1.0 PROCESS DESCRIPTION AND OPERATIONAL OVERVIEW

It is the intent of the design team that the entire Wastewater Treatment Plant (WTP) will be controlled utilizing the existing Programmable Logic Controllers (PLC) with a Human Machine Interface (HMI). The existing PLC will be reconfigured. The overall wastewater treatment plant process is depicted on the Process and Instrumentation Diagrams (P&ID). Generally, the biological process that will be used at the WWTP is conventional activated sludge, which will consist of the following unit processes:

- Raw Wastewater Pumping
- Screening
- Primary Treatment (Filtration)
- Biological Process (Anoxic zones for denitrification; Aerobic Zones for BOD and ammonia reduction)
- Secondary Clarification
- Waste Activated Sludge (WAS) thickening- Dissolved Air Flotation (DAF)
- Thickened WAS Storage
- Dewatering (Belt Filter Press)

It is intended that the WWTP be capable of operating on a continuous basis and in an automatic mode. When the plant is called to start and all equipment is in automatic mode, the Main PLC will control and operate the plant. Various conditions of alarms will be detected and reported to the Main PLC, some will shut the plant down and others will turn on back-up equipment. This control philosophy will outline all alarms including set points, normal operation, abnormal operation and manual controls.

2.0 RAW WASTEWATER PUMPING/LIFT STATION

2.1 Normal Operation

The raw wastewater pumping will be controlled through the Main PLC. There is no equipment PLC for this area of the Plant.

Under normal operation, the lead/lag raw WW pumps, P-102 and P-103, will be started based on the level indicated in the raw WW lift station. The raw WW lift station will be equipped with a level transmitter, which will communicate the level of WW in the lift station to the PLC. The PLC will then start the lead raw WW pump, P- 102. There will be various level setpoints programmed in the PLC that will start/stop one or both of the lead/lag raw WW pumps, P-102 and P-103. P-102 and P-103 have a capacity of 50% of Phase 1 peak flows and are equipped with a VFD. The speed of P-102 and P-103 will be modulated to maintain the desired water level setpoint in the raw WW lift station.

P-104 is the standby pump and has a capacity of 50% of Phase 1 peak flows. P-104 is equipped with a VFD and it will serve as emergency back-up to the lead/lag pumps, P-102 and P-103.

The raw WW supply to the plant will be measured using the magnetic flow meter, FE-XXX, located on the discharge side of the raw WW pumps on the 200 mm Diam. forcemain feeding the screening process.

2.1.1 Normal Equipment Status

Equipment Tag #	Description	Status
P-102	Raw WW Pump (VFD)	Auto-lead
P-103	Raw WW Pump (VFD)	Auto- lag
P-104	Raw WW Pump (VFD)	Stand-by
FE-XXX	Flowmeter associated with the 200 mm Diam. Raw WW Feed pipe (XX mm)	On
LE-XXX	Level Transmitter in Raw WW Lift Station	On

2.1.2 Sequence of Normal Operation

Input	Action
LSH-1 Start Lead P- 102	Start lead pump P- 102 at Level Switch High 1 (@ elevation 8.4 m, 3.4 m above the RWW lift station lower floor)

Input	Action
LSH2 Start Lag P- 103	Start lag pump P- 103 at Level Switch High 2 (@ elevation 9.2 m, 4.2m above the RWW lift station lower floor)
LSL1 Stop Lead P- 102	Stop lead pump P- 102 at Level Switch Low 1 (@ elevation 6.8 m, 1.8 m above the RWW lift station lower floor)
LSL2 Stop Lag P- 103	Stop lag pump P- 103 at Level Switch Low 2 (@ elevation 7.6m, 2.6m above the RWW lift station lower floor)
LS Maintain Level	Maintain Level Setpoint @ elevation 8.0 m, 3 m above the RWW lift station lower floor)
FE- XXX Active	FIT- XXX transmits flow measurement to Main PLC and totalizes flow to screening process.

