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GIBSON ISLAND, WATER RECLAMATION PLANT FINAL SETTLING TANK CAPACITY UPGRADE

OPERATION & MAINTENANCE MANUAL

VOLUME 5

DESIGN REPORTS, APPROPRIATE RECORDS & APPENDICES

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Contents

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1. Design Details

Gibson Island Water Reclamation Plant (WRP) commissioned in 1989 has a hydraulic capacity of 45 ML/day ADWF (average dry weather flow) and a biological capacity of 11.2 $tBOD_5$/day. The plant, prior to installation of FST 7&8 is treating up to 45 ML/d ADWF with a biological load (80^{th} percentile) of 10.8 $tBOD_5$/day.

Separate hydraulic and biological models have been developed to determine 'bottlenecks' to the plant's operation during both wet and dry weather conditions. The modelling outputs suggested Gibson Island WRP can treat between 90 to 120 ML/d of wet weather flow depending on the settleability of the sludge, which is far below, the target of 135 ML/d of wet weather flow.

The key outcome from the modelling was the identification of Final Settling Tanks (FSTs) as the major wet weather 'bottleneck' and the need to have the FST capacity upgraded.

The plant has also suffered process control problems due to inaccurate flow metering in mixed liquor lines to existing Distribution Chambers No. 1 & 2 due to air entrapment. The installation of de-aeration chambers, one on each mixed liquor line before the flow meters was the solution to this problem.

The Gibson Island Reclamation Project comprised the installation of two new fully functional FSTs with the capacity to treat an additional 50 ML/d (as the Peak Value including allowance for wet weather conditions) of raw sewage into the plant (existing FSTs have a capacity of 120 ML/d during wet weather).

The installation also included associated mechanical and electrical infrastructure as well as provision for future flows and connections also made to accommodate future plant upgrades.

The new plant consists of the following equipment;

- New Weirs and Outlet Weir Chamber on existing Bioreactors No. 1&2.
- Distribution Chamber No. 3.
- Two new FSTs No. 7 & 8.
- Mixed Liquor Line from Outlet Weir Chambers through Flow Distribution Chamber No. 3 to FST No 7 & 8.
- RAS lines from FST No. 7& 8 to existing RAS pump station wet well.
- Four Scum Pump Stations No 71,72,81 & 82.
- Scum line from FST No. 7 & 8 to the head of the existing plant.

- Effluent Line from FST No. 7 & 8 to the existing outfall main.
- Carport type facility to accommodate a new FSTs switchboard.
- Power supply from the existing Plant Main Switchboard to a new FSTs switchboard.
- All associated mechanical and electrical works including flow meters required for operational performance and all instrumentation.
- A PLC based control system for the above, programming and linking to SCADA system.
- De-aeration chambers, one on each Mixed Liquor Line to existing Distribution Chambers No. 1 & 2.
- Install flow meters and link to existing plant PLC system.

Mixed liquor will leave the existing bioreactors via the new weirs. Flow control is achieved through the side winder gates.

The mixed liquor enters DC3 by way of the 960 MSCL pipe line from the weir chambers. The distribution chamber distributes the mixed liquor to FST 7&8 equally via fixed internal weirs. The mixed liquor goes out through the energy dissipation inlet out into the settling tank. The RAS settles to the bottom and the effluent water overflows the "v" notch weir and leaves the tanks via the out fall drop boxes.

The scum is removed by way of skimmers and pumped back to the head of the plant.

The RAS leaves the FST and goes through a flow meter and eccentric plug valve to the existing RAS station.

All electrical equipment has control push buttons and status indication lights on their starter panel front door, located inside the MCC cabinet.

All electrical equipment shall have three modes of operation selectable from a three position (Local/Off/Remote) mode selector switch mounted on the starter panel front door, located inside the MCC cabinet.

Local Mode

This mode is active when the mode selector switch is selected in local mode. In local mode, the drive can be controlled using the switchboard start, stop and reset push buttons. The operator can start the drive via the start push button if the start and run interlocks are healthy. The drive will stop if the operator presses the stop push button or if any of the run interlocks become faulty.

Remote Manual Mode

This mode is active when the mode selector switch is selected in remote mode and the operator has selected manual from the auto/manual selection on the Citect SCADA system. In remote manual mode, the operator can start and stop the pump from the Citect SCADA system using the control popup screen (start/stop/reset buttons), if run and start conditions are healthy. The drive will also stop if any of the run interlocks become faulty.

Remote Auto Mode

This mode is active when the mode selector switch is selected in remote mode and the operator has selected auto from the auto/manual selection on the Citect SCADA system. In remote auto mode, the drive is controlled by either, run request input from the PLC as part of automatic control logic. The drive will stop once stop command is issued by the PLC.

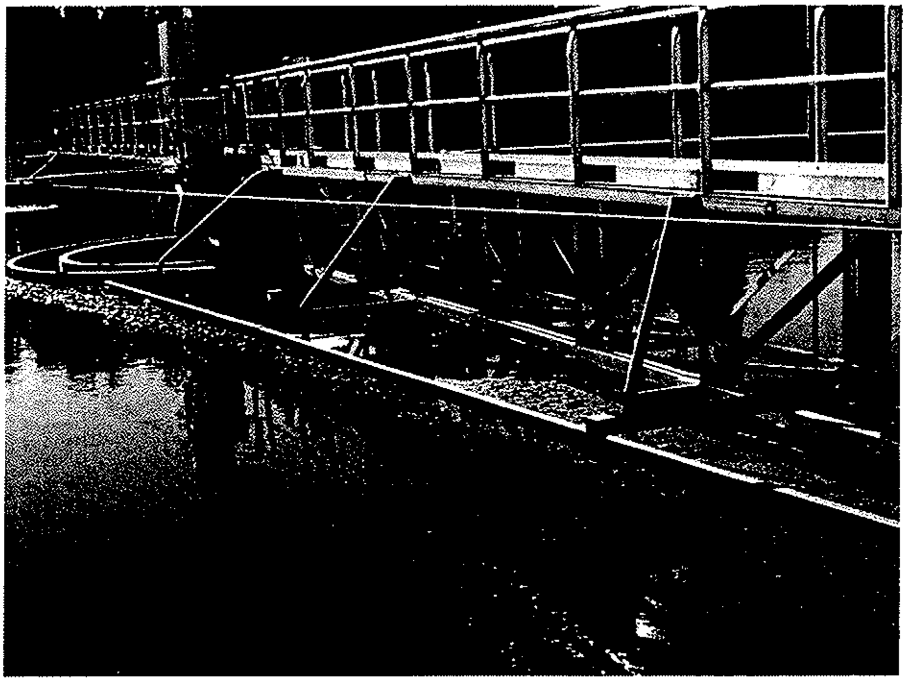
2. Design Criteria

Simmonds & Bristow
Established 1965 ACN 010 252 418 Pty Ltd

HENRY AND HYMAS

GIBSON ISLAND WASTEWATER TREATMENT PLANT

DETAIL DESIGN OF CLARIFIERS



June 2009

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Gibson Island Wastewater Treatment Plant
Clarifier Detail Design

June 2009

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1. INTRODUCTION

This report covers the hydraulics for the two stage upgrade of Gibson Island Wastewater Treatment Plant. According to the scope of work, Simmonds and Bristow will produce the following reports:

- Plant Hydraulics;
- Hazop and
- Commissioning and testing.

2. HYDRAULIC CONSIDERATIONS

2.1 Hydraulic profile

Brisbane water has carried out a conceptual design for two new clarifiers, distribution chambers and pump systems. According to several workshops with Henry and Hymas as well as Thomas and Coffey, a detailed hydraulic design has to be carried out to confirm:

- Water surface elevations;
- Levels of control devices such as weirs, tanks and channel depths and
- Pipeline sizes.

2.2 Flowrates

The flows used as a basis for this detailed design has been provided by Brisbane Water in the following reference, drawing No. 486/5/5-0046-004. A simplified process layout is provided by Figure 1 and Figure 2 for the Final Settling Tank (FST) Upgrade and Final Settling Tank (FST) stage 3 Upgrade.

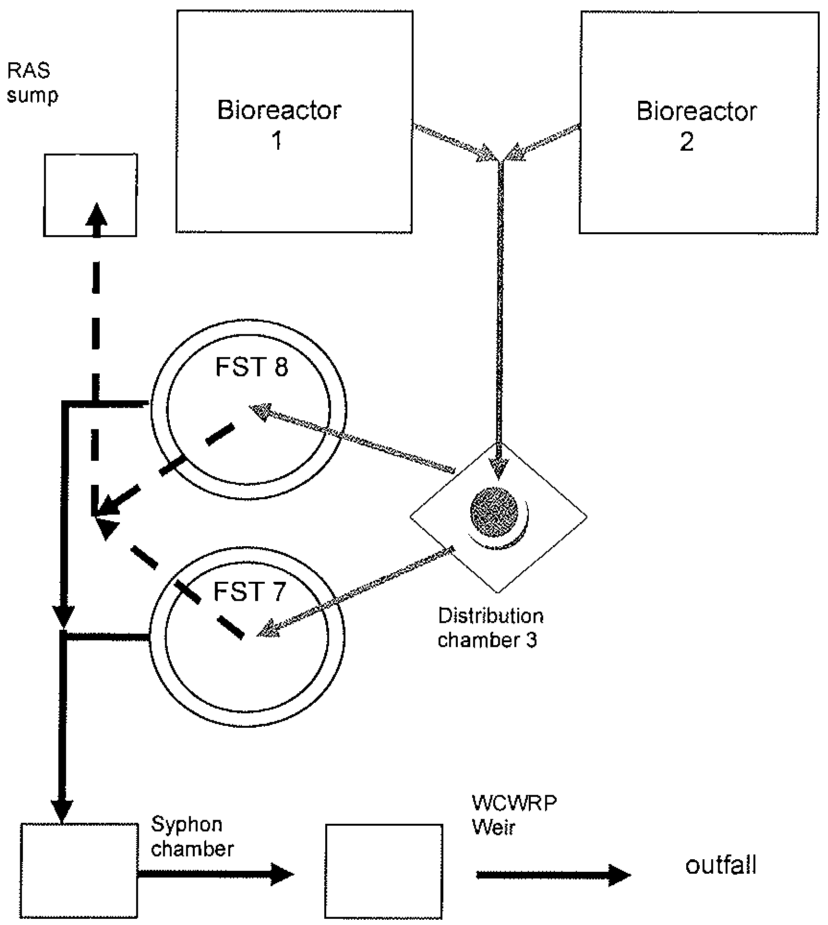


Figure 1: Schematic of Final Settling Tank (FST) Upgrade Stage

The final settling Tank (FST) upgrade stage is shown in figure 1 above and includes the following new equipment:

- Clarifier 7 and 8;
- Distribution chamber 3;
- RAS station;
- Scum pump station and
- Syphon chamber;

The hydraulic loading at this stage to each clarifier (including RAS):

- MDWF : 94 L/s; ADWF : 153 L/s ; PDWF : 255 L/s ; PWWF: 383 L/s

The RAS rate will vary from 46 L/s to 128 L/s.

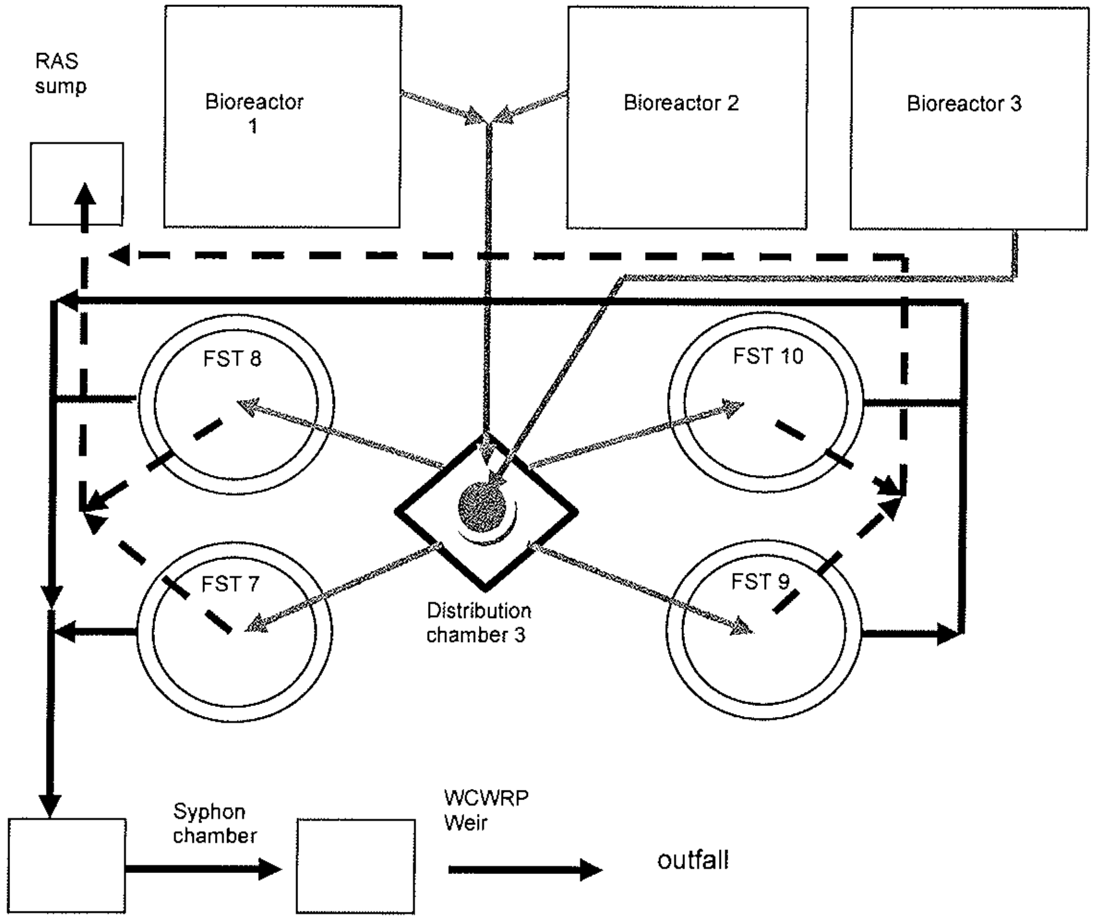


Figure 2: Schematic of Final Settling Tank (FST) Stage 3 Upgrade

The final settling Tank (FST) stage 3 upgrade is shown in figure 2 above and includes the following new equipment:

- Bioreactor 3;
- Clarifier 9 and 10;
- RAS station and
- Scum pump station;

The hydraulic loading at this stage to each clarifier (including RAS):

- MDWF : 107 L/s; ADWF : 176 L/s ; PDWF : 293 L/s ; PWWF: 439 L/s

The RAS rate is expected to vary from 50 L/s to 135 L/s.

