wastewater in the EQ tank is monitored by a real time ultrasonic level sensor as well as six mechanical float switches. The pH of the wastewater within the EQ tank is also monitored. Raw wastewater is lifted out of the EQ tank into a gravity flow channel by three (lead-lag-lag) submersible wastewater pumps. The operation of the raw wastewater pumps is regulated by the level monitoring instrumentation in the EQ tank.

1.2.2 Raw Wastewater Comminution and Screening

Wastewater pumped from the EQ tank is lifted into an outlet well where movement of the raw wastewater transitions to gravity flow. The lifted raw wastewater flows into the SPP Control Building via 250 mm pipe. As raw wastewater is conveyed into the SPP Control Building, flow is monitored/recorded by an inline magnetic flow meter. Once in the Control Building, raw wastewater is directed to one of two in-channel comminutors that are used to macerate solids present in the raw wastewater as it proceeds to the downstream aeration tanks. A standby manual screen (25 mm bar spacing) is available should the comminutors be offline for maintenance. The comminutors are run in an ON/OFF configuration.

1.2.3 Chemical Feed and Storage

The effluent of the SPP comminutors/bar screen flows towards the SPP aeration tanks via a 300 mm channel which extends from the Control Building to the north end of the existing (east and west) treatment train aeration tanks. Aluminum sulphate (Alum) and polymer are added to the effluent of the screen/comminutors to assist in the removal of phosphorus as well as enhance settling within the final settling tank. Alum is stored in two bulk tanks in the basement of the Control Building. Polymer is made into a dilute solution from a dry polymer. The polymer solution tank is in the basement of the Control Building. Magnesium hydroxide solution is also added to the effluent of the screen/comminutors to provide additional alkalinity necessary for nitrification (ammonia removal). The chemical dosing pumps are operated in a manual configuration with the output of the chemical feed pumps adjusted manually at the pump (by adjusting stroke length).

1.2.4 Raw Wastewater Flow Splitting

The addition of a third treatment train (North Train) to the SPP will require flow splitting of the raw wastewater to the active treatment trains (will vary between 1-3 treatment trains). Flow splitting will be achieved by means of manually controlled knife gate valves that can be used to adjust the flow to the operational treatment trains or fully isolate a treatment train from the raw wastewater channel. In order to minimize surcharging of the upstream channels/equipment, the knife gate valves will be (manually) operated in a "most open valve" configuration.

1.2.5 East/West Aeration Tank and Blower Systems

The existing SPP treatment trains (east and west trains) are provided process/mixing air by three existing (472 L/s, 50 HP) blowers. Air from these blowers is directed to the EQ tank, east and west treatment trains (aeration and aerobic digestion) as well as the SPP airlift pumps (used for RAS/WAS). The number of operational blowers is dictated by the SPP Operators. The blowers are operated (turned ON/OFF) as needed to satisfy the air demands of the SPP. Air flow to the east and west treatment trains as well as the EQ tank is monitored by inline differential pressure based air flow meters. Dissolved oxygen is measured in the contact stabilization tank of the east and west treatment trains. This information is provided at a local display as well as on the SPP SCADA display. The distribution of air from the existing blower system is regulated by a series of manual valves. Following the execution of the third train upgrade, the existing blowers and east/west treatment trains will continue to operate in a manual manner.

1.2.6 Third Treatment Train Aeration Tank and Blower Systems

The third treatment train aeration tank and blower systems will operate in an automated configuration. The third treatment train will be equipped with a dissolved oxygen sensor as well as fine bubble diffusers (two diffuser grids). Process/mixing air will be provided to the third treatment train by two (lead-lag) positive displacement blowers (120 L/s, 20 HP). The output of the third train aeration blowers will be regulated by the dissolved oxygen level measured in the third treatment train aeration tank. The measured DO level will dictate the number of aeration blowers required and operating speed.

1.2.7 East/West Final Settling Tank and RAS/WAS Pumping

Treated wastewater and mixed liquor (i.e., suspension of aerobic bacteria) flow from the East/West aeration tanks into the East and West final settling tanks. In the final settling tanks, treated wastewater is separated from the mixed liquour. The settled bacteria (sludge) is transported to the final settling tank sludge hopper (at influent end of tank) by a chain and flight sludge collection mechanism. The sludge collection mechanism operates at a constant speed in an ON/OFF configuration. The sludge collection mechanism also assists in directing scum (floatables/oil/grease) to the final settling tank scum trough (located at the effluent end of the tank). Sludge collected in the final settling tank sludge hoppers is conveyed by three (lead-lag-standby) submersible RAS/ WAS pumps. These pumps are utilized to continuously return RAS to the East/West aeration tanks at a flow rate proportional (%) to the average flow through the corresponding treatment train. The same submersible pumps are also used to intermittently direct WAS to the East/West aerobic digesters by means of actuated control valves.

1.2.8 Third Train Final Settling Tank and RAS/WAS Pumping

Treated wastewater and mixed liquor (i.e., suspension of aerobic bacteria) will flow from the third train aeration tank into the third train final settling tank. In the final settling tank, treated wastewater is separated from the mixed liquour. The settled bacteria (sludge) is transported to the final settling tank sludge hopper (at influent end of tank) by a chain and flight sludge collection mechanism. The sludge collection mechanism will operate at a constant speed in an ON/OFF configuration. The sludge collection mechanism also assists in directing scum (floatables/oil/grease) to the final settling tank scum trough (located at the effluent end of the tank). Sludge collected in the final settling tank sludge hopper will be conveyed by three (lead-lag-standby) submersible RAS/WAS pumps. These pumps are utilized to continuously return RAS to the third train aeration tank at a flow rate proportional (%) to the average flow through the treatment train. The same submersible pumps will also be used to intermittently direct WAS to the third train aerobic digesters by means of actuated control valves.

1.2.9 East/West Aerobic Digesters

Waste activated sludge (WAS) is routinely (typically daily) wasted from the East/West treatment trains to regulate the mixed liquor concentration in the East/West aeration tanks. The aerobic digesters are configured in two stages: stage 1 and stage 2, with stage 1 accounting for approximately 2/3rds of the digester volume. The East/West aerobic digesters are continuously mixed by means of coarse bubble diffuser systems supplied with air from the existing SPP positive displacement blowers (472 L/s, 50 HP). The flow of air to the aerobic digesters is adjusted at the

SPP operators discretion based on operating level and manual (portable probe) dissolved oxygen measurements. Sludge is transferred from stage 1 to stage 2 of the aerobic digester by means of air lift pumps. The air lift pumps are operated manually by plant Operators. The level in the aerobic digesters is continuously monitored. Both stages of the aerobic digester include pivoting decant arms that allow for removal of supernatant.

1.2.10 Third Train Aerobic Digesters

The third train aerobic digester will operate in a similar manner to the existing East/West aerobic digesters. The third train aerobic digester is configured as two stages with stage 1 accounting for approximately 2/3rds of the digester volume. The level in each stage of the aerobic digesters is continuously monitored. The two stages of the aerobic digester are provided with mixing/process air by means of coarse bubble mixing grids. Air to the third train coarse bubble grids is provided by a new dedicated aerobic digester blower (190 L/s, 25 HP). The output of the third train aerobic digester blower is regulated based on the level within the aerobic digester to achieve a unit volume of air per unit volume of sludge in the aerobic digesters (e.g., cubic meters per hour of air per cubic meter of sludge). As with the East/West treatment trains, the third treatment train includes pivoting decant arms that allow for removal supernatant from the digester.

1.2.11 East/West Train Unwatering Sump

The Unwatering Sump of the East and West treatment trains serves several functions. Through manipulation of manual valves, the Unwatering Sump allows for: transfer of supernatant from the aerobic digesters to the SPP EQ tank, transfer of digested sludge from the aerobic digester to the sludge lagoons or sludge hauling station, and unwatering (i.e., draining) of the East/West treatment train aeration tanks, final settling tanks, or aerobic digesters to the previously mentioned tanks/processes. Transfer of wastewater and/or sludge is facilitated by two (duty/standby) self-priming pumps (5 L/s, 5 HP). The Unwatering Sump pumps are operated in an ON/OFF configuration at the SPP operators discretion.

1.2.12 Third Train Sludge Wasting/Decant Sump

The third treatment train sludge wasting/decant sump will provide a similar function to the existing SPP Unwatering Sump. The third train Sludge Wasting/Decant Sump will include two submersible (5 L/s, 5 HP) pumps that will allow for transferring of sludge/wastewater to the SPP EQ tank or the SPP sludge lagoons (via connection to an existing forcemain). The third train Sludge Wasting/Decant Sump will receive digested sludge from the third train aerobic digester, supernatant from the third train aerobic digester, and wastewater (during draining) from the third train aeration tank. The Sludge Wasting/Decant Sump pumps will operate based on level setpoint controls (continuous level sensor) as well as back-up level switches. The sludge wasting/decant sump pumps will operate on VFDs.

1.2.13 UV Disinfection

The SPP UV Disinfection system provides disinfection treatment of the SPP secondary effluent (final settling tank effluent). The UV disinfection system is a vendor packaged system that includes a local process logic controller (which governs system operation), UV sump, UV Channel Feed pumps, and UV lamp assembly. Secondary effluent from the SPP treatment trains (including third train) will flow

by gravity to the UV sump. The self-priming, VFD controlled UV Channel Feed pumps (57 l/s, 15 HP) operate (as controlled by UV system PLC) to maintain a setpoint level in the UV sump (the UV sump level is continuously monitored). The UV lamp assembly operates in an ON/OFF configuration in unison with the operation of the UV Channel feed pumps.

1.2.14 MISA Sampling System

The new MISA sampling system is located in the UV Building adjacent to the UV disinfection system. The new MISA sampling system will include two new SPP effluent sampling pumps (variable speed peristaltic pumps), continuously overflowing sample pot, a new pH sensor, and a new conductivity sensor. The new MISA sampling system will be configured to allow the refrigerated composite samplers in the UV building to draw sample from either the overflowing sample pot or from the UV disinfection system effluent trough (as is currently done). The new MISA sampling pumps will be monitored controlled by the SPP master PLC. The new pH and conductivity sensors will be integrated into the new master PLC to allow for monitoring and data logging.

1.2.15 SPP Control Building Drainage System

The SPP Control Building includes a network of floor drains that direct floor drainage from both levels of the building to a drainage sump in the basement. In addition to collecting floor drainage from within the Control Building, the basement drainage sump also collects drainage from the perforated underdrain system, which extends around the perimeter (at structural footing) of the SPP treatment tanks. Drainage collected in the sump is pumped (based on level set point controls) to the front end of the SPP for treatment.

1.2.16 SPP Electrical Systems

The SPP historically included an annunciator panel that would allow display of alarm statuses (via indicator lights). The annunciator panel is to be eliminated from the SPP electrical control room. All alarm status information that previously displayed on the annunciator panel will be rewired to the SPP master PLC. Alarm status information associated with wastewater treatment operations are covered elsewhere in the previous sections of this document. Alarm statuses associated with the SPP electrical hardware are detailed in this section.

1.3 Automation Control System Overview

The process control strategy is designed to be as simple as feasible and generally provides two control levels, as follows:

- Level 1 - Local Control (Equipment is in LOCAL and manually controlled at the local control panel or MCC [i.e., field control]).
- Level 2 - Remote Control (Equipment is in REMOTE and controlled by the PLC/SCADA system).

Most of the Level 2 control "Remote Control" is normally used for day-to-day operation, and allows for the following two possible modes of control:

- REMOTE-AUTO Mode (Equipment is controlled by the AUTO program in the PLC)
- REMOTE-MANUAL Mode (Equipment is manually controlled by an Operator through the SCADA system)

The automation system consists of one main Program Logic Controllers (PLCs) located in the SPP Control Building electrical room, and a central SCADA computer located in the Control Room. A secondary SCADA computer terminal is located in the SPP electrical room. The packaged treatment equipment (e.g. the existing UV disinfection system) will operate independently of the SPP PLC/SCADA and will include integral controls for automatic system operation. Limited monitoring/control of packaged systems will be available via the SPP SCADA. Communication between the SPP PLC and the packaged systems will be via Ethernet network and discrete (dry) contacts.