2.2 Abnormal Operation

Abnormal Condition	Action	Alarm	Annunciation
P-102 or P-103 Fails	Lead or Lag pump fails Start standby pump P-104 as duty pump	Alarms	Main PLC
P-104 Fails	Standby Pump Fails Both raw WW pumps fail	Alarms	Main PLC and Dial Out
No flow measured by FE- XXX while the lead pump P-102 is running (FE- XXX to be monitored after 1min timer elapses.)	Lead Pump Fails See Above	FAL Alarms	Main PLC

Abnormal Condition	Action	Alarm	Annunciation
No flow measured by FE- XXX while the lag pump P-103 is running (FE- XXX to be monitored after 1min timer elapses.)	Lag Pump Fails See Above	FAL Alarms	Main PLC
No flow measured by FE- XXX while the stby pump P-104 is running (FE- XXX to be monitored after 1min timer elapses.)	Standby Pump Fails See Above	FAL Alarms	Main PLC and Dial out
LSLL in RWW lift Station	Low low level in Raw WW Lift Station Shutdown and inhibit all pumps, P-102, P-103, and P-104 running (low low level at elevation 6.0 m, 1 m above the RWW lift station lower floor)	LAL Alarms	Main PLC and Dial Out
LSHH in Raw WW Lift Station	High high level in Raw WW Lift Station Start standby pump, P-104. (high high level at elevation 10.0 m, 5 m above the RWW lift station lower floor)	LAH Alarms	Main PLC and Dial Out

3.0 SCREENING

3.1 Normal Operation

The screening process will be controlled through the Main PLC. There is no equipment PLC for this area of the Plant.

Under normal operation, raw WW will discharge into the screening channels upstream of the screw screens, SSCR- 105 and SSCR- 106. The screw screens will be started by the main PLC based on a pre-set level indicated by the level transmitter, LIT- XXX, located in the upstream common channel at the inlet of the individual screening channels. There will be level setpoints programmed in the PLC that will start/stop both of the screw screens, SSCR- 105 and SSCR- 106. Normally both screens operate simultaneously, however, each screen can be isolated. Each screen is sized to handle 50% of the Phase 2 peak flow (167 L/s) and can operate alone when the other screen must be taken out of service for maintenance. The cleaning process for SSCR-105 and SSCR-106 is initiated simultaneously with the screw augers themselves at a preset level in the in the upstream common channel at the inlet of the individual screening channels. As the screw augers convey the screenings to the discharge point, the cleaning process is started. The cleaning

process requires a filtered effluent water supply. The screenings are discharged to a dump trailer (TRL-109) located below the screw screens on the first floor of the headworks building

The Screw Screens will also be started on a timer. If the Screw Screens have not been started for an adjustable time period (ie 1 hour), the Screw Screens will be called to start.

3.1.1 Normal Equipment Status

Equipment Tag #	Description	Status
SSCR-105	Screw Screen	Auto-duty
SSCR-106	Screw Screen	Auto-duty
LE-XXX	Level Transmitter in Common Channel upstream, of Screw Screens	Active
LE-XXX	Back-up Level Float Switch in Common Channel upstream, of Screw Screens	Active

3.1.2 Sequence of Normal Operation

Input	Action
LSH Start both SSCR-105 and SSCR- 106	Start both screw screens at level switch high plus an adjustable delay time (@ elevation 16.017 m, 500 mm above the bottom of common channel) Start cleaning process.
LSL Stop both SSCR-105 and SSCR- 106	Stop both screw screens at level switch low plus an adjustable delay time (@ elevation XXX m, XXX mm above the bottom of common channel) Stop cleaning process.