The design for each clarifier will be for ultimate hydraulic loading of 8.7 ML/d.

2.3 Plant Head Loss

Plant head loss calculations were based on the Peak Wet Weather Flow (PWWF) using the following concept drawings from Brisbane Water as reference:

General Arrangement	486/5/5-0046-015 and
Hydraulic Profile	486/5/5-0046-005

Table 1: Available Head for Connecting Structures as determined using Brisbane Waters Concept Design

[illegible]	[illegible]	[illegible]	[illegible]
Bioreactor(1 & 2) to Distribution chamber 3	5.880	5.910	-0.030
Distribution chamber 3 to Clarifier 7/8/9/10	5.200	5.137	0.063
Clarifier 7 Launder	4.650	3.857	0.793
Clarifier 8 Launder	4.650	4.095	0.557
Clarifier 10 Launder	4.650	4.531	0.121
Clarifier 9 Launder	4.650	4.573	0.079

Table 1 summarises the head available between connecting structures. The WCWRP weir was used as the reference point. The head available is the tank weir level minus the downstream launder AHD. The detailed head loss calculations are provided in Appendix A and incorporate losses due to fittings and friction. At PWWF, the bioreactor launder is flooded. Distribution chamber 3 and Clarifier 9 outlet launder has a freefall of 63 mm and 79 mm respectively. Available head for launder freefall to range between 100 mm and 150 mm to provide a safety factor for solids deposition and construction irregularities[3]. If there is no freefall, there is a risk of backflow and this may affect the operation of the plant upstream.

The syphon chamber outlet pipeline, a twin OD630 PE, has a high headloss as pipe velocity is at 2.15 m/s at PWWF (see Table 5). This pipe size needs to increase to a 2 off OD 800 PE 100 SDR 26 pipe.

Table 2: Available Head for Connecting Structures with Modifications

[redacted]			
Bioreactor(1 & 2) to Distribution chamber 3	5.880	5.910	-0.030
Distribution chamber 3 to Clarifier 7/8/9/10	5.200	5.137	0.063
Clarifier 7 Launder	4.650	3.447	1.230
Clarifier 8 Launder	4.650	3.683	0.994
Clarifier 10 Launder	4.650	4.119	0.558
Clarifier 9 Launder	4.650	4.161	0.516

Table 2 shows that the available head at Clarifier 9 launder has increased by 437 mm, therefore, there is head available for adjustment of tank levels. These levels can include a safety factor of at least 150 mm for the bioreactor (1 & 2) launder and at least 100 mm for the distribution chamber 3 launder. After discussion with Brisbane Water, their recommended tank level adjustments were made (attached in Appendix E. Rearrangement of tank levels to include safety factor provides weir levels as shown in Table 3. These levels are shown on Hydraulic Profile Diagram 486/5/5-0046-302 (P5).

Table 3: Agreed Weir Levels for Connecting Structures

[redacted]			
Bioreactor(1 & 2) to Distribution chamber 3	5.880	5.780	0.100
Distribution chamber 3 to Clarifier 7/8/9/10	5.070	4.937	0.133
Clarifier 7 Launder	4.450	3.621	0.829
Clarifier 8 Launder	4.450	3.857	0.593
Clarifier 10 Launder	4.450	4.293	0.157
Clarifier 9 Launder	4.450	4.335	0.115

2.4 Pipe Velocities and Pipe size

Table 4: FST Upgrade Pipe Velocities

[redacted]				
Bioreactor (1 & 2) to Distribution chamber 3	DN900	0.35	1.20	Poor
Distribution chamber 3 to Clarifier 7 / 8	DN600	0.50	1.24	Acceptable
RAS 7/8 to connector	DN375	0.60	0.95	Acceptable
RAS connector to Sump	DN450	1.07	1.61	Good
Clarifier 8 to Clarifier 7	DN900	0.35	1.2	Poor
Clarifier 7 to Syphon	DN1000	0.21	0.65	Poor
Syphon to New Manhole	2OD630	0.30	0.90	Poor
Scum Pump -common	DN150	0.62	1.24	Acceptable for scum flow

Table 5: FST Stage 3 Pipe Velocities

[redacted]				
Bioreactor (1 & 2) to Distribution chamber 3	DN900	0.33	0.82	Poor
Distribution chamber 3 to Clarifier 7 / 8	DN600	0.57	1.43	Acceptable
RAS 7/8 to connector	DN375	0.70	1.05	Good
RAS connector to Sump	DN450	1.26	1.89	Good
Clarifier 8 to Clarifier 7	DN900	0.48	1.43	Acceptable
Clarifier 7 to Syphon	DN1000	0.51	1.55	Acceptable
Syphon to New Manhole	OD630	0.71	2.15	Unacceptably High
Scum Pump-common	DN150	0.62	1.24	Acceptable for scum flow

Pipe velocities for each stage is summarised above in Table 4 and 5. Design Requirements for pipe velocities - ADWF - 0.6 m/s to a maximum of 1.8 m/s [1].

The pipeline from Bioreactors (1 and 2) to Distribution chamber 3, DN 900 has a poor velocity for both upgrade stages, with solids deposition to be expected. The pipe line has a higher than normal slope of 2.4 m : 100m (recommended is 1m : 100m[2]) which will reduce deposition. It is recommended to periodically flush (operational task) this pipeline to prevent any likely sedimentation in pipeline. The pipe material used is MSCL which is acceptable for wastewater conveyance.

The pipeline for return activated sludge (RAS) from Clarifier 7 and 8 is a DN 375 - for both stages of the upgrade, the pipe velocities are acceptable. However, the current pipeline arrangement, 90 degree elbows, vertical sections of pipe, a modulating valve and a long transfer pipe section encourage sedimentation and blockages. The RAS system is critical to the efficient operation of a clarifier, therefore, it is highly recommended to review this system.

The pipeline velocities from the clarifiers to outfall are low for the initial upgrade. However the velocity does increase with the final upgrade. The low velocities is not expected to cause any problems as the effluent will have a low suspended solids concentration (<10 mg/l) and a low potential of sedimentation.

Syphon Chamber outlet pipeline velocity is unacceptably high at 2.15 m/s, the pipe size needs to be increased to a 735 ID, this will reduce the head losses in this section.

2.5 Pipeline Material

For conveyance of wastewater:

- Ductile iron concrete lined (DICL) is highly suitable material for wastewater conveyance. Special linings are also provided such as polyethylene sleeve to protect against acidic soils.
- Mild steel concrete lined (MSCL) is also preferred and is recommended to have special coatings such as Sintakote.

3. CLARIFIER HYDRAULIC ASSESSMENT

3.1 Typical Design Values

1) Surface Overflow rates at ADWF < 15 m3/m2.d and PWWF < 35 m3/m2.d[2];

2) Solids loadings at average and peak design flows: < 50 kg/m^2·d and <220 kg/m^2·d, respectively [2];

3) The weir loading shall not exceed 372 m^3/m·d at peak design flows[2].

Based on Brisbane Water's conceptual design:

Final Settling Tank Diameter = 45 m

Bioreactor Design MLSS = 4500 mg/l;

Bioreactor Operational range for MLSS = (3000 - 6000) mg/l.

Table 6: FST Upgrade Hydraulics

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Surface Overflow Rate	m3/m2.d	8.3	20.8	Good
Solids Loading	Kg/m2.d	37.4	93.6	Good
Weir Loading	m3/m.d	-	234	Good

Table 7: FST Stage 3 Hydraulics

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Surface Overflow Rate	m3/m2.d	9.6	23.8	Good
Solids Loading	kg/m2.d	43.0	107	Acceptable
Weir Loading	m3/m.d	-	268	Good

For the FST upgrade stage, the clarifier internal diameter is good for both ADWF and PWWF as shown in Table 5.

In Table 6, the solids loading parameter is limiting for Stage 3 upgrade, therefore, there should be no reduction in the surface area for the clarifiers.

A solids flux test was carried out to determine the sludge settleability. These results are presented in Appendix C. In summary, the settling test show that the Gibson Island Wastewater Plant has a good settling sludge, vo = 11.6 m/h and k = 0.626 [4]. The clarifier critical loading is at 2.5 kg/m2.h and the design is at 1.8 kg/m2.h at ADWF. A 39 % margin for safety is allowed for solids loading.

3.2 Depth of Final Settling Tank

The total depth of the FST is calculated as follows:

Side water depth (SWD) of FST = depth of clear water zone + depth of thickening zone + depth of sludge storage zone [3];

Depth of Clear Water Zone:
The clarifier clear water zone range from 2.5 m to 3.0m, and is dependent on the sludge settling characteristics. The sludge being tested to be a good settling sludge indicates that a conservative depth of 3m can be used.

Depth of Thickening Zone:
In order to estimate the thickening zone, it is assumed that under normal conditions, the mass of solids retained in the FST is 30% of the mass of solids in the aeration basin and that the average concentration of solids in the thickening zone is 9000 mg/l (2 x Bioreactor MLSS)[3].

The mass of solids per FST	=	10387 kg
Depth of thickening zone	=	mass solids/ (concentration x Area)
	=	0.73 m (see Appendix B for detailed calculation)

Depth of Sludge Storage Zone:
This zone is provided to store excess solids for a 5 day sustained load at ADWF (i.e. solids production achieved in a 5 day period due to dewatering failure)

The mass of solids per FST	=	9272 kg
Depth of Sludge Storage	=	mass solids / (concentration x Area)
	=	0.65 m (see Appendix B for calculations);
SWD of FST	=	3.0 m + 0.73m + 0.65m
	=	4.38 m say 4.5 m

A 4.5 m FST SWD provides adequate depth for storage with the cone providing a factor of safety.

The concept design provided by Brisbane Water drawing No. 486/5/5-0046-005 has deeper clarifiers, 4.95 m SWD and it is highly recommended to install 4.5 m SWD clarifiers based on the following conditions:

- Existing clarifiers are 40 m diameter with a SWD of 4.05 m and producing final effluent suspended solids of 2.5 mg/l average. These clarifiers are performing highly efficiently as their discharge limit is < 30 mg/l suspended solids;
- New clarifiers are interlinked with existing clarifiers by a common return activated sludge system so the bioreactors will operate at similar solids concentration (assuming that the bioreactors are balanced by operating at the same Food(raw influent) to biomass ratio. A buildup of solids in the reactor will create similar solids loading stress on all clarifiers. Therefore the existing clarifiers are expected to fail before the new clarifiers. Therefore the full benefit of storage in the new clarifiers will not be realized without adversely affecting the quality of the final effluent on the existing clarifiers.
- Solids flux test result show that the new clarifiers will be underloaded and has the capacity to absorb a 39 % above design solids loading rate.

4. RECOMMENDATION

- Increase syphon chamber outlet pipe size to OD 800 PE 100 SDR 26;
- Lower Distribution chamber 3 by 130 mm and Clarifier 7 and 8 by 200mm;
- Pipeline between bioreactor (1 & 2) and distribution chamber 3 needs to be periodically flushed to remove settled sediments due to the low pipeline velocity;
- A reduction in the clarifier depth from 4.95 m to 4.50 m (Brisbane water agreed to 4.75 m depth) will still provide high performance for solids removal;
- RAS off-take pipeline arrangement needs to be reviewed as it may result in blockages.

5. REFERENCES

[1] Wastewater Treatment Plants: Planning, Design and Operation; by Sayed R and Qasim; Ed. 2, Published by CRC Press (1998);

[2] Design and Retrofit of Wastewater Treatment Plants for Biological Nutrient Removal; by Clifford W. Randall, James Lang Barnard, H. David Stensel, Ed. 2, Published by CRC Press (1992);

[3] Wastewater Engineering: Treatment, Disposal and Reuse by Metcalf and Eddy, Ed.3, published by McGraw-Hill Book Co (1991);

[4] Operational Dynamics and Control of Secondary Clarifiers, Journ. WPCF; by Keinath, T.M., 59, 770, (1985);

APPENDIX A

PLANT HEADLOSS CALCULATIONS

APPENDIX A: HYDRAULIC CALCULATIONS -Modifications

List of Equations

Head Over Rectangular weir(sharp crested)

$H = [Q/(Cw*L)]^{0.67}$ **Eqn 1**

Cw	=	Coefficient -1.84
L	=	Weir length (m)
Q	=	flow rate (m3/s)
H	=	Head over weir (m)

Head Loss In Pipeline

Manning Eqn

$H_f = L*((n*Q/A)/R^{.67})2$ **Eqn 2**

L	=	length of pipe (m)
Q	=	flow rate (m3/s)
H_f	=	Frictional head loss (m)
A	=	Cross-sectional area (m)
n	=	manning Coefficient of friction
R	=	hydraulic radius (m)

Minor head loss

$H_m = K[(Q/A)^2/2g]$ **Eqn 3**

H_m	=	Minor head loss (m)
K	=	Minor Loss coefficient
Q	=	flow rate (m3/s)
A	=	Cross sectional area(m2)
g	=	9.82 m2/s

Surface Overflow Rate

SOR = Q/A **Eqn 4**

Q	=	flow rate (m3/d)
A	=	Cross sectional area of clarifier (m2)

Solids Loading

SL = MLSS/A **Eqn 5**

MLSS	=	mass flow of MLSS (kg/d)
A	=	Cross sectional area of clarifier (m2)

Weir Loading

WL = Q/L **Eqn 6**

Q	=	flow rate over weir (m3/d)
L	=	Length of weir (m)

Head Over V-notch weir

$H = [Q/(C\tan(x/2))]^{0.4}$ **Eqn 7**

C	=	Coeficient -1.34
x	=	V-notch angle (deg)
Q	=	flow rate (m3/s)
H	=	Head over weir (m)

HEAD LOSS CALCULATIONS

Headloss between Oxidation Ditch and Distribution Chamber 3 (PWWF upgrade)

Flow from each Oxidation ditch to DN600 pipe						0.383	m3/s	
Connecting pipe								
Friction Head loss								
	pipe length					15	m	
	Internal diameter of DN600					0.624	m	
	Area					0.305815195	m2	
MSCL	n					0.012		
	P					1.960353816	m	
	R					0.156	m	
	Hf					0.040845688	m	Eqn2
Minor Head Loss		No.	K			0.083940146	m	Eqn3
	Entrance	1	0.5	0.5				
	90 Elbow	1	0.3	0.3				
	Valve	1	0.2	0.2				
	Flow meter	1	0.05	0.05				
				1.05				
Total Head Loss in pipeline(A)						0.124785834	m	
Flow into distribution chamber 3								
Number of clarifiers operating						2		
Flow in commonMLSS pipe						0.766	m3/s	
Length of weir						3	m	
Number of weirs operating						2		
Flow over weir						0.383	m3/s	
Head over weir	H (chamber 3)					0.168852099	m	Eqn1
Weir level		R.L				5.07	m	
Head over weir R.L.						5.238852099	m	
Connecting pipe								
Friction Head loss								
	pipe length					125	m	
	diameter					0.87	m	
	Area					0.59446787	m2	
MSCL	n					0.012		
	P					2.733185609	m	
	R					0.2175	m	
	Hf					0.230822351	m	Eqn2
Minor Head Loss		No.	K			0.185330065	m	Eqn3
	Entrance	1	0.5	0.5				
	Outlet	1	0.5	0.5				
	11 deg bend	3	0.08	0.24				
	Connector			0.3				
	22 deg bend	2	0.2	0.4				
	45 deg bend	1	0.25	0.25				
				2.19				
Total Head Loss in pipeline(B)						0.416152416	m	
Head differential between Distribution/8R						0.70979035		
Oxidation ditch launder leve		**R.L**				**5.77979035**	**m**	