As previously noted, the majority of the existing SPP treatment systems are controlled manually. These systems generally only have Level 1 (as detailed above) level of Control. When Level 2 control capability is available, such automatic operations will be described in a plain English format.

1.4 Alarm Management Overview

Alarms generated by the automation system will be divided into one of the following two categories based on their priority.

Priority 1 – HIGH Priority 1 or High level alarms require immediate Operator action. They typically would mean the treatment system is, or about to, shut-down, a tank is about to overflow, a critical pump has failed, etc.

Priority 2 – Warning Priority 2 or Warning alarms will require Operator action but the action is not critical and can wait. Examples would be a pump has failed but the system is operating on the stand-by, a tank is at a high level (but below the high, high alarm), one of the 3 pH meters has failed, etc.

2. Raw Wastewater Equalization and Pumping

2.1 Overview

Wastewater is conveyed to the SPP from pump stations across the Bruce Power Site. All pumped wastewater is conveyed to the SPP Equalization (EQ) Tank (TK-11). The SPP EQ tank buffers peak flows and allows for more consistent wastewater quality to be fed to the downstream treatment systems. The EQ tank provides approximately 540 cubic meters (m^3) of volume capacity and allows for 3-8 hours (approximately) of retention time. The EQ tank is mixed/aerated by means of coarse bubble diffuser headers connected to the existing SPP blower system (blowers WW-79630-CP1/CP2/CP3). The level of wastewater in the EQ tank is monitored by a real time ultrasonic level sensor (LT-1) as well as six mechanical float switches (LS1/LS2/LS3/LS4/LS5/LS6). The pH (pH1000) of the wastewater within the EQ tank is also monitored. Raw wastewater is lifted

out of the EQ tank into a gravity flow channel by three (lead-lag-lag) submersible wastewater pumps (WW-79610-P1/P2/P3). P1 is a lower capacity raw sewage pump as compared to P2 and P3. The operation of the raw wastewater pumps is regulated by the level monitoring instrumentation in the EQ tank.

2.2 Major Equipment

- TK-11 SPP EQ Tank
- LT-1 SPP EQ Tank Level Sensor
- pH-1000 SPP EQ Tank pH Sensor
- LS1/2/3/4/5/6 SPP EQ Tank Level Switches
- WW-79610-P1/P2/P3 Raw Wastewater Pumps
- LS7 Outlet Well High Level Switch
- FE-1000 SPP Influent Flow Meter
  - All tags associated with SPP treatment equipment are proceeded by WW-79610 unless otherwise noted.
  - All tags associated with SPP instrumentation are proceeded by WW-67961 unless otherwise noted.

2.3 Control Description

2.3.1 Normal Operation

Raw wastewater received at the SPP EQ Tank (TK-11) is equalized (both for flow and quality) then is directed to the downstream treatment systems by the raw sewage pumping station. The level/quantity of sewage present in the EQ tank is continuously monitored via a non-contacting ultrasonic level sensor (LT-1). The level in the EQ and raw sewage pumping station is also monitored by six (6) mechanical float switches. The raw sewage pumps (P1/P2/P3) operate in a lead-lag-lag mode of operation in response to the influent flow/level within the EQ tank. Primary control of the raw sewage pumping systems is facilitated by the SPP master PLC. All monitored signals associated with the raw sewage equalization and pumping systems will be monitored and recorded by the master PLC/SCADA system. Operator adjustable set points can be adjusted via the SCADA terminals in the Control Room and Electrical Room.

The raw sewage pumping systems have both local and remote control capabilities.

LOCAL – Local control of the raw sewage pumps (P-1/2/3) involves moving the individual pump LOCAL-OFF-REMOTE (LOR) switch into the LOCAL position. The raw sewage pump can be started/stopped using push buttons (at local panel) when in LOCAL mode. The operating speed of the pump can be adjusted using the pump associated pump potentiometer. Status on the SCADA will be displayed as LOCAL. This mode of operation is only recommended for commissioning/troubleshooting purposes.

REMOTE MANUAL – Manual control of the individual raw sewage pumps (P-1/2/3) can be achieved by placing the pump (LOR) switch in REMOTE and selecting "manual" operation on the treatment

system SCADA interface. The pump can then be started and stopped using the SCADA interface. Control of the raw sewage pump operating speed (%) can also be adjusted when operating in REMOTE MANUAL mode.

REMOTE AUTO – Auto control of the raw sewage pumps (P-1/2/3) involves putting the pump LOR switch in AUTO and selecting REMOTE-AUTO mode of operation on the SCADA interface. When set to this operating mode, the raw sewage pumps will operate in one of two operating modes:

- Level switch/Level set point control of raw sewage pumps: In this mode of operation, the liquid level within the EQ tanks is continuously monitored via the SPP SCADA system. The number of operating raw sewage pumps (and selection of which pumps are in operation) is dictated by the measured liquid level within the EQ tank (as per LT-1 and the raw sewage pumping station level switches, LS1/2/3/4/5/6). Pumps must be in REMOTE-AUTO mode for this control mode to be available.
- Proportional, Integral, and Derivative (PID) Control of Raw Sewage Pumps: This control mode utilizes a changing measured water level in TK-11 to estimate the incoming flow to the SPP. This estimated influent flow is compared to a target set point for flow through the SPP. Based on the estimated influent flow to the SPP, the SPP PLC/SCADA systems identifies which/how many of the raw sewage pumps is to be in operation to satisfy the target influent flow. Pumps must be in REMOTE-AUTO mode for this control mode to be available.

2.3.2 Field Points

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		DI	P1		Pump Run Status	
		DI	P2		Pump Run Status	
		DI	P3		Pump Run Status	
		DI	P1		Pump General Alarm	
		DI	P2		Pump General Alarm	
		DI	P3		Pump General Alarm	
		DI	P1		Pump Remote/Local Status	From LOR Switch
		DI	P2		Pump Remote/Local Status	From LOR Switch
		DI	P3		Pump Remote/Local Status	From LOR Switch
		DI	LS1		EQ tank Level Switch 1	
		DI	LS2		EQ tank Level Switch 2	
		DI	LS3		EQ tank Level Switch 3	
		DI	LS4		EQ tank Level Switch 4	
		DI	LS5		EQ tank Level Switch 5	
		DI	LS6		EQ tank Level Switch 6	
		AI	FE1000		Influent Flow	
		AI	LT1		EQ Tank Level	
		AI	pH1000		EQ Tank pH	
		DO	P1		Pump Run Command	

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		DO	P2		Pump Run Command	
		DO	P3		Pump Run Command	
		AO	P1		Pump Speed Control	
		AO	P2		Pump Speed Control	
		AO	P3		Pump Speed Control	
		DI	LS7		Outlet Well High Level Switch	

Notes:
1. All tags associated with SPP treatment equipment are proceeded by WW-79610 unless otherwise noted.
2. All tags associated with SPP instrumentation are proceeded by WW-67961 unless otherwise noted.

2.3.3 Alarm Management

Description	Event	Priority	Notes
P1 General Alarm	Alarm	1	De-energize Pump
P2 General Alarm	Alarm	1	De-energize Pump
P3 General Alarm	Alarm	1	De-energize Pump
EQ Tank Liquid Level Hi Hi	Alarm	1	
EQ Tank Liquid Level Hi	Warning	2	
EQ Tank Liquid Level Lo	Warning	2	
EQ Tank Liquid Level LoLo	Alarm	1	De-energize Pumps
EQ Tank pH Level HiHi	Alarm	1	
EQ Tank pH level Hi	Warning	2	
EQ Tank pH Level Lo	Warning	2	
EQ Tank pH Level LoLo	Alarm	1	
Outlet Well High Level Switch	Alarm	1	

Notes:
1. All tags associated with SPP treatment equipment are proceeded by WW-79610 unless otherwise noted.
2. All tags associated with SPP instrumentation are proceeded by WW-67961 unless otherwise noted.

2.3.4 Monitoring

Event	Classification
P1 LOR SS REMOTE Position	Status
P2 LOR SS REMOTE Position	Status
P3 LOR SS REMOTE Position	Status
P1 Run Time	Data
P2 Run Time	Data
P3 Run Time	Data
EQ Tank Liquid Level	Data
EQ Tank pH Level	Data

Notes:
1. All tags associated with SPP treatment equipment are proceeded by WW-79610 unless otherwise noted.
2. All tags associated with SPP instrumentation are proceeded by WW-67961 unless otherwise noted.

2.3.5 Set Points

Description	Range
Target Influent Flow Set Point	0-55 L/s
Friday EQ Tank Level Set Point	0-100%

2.3.6 Unusual Circumstances

The following is a list of unusual circumstances and potential actions that may be taken by the SPP SCADA system and/or plant Operators:

- In the event that the SPP waste activated sludge valves (MV-11/12/13/14) are activated and P1 is running, P1 will be deactivated and either P2 or P3 will be activated to maintain flow through the SPP. If the raw sewage pumps are operating on PID control, this control function will be temporarily deactivated. PID control may resume once wasting activities have been completed.
- In order to ensure sufficient volume of raw sewage is present in the EQ tank to provide continuous flow to the SPP over the weekend (i.e. Saturday/Sunday), the liquid level in the EQ tank is allowed to rise to a set point level on Friday.

3. Raw Wastewater Comminution and Screening

3.1 Overview

Wastewater pumped from the EQ tank is lifted into an outlet well where movement of the raw wastewater transitions to gravity flow. The lifted raw wastewater flows into the SPP Control Building via 250 mm pipe. As raw wastewater is conveyed into the SPP Control Building to flow is monitored/recorded by an inline mag meter. Once in the Control Building, raw wastewater is directed to one of two in channel comminutors that are used to macerate solids present in the raw wastewater as it proceeds to the downstream aeration tanks. A standby manual screen (25 mm bar spacing) is available should the comminutors be offline for maintenance. The comminutors are operated manually in an ON/OFF configuration.

3.2 Major Equipment

CMT1	SPP Influent Comminutor
CMT2	SPP Influent Comminutor
Bar Screen	SPP Influent Manual Bar Screen

3.3 Control Description

3.3.1 Normal Operation

The SPP comminution and screening systems are only available for operation in a manual mode (i.e. LOCAL control). The comminutors can be run in an ON/OFF configuration via local control (via local disconnects/MCC breakers). The run status of the comminutors is monitored by the SPP PLC/SCADA system but no control functionality is available.

The SPP influent manual screen is a static piece of treatment equipment that is typically only used if the influent comminutors are not available. The screen is not operated or monitored by the SPP PLC/SCADA system.

3.3.2 Field Points

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		DI	CMT1		Comminutor 1 Status	
		DI	CMT2		Comminutor 2 Status	
		DI	CMT1		Comminutor 1 General Alarm	
		DI	CMT2		Comminutor 2 General Alarm	

Notes:
1. All tags associated with SPP treatment equipment are proceeded by WW-79610 unless otherwise noted.
2. All tags associated with SPP instrumentation are proceeded by WW-67961 unless otherwise noted.

3.3.3 Alarm Management

Description	Event	Priority	Notes
CMT1 General Alarm	Alarm	1	
CMT2 General Alarm	Alarm	1	

3.3.4 Monitoring

Event	Classification
Comminutor 1 Run Time	Data
Comminutor 2 Run Time	Data

3.3.5 Setpoints

- N/A

3.3.6 Unusual Circumstances

The following is a list of unusual circumstances and potential actions that may be taken by the SPP SCADA system and/or plant Operators:

- In the event that one of both of the raw wastewater comminutors is unavailable, raw influent to the SPP may be passed through the manual screen. Manual flow diversion gates 8, 10, and 12 can be used to divert flow to the manual screen. When the manual screen is in operation, SPP Operators must manually clear intercepted screenings to prevent surcharging the upstream piping.