3.2 Abnormal Operation

Abnormal Condition	Action	Alarm	Annunciation
SSCR-105 or SSCR-106	One of the screw screens fail Continue to run other screw screen	YA Alarms	Main PLC

Abnormal Condition	Action	Alarm	Annunciation
Both Fail	Both screw screens fail No Action	YA Alarm	Main PLC and Dial Out
LSH Overflow situation	Level Switch high indicates an overflow situation in the bypass channel (tank level XXmm)	LAH Alarms	Main PLC
LSHH Overflow situation	Redundant high level Switch indicates an overflow situation in the bypass channel (tank level XXmm)	LAHH Alarms	Main PLC and Dial Out
LE Fails	Level Transmitter fails. SSCR-105 and SSCR-106 are called to start if FE-XXX has measured flow over 2L/s for over an adjustable time period (ie 1 hr).	Alarm	Main PLC

4.0 PRIMARY TREATMENT-FILTRATION

4.1 Normal Operation

The primary filter will be controlled using the equipment PLC supplied with the unit itself. Communication between the primary treatment PLC and the main PLC will occur via an Ethernet communication signal.

Under normal operation, screened sewage will discharge by gravity from the screening system into the primary treatment filtration unit. The primary treatment filtration unit, PFT- 108, will be run by the package PLC in automatic mode. The primary treatment filtration unit is sized to handle Phase 2 Peak Flows with no stand-by. There will be a manual bypass around the primary treatment filtration unit for shutdown and maintenance purposes. Refer to the Package PLC control philosophy specific to PFT-108 for further information on the control of this unit.

The screenings are discharged to the same dump trailer as for the screw screens, TRL-109, located on the first floor of the headworks building

The tables below describe the required input/output signals from the PFT-108 package PLC to the main PLC and vice versa.

4.1.1 Input Signals from PFT-108 Package PLC

Inputs to Main PLC	Action
Run Status	N/a
Common Alarm (equipment failure or overflow condition)	Main PLC and Dial Out

4.1.2 Output Signals to Package PLC from Main PLC

Outputs to PFT-108 Package PLC	Action
Permissive to Run	On start of flow, PFT-108 enabled to run On loss of flow, run PFT-108 for XX mins (time delay)

5.0 BIOREACTORS

5.1 Normal Operation

All equipment associated with the biological process in Bioreactors 1 and 2 will be controlled through the Main PLC. There is no equipment PLC for this area of the Plant.

The bioreactors run 24 hours per day in parallel trains. Normally, two bioreactors are in operation receiving 50% of the incoming primary effluent. The primary effluent flow is split using the flow split box upstream of Anoxic cell 1 in Bioreactors 1 and 2. The primary effluent is mixed in each of the anoxic zones. The mixers, MXR-201 and MXR-202, operate continuously at a constant speed in Anoxic cell 1 of Bioreactors 1 and 2, respectively.

5.1.1 Aeration Normal Operation

The mixed liquor is then discharged from the Anoxic zone into the Aerobic zone. Each of the two Aerobic Zones will be split into 3 cells, Aerobic Cell 1, 2 and 3 by use of concrete baffle walls. All of the aerobic cells will be aerated with a fine bubble aeration system for maintaining a pre-determined setpoint of dissolved oxygen as well as to promote mixing to maintain the mixed liquor in suspension. Continuous monitoring of the dissolved oxygen (DO) concentrations using DO probes is provided in Aerobic Cells 2 and 3 in both bioreactors. One DO probe will be located in Aerobic Cell 2 and 3 in each of the Bioreactors.

The feedback signal from the DO probes will be used to control the flow of air to each bioreactor. There are flow control valves, (FCV-XXX, FCV-XXX, FCV-XXX and FCV-XXX), located on the aeration piping dropleg in Aerobic Cell 2 and 3 in Bioreactors 1 and 2. Process control will be accomplished by modulating the position of the FCVs on each drop leg to maintain a desired DO setpoint. Manual valves will be provided on the aeration dropleg piping in Aerobic Cell 1 in each bioreactor. The manual valves will be set-up to ensure that adequate air is provided to Acrobic Cell 1 in each bioreactor. The desired DO setpoints in each aerobic cell will be set during commissioning.

The nitrified mixed liquor (NMLQ) is recycled back to the Anoxic zone of each bioreactor from the Aerobic 3 cell therefore it is important to minimize the DO in the NMLQ. As a result, the desired DO level in Aerobic 1 and 2 cell will be higher than the desired DO level in Aerobic 3 Cell of both bioreactors. There will be both fine bubble aeration and small mixers in Aerobic 3 cell of both bioreactors. The mixers are to ensure adequate mixing of the mixed liquor during the low flow/low aeration demand periods (ie during the night).