Headloss between Distribution Chamber 3 and Clarifier 7/8/9/10 Influent (PWWF stage 3)

		No.	K		Value	Unit	
Number of clarifiers operating					4		
Flow into clarifier					0.439	m3/s	
Launder width					0.8	m	
Clarifier internal Diameter					45	m	
Length of Effluent weir plate					136.3451212	m	
90 deg V-Notch							
Depth					35	mm	
Notch -Centre to Centre					9	cm	
Total number of notches					1515		
Flow over V-notch @ ADWF(stage 3) exclude RAS					0.304	m3/s	
Flow per notch					0.000200667	m3/s per notch	
Head over V-notch					0.029180059	m	Eqn 7
Clarifier Weir level	R.L				4.45	m	
Head over weir R.L.					4.479180059	m	
Connecting pipe							
Friction Head loss							
pipe length					50	m	
diameter					0.624	m	
Area					0.305815195	m2	
MSCL n					0.012		
P					1.960353816	m	
R					0.156	m	
Hf					0.178877804	m	Eqn2
Minor Head Loss		No.	K		0.279378868	m	
Entrance		1	0.5	0.5			
Outlet		1	0.5	0.5			
90 Elbow		1	0.3	0.3			
EDI		0	0.5	0.5			
22 deg Elbow		2	0.08	0.16			
45 deg Elbow		2	0.25	0.5			
valve		1	0.2	0.2			
				2.66			
Total Head Loss in pipeline					0.48743673	m	
Distribution chamber 3 launder leve	**R.L**				**4.93743673**	**m**	

WCWRP Weir to Syphon chamber (PWWF stage 3 Upgrade)

Section: Weir to MH2

		No.	K		Value	Unit	
Flow over WCWRP chamber					2.604	m3/s	
Reference point(weir level)					2	m	
Length of weir					4.7	m	
Head over weir					0.44924529	m	Eqn1
Connecting pipe							
Friction Head loss							
pipe length					25	m	
diameter					1.6	m	
Area					2.010619298	m2	
MSCL n					0.012		
P					5.026548246	m	
R					0.4	m	
Hf					0.0206141	m	Eqn2
Minor Head Loss		No.	K		0.085491564	m	Eqn3
Entrance		1	0.5	0.5			
Outlet		1	0.5	0.5			
				1			
Total Head Loss in pipeline					0.555350954	m	
level in MH2	**R.L**				**2.555350954**	**m**	

Section: MH3 to MH2						2.141	m3/s	
Connecting pipe								
Friction Head loss								
	pipe length					50	m	
	diameter					1.3	m	
	Area					1.327322896	m2	
MSCL	n					0.013		
	P					4.08407045	m	
	R					0.325	m	
	Hf					0.09913184	m	Eqn2
Minor Head Loss		No.	K			0.132611491	m	Eqn3
	Entrance		1	0.5	0.5			
	Outlet		1	0.5	0.5			
					1			
Total Head Loss in pipeline						0.231743332	m	
Level in MH3		R.L				**2.787094286**	**m**	
Section: New MH to MH3						1.678	m3/s	
Connecting pipe								
Friction Head loss								
	pipe length					50	m	
	diameter					1.2	m	
	Area					1.130973355	m2	
MSCL	n					0.012		
	P					3.769911184	m	
	R					0.3	m	
	Hf					0.079555312	m	Eqn2
Minor Head Loss		No.	K			0.112196721	m	Eqn3
	Entrance		1	0.5	0.5			
	Outlet		1	0.5	0.5			
					1			
Total Head Loss in pipeline						0.191752032	m	
Level in New MH		R.L				**2.978846318**	**m**	
Section: Syphon Chomber to New MH						1.216	m3/s	
Connecting pipe						0.608	m3/s	
Friction Head loss								
	pipe length					16	m	
	diameter					0.735	m	
	Area					0.424291723	m2	
MSCL	n					0.009		
	P					2.3090706	m	
	R					0.18375	m	
	Hf					0.025764303	m	Eqn2
Minor Head Loss		No.	K			0.104659592	m	Eqn3
	Entrance		1	0.5	0.5			
	Outlet		1	0.5	0.5			
					1			
Total Head Loss in pipeline						0.259847789	m	
Level in Syphon Chamber		R.L				**3.238694107**	**m**	
Section: Syphon chamber to Clorifier 7						1.216	m3/s	
Length of weir						2.5	m	
Head over weir		H (syphon chamber)				0	m	Eqn1
Friction Head loss								
	pipe length					15	m	
	diameter					0.975	m	
	Area					0.746619129	m2	
MSCL	n					0.012		
	P					3.063052837	m	
	R					0.24375	m	
	Hf					0.037985415	m	Eqn2
Minor Head Loss		No.	K			0.344754626	m	Eqn3
	Entrance		1	0.5	0.5			
	Submerged weir				1.5			
	Outlet		1	0.5	0.5			
	Flow meter		1	0.05	0.05			
					2.55			
Total Head Loss in pipeline						0.382740041	m	
level in FST 7 channel		**R.L**				**3.621434148**	**m**	

Headloss between Clarifier 7 and Clarifier 8 Effluent (PWWF stage 3)

Flow						0.912	m3/s	
FST7		R.L				3.621434148	m	
Connecting pipe								
Friction Head loss								
	pipe length					60	m	
	diameter					0.9	m	
	Area					0.636172512	m2	
MSCL	n					0.012		
	P					2.827433388	m	
	R					0.225	m	
	Hf					0.131047592	m	Eqn2
Minor Head Loss		No.	K			0.104746826	m	Eqn3
	Entrance	1	0.5	0.5				
	Outlet	1	0.5	0.5				
				1				
Total Head Loss in pipeline						0.235794418	m	
Level in FST 8 channel		**R.L**				**3.857228566**	**m**	

Headloss between Clarifier 8 and Clarifier 10 Effluent (PWWF stage 3)

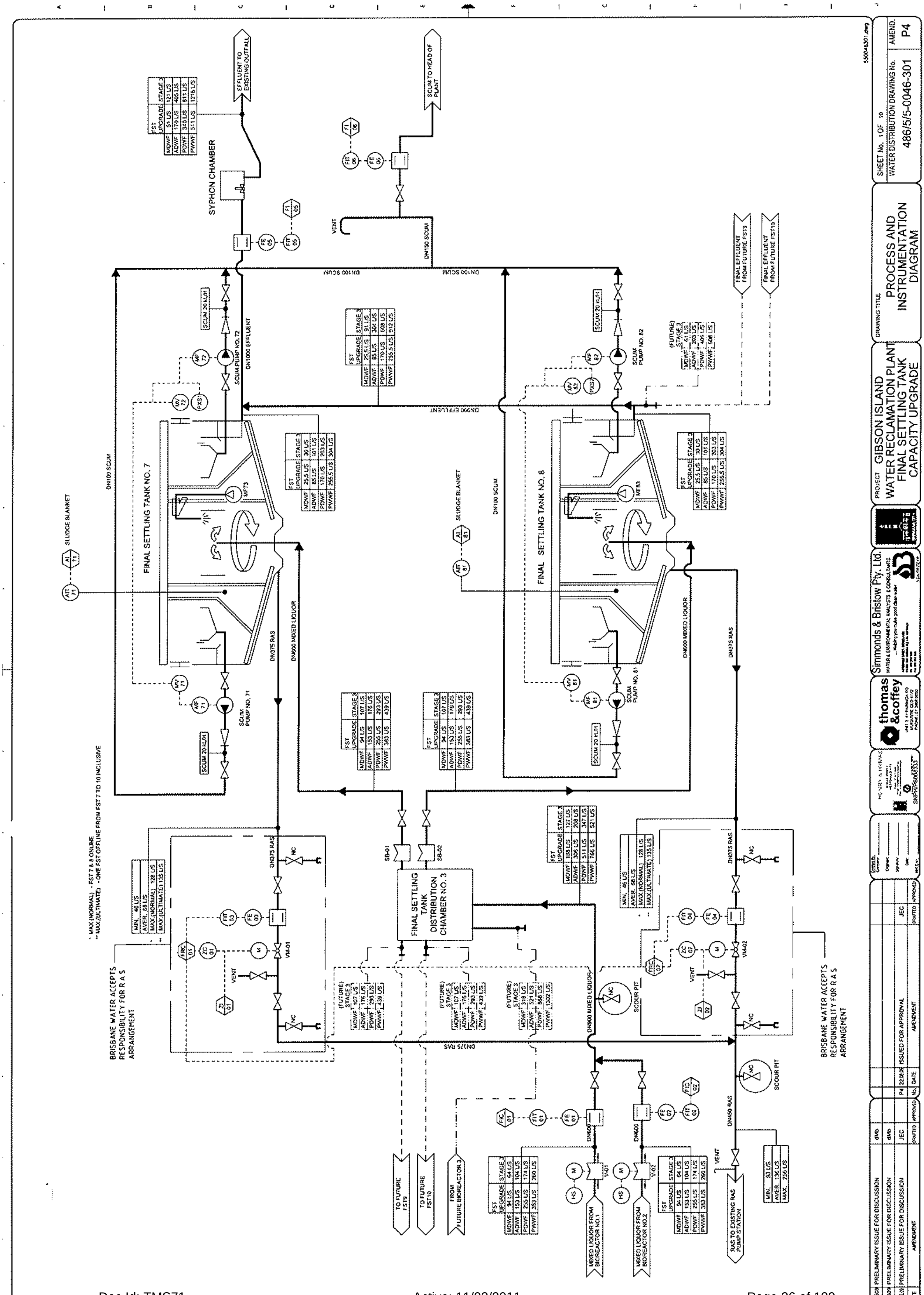
Flow					0.604	m3/s	
Connecting pipe							
Friction Head loss							
	pipe length				170	m	
	diameter				0.806	m	
	Area				0.510222921	m2	
MSCL	n				0.012		
	P				2.532123679	m	
	R				0.2015	m	
	Hf				0.293519388	m	Eqn2
Minor Head Loss		No.	K		0.142851544	m	Eqn3
	Chamber	2	1	2			
				2			
Total Head Loss in pipeline					0.436370932	m	
Level in FST 10 channel		**R.L**			**4.293299498**	**m**	

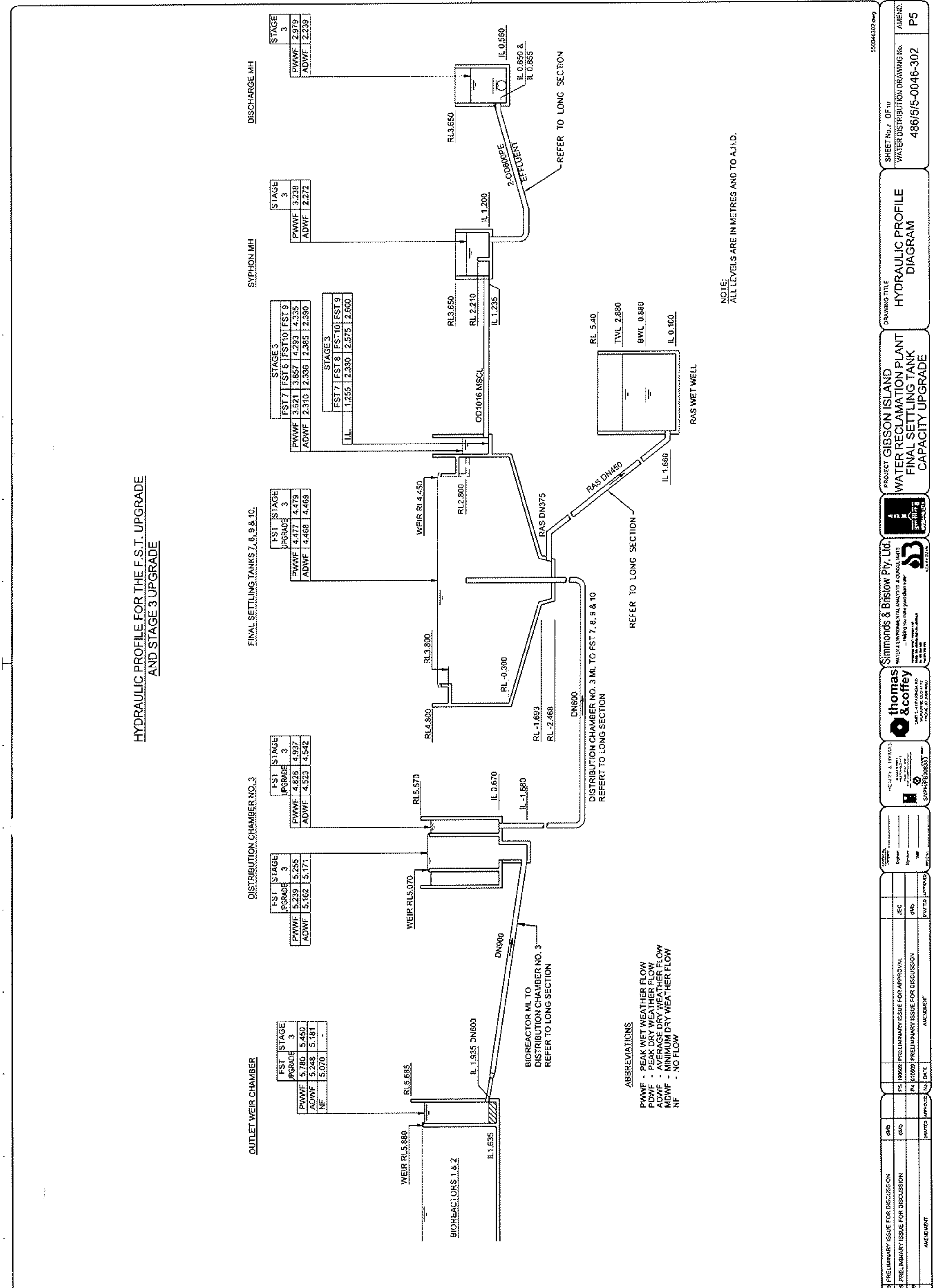
Headloss between Clarifier 10 and Clarifier 9 Effluent (PWWF stage 3)