4. Chemical Feed

4.1 Overview

The effluent of the SPP comminutors/bar screen (CMT1, CMT2, bar screen) flows towards the SPP re-aeration tanks (TK5, TK6) via a 300 mm channel which extends from the Control Building to the north end of the existing (east and west) treatment train aeration tanks. Aluminum sulphate (Alum) and polymer are added to the effluent of the screen/comminutors to assist in the removal of phosphorus as well as enhance settling within the final settling tank. Magnesium hydroxide solution is also added to the effluent of the screen/comminutors to provide additional alkalinity necessary for nitrification (ammonia removal). The chemical dosing pumps (Polymer - P1000, Magnesium Hydroxide – P1, Alum –P1, P2) are operated in a manual configuration (ON/OFF) with the output of the chemical feed pumps adjusted manually at the pump (by adjusting stroke length).

4.2 Major Equipment

P1	Magnesium Hydroxide Solution Dosing Pump
MX1000	Magnesium Hydroxide Solution Mixer
MX1001	Magnesium Hydroxide Solution Mixer
P1000	Polymer Solution Dosing Pump
MX1000	Polymer Solution Mixer
LS1000	Polymer Solution Tank Level Switch
P1	Alum Dosing Pump 1
P2	Alum Dosing Pump 2
LT001	Alum Tank #1 Level Sensor
LT002	Alum Tank #2 Level Sensor

4.3 Control Description

4.3.1 Normal Operation

As previously noted, magnesium hydroxide, aluminum sulphate solution, and polymer solution are added to the influent of the SPP to facilitate treatment. These systems currently operate only in a LOCAL control mode of operation with limited monitoring capability of these systems from the plant PLC/SCADA system. No control capability is available from the plant SCADA system.

4.3.2 Field Points

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		DI	P1		Alum Dosing Pump #1 Run Status	
		DI	P2		Alum Dosing Pump #2 Run Status	
		DI	P1000		Polymer Pump Run Status	
		AI	LT1001		Alum Tank #1 Level	
		AI	LT1002		Alum Tank #2 Level	

Notes:

1. All tags associated with SPP alum dosing systems: equipment tags are proceeded by WW-79660 and instrumentation is proceeded by WW-67966.
2. All tags associated with SPP polymer dosing systems: equipment tags are proceeded by WW-79650-SPP and instrumentation is proceeded by WW-79650-SPP.

4.3.3 Alarm Management

Description	Event	Priority	Notes
Alum Tank #1 Level HiHi	Alarm	1	
Alum Tank #1 Level Hi	Warning	2	
Alum Tank #1 Level Lo	Warning	2	
Alum Tank #1 Level LoLo	Alarm	1	
Alum Tank #2 Level HiHi	Alarm	1	
Alum Tank #2 Level Hi	Warning	2	
Alum Tank #2 Level Lo	Warning	2	
Alum Tank #2 Level LoLo	Alarm	1	

4.3.4 Monitoring

Event	Classification
Alum Dosing Pump #1 Run Time	Data
Alum Dosing Pump #2 Run Time	Data
Polymer Dosing Pump Run Time	Data

4.3.5 Setpoints

- N/A

4.3.6 Unusual Circumstances

- N/A

5. Raw Wastewater Flow Splitting

5.1 Overview

The addition of a third treatment train to the SPP will require flow splitting of the raw wastewater to the active treatment trains (will vary between 1-3 treatment trains). Flow splitting will be achieved by means manually controlled knife gate valves which can be used to adjust the flow to the operational treatment trains or fully isolate a treatment train from the raw wastewater channel. In order to minimize surcharging of the upstream channels/equipment, the knife gate valves will be manually operated in a "most open valve" configuration.

5.2 Major Equipment

- North Train Influent Valve WW-79630-V42
- East Train Influent Valve WW-79630-V43
- West Train Influent Valve WW-79630-V44

5.3 Control Description

5.3.1 Normal Operation

During normal operation the influent valves to the SPP treatment trains are manually open, closed, and throttled by plant Operators to achieve the desired flow split between the three SPP treatment trains. The effluent flumes and associated flow meters can be used for adjustment of the flow split between the treatment trains.

5.3.2 Field Points

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
N/A						

5.3.3 Alarm Management

Description	Event	Priority	Notes
N/A			

5.3.4 Monitoring

Event	Classification
N/A	

5.3.5 Setpoints

Description	Range
N/A	

5.3.6 Unusual Circumstances

- N/A

6. East/West Aeration Tank and Blower Systems

6.1 Overview

The existing SPP treatment trains (east and west trains) are provided process/mixing air by three existing (472 L/s, 50 HP) - WW-79630-CP1/CP2/CP3 - blowers. Air from these blowers is directed to the EQ tank (TK11), east and west treatment trains (TK3/TK4/TK5/TK6) as well as the existing SPP airlift pumps (WW-79630-ER2/3). The number of operational blowers is manually dictated by the SPP Operators. The blowers are operated (turned ON/OFF) as needed to satisfy the air demands of the SPP. Air flow to the east and west treatment trains as well as the EQ tank is monitored by inline differential pressure based air flow meters (WW-67963-FE1/2/3). Dissolved oxygen is measured in the contact stabilization tank of the east and west treatment trains (DOX1000/1002). This information is provided at a local (field transmitters) as well as at the SPP SCADA interface. The distribution of air from the existing blower system is regulated by a series of manual valves.

6.2 Major Equipment

SPP Aeration Blower #1	WW-79630-CP1
SPP Aeration Blower #2	WW-79630-CP2
SPP Aeration Blower #3	WW-79630-CP3
Air Flow Element #1	WW-67963-FE1
Air Flow Element #2	WW-67963-FE2
Air Flow Element #3	WW-67963-FE3
Aeration Tank DO Sensor	WW-79630-DO1000
Aeration Tank DO Sensor	WW-79630-DO10002

6.3 Control Description

6.3.1 Normal Operation

As previously noted, the number of operational SPP blowers is dictated by the SPP Operators. The existing blowers currently operate only in a LOCAL control mode of operation with limited monitoring capability of these systems from the plant PLC/SCADA system. No control capability of the SPP blowers is available from the plant SCADA system.

6.3.2 Field Points

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		DI	CP1		Blower 1 Run Status	
		DI	CP2		Blower 2 Run Status	
		DI	CP3		Blower 3 Run Status	
		DI	CP1		Blower General Alarm	
		DI	CP2		Blower General Alarm	
		DI	CP3		Blower General Alarm	
		AI	FE/FT1		Air Flow Meter #1	
		AI	FE/FT2		Air Flow Meter #2	
		AI	FE/FT3		Air Flow Meter #3	
		AI	DOX1000/ 1001		TK3 Dissolved Oxygen	
		AI	DOX1002/ 1003		TK4 Dissolved Oxygen	

Notes:
1. All tags associated with SPP treatment equipment are proceeded by WW-79630 unless otherwise noted.
2. All tags associated with SPP instrumentation are proceeded by WW-67963 unless otherwise noted.

6.3.3 Alarm Management

Description	Event	Priority	Notes
Blower 1 General Alarm	Alarm	1	
Blower 2 General Alarm	Alarm	1	
Blower 3 General Alarm	Alarm	1	
Air Flow Meter #1 HiHi			
Air Flow Meter #1 Hi			
Air Flow Meter #1 Lo			
Air Flow Meter #1 LoLo			
Air Flow Meter #2 HiHi			
Air Flow Meter #2 Hi			
Air Flow Meter #2 Lo			
Air Flow Meter #2 LoLo			
Air Flow Meter #3 HiHi			
Air Flow Meter #3 Hi			
Air Flow Meter #3 Lo			
Air Flow Meter #3 LoLo			

6.3.4 Monitoring

Event	Classification
Blower 1 Run Time	Data
Blower 2 Run Time	Data
Blower 3 Run Time	Data

Event	Classification
Air Flow Meter 1	Data
Air Flow Meter 2	Data
Air Flow Meter 3	Data
TK3 Dissolved Oxygen	Data
TK4 Dissolved Oxygen	Data

6.3.5 Setpoints

- N/A

6.3.6 Unusual Circumstances

- N/A

7. Third Train Aeration Tank and Blower Systems

7.1 Overview

The third treatment aeration tank and blower systems will operate in an automated configuration. The third treatment train will be equipped with a dissolved oxygen sensor as well as fine bubble diffusers (two diffuser grids). Process/mixing air will be provided to the third treatment train by two (lead-lag) positive displacement blowers (120 L/s, 20 HP). The output of the third train aeration blowers will be regulated by the dissolved oxygen level measured in the third treatment train aeration tank. The measured DO level will dictate the number of aeration blowers required and operating speed.

7.2 Major Equipment

Third Train Aeration Tank Pass 1	WW-79610-TK12
Third Train Aeration Tank Pass 2	WW-79610-TK13
Third Train Aeration Blower #1	WW-79630-CP4
Third Train Aeration Blower #2	WW-79630-CP5
Third Train Aeration/Digester Blower #3	WW-79630-CP6
Third Train Aeration/Digester Blower #4	WW-79630-CP7Third Train Dissolved Oxygen Sensor WW-67961-DOX1004
Third Train Blower Header Pressure Sensor	WW-67963-PS106

7.3 Control Description

7.3.1 Normal Operation

The third train aeration systems will operate continuously whenever the train is in service. Low pressure air will be constantly supplied to the third train aeration tank to keep the contents of the

tanks thoroughly mixed and to supply the oxygen necessary for the metabolism of contaminants present in the wastewater. Air will be supplied to the basins via two variable speed blowers (WW-79630-CP4/CP5) which will operate in a lead/lag configuration. Pressure on the aeration header will also be continuously monitored (WW-67963-PS106). Multiple level alarm setpoints shall exist for the aeration header pressure sensor. A third standby blower (WW-79630-CP6) will be available that may provide additional process air, if required, to either the third train aeration tanks or third train aerobic digesters.

The third train blowers may be operated in three modes: REMOTE-AUTO, REMOTE-MANUAL, and REMOTE-LOCAL.

In REMOTE-AUTO mode, the measured dissolved oxygen (DO) level within the third train aeration tank will be utilized to control the airflow to the aeration tanks. Operators will be able to assign lead-lag duty to each of the main third train aeration blowers. Based on the measured DO level (WW-67961-DOX1004), the SPP main PLC/SCADA system will increase or decrease air flow to the aeration tanks to maintain an Operator specified DO level setpoint within the aeration tanks. The VFDs of the selected lead blower will ramp up/down based on varying process conditions (i.e., measure DO levels). Should a single blower (lead blower) be unable to achieve or maintain the setpoint DO level, the lag blower will be brought online. The blower speeds will ramp up/down in unison as needed to maintain or achieve the DO setpoint. Pressure setpoints associated blower discharge header pressure sensor (WW-67963-PS106) will ensure that the aeration blowers are not operated at pressures that may result in damage to the SPP equipment. Hard-programmed minimum and maximum blower VFD speeds shall exist to prevent operation of the blowers outside of the recommended range. A minimum blower setpoint (based on VFD setting) will exist to ensure a minimum volume of air is applied to the aeration tanks to ensure they stay fully mixed.

The Operator will also have the ability to manually specify the blower speeds (% of max) via the SPP SCADA system (while operating in REMOTE-MANUAL mode). While operating in REMOTE-MANUAL, blower speeds must not be set below the minimum setting necessary to achieve complete mixing within the third train aeration tank.

The aeration tank blowers may also be operated locally at the SPP motor control center (MCC) VFD interface (LOCAL-MANUAL).