The existing 25hp and 50 hp blowers will supply the airflow to the aeration system in each of the aerobic zones. The blowers will be controlled using pressure transmitters installed on the main process air discharge header. The feedback signal from the pressure transmitter will be used to modulate the speed of the blowers to maintain a desired pressure set point. In the event that a

single blower is unable to meet the desired pressure set point, then additional blowers will be started to achieve the desired setpoint. The desired blower operating selection will be executed from the main PLC.

The two 25 hp blowers and the two 50 hp blowers are equipped with VFDs. Initially, the two 25-hp blowers with VFDs will be used to meet the majority of the flows for Phase 1. The two 50 hp blowers with VFDs will be used once air flow demands increase beyond the capacity of the two – 25 hp blowers. It is recommended that a VFD be installed on two of the existing 50 hp blowers intially.

The main aeration discharge header will be equipped with a blow off line and control valve (FCV-XXX) to eliminate any excess pressure buildup in the line. The control valve will open at a preset high pressure setpoint and vent the excess air to the outside of the building.

5.1.2 Nitrified Mixed Liquor Recycle (NMLQ) Normal Operation

The NMLQ recycle pumps are equipped with VFDs and rated to deliver 3 times the average day flow to each Bioreactor. The existing submersible FLYGT pumps will be reused for the NMLQ pumps and they are equipped with VFDS. The Operator will adjust the NMLQ recycle rate by manually adjusting the speed of the NMLQ pumps via the plant PLC System. The NMLQ Pumps, P-203 and P-204 are located in Aerobic Cell 3 of Bioreactor 1 and 2, respectively. Each NMLQ line is equipped with a flowmeter to ensure that the desired NMLQ rate is achieved. The flow meters provide both remote and local indication of the NMLQ flow rate. The NMLQ rate is adjusted on a weekly basis or as per the Operator's discretion.

The NMLQ pumps can also be used to drain one bioreactor to the other for maintenance and repair situations.

5.1.3 Waste Activated Sludge (WAS) Normal Operation

The WAS is removed from the top of each bioreactor in the aerobic zone. This is achieved using a floating baffle wall located on the top of the aerobic zone in each Bioreactor. The floating baffle directs the WAS from each Bioreactor to a sump located in each bioreactor. There is a WAS pump dedicated to each Bioreactor that pumps the WAS to the dissolved air flotation (DAF) system. Refer to Section 7.0- Waste Thickening Dissolved Air Flotation System below for further information on the operation of the WAS pumps.

5.1.4 Normal Equipment Status

Equipment Tag #	Description	Status
MXR-201	Mixer in Anoxic Cell 1 in Bioreactor 1	Auto-duty
MXR-202	Mixer in Anoxic Cell 1 in Bioreactor 2	Auto-duty
MXR-203	Mixer in Aerobic Cell 3 in Bioreactor 1	Auto-duty
MXR-204	Mixer in Aerobic Cell 3 in Bioreactor 2	Auto-duty

Equipment Tag #	Description	Status
P-203	NMLQ Pump located in Aerobic Cell 3 in Bioreactor 1	Auto-Duty
P-204	NMLQ Pump located in Aerobic Cell 3 in Bioreactor 2	Auto-Duty
FE-XXX	Flowmeter associated with P-203	Active
FE-XXX	Flowmeter associated with P-204	Active
B-214	25 hp Aeration Blower (VFD)	Auto-Lead
B-215	25 hp Aeration Blower (VFD)	Auto-Lag
B-216	25 hp Aeration Blower (no VFD but connected with switch to one of the other blower's VFD)	Shelf Spare-leave installed as is and cycle blowers for equal wear.
B-217	50 hp Aeration Blower (VFD)	Auto-Duty
B-218	50 hp Aeration Blower(VFD)	Auto-Standby
B-219	50 hp Aeration Blower (no VFD but connected with switch to one of the other blower's VFD)	Shelf Spare-leave installed as is and cycle blowers for equal wear.
FCV-XXX	Flow Control Valve on Aeration Piping in Aer Cell 2 in Bioreactor 1	Remote and Throttling
FCV-XXX	Flow Control Valve on Aeration Piping in Aer Cell 3 in Bioreactor 1	Remote and Throttling
FCV-XXX	Flow Control Valve on Aeration Piping in Aer Cell 2 in	Remote and Throttling