Flow					0.304	m3/s	
Connecting pipe							
Friction Head loss							
	pipe length				55	m	
	diameter				0.806	m	
	Area				0.510222921	m2	
MSCL	n				0.012		
	P				2.532123679	m	
	R				0.2015	m	
	Hf				0.024056024	m	Eqn2
Minor Head Loss		No.	K		0.018093735	m	Eqn3
	Chamber	1	1	1			
				1			
Total Head Loss in pipeline					0.04214976	m	
Level in FST 9 channel		**R.L**			**4.335449258**	**m**	

Clarifier 7 and Clarifier 8: Surface Overflow Rate, Solids Loading and Weir Loading

PWWF (Stage 3)	439	l/s			
SWD	4.95	m			
PWWF	1580.4	m3/h			
Internal Diameter	45	m			
Surface area	1590.431	m2			
Surface overflow rate	23.84863	m3/m2.d	**< 35**	m3/m2.d	Eqn 4
Surface overflow rate	0.993693	m/h	<1.46	m/h	
weir loading	268.297	m3/m.d	**< 375**	m3/m.d	Eqn 6
Volume of Clarifier	8659.898	m3			
Hydraulic retention time	5.479561	h			
MLSS	4.5	g/l			
Solids per day per FST	170683.2	kg/d			
Solids loading rate	107.3188	kg/m2.d	**< 150**	kg/m2.d	Eqn 5


PROCESS AND INSTRUMENTATION DIAGRAM
GIBSON ISLAND WATER RECLAMATION PLANT FINAL SETTLING TANK CAPACITY UPGRADE
SHEET No. 1 OF 10
WATER DISTRIBUTION DRAWING No.
486/5/5-0046-301
AMEND.
P4
Simmonds & Bristow Pty. Ltd.
thomas &coffey
FINAL SETTLING TANK NO. 7
FINAL SETTLING TANK NO. 8
FINAL SETTLING TANK DISTRIBUTION CHAMBER NO. 3
SYPHON CHAMBER
EFFLUENT TO EXISTING OUTFALL
SCUM TO HEAD OF PLANT
FINAL EFFLUENT FROM FUTURE FST9
FINAL EFFLUENT FROM FUTURE FST10
BRISBANE WATER ACCEPTS RESPONSIBILITY FOR R A S ARRANGEMENT
TO FUTURE FST9
TO FUTURE FST10
FROM FUTURE BIOREACTOR 3
MIXED LIQUOR FROM BIOREACTOR NO.1
MIXED LIQUOR FROM BIOREACTOR NO.2
RAS TO EXISTING RAS PUMP STATION
P3 PRELIMINARY ISSUE FOR DISCUSSION
P2 PRELIMINARY ISSUE FOR DISCUSSION
P1 PRELIMINARY ISSUE FOR DISCUSSION
P4 ISSUED FOR APPROVAL


HYDRAULIC PROFILE FOR THE F.S.T. UPGRADE
AND STAGE 3 UPGRADE
OUTLET WEIR CHAMBER
DISTRIBUTION CHAMBER NO.3
FINAL SETTLING TANKS 7, 8, 9 & 10.
SYPHON MH
DISCHARGE MH
FST UPGRADE STAGE 3
PWWF 5.780 5.450
ADWF 5.248 5.181
NF 5.070 -
PWWF 5.239 5.255
ADWF 5.162 5.171
PWWF 4.826 4.937
ADWF 4.523 4.542
PWWF 4.477 4.479
ADWF 4.468 4.469
STAGE 3 FST 7 FST 8 FST10 FST 9
PWWF 3.621 3.857 4.293 4.335
ADWF 2.310 2.336 2.385 2.390
I.L. 1.255 2.330 2.575 2.600
PWWF 3.238
ADWF 2.272
PWWF 2.979
ADWF 2.239
BIOREACTORS 1 & 2
WEIR RL5.880
RL6.685
IL1.635
IL 1.935 DN600
DN900
BIOREACTOR ML TO DISTRIBUTION CHAMBER NO. 3 REFER TO LONG SECTION
DISTRIBUTION CHAMBER NO. 3 REFER TO LONG SECTION
WEIR RL5.070
RL5.570
IL 0.670
IL -1.680
DISTRIBUTION CHAMBER NO. 3 ML TO FST 7, 8, 9 & 10 REFERT TO LONG SECTION
DN600
RL4.800
RL3.800
RL -0.300
RL -1.693
RL -2.468
WEIR RL4.450
RL2.800
RAS DN375
RAS DN450
REFER TO LONG SECTION
IL 1.660
OD1016 MSCL
RL3.650
RL 2.210
IL 1.235
IL 1.200
2-OD800PE EFFLUENT
REFER TO LONG SECTION
RL3.650
IL 0.650 &
IL 0.855
IL 0.560
RL 5.40
TWL 2.880
BWL 0.880
IL 0.100
RAS WET WELL
NOTE:
ALL LEVELS ARE IN METRES AND TO A.H.D.
ABBREVIATIONS
PWWF - PEAK WET WEATHER FLOW
PDWF - PEAK DRY WEATHER FLOW
ADWF - AVERAGE DRY WEATHER FLOW
MDWF - MINIMUM DRY WEATHER FLOW
NF - NO FLOW
P3 PRELIMINARY ISSUE FOR DISCUSSION
P2 PRELIMINARY ISSUE FOR DISCUSSION
P5 PRELIMINARY ISSUE FOR APPROVAL
P4 PRELIMINARY ISSUE FOR DISCUSSION
Simmonds & Bristow Pty. Ltd.
thomas &coffey
PROJECT GIBSON ISLAND WATER RECLAMATION PLANT FINAL SETTLING TANK CAPACITY UPGRADE
DRAWING TITLE HYDRAULIC PROFILE DIAGRAM
SHEET No. 2 OF 10
WATER DISTRIBUTION DRAWING No. 486/5/5-0046-302
AMEND. P5

APPENDIX B

CLARIFIER DEPTH CALCULATION

APPENDIX B: CLARIFIER DEPTH to FST STAGE 3 UPGRADE

Current Operating Data

Current ADWF		34.4 ML/d

Existing Design

Number of Bioreactors		2
Volume per bioreactor		19785.5 m3
Normal Operating MLSS		4.5 kg/m3
Total solids in Bioreactor(1 & 2)		178069.5 kg
Design ADWF to both reactors		45 ML/d

Existing Clarfiers

Current Treatment capacity ADWF		35 ML/d
Number of Clarifiers		6
Internal Diameter		40 m
SWD		4.05 m
Area per clarifier		1256.637 m2
Volume(exclude cone) per clarifier		5089.38 m3
underflow concentration		7.5 kg/m3

New Clarifier

Number of clarifiers		4
Internal Diameter		45 m
Area per clarifier		1590.431 m2
underflow concentration		9 kg/m3

clarifier thickening depth

Clarifier normally holds 30% of Bioreactor solids:	Bioreactor solids*(35ML/45ML) =	41549.55 kg
Solids per clarifier		10387.39 kg
Average concentration of thickening zone		9 kg/m3
Depth of thickening zone	mass/(conc x area)	0.725686 m

Clarifier Storage Depth

kg Solids produced per kg BOD		0.85 kg/kg BOD
Influent BOD (Brisbane Water)		0.25 kg/m3 BOD
Influent per clarifier (ADWF)		0.101 m3/s
		0.02525 kg/s
BOD produced		2181.6 kg/d
Solids produced per day per clarifier		1854.36 kg/d
5 day storage at sustained load		9271.8 kg
Average concentration of storage zone		9 kg/m3
Depth of storage zone	mass/(conc x area)	0.647749 m

Total depth of clarifier

Total depth = 3 + 0.72 + 0.65 = 4.37 m

Safety factor is the cone area - relative height = 0.5 m

APPENDIX C

SETTLING FLUX TEST

Simmonds & Bristow
Established 1965 ACN 010 252 418 Pty Ltd

HENRY AND HYMAS

GIBSON ISLAND WASTEWATER TREATMENT PLANT SETTLING FLUX TEST

June 2009

Simmonds & Bristow

Established 1965 ACN 010 252 418 Pty Ltd

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Document Control		Rev 1	
	Name	Initial	Date
Written By:	Kersval Naidoo	KN	11/06/2009
Reviewed By:	Philippe DE GRASLAN	PDG	9/06/2009

Gibson Island Wastewater Treatment Plant
Clarifier Detail Design

June 2009

TABLE OF CONTENTS

TABLE LIST

FIGURE LIST

1. INTRODUCTION

The batch settling flux approach has been employed for years as one method of designing secondary clarifiers. Although this is certainly an important application of this technique, another equally important use of batch settling flux curves can be found in the generation of secondary clarifier operation and control data. An activated sludge system is comprised of an aeration basin and a secondary clarifier. Both individual unit operations (the aeration basin and the final clarifier) are in a cooperative relationship.

Please refer to Figure 1 for a review of the activated sludge system and definition of terms.
Q_i = Influent treatment plant flow rate
Q_u = Clarifier underflow flow rate
Q_R = Recycle flow rate
C_o = Clarifier influent TSS concentration (often referred to as mixed liquor suspended solids (MLSS) and is the concentration in the aeration basin)
C_u = Clarifier underflow TSS concentration
Q_w = Clarifier waste sludge flow rate

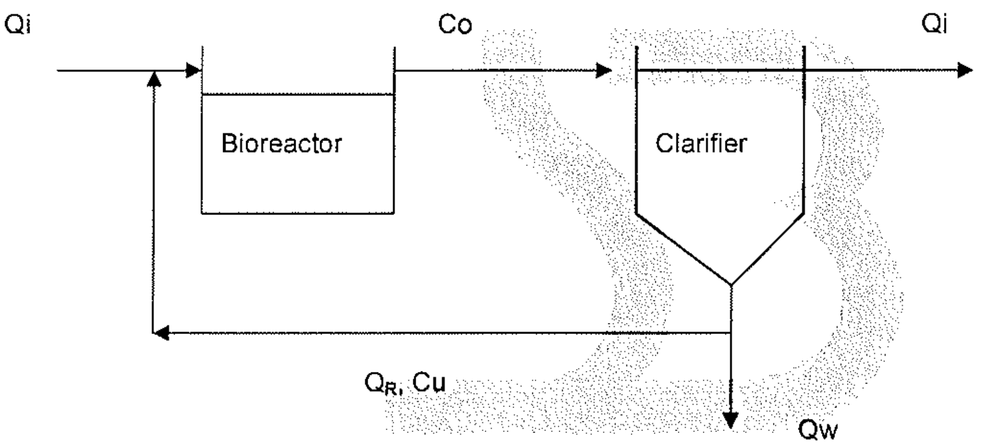

Figure 1: Schematic of an Activated Sludge System

2. SETTLING FLUX DEFINED

Activated sludge entering the secondary clarifier from the activated sludge basin settles toward the bottom of the clarifier by two velocity components;
(i) A velocity component that results from gravitational forces (V_s) and
(ii) A velocity component resulting from the removal of sludge from the bottom of the clarifier ($V_b = Q_u/A$), where A is the clarifier surface area.

The solids flux that results from gravitational settling velocity is termed settling flux (G_s) while that flux resulting from underflow flow rate is termed bulk flux (G_b). The total flux is the sum of the settling and bulk flux components and has units of mass per unit clarifier area per time (kg/m2.d). The components comprising total flux are mathematically defined in equation 1 and 2.

$GVC_{ss} = (1)$
$GVC_{bb} = (2)$

where C is the concentration of solids passing through a given unit area of clarifier.

3. EXPERIMENT METHODOLOGY

A 20 L sample of Bioreactor Mixed liquor was collected and settling flux data were collected by performing a series of settling tests. These tests are conducted in a series of six glass columns (3" ID x 24") in which a range of concentrations of activated sludge is added. The interface (the zone between the clear water and the top of the sludge blanket) height is recorded as a function of time, this is shown in Table 1 below and a plot generated from the height-time data pairs for each sludge concentration (Figure 2).

Table 1: Level of solids-liquid interface (in cm under the liquid surface) as a function of time for different sludge concentrations

Interface Height cm	Sludge Concentration (g/l)					
	C: 1.2 minutes	C: 1.6 minutes	C: 1.7 minutes	C: 2.1 minutes	C: 2.3 minutes	C: 3.0 minutes
-2.5	0.40	0.47	0.73	1.05	1.35	1.80
-5.0	0.72	0.83	1.17	1.53	1.92	2.57
-7.5	1.07	1.25	1.62	2.07	2.70	3.37
-10.0	1.30	1.58				
-12.0			2.75	3.53	5.15	7.42
-12.5	1.62	1.93				
-15.0	1.90	2.27				12.07
-16.0						14.03
-17.5	2.15	2.65	4.25	6.23	9.63	
-20.0	2.43	3.00			12.68	
-22.5	2.68	3.60		9.98	14.28	
-23.0			6.62	11.47		
-24.0			7.58			
-25.0	3.02	4.45				
-27.5	3.58	5.88				
-30.0	3.78					

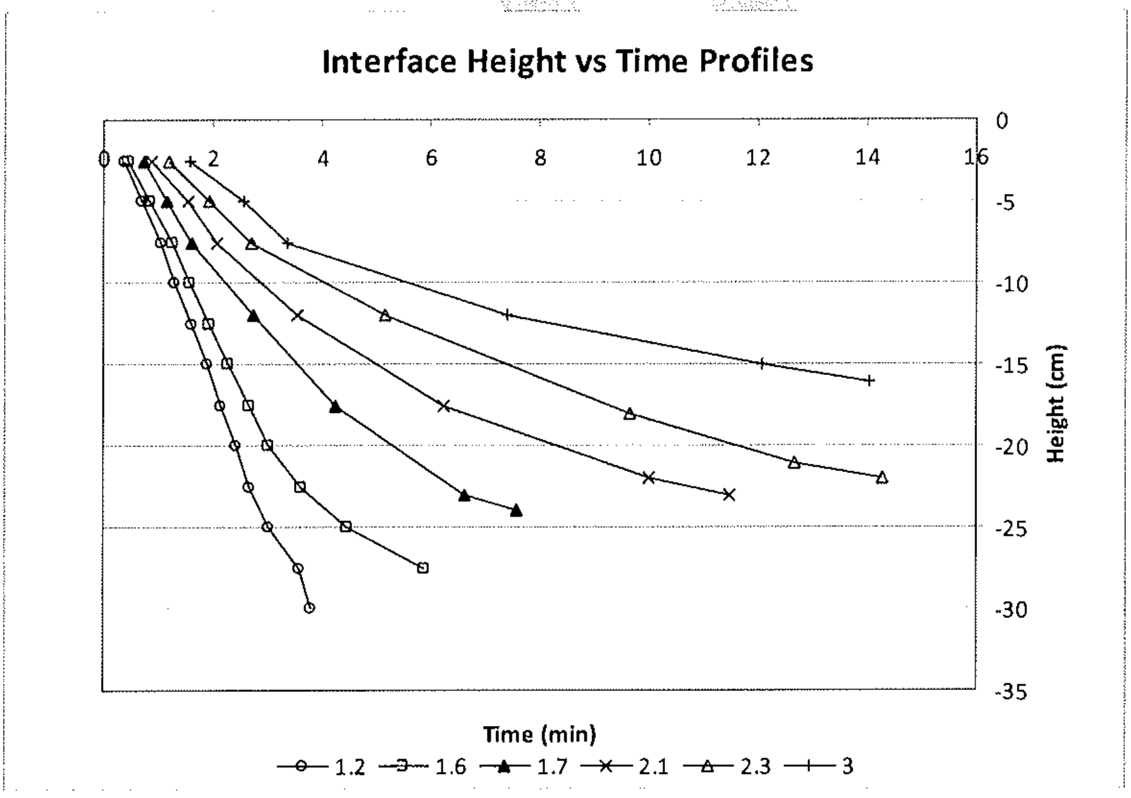

Figure 2: Interface Height -Time Profiles as a function of Sludge Concentration

A velocity is determined using the linear portion of each curve (Figure 2). The resulting velocity-concentration data pairs are then plotted as Ln(ZSV) vs. sludge concentration and the data fit with a linear line of best fit. This curve is represented in Figure 3.