The Operators will have the ability to 'fine tune" air flow distribution within the aeration tanks through manipulation of the aeration tank diffuser grid drop leg throttling valves. This manual control feature will allow for tapered air flow control along the length of the aeration basin (if desired, needed). The highest strength waste and thus the greatest quantity of air will be required at the inlet of the aeration basin. Careful operator attention is required to maintain the manual air distribution valves in their collective "most open" position to minimize air header pressure.

7.3.2 Field Points

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		AI	DOX1004		Third Train Aeration DO Level	
		AI	PS106		Third Train Blower Header Pressure	

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		DI	CP4		Third Train Aeration Blower Run Status	
		DI	CP4		Third Train Aeration Blower Fault Status	
		DI	CP4		Third Train Aeration Blower Local/Remote Status	
		DO	CP4		Third Train Aeration Blower Start/Stop	
		AO	CP4		Third Train Aeration Blower Speed Setpoint	
		AI	CP4		Third Train Aeration Blower Speed Reference	
		DI	CP4		Third Train Aeration Blower E-Stop Status	
		DI	CP4		Third Train Aeration Blower Suction Pressure Alarm	
		DI	CP4		Third Train Aeration Blower Discharge Pressure Alarm	
		DI	CP4		Third Train Aeration Blower Discharge Temperature Alarm	
		DI	CP5		Third Train Aeration Blower Run Status	
		DI	CP5		Third Train Aeration Blower Fault Status	
		DI	CP5		Third Train Aeration Blower Local/Remote Status	
		DO	CP5		Third Train Aeration Blower Start/Stop	
		AO	CP5		Third Train Aeration Blower Speed Setpoint	
		AI	CP5		Third Train Aeration Blower Speed Reference	
		DI	CP5		Third Train Aeration Blower E-Stop Status	
		DI	CP5		Third Train Aeration Blower Suction Pressure Alarm	
		DI	CP5		Third Train Aeration Blower Discharge Pressure Alarm	
		DI	CP5		Third Train Aeration Blower Discharge Temperature Alarm	
		DI	CP6		Third Train Aeration Blower Run Status	
		DI	CP6		Third Train Aeration Blower Fault Status	

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		DI	CP6		Third Train Aeration Blower Local/Remote Status	
		DO	CP6		Third Train Aeration Blower Start/Stop	
		AO	CP6		Third Train Aeration Blower Speed Setpoint	
		AI	CP6		Third Train Aeration Blower Speed Reference	
		DI	CP6		Third Train Aeration Blower E-Stop Status	
		DI	CP6		Third Train Aeration Blower Suction Pressure Alarm	
		DI	CP6		Third Train Aeration Blower Discharge Pressure Alarm	
		DI	CP6		Third Train Aeration Blower Discharge Temperature Alarm	

7.3.3 Alarm Management

Description	Event	Priority	Notes
Blower Header High Pressure Warning	Warning	2	
Blower Header High High Pressure Alarm	Alarm	1	Deactivate all third train blowers
Third Train Aeration Tank Low DO Warning	Warning	2	
Third Train Aeration Tank Low Low DO Alarm	Alarm	1	Activate lag third train blower if not already active
Blower Estop Alarm	Alarm	1	Deactivate Blower
Blower Suction Pressure Alarm	Alarm	1	Deactivate blower; activate lag blower if available
Blower Discharge Pressure Alarm	Alarm	1	Deactivate blower; activate lag blower if available
Blower Discharge Temperature Alarm	Alarm	1	Deactivate blower; activate lag blower if available
Blower Fault	Alarm	1	Deactivate blower, activate lag blower if available

7.3.4 Monitoring

Event	Classification
Third Train Aeration Tank DO	Data

Event	Classification
Third Train Aeration Header Pressure	Data
Third Train Blower CP4 Run Time	Data
Third Train Blower CP5 Run Time	Data

7.3.5 Setpoints

Description	Range
Third Train Aeration Tank DO Set Point	xx-xx mg/L
Minimum Blower Speed to Maintain Mixing	xx-xx%

7.3.6 Unusual Circumstances

- In the event of a low low DO alarm in the third train aeration basin, the lag aeration blower will be brought online by the SPP PLC (if not already active) to attempt to increase the aeration tank DO level.
- In the event of a high high pressure alarm on the third train blower header, the active third train blowers will be deactivated by the SPP PLC.
- In the event of a blower fault, the blower will be deactivated by the SPP PLC and the lag blower (if available) will be brought online.
- In the event of a high suction pressure, high discharge pressure, or high discharge temperature for any of the third train blowers, the blower will be deactivated by the SPP PLC and the lag blower (if available) will be brought into service.
- In the event of an Estop activation for any of the third train blowers, the blower will be deactivated.

8. East/West Final Settling Tank and RAS/WAS Pumping

8.1 Overview

Treated wastewater and mixed liquor (i.e., suspension of aerobic bacteria) flow from the East/West aeration tanks into the East and West final settling tanks. In the final settling tanks, treated wastewater is separated from the mixed liquour. The settled bacteria (sludge) is transported to the final settling tank sludge hopper (at influent end of tank) by a chain and flight sludge collection mechanisms (WW-79610-CN1/CNV2). The sludge collection mechanism operates at a constant speed in an ON/OFF configuration. The sludge collection mechanism also assists in directing scum (floatables/oil/grease) to the final settling tank scum trough (located at the effluent end of the tank). Sludge collected in the final settling tank sludge hoppers is conveyed by variable speed submersible sludge pumps (WW-79610-P9/P10/P11/P12/P13/P14) to either the east/west treatment train re-aeration tanks (TK5/6) or the east/west train aerobic digesters (TK7/8). The submersible sludge pumps operate continuously so long as the associated treatment train is active. The sludge pumps operate in a lead/lag/standby configuration to provide a RAS (or WAS) flow proportional to the flow

through the treatment train. The final discharge location for the RAS/WAS conveyed by the submersible sludge pumps is dictated by New actuated valves (WW-79610-MV11/12/13/14). These valves control whether sludge is directed to the re-aeration tanks or the first stage of the existing aerobic digesters.

8.2 Major Equipment

East Final Settling Tank Sludge Collection Mechanism	WW-79610-CNV1
West Final Settling Tank Sludge Collection Mechanism	WW-79610-CNV2
East Treatment Train RAS/WAS Flow Meter	WW-67961-FE130
West Treatment Train RAS/WAS Flow Meter	WW-67961-FE131
East Treatment Train RAS/WAS Pumps	WW-79610-P9/P10/P11
West Treatment Train RAS/WAS Pumps	WW-79610-P12/P13/P14
New East Treatment Train WAS Valve	WW-79610-MV13
New East Treatment Train RAS Valve	WW-79610-MV14
New West Treatment Train WAS Valve	WW-79610-MV12
New West Treatment Train RAS Valve	WW-79610-MV11

8.3 Control Description

8.3.1 Normal Operation

The existing sludge collection mechanisms of the east/west treatment train final settling tanks operate continuously at constant speed when the associated treatment train is in service. The sludge collection mechanisms can only be operated in LOCAL control mode. Limited monitoring capability is available at the SPP PLC/SCADA system for the sludge collection mechanisms.

Sludge collecting in the sludge hoppers of the East and West treatment trains is conveyed by submersible sludge pumps configured in a lead-lag-standby arrangement. The pumps operate on VFDs to achieve a setpoint flowrate proportional to the flow through the associated treatment train (as measured by the train discharge flume flow meter). The submersible sludge pumps may be operated in three modes: REMOTE-AUTO, REMOTE-MANUAL, and REMOTE-LOCAL.

In REMOTE-AUTO mode, the measured flow through the East or West treatment train will be utilized to control the rate of RAS/WAS flow. Operators will be able to assign lead-lag-standby duty to each of the East or West train submersible sludge pumps. Based on the measured flow through the treatment train, the SPP main PLC/SCADA system will increase or decrease the rate of RAS/WAS flow to achieve an Operator defined flow setpoint (as a % of the measured flow through the treatment train). The VFD of the selected lead pump will ramp up/down based on varying process conditions (i.e., treatment train flow). Should a single pump (lead pump) be unable to achieve or maintain the setpoint flow, the lag pump will be brought online. The pump speeds will ramp up/down in unison as needed to maintain or achieve the flow setpoint. The RAS/WAS flow for each train will be continuously monitored. Hard-programmed minimum and maximum pump VFD speeds shall exist to prevent operation of the pumps outside of recommended range.

The Operator will also have the ability to manually specify the pump speeds (% of max) via the SPP SCADA system (while operating in REMOTE-MANUAL mode).

The sludge pumps may also be operated locally at the SPP motor control center (MCC) VFD interface (LOCAL-MANUAL).

Sludge conveyed from the collection hopper of the east/west final settling tanks can be directed to either re-aeration tanks (front end of aeration process as RAS) or to the first stage of the aerobic digester (as WAS) for the associated treatment train. The direction the sludge is conveyed is dictated by new actuated valves on the discharge of the air lift pumps. Under normal circumstances, sludge will be continuously directed as RAS to the front end of the aeration tanks of the east and west treatment trains. Periodically, at SPP Operators discretion, sludge will be wasted from the treatment trains (as WAS) to the aerobic digesters. Sludge will be wasted to achieve operator set point liquid levels within the aerobic digesters. The actuated valves on the discharge of the air lift pumps will operate in the following modes:

LOCAL – Local control of the actuated valves on the discharge of the air lift pumps involves putting the valves into LOCAL mode (from LOCAL-REMOTE selector switch on valve actuator or remote control station). The valve can then be opened/closed by using the OPEN/CLOSE selector switch. Note: at least one of the two valves on a particular treatment train (i.e. east or west) must be open at all times to prevent flooding of the sludge metering box).

REMOTE-MANUAL – Manual control of the actuated valves on the discharge of the east/west treatment train air lift pumps can be achieved by placing the valves selector switch in REMOTE control mode and selecting "manual" control mode of operation at the SPP SCADA interface. The valves can then be opened/closed as desired by SPP Operators from the SPP SCADA interface. Note: at least one of the two valves on a particular treatment train (i.e. east or west) must be open at all times to prevent flooding of the sludge metering box).

REMOTE-AUTO – Auto control of the RAS/WAS actuated valves can be achieved by placing the valve selector switch in REMOTE and selecting "auto" control on the SPP SCADA interface. When in this operating mode, the RAS valves for the existing treatment trains will remain open and the WAS valves will remain closed. The valve positions will only cycle if the SPP Operators initiate a sludge wasting event. Once a sludge wasting event is initiated, the WAS valve will open and the RAS valve will close. Sludge will be directed to the first stage of the treatment train actively wasting sludge until an operator specified level is achieved in the first stage aerobic digester tank receiving WAS. Once this set point is achieved, the sludge wasting event is complete and the RAS valve will open and the WAS valve will close.