Equipment Tag #	Description	Status
	Bioreactor 2	
FCV-XXX	Flow Control Valve on Aeration Piping in Aer Cell 3 in Bioreactor 2	Remote and Throttling
FCV-XXX	Flow Control Valve on Discharge Aeration Header blow off line	Remote and Closed
AE-XXX	DO probe in Aer.2 cell in Bioreactor 1	Active
AE-XXX	DO probe in Aer.3 cell in Bioreactor 1	Active
AE-XXX	DO probe in Aer.2 cell in Bioreactor 2	Active
AE-XXX	DO probe in Aer.3 cell in Bioreactor 2	Active
LE-XXX	Level Transmitter in Anoxic Zone of Bioreactor 1	Active
LE-XXX	Level Transmitter in Anoxic Zone of Bioreactor 2	Active
PIT-XXX	Pressure transmitter on Aeration Discharge Header	Active-Duty
PIT-XXX	Standby Pressure transmitter on Aeration Discharge Header	Active-Stby.

5.1.5 Sequence of Normal Operation

Input	Action
MXR-201 start	Start Mixer in Anoxic Cell 1 in Bioreactor 1
MXR-202 start	Start Mixer in Anoxic Cell 1 in Bioreactor 2
MXR-203 start	Start Mixer in Aerobic Cell 3 in Bioreactor 1 when AIT-XXX transmits preset minimum DO

	measurement to Main PLC in Aerobic 3 cell. **CORRECT?**
MXR-204 start	Start Mixer in Aerobic Cell 3 in Bioreactor 2 when AIT-XXX transmits preset minimum DO measurement to Main PLC in Aerobic 3 cell. **CORRECT?**
P-203 start	Start NMLQ Pump (VFD) in Aerobic Cell 3 in Bioreactor 1
P-204 start	Start NMLQ (VFD) Pump in Aerobic Cell 3 in Bioreactor 2
FE-XXX Active	FIT-XXX transmits flow measurement to Main PLC and totalizes flow.
FE-XXX Active	FIT-XXX transmits flow measurement to Main PLC and totalizes flow.
B-214 start	Start Lead Aeration Blower (VFD/25 hp) and vary speed of B-214 to adjust header pressure to pre-determined setpoint (45 kPA-to be determined in the field)
PSL1 detected by PIT-XXX Start B-215	Start lag trimming Aeration Blower (VFD/25 hp) at Pressure level switch low 1 and after an adjustable delay period. (PSL1 is at 42.5 kPA-to be determined in the field) Vary the speed of B-214 and B-215 to adjust header pressure to pre-determined setpoint and such that both blowers are running at the same speed **IS THIS CORRECT?.**
PSL 2 detected by PIT-XXX Stop B-215 Start B-217	Stop lag trimming Aeration Blower B-215 (VFD/25 hp) at Pressure level switch low 2 and after an adjustable delay period. (PSL2 is - to be determined in the field) Start trimming Duty Aeration Blower (future VFD/50 hp) at PSL2 and after an adjustable delay period. Vary the speed of B-214 and B-217 to adjust header pressure to pre-determined setpoint and

	such that both blowers are running at the same speed **IS THIS CORRECT?.**
AE-XXX Active	AIT-XXX transmits DO measurement to Main PLC and modulates FCV-XXX to maintain desired DO setpoint.
AE-XXX Active	AIT-XXX transmits DO measurement to Main PLC and modulates FCV-XXX to maintain desired DO setpoint.
AE-XXX Active	AIT-XXX transmits DO measurement to Main PLC and modulates FCV-XXX to maintain desired DO setpoint.
AE-XXX Active	AIT-XXX transmits DO measurement to Main PLC and modulates FCV-XXX to maintain desired DO setpoint.