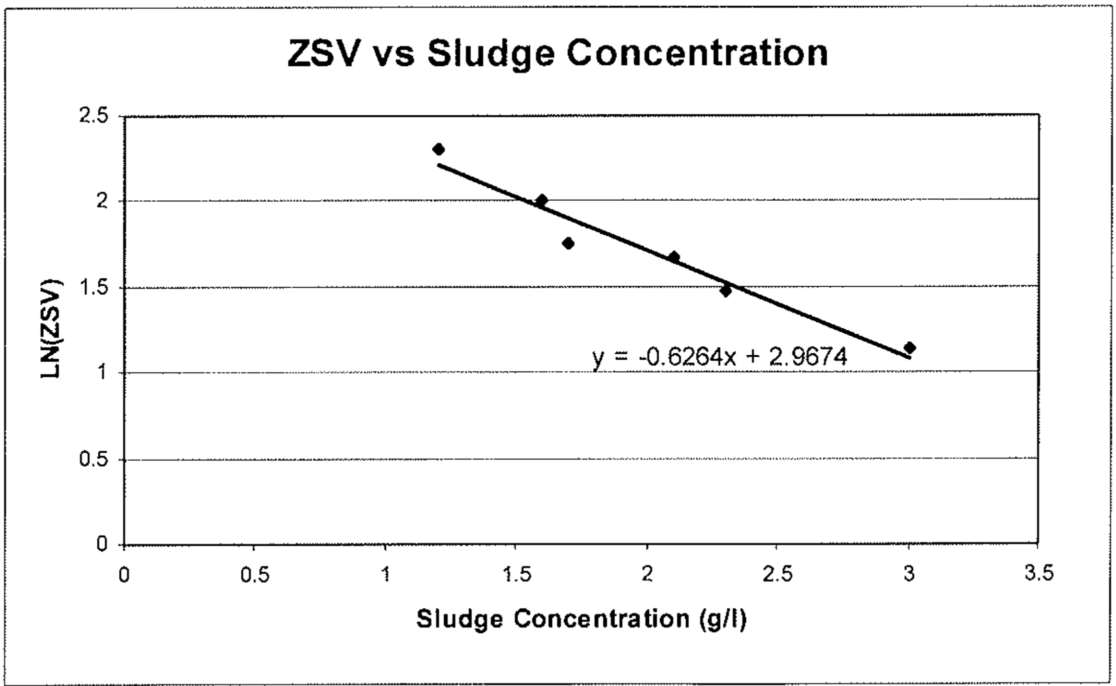

Figure 3: Zone Settling Velocity versus Sludge Concentration

The line of best fit is then used to obtain V-C data pairs that are used to determine the settleability constants vo and k for the Versiland[6] equation, Vs = voexp(-kC).
Ln(vo) = 2.97, therefore vo = 11.66 m/h and k = 0.626.

Using the Versiland equation, G_s (recall $G_s = V_s C$), represents the gravity settling flux per unit area of clarifier that would be expected to occur at the corresponding activated sludge concentration (MLSS). Values of G_s, resulting from the use of Figure 3, are used to develop a batch settling flux curve as shown in Figure 4.

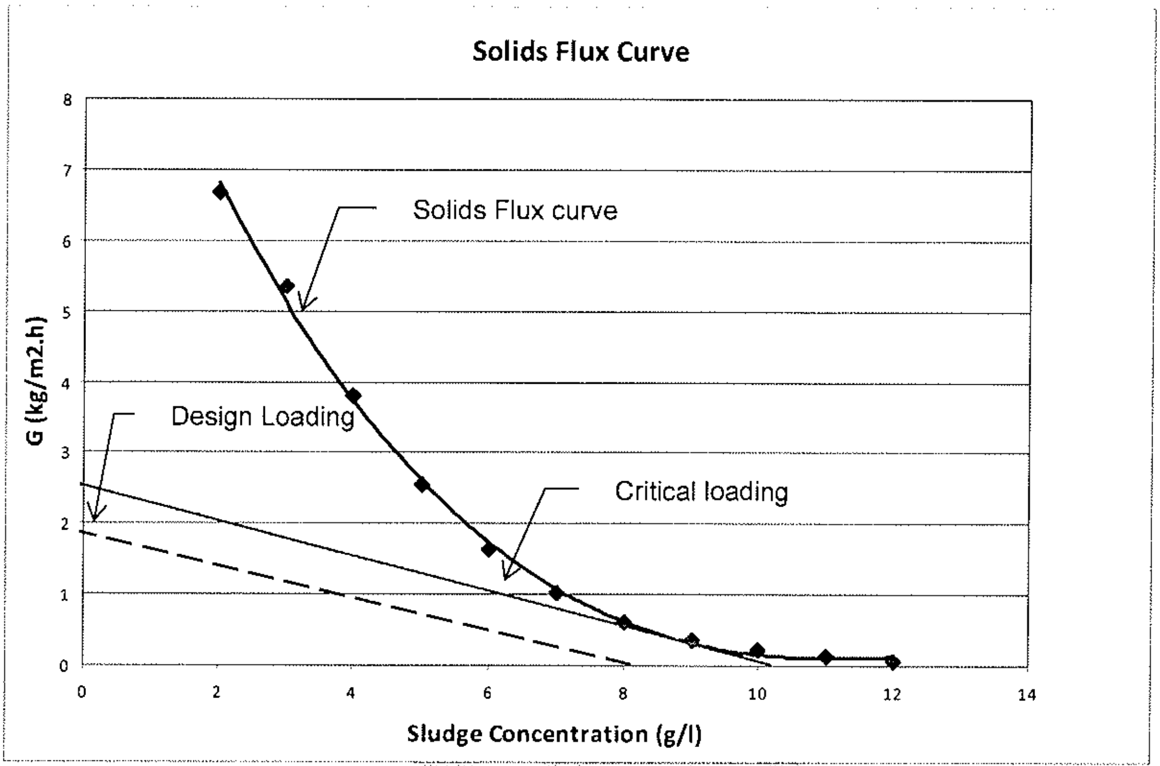

Figure 4: Solids Flux Curve

Results from Solids Flux Test for a 10 g/l underflow concentration is selected (normally range from 8 -12 g/l)[5,6] as it is reasonably representative of a final clarifier underflow TSS concentration. A line is drawn from this value, tangent to the flux curve, intersecting the y-axis. This line is the underflow operating line and has a slope equal to Qu/A, the bulk underflow velocity Vb. The y-intercept is termed the limiting flux (G_L) and is 2.5 kg/m2.h , the clarifier is said to be critically loaded at this point(i.e. the solids into clarifier is equal to solids out off clarifier). The current Gibson Island WWTP new clarifiers is designed for 1.8 kg/m2.h solids loading at ADWF. The design loading line is below the critical loading, therefore, the clarifier is said to be operated in an underloaded condition.

4. CONCLUSION

According to Versiland[4], the sludge settling is good as vo = 11.6 m/h and k = 0.626 and These clarifiers will operate in an underloaded condition.

5. REFERENCES

[1] Wastewater Treatment Plants: Planning, Design and Operation; by Sayed R and Qasim; Ed. 2, Published by CRC Press (1998);

[2] Design and Retrofit of Wastewater Treatment Plants for Biological Nutrient Removal; by Clifford W. Randall, James Lang Barnard, H. David Stensel, Ed. 2, Published by CRC Press (1992);

[3] Wastewater Engineering: Treatment, Disposal and Reuse by Metcalf and Eddy, Ed.3, published by McGraw-Hill Book Co (1991);

[4] Operational Dynamics and Control of Secondary Clarifiers; by Keinath, T.M., Journ. WPCF, 59, 770, (1985);

APPENDIX D

LAND SURVEY INFORMATION

Kersval Naidoo

From:	Philip Gooding [PGooding@thomascoffey.com.au]
Sent:	Tuesday, 9 June 2009 3:49 PM
To:	Kersval Naidoo
Cc:	Bruce Bradnam; Peter Warren; Wayne Tyler; Richard Duffy
Subject:	Gibson Island - Existing Weir and Outflow survey
Attachments:	GI Survey 090609.pdf

Kersval,

Please find attached the results of today's survey.

Summarising the important results:

- **Main Outfall Weir (top of weir) is effectively at RL 2.000** (2.006 north end, 1.994 south end).
- **Bioreactor number 1 Weir Height (top of weir "TOPWEIR2") is RL 5.883.**
- **Bioreactor number 2 Weir Height (top of weir "TOPMETALPL") is 5.880** ("TOPWEIR1" refers to top of weir concrete, "TOPMETALPL" is the effective weir height).

Please also note:

- It is apparent that the Bioreactor weirs each have a metal plate approximately 33mm above the weir concrete wall – the top of metal is the effective weir height.
- Bioreactor 1 weir concrete height was not surveyed – it was not easily accessible for survey instrumentation.
- The outfall manholes were each flooded above the outfall line – it was not possible to determine invert levels nor outfall pipe size.
- FST 1+2 manhole was not surveyed – lengths can be scaled from drawing 486/5/5 – 0046 – 002 (Rev 0).
- As per concept drawing 486/5/5 – 0046 – 005 (Rev 0) **the indicated outfall main size is nominally 1200 mm diameter.**

We trust that these survey dimensions confirm the actual levels and operational constraints for the upgrade.

Best Regards,

Philip Gooding
Engineering Design Manager - Process

Thomas & Coffey Limited
P: 07 3908 8000 F: 07 3908 8099 D: 07 3908 8036 M: 0448 850 758
W: www.thomascoffey.com.au

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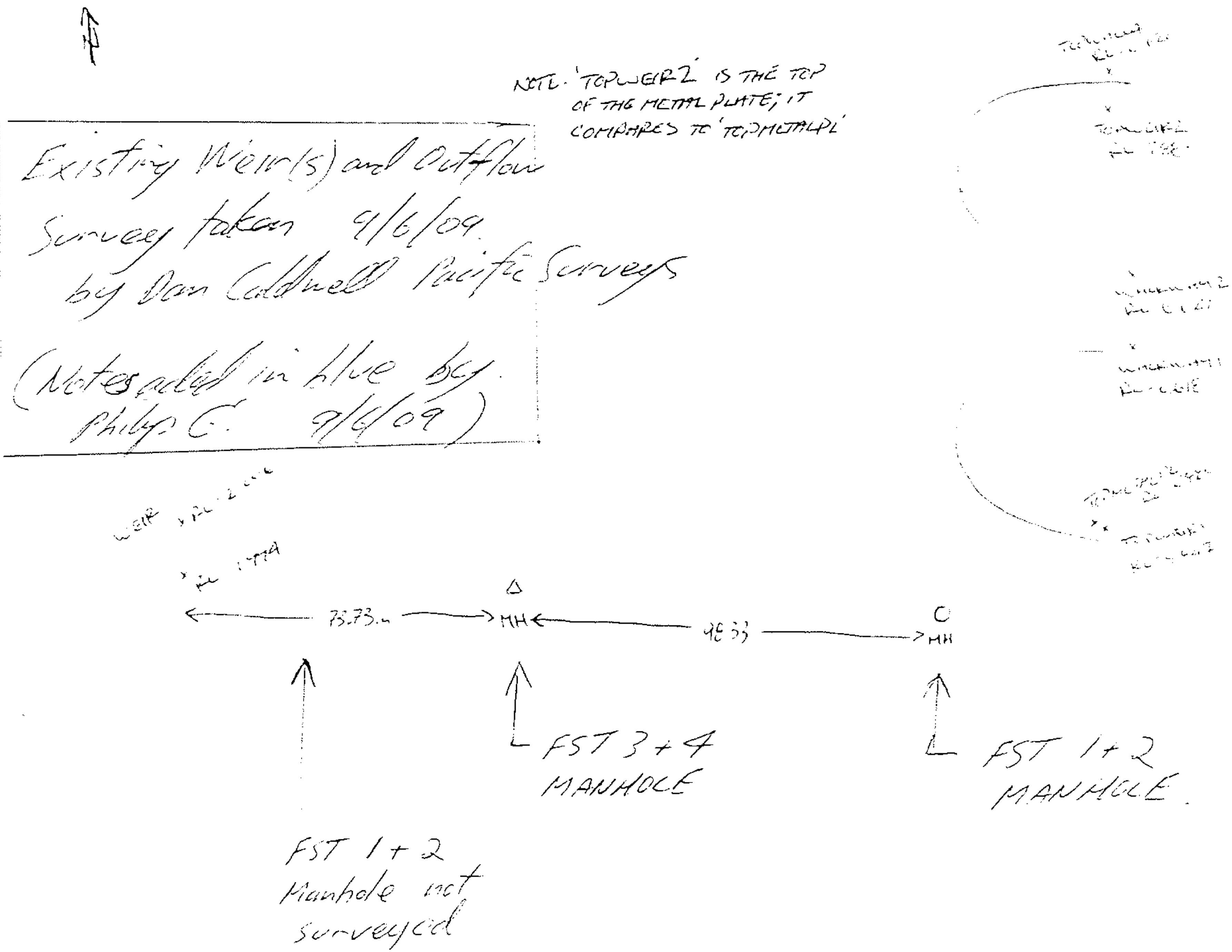
NOTE. 'TOPWEIR2' IS THE TOP OF THE METAL PLATE; IT COMPARES TO 'TOPMETALPL'
Existing Weir(s) and Outflow Survey taken 9/6/09. by Dan Caldwell Pacific Surveys
(Notes added in blue by Philip C. 9/6/09)
73.73m
MH
MH
FST 3 + 4 MANHOLE
FST 1 + 2 MANHOLE.
FST 1 + 2 Manhole not surveyed

APPENDIX E

GIBSON ISLAND PLANT INFORMATION

WD response to Detail design of Clarifiers, Gibson Island WRP.