8.3.2 Field Points

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		DI	MV11		MV11 Open Position	
		DI	MV11		MV11 Closed Position	
		DI	MV12		MV12 Open Position	
		DI	MV12		MV12 Closed Position	
		DI	MV13		MV13 Open Position	

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		DI	MV13		MV13 Closed Position	
		DI	MV14		MV14 Open Position	
		DI	MV14		MV14 Closed Position	
		DI	MV11		MV11 Fault	
		DI	MV12		MV12 Fault	
		DI	MV13		MV13 Fault	
		DI	MV14		MV14 Fault	
		DI	MV11		MV11 Remote/Local	
		DI	MV12		MV12 Remote/Local	
		DI	MV13		MV13 Remote/Local	
		DI	MV14		MV14 Remote/Local	
		DO	MV11		MV11 Open Command	
		DO	MV11		MV11 Close Command	
		DO	MV12		MV12 Open Command	
		DO	MV12		MV12 Close Command	
		DO	MV13		MV13 Open Command	
		DO	MV13		MV13 Close Command	
		DO	MV14		MV14 Open Command	
		DO	MV14		MV14 Close Command	
		DI	CNV1		East Train Sludge Collector Status	
		DI	CNV2		West Train Sludge Collector Status	
		DI	CNV1		East Train Sludge Collector General Alarm	
		DI	CNV2		West Train Sludge Collector General Alarm	
		AI	FE130		East Train RAS/WAS Flow	
		DI	P9		Pump High Temp/Leak Detection	
		DI	P9		Pump Run Status	
		DI	P9		Pump Fault	
		DI	P9		Local/Remote Status	
		DO	P9		Start/Stop Command	
		AO	P9		Pump Speed Setpoint	
		AI	P9		Pump Speed Feedback	
		DI	P10		Pump High Temp/Leak Detection	
		DI	P10		Pump Run Status	
		DI	P10		Pump Fault	
		DI	P10		Local/Remote Status	
		DO	P10		Start/Stop Command	
		AO	P10		Pump Speed Setpoint	

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		AI	P10		Pump Speed Feedback	
		DI	P11		Pump High Temp/Leak Detection	
		DI	P11		Pump Run Status	
		DI	P11		Pump Fault	
		DI	P11		Local/Remote Status	
		DO	P11		Start/Stop Command	
		AO	P11		Pump Speed Setpoint	
		AI	P11		Pump Speed Feedback	
		AI	FE131		West Train RAS/WAS Flow	
		DI	P12		Pump High Temp/Leak Detection	
		DI	P12		Pump Run Status	
		DI	P12		Pump Fault	
		DI	P12		Local/Remote Status	
		DO	P12		Start/Stop Command	
		AO	P12		Pump Speed Setpoint	
		AI	P12		Pump Speed Feedback	
		DI	P13		Pump High Temp/Leak Detection	
		DI	P13		Pump Run Status	
		DI	P13		Pump Fault	
		DI	P13		Local/Remote Status	
		DO	P13		Start/Stop Command	
		AO	P13		Pump Speed Setpoint	
		AI	P13		Pump Speed Feedback	
		DI	P14		Pump High Temp/Leak Detection	
		DI	P14		Pump Run Status	
		DI	P14		Pump Fault	
		DI	P14		Local/Remote Status	
		DO	P14		Start/Stop Command	
		AO	P14		Pump Speed Setpoint	
		AI	P14		Pump Speed Feedback	

Notes:
1. All tags associated with SPP treatment equipment are proceeded by WW-79610 unless otherwise noted.
2. All tags associated with SPP instrumentation are proceeded by WW-67961 unless otherwise noted.

8.3.3 Alarm Management

Description	Event	Priority	Notes
MV 11 Fault	Alarm	1	
MV 12 Fault	Alarm	1	
MV 13 Fault	Alarm	1	

Description	Event	Priority	Notes
MV 14 Fault	Alarm	1	
East Train RAS/WAS Flow Low	Warning	2	
East Train RAS/WAS Flow Low Low	Alarm	1	Activate standby sludge pump if not already active
West Train RAS/WAS Flow Low	Warning	2	
West Train RAS/WAS Flow Low Low	Alarm	1	Activate standby sludge pump if not already active
Pump High Temp/Leak Detection Alarm	Alarm	1	Denergize pump; activate standby pump if available
Pump Fault	Alarm	1	Denergize pump; activate standby pump if available

8.3.4 Monitoring

Event	Classification
Final Sludge Collector 1 Run Time	Data
Final Sludge Collector 2 Run Time	Data
MV11 LOR Remote Position	Status
MV12 LOR Remote Position	Status
MV13 LOR Remote Position	Status
MV14 LOR Remote Position	Status
Sludge Pump Run Time	Data
East Train Sludge Flow/Volume	Data
West Train Sludge Flow/Volume	Data

8.3.5 Setpoints

Description	Range
Aerobic Digester Stage 1 (TK7)Wasting Event Level Set Point – EAST TRAIN	
Aerobic Digester Stage 1 (TK8)Wasting Event Level Set Point – West TRAIN	
East Train RAS/WAS Flow Setpoint	
West Train RAS/WAS Flow Setpoint	

8.3.6 Unusual Circumstances

The following is a list of unusual circumstances and potential actions that may be taken by the SPP SCADA system and/or plant Operators:

- In the event that the high level switch (LS9/LS10) is active in the first stage aerobic digester of a treatment train that is to execute a sludge wasting event, the associated WAS valve (MV12/13 will be prevented from opening. This control interlock will prevent overfilling of the aerobic digesters.
- In the event of sludge pump fault, high temp/leak detection the associated pump will be deactivated and the standby pump (if available) will be activated.

- In the event of a low low flow alarm for the east or west treatment train, the associated lead pump will be denergized and the standby pump will be activated.

9. Third Train Final Settling Tank and RAS/WAS Pumping

9.1 Overview

Treated wastewater and mixed liquor (i.e., suspension of aerobic bacteria) flow from the third train aeration tank into the third train final settling tank. In the final settling tank, treated wastewater is separated from the mixed liquour. The settled bacteria (sludge) is transported to the final settling tank sludge hopper (at influent end of tank) by a chain and flight sludge collection mechanism. The sludge collection mechanism operates at a constant speed in an ON/OFF configuration. The sludge collection mechanism also assists in directing scum (floatables/oil/grease) to the final settling tank scum trough (located at the effluent end of the tank). Sludge collected in the final settling tank sludge hopper is conveyed by three (lead-lag-standby) submersible RAS/ WAS pumps. These pumps are utilized to continuously return RAS to the third train aeration tank at a flow rate proportional (%) to the average flow through the treatment train. The same submersible pumps are also used to intermittently direct WAS to the third train aerobic digesters by means of actuated control valves.

9.2 Major Equipment

Third Train Sludge Collection Mechanism	WW-79610-CNV3
Third Train RAS/WAS Pump #1	WW-79610-P6
Third Train RAS/WAS Pump #2	WW-79610-P7
Third Train RAS/WAS Pump #3	WW-79610-P8
Third Train RAS/WAS Flow Meter	WW-67961-FE2000
Third Train WAS Valve	WW-79610-V46
Third Train RAS Valve	WW-79610-V47

9.3 Control Description

9.3.1 Normal Operation

The sludge collection mechanisms of the third treatment train final settling tank operate continuously at constant speed when the treatment train is in service. The sludge collection mechanisms can only be operated in an ON/OFF configuration. In REMOTE-AUTO mode of operation the collection mechanism will operate continuously whenever flow is detected flowing through the third treatment train (as detected by the third train discharge flume flow meter). In REMOTE-MANUAL, the collection mechanism may be started stopped via the SPP control interface. In LOCAL-MANUAL mode of operation, the collection mechanism may be started/stopped for the third train motor control center (MCC).

Sludge collecting in the sludge hoppers of the third treatment train is conveyed by submersible sludge pumps configured in a lead-lag-standby arrangement. The pumps operate on VFDs to achieve a setpoint flowrate proportional to the flow through the treatment train (as measured by the train discharge flume flow meter). The submersible sludge pumps may be operated in three modes: REMOTE-AUTO, REMOTE-MANUAL, and REMOTE-LOCAL.

In REMOTE-AUTO mode, the measured flow through the third treatment train will be utilized to control the rate of RAS/WAS flow. Operators will be able to assign lead-lag-standby duty to each of the third train submersible sludge pumps. Based on the measured flow through the treatment train, the SPP main PLC/SCADA system will increase or decrease the rate of RAS/WAS flow to achieve an Operator defined flow setpoint (as a % of the measured flow through the treatment train). The VFD of the selected lead pump will ramp up/down based on varying process conditions (i.e., treatment train flow). Should a single pump (lead pump) be unable to achieve or maintain the setpoint flow, the lag pump will be brought online. The pumpspeeds will ramp up/down in unison as needed to maintain or achieve the flow setpoint. The RAS/WAS flow for each train will be continuously monitored.. Hard-programmed minimum and maximum pump VFD speeds shall exist to prevent operation of the pumps outside of recommended range.

The Operator will also have the ability to manually specify the pump speeds (% of max) via the SPP SCADA system (while operating in REMOTE-MANUAL mode).

The sludge pumps may also be operated locally at the SPP motor control center (MCC) VFD interface (LOCAL-MANUAL).

Sludge conveyed from the collection hopper of the third train final settling tanks can be directed to either aeration tanks (front end of aeration process as RAS) or to the first stage of the aerobic digester (as WAS) for the associated treatment train. The direction the sludge is conveyed is dictated by actuated valves on the discharge of the sludge pumps. Under normal circumstances, sludge will be continuously directed as RAS to the front end of the aeration tanks of the third treatment train. Periodically, at SPP Operators discretion, sludge will be wasted from the treatment trains (as WAS) to the aerobic digesters. Sludge will be wasted to achieve operator set point liquid levels within the aerobic digesters. The actuated valves on the discharge of the sludge pumps will operate in the following modes:

LOCAL – Local control of the actuated valves on the discharge of the Sludge pumps involves putting the valves into LOCAL mode (from LOCAL-REMOTE selector switch on valve actuator or remote control station). The valve can then be opened/closed by using the OPEN/CLOSE selector switch. Note: at least one of the two valves on a particular treatment train must be open to prevent dead heading the sludge pump.

REMOTE-MANUAL – Manual control of the actuated valves on the discharge of the third train sludge pumps can be achieved by placing the valves selector switch in REMOTE control mode and selecting "manual" control mode of operation at the SPP SCADA interface. The valves can then be opened/closed as desired by SPP Operators from the SPP SCADA interface. Note: at least one of the two valves on a particular treatment train must be open to prevent dead heading the sludge pumps.

REMOTE-AUTO – Auto control of the RAS/WAS actuated valves can be achieved by placing the valve selector switch in REMOTE and selecting "auto" control on the SPP SCADA interface. When

in this operating mode, the RAS valves for the third train will remain open and the WAS valves will remain closed. The valve positions will only cycle if the SPP Operators initiate a sludge wasting event. Once a sludge wasting event is initiated, the WAS valve will open and the RAS valve will close. Sludge will be directed to the first stage of the treatment train actively wasting sludge until an operator specified level is achieved in the first stage aerobic digester tank receiving WAS. Once this set point is achieved, the sludge wasting event is complete and the RAS valve will open and the WAS valve will close.

9.3.2 Field Points

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		DI	V46		Open Position	
		DI	V46		Closed Position	
		DI	V47		Open Position	
		DI	V47		Closed Position	
		DI	V46		Fault	
		DI	V47		Fault	
		DI	V46		Remote/Local	
		DI	V47		Remote/Local	
		DO	V46		Open Command	
		DO	V46		Close Command	
		DO	V47		Open Command	
		DO	V47		Close Command	
		DI	CNV3		Sludge Collector Status Overtorque Alarm	
		DI	CNV3		Sludge Collector Status	
		DI	CNV3		Sludge Collector Fault	
		DI	CNV3		Local/Remote Status	
		DO	CNV3		Start/Stop Command	
		AI	FE2000		Third Train RAS/WAS Flow	
		DI	P6		Pump High Temp/Leak Detection	
		DI	P6		Pump Run Status	
		DI	P6		Pump Fault	
		DI	P6		Local/Remote Status	
		DO	P6		Start/Stop Command	
		AO	P6		Pump Speed Setpoint	
		AI	P6		Pump Speed Feedback	
		DI	P7		Pump High Temp/Leak Detection	
		DI	P7		Pump Run Status	
		DI	P7		Pump Fault	
		DI	P7		Local/Remote Status	
		DO	P7		Start/Stop Command	
		AO	P7		Pump Speed Setpoint	

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		AI	P7		Pump Speed Feedback	
		DI	P8		Pump High Temp/Leak Detection	
		DI	P8		Pump Run Status	
		DI	P8		Pump Fault	
		DI	P8		Local/Remote Status	
		DO	P8		Start/Stop Command	
		AO	P8		Pump Speed Setpoint	
		AI	P8		Pump Speed Feedback	

9.3.3 Alarm Management

Description	Event	Priority	Notes
V46 Fault	Alarm	1	
V47 Fault	Alarm	1	
Third Train RAS/WAS Flow Low	Warning	2	
Third Train RAS/WAS Flow Low Low	Alarm	1	Activate standby sludge pump if not already active
Pump High Temp/Leak Detection Alarm	Alarm	1	Denergize pump; activate standby pump if available
Pump Fault	Alarm	1	Denergize pump; activate standby pump if available

9.3.4 Monitoring

Event	Classification
Final Sludge Collector Run Time	Data
V46 LOR Remote Position	Status
V47 LOR Remote Position	Status
Sludge Pump Run Time	Data
Third Train Sludge Flow/Volume	Data

9.3.5 Setpoints

Description	Range
Aerobic Digester Stage 1 (TK16)Wasting Event Level Set Point – Third TRAIN	
Third Train RAS/WAS Flow Setpoint	

9.3.6 Unusual Circumstances

The following is a list of unusual circumstances and potential actions that may be taken by the SPP SCADA system and/or plant Operators:

- In the event that the high level switch (LS100) is active in the first stage aerobic digester of a treatment train that is to execute a sludge wasting event, the associated WAS valve (V47) will be prevented from opening. This control interlock will prevent overfilling of the aerobic digesters.
- In the event of sludge pump fault, high temp/leak detection the associated pump will be deactivated and the standby pump (if available) will be activated.
- In the event of a low low flow alarm for the third treatment train, the associated lead pump will be denergized and the standby pump will be activated.