5.2 Abnormal Operation

Abnormal Condition	Action	Alarm	Annunciation
MXR-201 Fails	No Action No Stby provided	Alarm	Main PLC
MXR-202 Fails	No Action No Stby provided	Alarm	Main PLC
NMLQ P-203 Fails	No Action No Stby provided	Alarm	Main PLC
NMLQ P-204 Fails	No Action No Stby provided	Alarm	Main PLC
No flow measured by FE-XXX while the P-203 is the duty pump and is running (FE-XXX to be monitored after 1 min timer elapses.)	Duty Pump NMLQ-P-203 Fails See above	FAL Alarms	Main PLC
No flow measured by FE-XXX while the NMLQ P-204 is the duty pump and is running (FE-XXX to be monitored after 1 min timer	Duty Pump NMLQ-P204 Fails See above	FAL Alarms	Main PLC

Abnormal Condition	Action	Alarm	Annunciation
elapses.)			
LSHH detected by LE-XXX	Level alarm high in the Anoxic 1 cell of Bioreactor 1 No Action	Alarm	Main PLC and dial out
LSHH detected by LE-XXX	Level alarm high in the Anoxic 1 cell of Bioreactor 2 No Action	Alarm	Main PLC and dial out
B-214 Fails	Lead Aeration Blower (VFD/25 hp) Fails Start stby blower B-216 (25 hp) and switch VFD from B-214 to B-216.	Alarm	Main PLC
B-215 Fails	Lag Aeration Blower (VFD/25 hp) Fails Start duty blower B-217 (VFD/50 hp)	Alarm	Main PLC and Dial out
B-217 Fails	Duty Aeration blower (VFD/50 hp) fails Start standby blower B-218 (VFD/50hp).	Alarm	Main PLC
No DO level measured in Aer Cell 2 in Bioreactor by AE-XXX while B-214, B-215, B-217 and /or B-218 are running	FCV-XXX failed or left closed No Action	Alarm	Main PLC
No DO level measured in Aer Cell 3 in Bioreactor 1 by AE-XXX while B-214, B-215, B-217 and /or B-218 are running	FCV-XXX failed or left closed No Action	Alarm	Main PLC
No DO level measured in Aer Cell 2 in Bioreactor 2 by AE-XXX B-214, B-215, B-217 and /or B-218 are running	FCV-XXX failed or left closed No Action	Alarm	Main PLC

Abnormal Condition	Action	Alarm	Annunciation
No DO level measured in Aer Cell 3 in Bioreactor 2by AE-XXX B-214, B-215, B-217 and /or B-218 are running	FCV XXX failed or left closed No Action	Alarm	Main PLC
PSLL detected by PIT-XXX Low low pressure	All Aeration Blowers Failed at XX kPA. (To be determined in the field).	Alarm	Main PLC and Dial Out
PSH detected by PIT-XXX High pressure	High pressure in the aeration discharge header (XX kPA- to be determined in the field) Open FCV-XXX on blow off line off of the aeration discharge header.	Alarm	Main PLC
PSHH detected by PIT-XXX High high pressure	High pressure in the aeration discharge header due to Diffusers being plugged or FCVs/PSVs failed (XX kPA -to be determined in the field) Shutdown and inhibit all Blowers from running	Alarm	Main PLC and Dial out

6.0 SECONDARY CLARIFICATION

6.1 Normal Operation

All equipment associated with the secondary clarifiers (SC) will be controlled through the Main PLC. There is no equipment PLC for this area of the Plant.

Under normal operation, mixed liquor is gravity fed to the clarifiers through a distribution chamber from the MLQ box downstream of the bioreactors. The Secondary Clarifier mechanisms

in SC-302 (CM-301) and SC-304 (CM-303) run continuously when the local HOA switch is in the AUTO position. Each clarifier is equipped with overtorque protection via torque switches.