The Simmonds & Britow / Henry and Hymas report June 09 has five recommendations listed on page 9 of 9.

1) Increase syphon chamber outlet pipe size to DN750.
   Agree in theory, would this be better with a DN800 pipe with an ID of 703mm?

2) Lower distribution chamber 3 by 180mm and clarifier 7 & 8 by 217mm.
   Our preference is to lower distribution chamber 3 by 130mm and clarifier 7 & 8 by 200mm. This would change table 3 on page 5 Available Head (m) to
   Bioreactor (1&2) to distribution chamber 3-0.100
   Distribution chamber 3 to clarifier 7/8/9/10 – 0.083

3) Pipeline between bioreactor (1&2) and distribution chamber 3 needs to be Periodically flushed to remove settled sediments due to the low pipeline velocity.
   WD agree but would like to see the flushing procedure incorporated in the O&M manual.

4) A reduction in the clarifier depth from 4.95m to 4.50m will still provide high performance for solids removal.
   WD are concerned that the level of 4.50m appears to be based on one sludge sample. The current SVI circumstance is not historically the norm and is a carry over from the drought. Historically we have higher sludge levels & less settling. WD would prefer 4.95m but could accept 4.75m although we would like to see the floor (cone) level stay the same with a reduced wall height.

5) RAS off-take pipeline arrangement needs to be reviewed as it may result in blockages.
   WD's position on this is as per- concept design. We acknowledge the concern how ever historically have had no problem of blocking in similar lines. We would like to see a Roding point added to the top bend though.

Kersval Naidoo

From: Kenny Liew [Kenny.Liew@brisbane.qld.gov.au]
Sent: Tuesday, 12 May 2009 9:07 AM
To: Kersval Naidoo
Cc: Peter Warren; Philip Gooding
Subject: Re: Clarifier Design -RFI

Kersval,

Please see below the follow information request and provided information:
1. Side Wall Depth (SWD) of Final Settling Tank = 4.05 metres
2. Diameter of Final Settling Tank = 40 metres
3. ADWF and PDWF to Final Settling Tank - No flow meter to individual Final Settling Tank - design and current ADWF and PWDF to treatment plant are:
Design: ADWF = 45 ML/d PDWF = 90 ML/d
Current: ADWF = 34.4 ML/d PDWF = 42.2 ML/d PWWF = 160 ML/d
4. Sludge blanket level during ADWF = 1.0 metres (average)
5. Operating RAS ratio = 145%
6.Current total volume of both oxidation ditches is 39571 m3

Also if you are coming on site at Gibson Island for sampling, please contact the WRP operator, Rob Painter on 04 0962 6596 before entering on site. He will induct you on site safety and sample point locations.

Regards,

Kenny Liew
Graduate Process Engineer
Brisbane City Council - Water Distribution

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Kenny.Liew@brisbane.qld.gov.au

>>> "Kersval Naidoo" <kersvaln@simmondsbristow.com.au> 11/05/2009 9:15 am >>>
Hi Kenny,

As discussed telephonically, if you can provide the following information:

Existing Clarifier:
- Depth(SWD), diameter, ADWF and PWDF to clarifier;
- Sludge blanket level: ADWF ;
- Operating RAS ratio (50 -150)% etc.;
- Clarifier Effluent SS;

Thanks,

Kersval Naidoo
Senior Engineer
Tel: +61 7 3710 9100
Fax: +61 7 3710 9199
Email: kersvaln@simmondsbristow.com.au

Kersval Naidoo

From: Kenny Liew [Kenny.Liew@brisbane.qld.gov.au]
Sent: Thursday, 21 May 2009 10:49 AM
To: Kersval Naidoo
Cc: Peter Warren; Philip Gooding
Subject: RE: Clarifier Design -RFI

Kersval,

Apologies for missing the Clarifier Effluent SS data.
Average is less than 2.5 mg/L (Laboratory equipment has low detection limit of 2.5 mg/L)

Regards,

Kenny Liew
Graduate Process Engineer
Brisbane City Council - Water Distribution

Luggage Point Water Reclamation Plant
200 Main Beach Road
Pinkenba
QLD 4008

Tel: +617 3403 2447
Mob: +614 1454 4945
Kenny.Liew@brisbane.qld.gov.au

>>> "Kersval Naidoo" <kersvaln@simmondsbristow.com.au> 11/05/2009 2:08 pm >>>
Hi Kenny,

One last bit of information - What is the current reactor volume(Total)

Thanks,

Kersval Naidoo
Senior Engineer
Tel: +61 7 3710 9100
Fax: +61 7 3710 9199
Email: kersvaln@simmondsbristow.com.au

Simmonds & Bristow
...Helping you make good clean water!

From: Kersval Naidoo
Sent: Monday, 11 May 2009 9:15 AM
To: 'Kenny.liew@brisbane.qld.gov.au'
Cc: Peter Warren; 'Philip Gooding'
Subject: Clarifier Design -RFI

Hi Kenny,

Kersval Naidoo

From: Kenny Liew [Kenny.Liew@brisbane.qld.gov.au]
Sent: Friday, 12 June 2009 7:07 AM
To: Kersval Naidoo
Cc: PGooding@thomascoffey.com.au; RDuffy@thomascoffey.com.au
Subject: RE: Clarifier Design -RFI

Kersval,

Apologies for the late reply. Please find the answers to your questions below:
1. Raw effluent average BOD = <5 mg/L
2. WAS volume per day removed from process = approx. 1700 kL/d (assuming RAS concentration of 7500 mg/L and MLSS concentration of 4500 mg/L, sludge age of 14 days)
3. WAS concentration = 19000 mg/L

Regards,

Kenny Liew
Graduate Process Engineer
Brisbane City Council - Water Distribution

Luggage Point Water Reclamation Plant
200 Main Beach Road
Pinkenba
QLD 4008

Tel: +617 3403 2447
Mob: +614 1454 4945
Kenny.Liew@brisbane.qld.gov.au
>>> "Kersval Naidoo" <kersvaln@simmondsbristow.com.au> 09/06/09 10:29 AM
>>> >>>
Hi Kenny,

Can you help me obtain the following information for Gibson Island WWTP:

1) raw effluent average BOD;

2) WAS volume per day removed from process and

3) WAS concentration.

Thankyou

Kersval Naidoo
Senior Engineer
Tel: +61 7 3710 9100
Fax: +61 7 3710 9199
Email: kersvaln@simmondsbristow.com.au

Simmonds & Bristow
...Helping you make good clean water!

3. Process Design Description

QUEENSLAND UrbanUtilities

Gibson Island Water Reclamation Plant -

CAPACITY UPGRADE PROJECT

FINAL SETTLING TANK 7 & 8

Control System Functional Specification

Document Approval

Name	Section	Signature
PAUL FISHER	**Projects**	
JIM STARK	**Project Engineer**	

CONTROL SHEET

Prepared By:	Andrew Cao	**Date:**	27/1/2010
Checked By:	Phil Bennington	**Date:**	27/1/2010
Authorised For Issue By:	Gary Ellis	**Date:**	27/1/2010

REVISION SHEET

REV.	DATE	COMMENT	APP.
A	15/10/2009	Initial	
B	23/10/2009	DRAFT 1	
C	08/12/2009	DRAFT 2	
D	18/1/2010	For Construction	
E	27/1/2010	Revised according to feedback from AIT	
F			
G			

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Glossary

Term	Description
CITECT	The SCADA software package used to control the equipment.
DOL	Direct On Line electrical motor starter
LOI	Local Operator Interface
OWS	Operator Work Station
NIC	Network Interface Card.
PLC	Programmable Logic Controller.
PCS	Plant Control System
SCADA	Supervisory Control And Data Acquisition.
TCP/IP	Transmission Control Protocol / Internet Protocol.
VSD	Variable Speed Drive
AI	Analogue Input
AO	Analogue Output
DI	Digital Input
DO	Digital Output
EWS	Engineering Work Station
FST	Final Settling Tank
IO	Input Output
Nm^3/hr	Normal m^3/hr
P&ID	Process and Instrumentation Diagram
RAS	Return Activated Sludge
WRP	Water Reclamation Plant
EDI	Energy Dissipating Inlet
FOBOT	Fibre Optic Break Out Termination

1. INTRODUCTION

1.1 Overview

Gibson Island Wastewater Reclamation Plant (WRP) capacity upgrade involves design and construction of two new Final Settling Tanks (FST), FST 7 and FST 8, to increase the process capacity by reducing the bottleneck of the existing 6 FSTs.

As part of the FST upgrade electrical package, a new switchboard including GE Fanuc RX3i PLC (PLC 15) is installed for FST 7&8. The PLC is programmed to provide data monitoring and control function to the following process and is linked to the existing SCADA system via high speed fibre connection.

Initially, mixed liquor from Bioreactor 1 and 2 flows into the Final Settling Tank distribution chamber 3, where it is transferred to FST 7 and FST 8. Mixed liquor enters the FST through the centre column into the energy dissipating inlet and is contained by the flocculation skirt. FST performs gravity separation providing appropriate flow rate. The settlement layer from the top to bottom can be described as scum, effluent and sludge.

Solids heavier than water settle to the bottom of the tank (commonly called activated sludge) due to bacteria contained to facilitate the wastewater treatment process, and are recycled back to the Bioreactors to maintain its biological production. In FST 7&8, RAS flow meters are coupled with actuated control valves to perform automatic flow rate adjustment.

The scum scraper guides the scum to the FST extremities where the hinged scum skimmer blade pushes the scum up the submerged scum box. Scum is drawn off via the scum box outlet pumps, which are located external to the settling tanks. A flow meter positioned on the combined scum pipeline continuously monitors the flow rate.

Effluent overflows out of the FST to the effluent outlet. An electromagnetic flow meter located in Flow Meter Pit No2 continually monitors the out flow rate.

The essential electrical components of the FST includes two scum pumps, a bridge drive, an EDI spray pump, a sludge blanket level monitoring system and various control and safety devices. Details of each are provided in separate sections of the functional specification.

1.2 P&IDs

This document should be read in conjunction with Gibson Island WRP Final Settling Tank Capacity Upgrade PLC network diagram, drawing number 486/5/5-0046-526 and process and instrumentation diagram, drawing number 486/5/5-0046-300, 486/5/5-0046-304, 486/5/5-0046-305 and 486/5/5-0046-306.

1.3 Switchboard

FST 7&8 Switchboard is positioned nearby, which provides motor control, power distribution and PLC control for the devices that are involved with the FST 7&8 upgrade.

A power meter provides continuous monitoring of the power consumption. Power parameters are monitored continually and are logged by the SCADA.

The design and structure of the MCC complies with Form 3B. Each motor (except for the EDI spray pump) has its own set of selector switches, push buttons and indicators mounted on the switchboard escutcheon panel. The mode of operation is selectable from a three way selector switch (local/off/remote). The electronic overload modules for the main drives include an auto reset function without the involvement of the PLC.

A 24V DC power supply (fed from a UPS) provides power to the PLC, control circuit, I/O and instrumentation. The control circuit operates on 24V DC. Fuses are used to provide protection to control circuits and IOs. The PLC and its IO modules are integrated into the switchboard. All PLC modules are Conformal coated (parylene polymer) for harsh environments.

Also within the MCC is a distribution board which supplies general Lighting and Power circuits.

1.4 Functional Specification Guideline

This document should be consistent with, and read in conjunction with the following documents:

- 'Software Guidelines - PLC Control Logic' dated August 04

- Citect Operators Manual v0.9
- Citect HMI Standards v2.5.doc
- Gibson Island Return Active Sludge Control System – PLC 5 Functional Specification
- SWAN v1.05+Audit Details.xls
- GibsonIslandPLC-PLCComms.xls

The existing PLC software should be used as a guide for how the system operates.

1.5 PLC Communication Link

The fibre optic link in FST 7&8 is connected to the RAS fibre optic break out termination block (FOBOT), where it joins the Gibson Island WRP fibre-optic ring.

All PLC's communicate via the existing 1 GB fibre optic ring network. All CITECT Servers are connected via 1 GB copper ports to the fibre-switches. All PLC's connect to the 1 GB/s Network via 100Mb/s to 1 GB/s switches.

2. MIXED LIQUOR FEED, SLIDE GATE VALVES

2.1 Process Overview

Mixed liquor is transferred from Bioreactor 1 and Bioreactor 2 into distribution chamber No.3, via flow meters located in flow meter pit No1, from where it is distributed to FST 7 and FST 8. Each outlet from the Bioreactors to the distribution chamber is fitted with an actuated slide gate valve for flow control purposes.

2.2 Equipment

Equipment	Tag	Process Media	Location
Slide gate Valve – Bioreactor 1	SG_0511-001	Mixed Liquor	Bioreactor Weir Chamber No1
Slide gate Valve – Bioreactor 2	SG_0512-001	Mixed Liquor	Bioreactor Weir Chamber No2

Table 1: Mixed Liquor Inlet Slide gate Valve

2.3 Control System Overview

The slide gate valves are electrically driven via a local control station and the PLC provides continuous monitoring of their status. The slide gate valve actuators are Rotork Model IQ10. Selectors are provided on the actuator's electrical control cover for local Open/Close Control.

2.4 Operation

2.4.1 Interlocks

There are no interlocks with any other equipment in any mode of operation.

2.4.2 Operating Modes

The valves operate in local mode only, which can be manually adjusted, with respect to the valves position and flow rate (span 0 and 100%).

There are no automatic control functions required. However, the PLC continually monitors the valves position. The 'Valve Position Indication" inputs from the actuator are analogue outputs (4-20mA), which provide valve position values anywhere from fully open to fully close.

2.5 SCADA Information

2.5.1 SCADA Display

The SCADA display shows the slide gate valves on the SCADA page and the following indication for each Valve: (2 OFF)

- Valve Position (0 to 100%)
- Valve Open/Close Limit Reached

Alarms:

- Valve Unavailable
- Position signal invalid (not within 4-20mA range)

2.5.2 Tags

Tag	R / W	PLC Address	Description	Type	Ctl	Alm	Trn	NOTES
BY AIT	R	BY AIT	Valve OPEN	DIG				

LEGEND:

RW – Read or Write IO Device – R = Read, W = Write

PLC Address – address in associated PLC unless otherwise noted.

Type (Citect Tag Data Type) – DIG = Digital, INT = Integer

Ctl (Control – is the tag used for control – i.e. data written to the PLC) Y = Yes, N = No, O = On / Off, P = Pulse (0 1 0), S =Setpoint

Alm (Alarm – is the tag used in a Citect Alarm?) Y = Yes, blank =No, I = used inverted i.e NOT <Tag> in Alarm Expression

Trn (Trend – is the tag used in a Citect Trend Tag?) Y = Yes, blank = No, E = used in a Trend Tag Expression – common for digital tags.