10. East/West Aerobic Digesters

10.1 Overview

Waste activated sludge (WAS) is routinely (typically daily) wasted from the East/West treatment trains to regulate the mixed liquor concentration in the East/West aeration tanks. Refer to Section 9 of this document for description of sludge wasting events from the east/west treatment trains. The aerobic digesters are configured in two stages: stage 1 (TK7/8) and stage 2 (TK9/10), with stage 1 accounting for approximately 2/3rds of the digester volume. The East/West aerobic digesters are continuously mixed by means of coarse bubble diffuser systems supplied with air from the existing SPP positive displacement blowers (472 L/s, 50 HP) – WW-79630-CP1/2/3. The flow of air to the aerobic digesters is adjusted at the SPP Operators discretion based on operating level and manual (portable probe) dissolved oxygen measurements. Sludge is transferred from stage 1 to stage 2 of the aerobic digester by means of air lift pumps (WW-79630-ER1/ER3). The air lift pumps are operated manually by plant Operators as need to transfer sludge between the digester stages. The level in the aerobic digesters is continuously monitored (LT9013/9014/9015/9016). Stage 1 of each of the aerobic digesters includes a high level switch (LS9/10). Both stages of the aerobic digester include pivoting decant arms that allow for removal of supernatant.

10.2 Major Equipment

West Digester Stage 1 Level Sensor	LT9014
West Digester Stage Level Switch	LS9
West Digester Stage 2 Level Sensor	LT9016
East Digester Stage 1 Level Sensor	LT9013
East Digester Stage Level Switch	LS10
East Digester Stage 2 Level Sensor	LT9015
West Digester Air Lift Pump	WW-79630-ER1
East Digester Air Lift Pump	WW-79630-ER3

10.3 Control Description

10.3.1 Normal Operation

The aerobic digesters of the existing SPP east/west treatment trains include no equipment that is monitored or controlled from the SPP PLC/SCADA system. Level monitoring instrumentation is available to provide continuous level readings within the Stage 1 and Stage 2 digesters.

10.3.2 Field Points

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		AI	LT9013		East Train Stage 1 Level	
		AI	LT9014		West Train Stage 1 Level	
		AI	LT9015		East Train Stage 2 Level	
		AI	LT9016		West Train Stage 2 Level	
		DI	LS9		West Train Stage 1 High Level Switch	
		DI	LS10		East Train Stage 1 High Level Switch	

Notes:
1. All tags associated with SPP treatment equipment are proceeded by WW-79610 unless otherwise noted.
2. All tags associated with SPP instrumentation are proceeded by WW-67961 unless otherwise noted.

10.3.3 Alarm Management

Description	Event	Priority	Notes
East Train Stage 1 Level HiHi	Alarm	1	
East Train Stage 1 Level Hi	Warning	2	
East Train Stage 1 Level Lo	Warning	2	
East Train Stage 1 Level LoLo	Alarm	1	
West Train Stage 1 Level HiHi	Alarm	1	
West Train Stage 1 Level Hi	Warning	2	
West Train Stage 1 Level Lo	Warning	2	
West Train Stage 1 Level LoLo	Alarm	1	
East Train Stage 2 Level HiHi	Alarm	1	
East Train Stage 2 Level Hi	Warning	2	
East Train Stage 2 Level Lo	Warning	2	
East Train Stage 2 Level LoLo	Alarm	1	
West Train Stage 2 Level HiHi	Alarm	1	
West Train Stage 2 Level Hi	Warning	2	
West Train Stage 2 Level Lo	Warning	2	
West Train Stage 2 Level LoLo	Alarm	1	
East Train Stage 1 High Level Switch	Alarm	1	
West Train Stage 1 High Level Switch	Alarm	1	

10.3.4 Monitoring

Event	Classification
East Digester Stage 1 Level	Data
East Digester Stage 2 Level	Data
West Digester Stage 1 Level	Data
West Digester Stage 2 Level	Data
East Digester High Level Switch	Status
East Digester High Level Switch	Status

10.3.5 Setpoints

- N/A

10.3.6 Unusual Circumstances

- N/A

11. Third Train Aerobic Digesters

11.1 Overview

The third train aerobic digester will operate in a similar manner to the existing East/West aerobic digesters. The third train aerobic digester is configured as two stages with stage 1 accounting for approximately 2/3rds of the digester volume. The level in each stage of the aerobic digesters is continuously monitored. The two stages of the aerobic digester are provided with mixing/process air by means of coarse bubble mixing grids. Air to the third train coarse bubble grids is provided by a new dedicated aerobic digester blower (190 L/s, 25 HP). The output of the third train aerobic digester blower is regulated based on the level within the aerobic digester to achieve a unit volume of air per unit volume of sludge in the aerobic digesters (e.g., cubic meters per hour of air per cubic meter of sludge). As with the East/West treatment trains, the third treatment train includes pivoting decant arms that allow for removal supernatant from the digester. Digested sludge (from Stage 2) is manually wasted from the digesters by SPP Operators to the sludge wasting/decant sump.

11.2 Major Equipment

Third Train Aerobic Digester Stage 1	WW-79610-TK16
Third Train Aerobic Digester Stage 2	WW-79610-TK17
Third Train Aerobic Digester Blower	WW-79630-CP7
Third Train Aeration/Aerobic Digester Blower	WW-79630-CP6
Third Train Digester Stage 1 Level Sensor	WW-67961-LS100
Third Train Digester Stage 1 Level Switch	WW-67961-LS102
Third Train Digester Stage 2 Level Sensor	WW-67961-LS101

11.3 Control Description

11.3.1 Normal Operation

The third train aerobic digesters will receive waste activated sludge from the third train aeration tanks as described in Section 9. SPP Operators will be able to manually decant water from the aerobic digester (both stages) using the manually operated decant arms. Sludge can be transferred from Stage 1 to Stage 2 of the aerobic digesters using manually operated valves in the wall between Stage 1 and Stage 2.

Low pressure air is applied to the third train aerobic digester tanks via coarse bubble aeration grids mounted to the bottom of the tanks. Low pressure air is provided by two positive displacement blowers configured in a duty-standby arrangement.

The third train aerobic digester blowers may be operated in three modes: REMOTE-AUTO, REMOTE-MANUAL, and REMOTE-LOCAL.

In REMOTE-AUTO mode, the measured liquid level within the third train aerobic digester tanks will be utilized to control the airflow to the digester tanks. Air flow will be set to achieve an operator defined setpoint of volume of air per volume of sludge within the digesters. Operators will be able to assign lead-lag duty to each of the third train aerobic digester blowers. Based on the measured liquid level (WW-67961-LS100/101) – operators may select which level sensor governs blower speed - the SPP main PLC/SCADA system will increase or decrease air flow to the digester tanks to maintain an Operator specified air flow per unit volume of sludge setpoint within the digester tanks. The VFD of the selected lead blower will ramp up/down based on varying process conditions (i.e., measured liquid levels). Pressure setpoints associated blower discharge header pressure sensor (WW-67963-PS106) will ensure that the blowers are not operated at pressures that may result in damage to the SPP equipment. Hard-programmed minimum and maximum blower VFD speeds shall exist to prevent operation of the blowers outside of recommended range. A minimum blower setpoint (based on VFD setting) will existing to ensure a minimum volume of air is applied to the digester tanks to ensure they stay fully mixed.

The Operator will also have the ability to manually specify the blower speeds (% of max) via the SPP SCADA system (while operating in REMOTE-MANUAL mode). While operating in REMOTE-MANUAL, blower speeds must not be set below the minimum setting necessary to achieve complete mixing within the third train digester tanks.

The digester tank blowers may also be operated locally at the SPP motor control center (MCC) VFD interface (LOCAL-MANUAL).

The Operators will have the ability to 'fine tune" air flow distribution within the digester tanks through manipulation of the digester tank diffuser grid drop leg throttling valves. Careful operator attention is required to maintain the manual air distribution valves in their collective "most open" position to minimize air header pressure.

11.3.2 Field Points

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		AI	LS100		Third Train Aerobic Digester Stage 1 Level	
		AI	LS101		Third Train Aerobic Digester Stage 2 Level	
		DI	LS102		Third Train Aerobic Digester Stage 1 High Level Switch	
		DI	CP7		Third Train Digester Blower Run Status	
		DI	CP7		Third Train Digester Blower Fault Status	
		DI	CP7		Third Train Digester Blower Local/Remote Status	
		DO	CP7		Third Train Digester Blower Start/Stop	
		AO	CP7		Third Train Digester Blower Speed Setpoint	
		AI	CP7		Third Train Digester Blower Speed Reference	
		DI	CP7		Third Train Digester Blower E-Stop Status	
		DI	CP7		Third Train Digester Blower Suction Pressure Alarm	
		DI	CP7		Third Train Digester Blower Discharge Pressure Alarm	
		DI	CP7		Third Train Digester Blower Discharge Temperature Alarm	
		DI	CP6		Third Train Digester Blower Run Status	
		DI	CP6		Third Train Digester Blower Fault Status	
		DI	CP6		Third Train Digester Blower Local/Remote Status	
		DO	CP6		Third Train Digester Blower Start/Stop	
		AO	CP6		Third Train Digester Blower Speed Setpoint	
		AI	CP6		Third Train Digester Blower Speed Reference	
		DI	CP6		Third Train Digester Blower E-Stop Status	
		DI	CP6		Third Train Digester Blower Suction Pressure Alarm	
		DI	CP6		Third Train Digester Blower Discharge Pressure Alarm	
		DI	CP6		Third Train Digester Blower Discharge Temperature Alarm	

11.3.3 Alarm Management

Description	Event	Priority	Notes
Third Train Stage 1 Level High High	Alarm	1	No further WAS wasting to tank until level is reduced
Third Train Stage 1 Level High	Warning	2	
Third Train Stage 1 Level Low	Warning	2	
Third Train Stage 1 Level Low Low	Alarm	1	
Third Train Stage 1 Level Switch High	Alarm	1	No further WAS wasting to tank until level is reduced
Third Train Stage 2 Level High High	Alarm	1	
Third Train Stage 2 Level High	Warning	2	
Third Train Stage 2 Level Low	Warning	2	
Third Train Stage 2 Level Low Low	Alarm	1	
Blower Estop Alarm	Alarm	1	Deactivate Blower
Blower Suction Pressure Alarm	Alarm	1	Deactivate blower; activate lag blower if available
Blower Discharge Pressure Alarm	Alarm	1	Deactivate blower; activate lag blower if available
Blower Discharge Temperature Alarm	Alarm	1	Deactivate blower; activate lag blower if available
Blower Fault	Alarm	1	Deactivate blower, activate lag blower if available

11.3.4 Monitoring

Event	Classification
Third Train Aerobic Digester Stage 1 Level	Data
Third Train Aerobic Digester Stage 2 Level	Data
Third Train Aerobic Digester Stage 1 Level Switch	Status
Third Train Blower CP7 Run Time	Data
Third Train Blower CP6 Run Time	Data

11.3.5 Setpoints

Description	Range
Third Train Aerobic Digester Air Rate	XX-XX SCFM/1000 ft3 of sludge

11.3.6 Unusual Circumstances

- In the event of a high high level alarm in the third train aerobic digesters, no further sludge may be wasted to the tanks (i.e. V46 cannot open).
- In the event of a high level switch alarm in the third train aerobic digesters, no further sludge may be wasted to the tanks (i.e. V46 cannot open).
- In the event of a high high pressure alarm on the third train blower header, the active third train blowers will be deactivated by the SPP PLC.