Secondary sludge, which settles to the bottom of each clarifier, is scraped to the sludge hopper at the clarifier centre by the spiral scraper mechanism. This sludge, referred to as return activated sludge (RAS), is then pumped back to the Bioreactors. Each clarifier is equipped with a dedicated RAS pump equipped with a VFD. RAS Pump 1, P-305 is associated with SC-302; RAS Pump 2, P-306 is associated with SC-304; RAS Pump 3, P-307 is the standby RAS pump for both clarifiers. The RAS pumping rate is manually set at the Main PLC by the Operator based on a pre-determined percentage of the average dry weather flow. Each RAS line to each Bioreactor is equipped with a flowmeter downstream of the pump to ensure that the desired RAS flow is achieved. The flow meters provide both remote and local indication of the RAS flow.

6.1.1 Normal Equipment Status

Equipment Tag #	Description	Status
CM-301	Clarifier Mechanism associated with SC-302	Auto-Duty
CM-303	Clarifier Mechanism associated with SC-304	Auto-Duty
P-305	RAS Pump dedicated to SC-302	Auto (VFD)-Duty
P-306	RAS Pump dedicated to SC-304	Auto (VFD)-Duty
P-307	Standby RAS Pump dedicated to SC-302 and SC-304	Auto (VFD)- Standby
FE-XXX	Flowmeter associated with RAS P-305	On
FE-XXX	Flowmeter associated with RAS P-306	On

6.1.2 Sequence of Normal Operation

Input	Action
Start CM-301 when Clarifier put in service	Start the Clarifier Mechanism associated with SC-302
Start CM-303 when Clarifier put in service	Start the Clarifier Mechanism associated with SC-304
Start P-305	Start RAS Pump P-305 associated with SC-302

Input	Action
Start P-306	Start RAS Pump P-306 associated with SC-304
FE-XXX Active	FIT-XXX transmits flow measurement to Main PLC and totalizes flow.
FE-XXX Active	FIT-XXX transmits flow measurement to Main PLC and totalizes flow.

6.2 Abnormal Operation

Abnormal Condition	Action	Alarm	Annunciation
RAS P-305 Fails	Start Stby RAS P-307	Alarm	Main PLC
RAS P-306 Fails	Start Stby RAS P-307	Alarm	Main PLC
Standby RAS P-307 Fails	No Action	Alarm	Main PLC and Dial out
No flow measured by FE-XXX while the RAS P-305 is running (FE-XXX to be monitored after 1 min timer elapses.)	RAS P-305 Fails See above	FAL Alarms	Main PLC
No flow measured by FE-XXX while the RAS P-306 is running (FE-XXX to be monitored after 1 min timer elapses.)	RAS P-306 Fails See above	FAL Alarms	Main PLC
No flow measured by FE-XXX (associated with SC-302) while the stby RAS P-307 is running (FE-XXX to be monitored after 1 min timer elapses.)	Stby RAS P-307 Fails See above	FAL Alarms	Main PLC and Dial Out
No flow measured by FE-XXX (associated with SC-304) while the stby RAS P-307 is running (FE-XXX to be monitored after 1 min timer elapses.)	Stby RAS P-307 Fails See above	FAL Alarms	Main PLC and Dial Out
CM-301 Fails	No Action No Stby provided	Alarm	Main PLC and Dial Out
CM-303 Fails	No Action No Stby provided	Alarm	Main PLC and Dial Out

7.0 WASTE THICKENING-DISSOLVED AIR FLOTATION

7.1 Normal Operation

The dissolved air flotation (DAF) unit will be controlled using the equipment control panel with hardwire inputs and outputs to and from the Main PLC. The WAS pumps and the Air Compressors will be controlled using the Main PLC.

Under normal operation, one DAF tank is required to handle the Phase 2 design solids loading of WAS from Bioreactors 1 and 2. There is no DAF standby unit. The DAF system is automated and designed to operate 24 hours a day therefore continuous operator attendance is not required. Both WAS Pumps P-205 and P-206 feed the DAF unit DAF-402.