Table 2: List of Citect Tags Associated with Mixed Liquor Inlet Slide gate Valve

2.5.3 SCADA Control

Local manual control only, no remote control required.

2.6 PLC information

2.6.1 Related IO

PLC Address	Description	P&ID Equipment No.
%AI013	Valve Position (4 - 20mA)	SG_0511-001
%AI015	Valve Position (4 - 20mA)	SG_0512-001

%I049	Valve Fully Open	SG_0511-001
%I050	Valve Fully Close	SG_0511-001
%I051	Valve Fully Open	SG_0512-001
%I052	Valve Fully Close	SG_0512-001

Table 3: List of I/Os Associated with Mixed Liquor Slide gate Valves

3. Flow Meter Pit No. 1

3.1 Process Overview

Flow Meter Pit No.1 is positioned downstream of the new additional outlet weirs of the Bioreactors. Its purpose is to monitor the mixed liquor intake of distribution chamber No.3. Two electromagnetic flow meters are installed within this pit, one for each of the mixed liquor lines. These flow meters provide flow rate information to the operator via PLC/SCADA.

A sump pump is installed in the flow meter pit to discharge any collected rain water or accidental spillage at the flow meter connection. It is controlled by integrated float switches, and the level is indicated on SCADA via a multi-trode level controller.

3.2 Equipment

Equipment	Tag	Process Media	Location
Flow Meter 1	FE_0511-001	Mixed Liquor	Flow Meter Chamber No1
Flow Meter 2	FE_0512-001	Mixed Liquor	Flow Meter Chamber No1
Flow Chamber No1 Sump Pump	PU_0512-001	Storm Water	Flow Meter Chamber No1

Multi-trode Level Probe	LT_0512-001	Storm Water	Flow Meter Chamber No1

Table 4: Flow Pit No.1 Equipment List

3.3 Control System Overview

No control is required for the flow meters, indication only.

The 240V sump pump is designed to operate specifically via the integrated float switches.

3.4 Operation

3.4.1 Interlocks

There are no interlocks with any other equipment in any mode of operation.

3.4.2 Flow Meter Control

The PLC monitors the flow rate data continually via an analogue input 4-20mA proportional to the flow rate. Flow data is alarmed when the effluent flow set points are reached. The set points are Low/Low, Low, High, High/High and are adjustable in SCADA. The alarm is indicative only.

3.4.3 Sump Pump Control

The 240V sump pump is designed to specifically operate via the float switches.

Level indication/monitoring will be provided on SCADA via a multi-trode level controller.

3.4.4 Alarms

3.4.4.1 Flow Meter Alarms

An alarm is activated when flow meter reading is not available.

An alarm is activated when flow meter reading is invalid (outside of the 4 – 20mA range).

An alarm is activated when flow meter detects a reverse flow.

Flow alarms are activated when the flow rate reaches any one of the four operator adjustable set points, (low/low, low, high and high/high alarms).

3.4.4.2 Water Level Alarms

Water level alarm (high and high high) in the flow meter pit is monitored by a multi-trode level controller. These levels are set higher than the sump pump run/stop level.

3.5 SCADA Information

3.5.1 SCADA Display

- Mixed Liquor Inlet Flow Rate from Bioreactor 1 to Distribution Chamber 3
- Mixed Liquor Inlet Flow Rate from Bioreactor 2 to Distribution Chamber 3
- Total Mixed Liquor Inlet Flow Rate from Bioreactor 1 and 2 to Distribution Chamber 3
- High Level - when water in pit reaches high level.
- High high Level - when water in pit reaches high high level.

3.5.2 Tags

	R/W	PLC Address	Description	Type	Ctl	Alm	Trn	NOTES
BY AIT	R	BY AIT	FLOW CHAMBER WATER LEVEL HIGH	DIG				
BY AIT	R	BY AIT	FLOW CHAMBER WATER LEVEL EXTRA HIGH	DIG				
LEGEND: see section 2.5.2.								

Table 5: List of SCADA Tags Associated with Flow Chamber 1

3.5.3 SCADA Control

Flow meter alarm set points (4 off) adjustable by the operator (low/low, low, high and high/high alarms).

3.6 PLC information

3.6.1 Related IO

PLC Address	Description	P&ID Equipement No.
%I025	LEVEL HIGH	Multi-trode Controller
%I026	LEVEL HIGH/HIGH	Multi-trode Controller
%AI001	FLOW (4-20mA)	FIT 0511-001
%AI003	FLOW (4-20mA)	FIT 0512-001
%I113	FLOW METER Forward	FIT 0511-001
%I114	FLOW METER Reverse	FIT 0511-001
%I115	FLOW METER Forward	FIT 0512-001
%I116	FLOW METER Reverse	FIT 0512-001

Table 6: List of I/Os Associated with Flow Meter Pit 1

4. FST 7&8 BRIDGE DRIVE AND EDI SPRAY PUMP

4.1 Process Overview

Mixed Liquor enters FST's 7&8 via a pipeline from distribution chamber 3, that runs underneath the FST's and then rises through the centre column into the energy dissipating inlet (EDI) and is contained by the flocculation skirt.

Solids flocculate and settle to the bottom of the tank. The level of solid settlement is monitored by the sludge blanket monitoring system. Scum floating on top of the effluent layer is scraped and drawn off by the scum pump. Effluent overflows a 'V' notched weir into a launder that runs the circumference of the FST. Functions of the scum pump and sludge blanket level monitor are documented in separate sections of this functional specification.

To ensure safety and provide protection for bridge drives, each FST has two limit switches for track wipers, one located at each end of the bridge (which will stop the bridge if there is a foreign object left on the track or if a launder cover is left open), also two limit switches are provided on the access ladder plough arms, one at each end of the bridge, (this will stop the bridge if there is a foreign object left on the pathway in front of the bridge access ladder). There is also a torque element limit switch to prevent overloading of the bridge drive. When activated, bridge drive will be stopped.

In addition, there are three safety relays, for dedicated for FST7, FST8 and MCC Emergency Stop, are installed to monitor the safety status of the bridge. Details are explained in Section 4.3.

A proximity sensor is installed on the bridge, which functions as a rotation timer to verify that the bridge is rotating at a constant speed.

EDI Spray Pumps are provided on the bridges and use effluent water from the FSTs to control the scum during wind events etc. They are controlled via timer relay and pushbuttons on the MCC.

4.2 Equipment

Equipment	Tag	Process Media	Location
BRIDGE 7 DRIVE MV71	MV71	Mixed Liquor	FST 7
BRIDGE 8 DRIVE MV81	MV81	Mixed Liquor	FST 8
BRIDGE 7 SPRAY PUMP MF73	MF73	Effluent Water	FST 7
BRIDGE 8 SPRAY PUMP MF83	MF83	Effluent Water	FST 8
Emergency Stop Push Buttons (2 OFF Each FST)			FST 7 & 8
Limit Switch (4 OFF Each FST)			FST 7 & 8
Torque Element (1 OFF Each FST)			FST 7 & 8
Proximity Switch - Rotation			FST 7 & 8

Timer (1 OFF Each FST)			

Table 7: Bridge Drive & Spray Pump Equipment List

4.3 Control System Overview

For FST's 7&8, the Bridge drive is able to be locally manual activated or remotely started by the control system. However, the bridge drives rotational speed can only be set at the VSD keypad on the MCC by the operator.

Emergency stops are installed at both ends of each bridge. If either of the emergency stops is activated, a dedicated safety relay will be energised and will shut down the relevant FST bridge drive. The SCADA will indicate the status and alarm if emergency stops are activated.

An additional safety relay is installed to monitor the Emergency Stop mounted on the MCC. This emergency stop will drop out both FST7 and FST8 bridge drives, if activated. The operation of this E-stop will be monitored by the SCADA.

All three safety relays are required to be reset manually via a single reset pushbutton mounted on the MCC.

The PLC is constantly monitoring the status of the torque element for torque overload on each bridge drive as well as all of the limit switches on the bridge (Refer to Section 4.1 for their functions). The limit switches are hardwired to the control circuit, so that when any of these switches are activated, the bridge drive will stop operating immediately, and the PLC input is indicative only.

Each FST bridge drive rotation is monitored by the PLC which receives a pulse input from a proximity sensor mounted of one end of the bridge. The pulse signal is activated at each 90° rotation of the bridge.

The EDI Spray pump is designed to operate in Local/manual mode only. The decision to activate the spray pump is to be decided by the plant operators and run time is controlled by a timer.

4.4 Operation

4.4.1 Operating Requirements

Emergency stop circuit has to be complete, ie: no stops activated

Limit switches in normal position and not activated.

Torque element (Over torque) must not be activated.

Rotation Timer is within the time limit. (In remote mode only).

4.4.2 Interlocks

The bridge drive affects the operation of the scum pumps. See scum pump section (Section 7) for details.

4.4.3 Operating Modes

The Bridge Drives can be operated in any one of the three modes – Local/Manual, Remote/Manual or Remote/Auto.

The spray pumps have only local control, and their control status is not displayed on the SCADA. A local timer provides adjustable run time, should the spray pump be inadvertently left on.

4.4.3.1 Bridge Drive Operating Modes

Local/Manual Mode

Local/Manual operation is achieved by setting the Local/Remote selector to Local. The selector switch and push buttons are located on the FST 7&8 switchboard.
The drive can now be started and stopped independently of the PLC via the local pushbuttons. However activation of any of the bridge limit switches or overload function will still stop the drive.

Remote / Manual Mode

When the selector is in Local, the Manual/Auto toggle on the SCADA screen will be "greyed-out". When the Control Mode Selector is set to "Remote", the operator can set the remote control mode to either Manual or Auto. Note: the previous setting, either Manual or Auto, must be remembered by the system when it is returned to Remote after having been set to Local Manual.

In Remote/Manual mode, the drives can be started and stopped via buttons on the SCADA screen. The bridge drive speed is not monitored and cannot be adjusted on the SCADA.

All fault protection will be available in Remote/Manual Mode to stop a drive that develops a fault. The drive will not start automatically after a power outage.

Remote / Auto Operation

Remote/Auto mode is normally used to operate the Bridge Drives. When Remote/Auto mode is selected, and the drive is "healthy", the Bridge Drive will start as per start sequence. When the power returns after a power outage, the drives will start automatically, (the PLC will provide timed re-starting of drives, to avoid all drives starting at the same time upon power resumption).

Alarms per Bridge Drive (1 off each FST)

	Alarm Description	Source	Latched	Action	Alarm Category
1.	Over-Torque Alarm	"Torque Element" input turns on	Latched	Inhibit drive operation	?
2.	Failed to Start	"Running" signal not received within 5 sec of request to start	Latched	Inhibit drive operation	?
3.	Control Power Unavailable	"Control Power Available" input turns off	Not latched	Inhibit drive operation	?
4.	VSD Not Ready	"VSD Ready/Auto" input turns off	Not latched	Inhibit drive operation	?
5.	Field Circuit Fault	"Field Circuit Isolator Healthy" input turns off	Not Latched	Inhibit drive operation	?
6.	Bridge Stopped	For Any Reason (This alarm is used to generate a dial out alarm for the Bridge)	N/A	Information Only	1

7.	Failed to Stop	Running" signal still on 5 secs after Run Signal removed (Only in Remote Mode)	Latched	Inhibit drive operation	?
8.	Rotation Failure	Bridge Running but Rotation Input not activated	Latched	Information Only	1
9.	ESTOP	Emergency Stop Signal turns off	Latched	Inhibit drive operation	1
10.	Arm or Track Limit	Input turns off	Latched	Inhibit drive operation	?

Table 8: Bridge Drive Alarm Table

4.4.3.1 Spray Pump Operating Modes

The spray pumps have only Local control with "running" indication to the SCADA. In addition, they are usually controlled by a timer relay, but can be started and stopped via the local pushbuttons on the MCC. The timer circuit incorporates a bypass switch to enable the Spray pumps to run continually.

4.5 SCADA Information

4.5.1 SCADA Display

For each FST: (2 OFF)

- Bridge Drive control mode: Local/Manual, Remote/Manual, Remote/Auto
- Bridge Drive Status: Healthy/Fault
- Rotation Time / Rotation Time Setpoint
- Spray Pumps: Running /Off

4.5.2 Tags

Tag	R/W	PLC Address	Description	Type	Ctl	Alm	Trn	NOTES
BY AIT	R	BY AIT						

LEGEND: see section 2.5.2.								

Table 9: FST Bridge Drive & Spray Pump Tag List

4.5.3 SCADA Control

For each FST Bridge Drive:

- When the selector switch is set to Remote: Auto/Manual select
- When the bridge drive is in Remote/Manual mode: Start/Stop select
- FST Fault Reset
- Rotation time set point

4.6 PLC information

4.6.1 Related IO

PLC Address	Description	Notes
%I081	Remote Selected	MV71
%I082	VSD Running	MV71
%I083	VSD Ready/Auto	MV71
%I084	Enable	MV71
%I085	Isolator Healthy	MV71
%I086	Control Supply	MV71
%I089	Remote Selected	MV81
%I090	VSD Running	MV81
%I091	VSD Ready/Auto	MV81
%I092	Enable	MV81
%I093	Isolator Healthy	MV81

%I094	Control Supply	MV81
%Q001	Run Enable	MV71
%Q002	Reset	MV71
%Q003	Fault Indicator	MV71
%Q005	Run Enable	MV81
%Q006	Reset	MV81
%Q007	Fault Indicator	MV81
%I029	Spray Pump Running Indicator	MF73
%I030	Spray Pump Running Indicator	MF83
%I033	Bridge 7 E-stop	FST 7
%I034	Bridge 7 Plough Arm & Track Wiper Limit Switches	FST 7
%I035	Bridge 7 Torque Element	FST 7
%I036	Bridge 7 Rotation Proximity Switch	FST 7
%I041	Bridge 8 E-stop	FST 8
%I042	Bridge 8 Plough Arm & Track Wiper Limit Switches	FST 8
%I043	Bridge 8 Torque Element	FST 8
%I044	Bridge 8 Rotation Proximity Switch	FST 8

Table 10: List of I/Os Associated with FST 7&8 Bridge Drive & Spray Pumps

5. FST Sludge Blanket level Monitoring

5.1 Process Overview

Solids flocculate and settle to the bottom of each FST. Settled solids are forced out via the RAS pipe by water pressure. Each tank has one level monitor to provide the height of the sludge in the tank comprising a Royce series ultrasonic level transmitter and detector. The detector is mounted under the bridge and the transmitter is mounted at the middle of the bridge. Sludge blanket level is not used for control purposes, but indication only on the SCADA.