- In the event of a blower fault, the blower will be deactivated by the SPP PLC and the lag blower (if available) will be brought online.
- In the event of a high suction pressure, high discharge pressure, or high discharge temperature for any of the third train blowers, the blower will be deactivated by the SPP PLCe and the lag blower (if available) will be brought into service.
- In the event of an Estop activation for any of the third train blowers, the blower will be deactivated.

12. East/West Train Unwatering Sump

12.1 Overview

The Unwatering Sump of the East and West treatment trains serves several functions. Through manipulation of manual valves, the Unwatering Sump allows for: transfer of supernatant from the aerobic digesters to the SPP EQ tank, transfer of digested sludge from the aerobic digester to the sludge lagoons or sludge hauling station, and unwatering (i.e., draining) of the East/West treatment train aeration tanks, final settling tanks, or aerobic digesters to the previously mentioned tanks/processes. Transfer of wastewater and/or sludge is facilitated by two (duty/standby) self-priming pumps (5 L/s, 5 HP) – WW-79630-P4/5. The Unwatering Sump pumps are operated in an ON/OFF configuration at the SPP operators discretion.

12.2 Major Equipment

Unwatering Sump Pump #1	WW-79630-P4
Unwatering Sump Pump #2	WW-79630-P5
Unwatering Sump Level Sensors	WW-67961-LT9008

12.3 Control Description

12.3.1 Normal Operation

The unwatering sump pumps operate in a manual mode (LOCAL control only). The unwatering sump pumps are activated/de-activated from local control stations (with start/stop push buttons). Run status for the unwatering well pumps is available on the SPP SCADA interface. The liquid level in the unwatering sump (well) is continuously monitored. One the unwatering sump pumps are activated low level software interlocks exist to prevent the pumps from running dry.

12.3.2 Field Points

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		DI	P4		Unwatering Pump P4 Run Status	
		DI	P5		Unwatering Pump P5 Run Status	

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		AI	LT9008		Unwatering well liquid level	
		DO	P4		P4 Low Level Stop Command	
		DO	P5		P5 Low Level Stop Command	

Notes:
1. All tags associated with SPP treatment equipment are proceeded by WW-79610 unless otherwise noted.
2. All tags associated with SPP instrumentation are proceeded by WW-67961 unless otherwise noted.

12.3.3 Alarm Management

Description	Event	Priority	Notes
Unwatering Well Level HiHi	Alarm	1	
Unwatering Well Level Hi	Warning	2	
Unwatering Well Level Lo	Warning	2	
Unwatering Well Level LoLo	Alarm	1	

12.3.4 Monitoring

Event	Classification
Unwatering Pump P4 Run Time	Data
Unwatering Pump P5 Run Time	Data
Unwatering Well Liquid Level	Data

12.3.5 Setpoints

Description	Range
Unwatering Pump P4 Low Level Shut off	
Unwatering Pump P5 Low Level Shut off	

12.3.6 Unusual Circumstances

- N/A

13. Third Train Sludge Wasting/Decant Sump

13.1 Overview

The third treatment train sludge wasting/decant sump (WW-79610-TK18) will provide a similar function to the existing SPP Unwatering Sump. The third train Sludge Wasting/Decant Sump will include two submersible (5 L/s, 5 HP) pumps that will allow for transferring of sludge/wastewater to the SPP EQ tank or the SPP sludge lagoons (via connection to an existing forcemain). The third train Sludge Wasting/Decant Sump will receive digested sludge from the third train aerobic digester, supernatant from the third train aerobic digester, and wastewater (during draining) from the third train aeration tank. The Sludge Wasting/Decant Sump pumps will operate based on level setpoint

controls (continuous level sensor) as well as back-up level switches. The sludge wasting/decant sump pumps will operate on VFDs.

13.2 Major Equipment

Sludge Wasting/Decant Pump #1	WW-79610-P15
Sludge Wasting/Decant Pump #2	WW-79610-P16
Sludge Wasting/Decant Sump Level Sensor	WW-67961-LS103
Sludge Wasting/Decant Sump High Level Switch	WW-67961-LS104
Sludge Wasting/Decant Sump Low Level Switch	WW-67961-LS105

13.3 Control Description

13.3.1 Normal Operation

SPP Operators must manually configure the disccharge valves for the sludge wasting/decant sump to direct supernatant or digested sludge to either the SPP EQ Tank or to the sludge holding lagoon. Directing of supernatant from the digesters or digester sludge from digester to the sump are activities manaully intiated and controlled by SPP Operators. The sump pumps operate in a duty-standby configuration. The submersible sump pumps may be operated in three modes: REMOTE-AUTO, REMOTE-MANUAL, and REMOTE-LOCAL.

In REMOTE-AUTO mode, the pumps will operate (turn ON/OFF) at an Operator defined speed based on liquid levels within the sump. Operators will be able to assign duty-standby duty to each of the submersible sump pumps. Duty assingment will automatically rotate following each pumping event.

The Operator will also have the ability to manually specify the pump speeds (% of max) via the SPP SCADA system (while operating in REMOTE-MANUAL mode).

The sump pumps may also be operated locally at the SPP motor control center (MCC) VFD interface (LOCAL-MANUAL).

13.3.2 Field Points

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		AI	LS103		Sludge Wasting/Decant Sump Level	
		DI	LS104		Sludge Wasting/Decant Sump High Level	
		DI	LS105		Sludge Wasting/Decant Sump Low Level	
		DI	P15		Pump High Temp/Leak Detection	
		DI	P15		Pump Run Status	
		DI	P15		Pump Fault	

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		DI	P15		Local/Remote Status	
		DO	P15		Start/Stop Command	
		AO	P15		Pump Speed Setpoint	
		AI	P15		Pump Speed Feedback	
		DI	P16		Pump High Temp/Leak Detection	
		DI	P16		Pump Run Status	
		DI	P16		Pump Fault	
		DI	P16		Local/Remote Status	
		DO	P16		Start/Stop Command	
		AO	P16		Pump Speed Setpoint	
		AI	P16		Pump Speed Feedback	

13.3.3 Alarm Management

Description	Event	Priority	Notes
Sump High High Level	Alarm	1	
Sump High Level	Warning	2	
Sump Low Level	Warning	2	
Sump Low Low Level	Alarm	1	Deactivate sump pumps
Sump Low Level Switch	Alarm	1	
Sump High Level Switch	ALarm	1	Deactivate sump pumps

13.3.4 Monitoring

Event	Classification
Sump Pump P15 Run Time	Data
Sump Pump P16 Run Time	Data
Sump Level	Data

13.3.5 Setpoints

Description	Range
Sump Pump Speed	XX-XX %
Sump Pump Start Level	XX-XX %
Sump Pump Stop Level	XX-XX %

13.3.6 Unusual Circumstances

The following is a list of unusual circumstances and potential actions that may be taken by the SPP SCADA system and/or plant Operators:

- In the event that the level low switch (LS105) is active, the sump pumps will be deactivated.
- In the event of pump fault, high temp/leak detection the associated pump will be deactivated and the standby pump (if available) will be activated.

14. UV Disinfection

14.1 Overview

Primary control/monitoring of the equipment/instrumentation associated with the existing SPP UV disinfection systems is facilitated by the UV system PLC. Ladder logic associated with the existing UV system should be reviewed in conjunction with this process narrative section for complete understanding of the control/operation of the SPP UV disinfection system.

The SPP UV Disinfection system provides disinfection treatment of the SPP secondary effluent (final settling tank effluent). The UV disinfection system is a vendor packaged system that includes a local process logic controller (which governs system operation), UV sump, UV Channel Feed pumps, and UV lamp assembly. Secondary effluent from the SPP treatment trains (including third train) will flow by gravity to the UV sump. The self-priming, VFD controlled UV Channel Feed pumps (57 l/s, 15 HP) operate (as controlled by UV system PLC) to maintain a setpoint level in the UV sump (the UV sump level is continuously monitored). The UV lamp assembly operates in an ON/OFF configuration in unison with the operation of the UV Channel feed pumps.

14.2 Major Equipment

UV System Inlet Well

UV Inlet Well Level Sensor	WW-67696-LIT9010
UV Inlet Well Level Switch High	WW-67696-LS9005
UV Inlet Well Level Switch Low	WW-67696-LS9006
UV Feed Pump	WW-79690-P9039
UV Feed Pump	WW-79690-P9040
UV System Lamp Bundles	Various
UV Channel Low Level Switch	WW-67696-LS9007
UV Channel UV Intensity	WW-67696-UVIE1
UV Channel Effluent TSS	WW-67696-9002

14.3 Control Description

14.3.1 Normal Operation

During normal operation, the UV system PLC regulates the operation of the UV system feed pumps and UV lamp banks. Key process information is conveyed to the SPP master PLC (via Ethernet communication) for display on the SCADA interface. No control functionality over the UV disinfection system is possible from the plant SCADA interface.

14.3.2 Field Points

Field points will be routed to the SPP master PLC via Ethernet communication from the UV system PLC.

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
			P9039		P9039 Run Status	
			P9040		P9040 Run Status	
			LIT9010		UV Inlet Well Level	
			LS9005		UV Inlet Well Level Switch High	
			LS9006		UV Inlet Well Level Switch Low	
			LS9007		UV Channel Level Switch low	
			UVIE1		UV Channel UV Intensity	
			AIT9002		UV Channel TSS	

Notes:
1. All tags associated with SPP treatment equipment are proceeded by WW-79690 unless otherwise noted.
2. All tags associated with SPP instrumentation are proceeded by WW-67969 unless otherwise noted.