Rotating skimmers push the float over a beach into a float box that feeds the gravity pipe leading to the thickened WAS (TWAS) Tank, T-408. See the following section for further information on the TWAS Tank.

The DAF tanks are covered and the headspace of each is vented to atmosphere with a dedicated small blower. Hatches in the cover allow operators to check on the operation of the DAF Tanks.

The WAS pumps, P-205 and P-206, are dedicated to Bioreactors 1 and 2, respectively and are both equipped with VFDs. The wasting rate is a function of the flow through the bioreactor and the desired solids retention time (SRT). The WAS pumping rate is manually adjusted at the Main PLC by the Operator to ensure a constant mixed liquor suspended solids (MLSS) concentration. Each WAS line is equipped with a flowmeter to ensure that the desired WAS rate is achieved. The flow meters provide both remote and local indication of the WAS flow. The WAS P-205 and P-206 are progressing cavity pumps and are equipped with a high pressure switch downstream, of the pump and a low flow switch upstream of the pump to shutdown the pump in case of a closed valve causing high pressures or the pump overheating from low flows.

The subnatant (SUB) is withdrawn from the DAF thickener by a submerged perforated pipe along the inside of the tank. It flows by gravity into a common collection box, the subnatant collector. A weir gate on the subnatant line controls the level in the DAF thickener. The subnatant is then drained by gravity to Aerobic Cell 3 in Bioreactors 1 and 2. The subnatant pipe to each Bioreactor will be equipped with isolation valves such that the subnatant flow can be directed to just one bioreactor in the event of a shutdown of the other bioreactor.

There is a pressurization system dedicated to the DAF thickener. The existing air compressors, COMP-601 and COMP-602, will provide the required compressed air for the pressurization system. The operator adjusts the settings of the pressurization system to provide the desired flow of dissolved air to the DAF tanks. The recycle pressurization pumps run normally at 300 kPa, and the pressurization tanks at 250 kPa. Both pressures are dependent on the setting of the back pressure control valves at the DAF tank, (usually set at 200 kPa). The pressurization system runs 24 hours a day. Operators adjust the setting on the back pressure valve to adjust the flow in the pressurization pumps. The air flow to the pressurization tanks is adjusted at the air flow control panels.

In the event that the DAF overflows, the overflow will be discharged to the Aerobic 3 Cell in both Bioreactors.

In the event that the DAF unit is shutdown for maintenance or repairs, the WAS will be wasted via the RAS line to the Belt Filter Press (refer to Section 8 for further information on the Belt Filter Press). There will be a pipe off of each RAS line from each Clarifier and it will be equipped with a flow control valve as well as a flowmeter. The Operator will manually throttle the flow control valve to waste a certain percentage of the RAS flow. The flowmeter will provide local indication only of the WAS to the Belt Filter Press. **Correct?**

The tables under 7.2 and 7.3 describe the required input/output signals from the DAF-402 package PLC to the main PLC and vice versa.

7.2 Input Signals from DAF-402 Control Panel to Main PLC

Inputs to Main PLC	Action
Run Status	HOA Switch is in Auto
Common Alarm (equipment failure, etc)	Stop WAS P-205 and P-206 Main PLC and Dial Out
Torque Alarm	Overtorque alarm signal to Main PLC **WOULD WE WANT A DIAL OUT?**

7.3 Output Signals to DAF-402 Control Panel from Main PLC

Outputs to DAF-402 Control Panel	Action
Permissive to Run	DAF-402 enabled to run Start WAS P-205 and P-206
Non-Pemissive to Run	High level in TWAS Tank Refer to Table 8.6 Stop DAF-402 from running

7.4 Normal Equipment Status for Main PLC

Equipment Tag #	Description	Status
COMP-201	Air Compressor 1	Auto-Duty
COMP-202	Air Compressor 2	Auto-Stby
P-205	WAS Pump located in Aerobic Cell 3 in Bioreactor 1	Auto-Duty
P-206	WAS Pump located in Aerobic Cell 3 in Bioreactor 2	Auto-Duty
FE-XXX	Flowmeter associated with WAS P-205	On