14.3.3 Alarm Management

Description	Event	Priority	Notes
UV Inlet Well Level HiHi	Alarm	1	
UV Inlet Well Level Hi	Warning	2	
UV Inlet Well Level Lo	Warning	2	
UV Inlet Well Level LoLo	Alarm	1	
UV Inlet Well Level Switch High	Alarm	1	
UV Inlet Well Level Switch Low	Alarm	1	
UV Channel Level Switch Low	Alarm	1	
UV Channel UV Intensity Level HiHi	Alarm	1	
UV Channel UV Intensity Level Hi	Warning	2	
UV Channel UV Intensity Level Lo	Warning	2	
UV Channel UV Intensity Level LoLo	Alarm	1	
UV Channel TSS Level HiHi	Alarm	1	
UV Channel TSS Intensity Level Hi	Warning	2	
UV Channel TSS Intensity Level Lo	Warning	2	
UV Channel TSS Intensity Level LoLo	Alarm	1	

14.3.4 Monitoring

Event	Classification
UV Feed Pump Run Time	Data
UV Feed Pump Run Time	Data
UV Inlet Well Level	Data

Event	Classification
UV Channel UV Intensity	Data
UV Channel TSS	Data

14.3.5 Setpoints

- N/A

14.3.6 Unusual Circumstances

- N/A

15. MISA Sampling System

15.1 Overview

The new MISA sampling system is located in the UV Building adjacent to the UV disinfection system. The new MISA sampling system will include two new SPP effluent sampling pumps (variable speed peristaltic pumps), continuously overflowing sample pot, a new pH sensor, and a new conductivity sensor. The new sampling pumps will draw secondary effluent from the SPP exit sump (north side of sump). The new MISA sampling system will be configured to allow the refrigerated composite samplers in the UV building to draw samples from either the overflowing sample pot or from the UV disinfection system effluent trough (as is currently done). The MISA sample pot will continuously overflow to the UV system inlet well. The new MISA sampling pumps will be monitored and controlled by the SPP master PLC. The new pH and conductivity sensors will be integrated into the new master PLC to allow for monitoring and data logging. The new MISA sampling system will include a flow switch on the discharge of MISA sample pumps that will confirm flow effluent is being directed to the sample pot. A high level switch located in the sample pot will prevent overfilling of the sample pot by the effluent sample pumps.

15.2 Major Equipment

New Effluent Sample Pump	WW-79640-P20
New Effluent Sample Pump	WW-79640-P21
New MISA pH Sensor	BS-67099-AE1
New MISA Conductivity Sensor	BS-67099-CE1
New MSA Sample Pot High Level Switch	WW-67099-LSH
New MISA Sample System Flow Switch	WW-67964-FS1

15.3 Control Description

15.3.1 Normal Operation

The new MISA sampling system will allow for continuous monitoring of the quality of the SPP effluent via online pH and conductivity sensors. The MISA sample pot will also provide means for the

collection of effluent composite samples by the existing refrigerated composite samplers within the UV Building.

The MISA effluent sample pumps will operate in a duty/standby configuration to continuously convey treated secondary effluent (discharge of final settling tank) to the MISA sampling system within the UV Building. The MISA sampling pumps will have both local and remote control functions and will be operated as follows:

LOCAL – Local control of the MISA sampling pumps can be achieved by putting the pump selector switch in LOCAL. In this mode of operation, control of the pump can be achieved at the local pump control interface. Status on the SPP SCADA interface will indicate LOCAL. This mode of operation is only recommended for maintenance or troubleshooting purposes.

REMOTE-MANUAL – Manual control of the individual MISA sampling pumps can be achieved by placing the pump selector switch in REMOTE and selecting "manual" operation at the SPP SCADA interface. The pump can then be started/stopped and flow controlled from the SPP SCADA interface.

REMOTE-AUTO – Auto control of the MISA sampling pumps can be achieved by placing the pump selector switch in REMOTE and selecting "auto" on the SPP SCADA interface. In this mode of operation, the two MISA sampling pumps will operate continuously (with rotating duty assignment on daily basis) at a specified flow set point. In the event of failure of the duty pump, the standby pump will automatically resume sampling operations.

15.3.2 Field Points

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		DI	67099-LSH		Sample Pot High Level Switch	
		AI	67099-CE1		Effluent Conductivity Sensor	
		AI	67099-AE1		Effluent pH Sensor	
		DI	P20		Pump Local/Remote Status	
		AI	P20		Pump Speed Feedback	
		DI	P20		Pump Run Status	
		DI	P20		Pump General Alarm	
		AO	P20		Pump Speed Set Point	
		DO	P20		Pump Start/Stop Command	
		DI	P21		Pump Local/Remote Status	
		AI	P21		Pump Speed Feedback	
		DI	P21		Pump Run Status	
		DI	P21		Pump General Alarm	
		AO	P21		Pump Speed Set Point	
		DO	P21		Pump Start/Stop Command	

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		DI	FS1		Sample Pump Discharge Flow Switch	

Notes:
1. All tags associated with SPP treatment equipment are proceeded by WW-79640 unless otherwise noted.
2. All tags associated with SPP instrumentation are proceeded by WW-67099 unless otherwise noted.

15.3.3 Alarm Management

Description	Event	Priority	Notes
Sample Pot High Level	Alarm	1	Disable MISA Sample Pumps P20/P21
Effluent Conductivity Level HiHi	Alarm	1	
Effluent Conductivity Level Hi	Warning	2	
Effluent Conductivity Level Lo	Warning	2	
Effluent Conductivity Level LoLo	Warning	2	
Effluent pH Level HiHi	Alarm	1	
Effluent pH Level Hi	Warning	2	
Effluent pH Level Lo	Warning	2	
Effluent pH Level LoLo	Alarm	1	
Sample Flow Switch	Alarm	1	Alarm in condition of no flow detected

15.3.4 Monitoring

Event	Classification
Effluent Conductivity	Data
Effluent pH	Data
MISA Sample Pump Run Time	Data
MISA Sample Pump Run Time	Data

15.3.5 Setpoints

Description	Range
MISA Sampling Flow Rate	0-100% [of Max Sample Pump Speed]

15.3.6 Unusual Circumstances

The following is a list of unusual circumstances and potential actions that may be taken by the SPP SCADA system and/or plant Operators:

- In the event that the high level switch (LSH) is triggered in the MISA sample pot (indicating overflow is imminent), the MISA sample pump operation will be terminated. An alarm will be generated.

16. SPP Control Building Drainage System

16.1 Overview

The SPP Control Building includes a network of floor drains that direct floor drainage from both levels of the building to a drainage sump in the basement. In addition to collecting floor drainage from within the Control Building, the basement drainage sump also collectes drainage from the perforated underdrain system, which extends around the perimeter (at structural footing) of the SPP treatment tanks. Drainage collected in the sump is pumped (based on level set point controls) to the front end of the SPP for treatment.

16.2 Major Equipment

Drainage Sump Pump 1	WW-71700-P1
Drainage Sump Pump 1	WW-71700-P2
Drainage Sump Level Sensor	WW-67170-LT1000
Drainage Sump High Level Switch	WW-67170-LS1000
Drainage Sump Level Switch 1	WW-67170-LS1
Drainage Sump Level Switch 2	WW-67170-LS2
Drainage Sump Level Switch 3	WW-67170-LS3
Drainage Sump Level Switch 4	WW-67170-LS4
Drainage Sump Level Switch 5	WW-67170-LS5

16.3 Control Description

16.3.1 Normal Operation

The SPP Control Building drainage sump pumps may be operated in several control modes including based on local hardwired controls as well as remote control from the SPP master PLC/SCADA system. The drainage sump pumps are operated as follows:

LOCAL – Local control of the MISA sampling pumps can be achieved by putting the pump selector switches in HAND/AUTO. In this mode of operation, control of the drainage sump pumps is achieved based on float switch controls. Float switches LS1 and LS2 will activate sump pump P1. Level switches P3 and P4 will activate sump pump P2. LS5 will send a high level alarm to the SPP master PLC/SCADA system. Status on the SPP SCADA interface will indicate LOCAL. When in LOCAL mode, the drainage sump pumps can also be run on HAND mode to manually operate the pumps. Such operation is only recommended for maintenance or troubleshooting purposes.

REMOTE-AUTO – Auto control of the SPP Control Building drainage sump pumps is possible from the SPP master PLC/SCADA system. This mode of operation is possible by putting the pump selector switches in AUTO/REMOTE. In this mode of operation, the drainage sump pumps will operate based on programmed start/stop level setpoints (as measured by LT1000). The SPP PLC will rotate pump starts with each pumping event. In the event that LS1000 is triggered, when

operating in this mode of operation, both of the drainage sump pumps (P1 & P2) will be activated. Both pumps will continue to run until LS1000 contact opens. Once this occurs, the pumps will continue to run for an additional 60 seconds then stop.

16.3.2 Field Points

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		AI	LT1000		Drainage Sump Level	
		DI	LS1000		Drainage Sump High Level Switch	
		DI	P1		P1 Run Status	
		DI	P2		P2 Run Status	
		AO	P1		P1 Run Command	
		AO	P2		P2 Run Command	
		DI	P1		P1 General Alarm	
		DI	P2		P2 General Alarm	
		DI	LS5		Building Sump Level Switch High	

Notes:
1. All tags associated with SPP treatment equipment are proceeded by WW-71700 unless otherwise noted.
2. All tags associated with SPP instrumentation are proceeded by WW-67170 unless otherwise noted.

16.3.3 Alarm Management

Description	Event	Priority	Notes
Drainage Sump High Level Switch (LS1000)	Alarm	1	Both Sump pumps activated
Drainage Sump Level HiHi	Alarm	1	
Drainage Sump Level Hi	Warning	2	
Drainage Sump Level Lo	Warning	2	
Drainage Sump Level LoLo	Alarm	1	
Drainage Sump Level Switch High (LS5)	Alarm	1	

16.3.4 Monitoring

Event	Classification
Drainage Sump Pump 1 Run Time	Data
Drainage Sump Pump 2 Run Time	Data
Drainage Sump Level	Data

16.3.5 Setpoints

Description	Range
Drainage Sump Start Level	0-100% [of Max Level]
Drainage Sump Stop Level	0-100% [of Max Level]

16.3.6 Unusual Circumstances

The following is a list of unusual circumstances and potential actions that may be taken by the SPP SCADA system and/or plant Operators:

- In the event that the high level switch (LSH) is triggered in the drainage sump, both of the drainage sump pumps will be activated until flot switch contact opens. The pumps will continue to run for an additional 60 seconds.

17. SPP Electrical System

17.1 Overview

The SPP historically included an annunciator panel that would allow display of alarm statuses (via indicator lights). The annunciator panel is to be eliminated from the SPP electrical control room. All alarm status information that previously displayed on the annuciator panel will be rewired to the SPP master PLC. Alarm status information assocaited with wastwater treatment operations are covered elsewhere in the previous sections of this document. Alarm statuses associated with the SPP electrical hardware are detailed in this section.

17.2 Major Equipment

Incoming Breaker Trip	5530-CB1A
Standby Power Trip	5530-CB4A
MCC1 Trip	5530-CB5A
MCC2 Trip	5530-CB6A
Circuit Breaker Trip	5530-CB7A
Transformer High Temp	5530-T1
Battery Charger Trouble	---
Breaker Trip Supply Fail	5530-BU4
MCC Over voltage	MCC5534 MCC1

17.3 Control Description

17.3.1 Normal Operation

In the event of tripping of any of the circuit breaker or alarm contacts listed above, an alarm will be generated on the SPP SCADA interface. No control action will be taken by the SPP PLC.

17.3.2 Field Points

I/O Tag	Node	I/O Type	Tag	ISA Tag	Description	Notes
		DI	5530-CB1A		Incoming Breaker Trip	
		DI	5530-CB4A		Standby Power Trip	
		DI	5530-CB5A		MCC1 Trip	
		DI	5530-CB6A		MCC2 Trip	
		DI	5530-CB7A		Circuit Breaker Trip	
		DI	5530-T1		Transformer High Temp	
		DI	---		Battery Charger Trouble	
		DI	5530-BU4		Breaker Trip Supply Fail	
		DI	MCC5534 MCC1		MCC Over voltage	

17.3.3 Alarm Management

Description	Event	Priority	Notes
Incoming Breaker Trip	Alarm	1	
Standby Power Trip	Alarm	1	
MCC1 Trip	Alarm	1	
MCC 2 Trip	Alarm	1	
Circuit Breaker Trip	Alarm	1	
Transformer High Temp	Alarm	1	
Battery Charger Trouble	Alarm	1	
Breaker Trip Supply Fail	Alarm	1	
MCC Over voltage	Alarm	1	

17.3.4 Monitoring

- N/A

17.3.5 Setpoints

- N/A

17.3.6 Unusual Circumstances

- N/A



about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

Chris Everest
Christopher.Everest@ghd.com
519.340.4150

www.ghd.com