5.2 Equipment

Equipment	Tag	Process Media	Location
Sludge Level Transmitter	LT_0617-001	Sludge Level	FST 7
Sludge Level Sensor	LE_0617-001	Sludge Level	FST 7
Sludge Level Transmitter	LT_0618-001	Sludge Level	FST 8
Sludge Level Sensor	LE_0618-001	Sludge Level	FST 8

Table 11: Sludge Blanket Level Monitoring Equipment List

5.3 Control System Overview

Sludge Blanket Level monitor installed in each FST provides the Operator with information to optimise RAS flow rates, particularly during high flow periods.

5.4 Operation

The control system monitors the values received from the sensors and provides an alarm on high blanket level. The blanket levels are also recorded for trending, but there are no control functions provided by the Sludge Blanket Level monitor.

The Sludge Blanket Level analogue inputs are evaluated against a set point in the PLC. If the level input is higher than the set point for 30mins. The sludge high level alarm will be activated.

5.4.1 Interlocks

There are no interlocks with any other equipment in any mode of operation.

5.4.2 Required Set Points

FST Sludge Blanket Hi Level Alarm Set point = TBAmm (range 0 - 3000mm)

5.4.3 Alarms

High level alarm should be activated if sludge level signal is above High Level alarm set point for 30mins. Alarm is for indication only.

Invalid alarm should be activated when analogue signal is out of 4-20mA range.

5.5 SCADA Information

5.5.1 Display

For Each FST (1 off):

- Sludge Blanket Level (m) one value per FST

5.5.2 Tags

Tag	R/W	PLC Address	Description	Type	Ctl	Alm	Trn	NOTES
BY AIT	R	BY AIT						
LEGEND: see section 2.5.2.								

Table 12: FST Sludge Blanket Tag List

5.5.3 Control

The Operator can input the following control function:

For each FST

- Sludge Blanket High Level Alarm Setpoint (mm)

5.6 PLC information

5.6.1 Related IO

PLC Address	Description	Notes
%AI025	SLUDGE LEVEL	Sludge Level FST 7
%AI027	SLUDGE LEVEL	Sludge Level FST 8

Table 13: Sludge Blanket I/O List

6. RAS FLOW CONTROL

6.1 Process Overview

The Return Activated Sludge (RAS) flow control arrangement for FST 7&8 consists of 2 flow control valves, and 2 flow meters. The 2 RAS valves are actuated modulating valves that display their current position (0-100 %). The valves allow RAS from the FST's, to flow into the existing RAS Wet Well. Each valve is modulated to regulate its flow to a set point (entered on the SCADA) using a flow signal from its associated flow meter.

6.2 Equipment

Equipment	Tag	Process Media	Location
Flow Meter FST 7 RAS	FE_0617-001	RAS	FST 7 RAS
Flow Meter FST 8 RAS	FE_0618-001	RAS	FST 8 RAS
Sludge Flow Control Valve FST 7	FCV_0617-001	RAS	FST 7 RAS
Sludge Flow Control Valve FST 8	FCV_0618-001	RAS	FST 8 RAS

Table 14: RAS Flow Control Equipment

6.3 Control System Overview (Subject to review)

6.3.1 RAS flow control valves

The valve actuators are Rotork Model IQ12F10A. Each Rotork actuator is fitted with a proportional control unit which allows the actuator to control the position of the valve in proportion to a continuous 4-20mA analogue input current signal.

Selectors are provided on the actuator's electrical control cover, one for Local/Stop/Remote selection, pad-lockable in each position and the other for Open/Close Control. This latter switch is for local manual control of the valve i.e. manual control from the actuator itself. The Valve Monitor Indicator digital input from the actuator is active when the valve is available for remote control i.e. control via the PLC.

This signal is inactive when any of the following conditions is true:

- Loss of one or more of the power supply phases
- There has been a motor thermostat trip
- The actuator mounted local stop selected
- The actuator mounted local control selected
- Loss of control circuit supply

The valve position analogue input from the actuator and the valve operation analogue output to the actuator are both linear signals i.e. 4-20 mA DC proportional to valve position.

6.3.2 RAS Flow Meters

These are magnetic flow meters which produce a 4-20 mA DC signal proportional to the RAS flow rate. Flow Meter range TBA.

6.4 Operation

The RAS flow control valves regulate the flow of RAS from the FST's to the RAS Wet Well. The flow is regulated to a set point entered via the SCADA.

The flow is set at a rate to keep the sludge blanket in the FST's to an acceptable level. The sludge blanket level monitor is for indication only and offers no control.

In addition, RAS flow control valve will close completely if reverse flow is detected by RAS flow meter.

6.4.1 Operating Requirements

Both valves must be available for operation in the selected mode.

6.4.2 Interlocks

RAS flow control valves will close if 'RAS wet well high signal is received from existing PLC05,

RAS flow control valves will close if a Reverse Flow alarm is activated.

RAS flow control valves will close if a RAS Pumps fail signal is received from existing PLC05.

6.4.3 Failure responses

6.4.3.1 Valve Unavailable

If a valve becomes unavailable, due to any of the basic operating requirements are acceptable, the valve will maintain its current position. Once all the operating requirements become met again, the valve is ready for operation and will operate according to the description for the mode that it is in.

The *Valve Monitoring Indicator* input to the PLC indicates the actuators availability for Remote control. When switched to Local, and the valve is ready for operation, it can be opened and closed using the local controls on the actuator. However, when switched to Local, the Actuator Available input goes off, raising an alarm on SCADA, but the valve can still be available for local operation. The *Valve Monitoring Indicator* input can also go off if a fault occurs, or there is no power to the valve.

In addition, PLC monitors the open limit and close limit of the valves position. SCADA will indicate when either open/close limit is reached.

6.4.3.2 PLC Failure

PLC failure results in the loss of the monitoring and alarming functionality that is provided by the PLC and SCADA. The PLC's ability to control the valve is also lost, and the valve will stay in the position that it was in before the failure.

6.4.4 Operating Modes

There are three main operating modes;

- Remote Auto

- Remote Manual
- Local Manual

6.4.4.1 Operating Mode Selection

The operating mode is able to be set to either "Remote Auto" or "Remote Manual" via the SCADA. "Local" mode is selectable from a switch on the actuator. If "Local" is selected, remote modes are unavailable and the PLC has no control over the valve.

6.4.4.2 Remote Auto

In Remote Auto the PLC modulates the RAS valves via PID Control loops to achieve the desired flow set points. The flow set points can be determined in one of three ways as described below.

1. "Flow Paced RAS Control" where the overall RAS flow rate is adjusted so as to be a ratio of the overall plant inflow rate and the RAS flow Setpoint is proportioned as per the respective weir lengths on the bioreactors that feed the FSTs. (Calculations done in PLC05)
2. "Fixed Plant RAS Control" where the overall RAS flow rate is fixed by the Operator and would be proportioned as per Option 1. (Calculations done in PLC05)
3. "Fixed FST RAS Flowrate Control" where the flow rates from sources Distribution chambers 1 & 2 and FSTs 7&8, can be entered separately. Generally, this mode would be used when short term tank maintenance such as cleaning weirs and launder channels is required. The RAS flow rate would be entered by the Operator/Process Engineer. Due care to enter appropriate RAS flows would be required as this mode is likely to be a higher risk than the other modes. There is one Setpoint per tank in this mode.

For options 1 and 2, the flow rate set points are determined in the existing RAS PLC (PLC05). They are transmitted via Ethernet Communications from the RAS PLC (PLC05) to the Final Settling Tank 7&8 PLC (PLC15). There is one setpoint per tank. In effect PLC15 will either be in Fixed FST RAS flow rate control, or it will be getting a set point from PLC05. NOTE: The calculations and description for these modes are contained in the Functional Specification for PLC05 (To be updated by QUU).

The PID Control Loop is to be slow acting so as not to cause large disturbances in the level of the RAS well.

The RAS well level is typically below the level of FST7&8 so as to allow hydraulic flow from FST7&8 through to the RAS Well. However, under certain circumstances, such as RAS Pump failure or Power Failure the RAS well can build up to a level that is higher than FST 7 and 8, and backflow would be possible to FST 7 & 8. Non-return valves are to be fitted to reduce this possibility.

In the event of a RAS Backflow Alarm the RAS Valves are to close. A Category 1 alarm will contact the operator immediately.

If the RAS Well reaches a High Level then the RAS Valves are to close. A signal will be sent from PLC05 to enable RAS Valve Operation.

If the RAS Pumps Fail then the RAS Valves are to close. A signal will be sent from PLC05 to enable RAS Valve Operation.

In the event of Flow meter Failure the valve will remain in its current position. The operator can switch the control to Remote-Manual to further control the valve. A Category 1 alarm will contact the operator immediately.

In the event of Communications failure to PLC05 the RAS valves are to remain in their current position, unless the backflow condition above is detected. A Category 1 alarm will contact the operator immediately.

In Auto Control the RAS Valves are to modulate between Minimum and Maximum Position Set points. The Set points for each valve are to be adjustable on the SCADA screen.

6.4.4.3 Remote Manual Operation

When Remote/Manual is selected, the operator can enter the desired valve position into the SCADA, and the valve is then driven to that position. The automatic RAS flow control function is turned off in this mode.

6.4.4.4 Local Operation

In this mode the operator must switch the actuator to 'Local' using the selector switch on the local controls on the actuator and set the desired position by using the local (Open/Close) control switches.

6.5 SCADA Information

6.5.1 SCADA Display

Total for FSTs (2 off):

- RAS Flow 24 hour Average. (This is a rolling average of the previous 24hrs flow rate, displayed as "ML/day" and updated once every 15 minutes)

Total for FSTs (2 off):

- FST Total RAS flow rate (L/s and also ML/day), which is the sum of the flow rates measured by the two individual FST RAS flow meters.

For Each FST (2 off):

- FST RAS flow (L/s) (Note: when the flow rate drops below 5 L/s, the displayed value is to be automatically zeroed, ie; displayed as 0 L/s)
- FST RAS required flow rate Set point (L/s)
- RAS control valve actual position (%)
- RAS open/close Limit reached

Alarms displayed on the Alarm Page (2 off):

- RAS flow valve failed.
- RAS HiHi, Hi, Lo and LoLo Alarms
- RAS flow invalid (outside of 4 – 20mA range)
- RAS reverse flow alarm

6.5.2 Tags

Tag	R/W	PLC Address	Description	Type	Ctl	Alm	Trn	NOTES
	R	BY AIT		DIG				
	R	BY AIT		DIG				
LEGEND: see section 2.5.2.								

Table 15: RAS Flow Control Tags

6.5.3 SCADA Control

The Operator can input the following control functions:

Global Set points for FST 7&8:

- Maximum RAS Flow rate Set point for each FST (L/s)
- Minimum RAS Flow rate Set point for each FST (L/s)

For each FST (2 off):

- RAS Control Valve Remote/Manual and Remote/Auto selection
- In Remote/Manual: RAS Control Valve Position (%)
- In Remote/Auto: Required Flow rate Control Set point (0 - ???L/s)
- FST RAS Flow Set Points (Low/low, Low, High and High/High).
- In Remote/Auto RAS Valve Min Position (0..100%)
- In Remote/Auto RAS Valve Max Position (0..100%)

6.6 PLC information

6.6.1 Related IO

PLC Address	Description	Notes
%AI005	RAS Flow Meter	FIT 0617-001
%I117	RAS Flow Meter Forward	FIT 0617-001
%I118	RAS Flow Meter Reverse	FIT 0617-001
%AI007	RAS Flow Meter	FIT 0618-001
%I119	RAS Flow Meter Forward	FIT 0618-001
%I120	RAS Flow Meter Reverse	FIT 0618-001
%AI017	VALVE Position Input	FCV 0617-001
%AI019	VALVE Position Input	FCV 0618-001
%AQ001	VALVE Position output	FCV 0617-001

%AQ002	VALVE Position output	FCV 0618-001
%I097	VALVE Monitor Indicator	FCV 0617-001
%I098	VALVE Remote Selected	FCV 0617-001
%I099	VALVE Fully Open	FCV 0617-001
%I100	VALVE Fully Close	FCV 0617-001
%I101	VALVE Monitor Indicator	FCV 0618-001
%I102	VALVE Remote Selected	FCV 0618-001
%I103	VALVE Fully Open	FCV 0618-001
%I104	VALVE Fully Close	FCV 0618-001

Table 16: List of I/Os Associated with RAS Flow Control

7. FST SCUM PUMPS & SCUM FLOW METER

7.1 Process Overview

Mixed liquor enters the FST through the centre column into the energy dissipating inlet and is contained by the flocculation skirt. The flocculation skirt is submerged approximately 50mm below the water line. This allows scum to float over the flocculation skirt. The scum scraper guides the scum to the FST extremities where the hinged scum skimmer blade pushes the scum up the submerged scum box beach where the scum is extracted from the FST.

Under normal Auto operation, the Scum Pumps are activated via 2 limit switches mounted at the drive end of the FST Bridge. One limit switch is dedicated to one scum pump. The limit switch is mechanically activated by striking a metal arc while the bridge travels through a set distance to be determined. The scum pumps will stay activated during this period until the limit switch is de-energised.

All delivery of scum is combined to a single rising main and monitored by an electromagnetic flow meter.

7.2 Equipment

Equipment	Tag	Process Media	Location
FST Scum pump	MF71	Scum	FST 7 Scum
FST Scum Pump	MF72	Scum	FST 7 Scum
FST Scum pump	MF81	Scum	FST 8 Scum
FST Scum Pump	MF82	Scum	FST 8 Scum
Sump Pump	PU_0617-001	Sump Water	For Scum Pump 71
Sump Pump	PU_0617-002	Sump Water	For Scum Pump 72
Sump Pump	PU_0618-001	Sump Water	For Scum Pump 81
Sump Pump	PU_0618-002	Sump Water	For Scum Pump 82
Scum Pump Activation Switch 71			FST 7
Scum Pump Activation Switch 72			FST 7
Scum Pump Activation Switch 81			FST 8
Scum Pump Activation Switch 82			FST 8
Flow Meter	FE-0617--006	Scum	Scum Transfer

Table 17: Scum Pump Equipment List

7.3 Control System Overview

In normal operations (Remote/Auto) the scum pumps operate without input from the Operator, however the Scum Pumps can be operated in Local/Manual or Remote/Manual if required.

In Remote/Auto mode, the Scum Pumps are activated via 2 limit switches. There are 4 limit switch activation arc on each tank (2 per limit switch) on each tank mounted 180^{o} apart on the external wall of the FST, each activation will run the relevant scum pump while the limit switch is on the activator. For each full revolution of the bridge, both scum pumps will run twice, due to their locations only a single pump will run at any time.

The flow meter which is positioned on the combined scum line measures scum transfer from FST 7 and FST 8 continually. To prevent over pressurisation, the scum flow rate is checked while any of the scum pumps are running, if any of the pump are running and no flow is detected, an alarm is to be activated and the scum pumps are to be stopped immediately.

No control is required for the sump pumps located in the scum pump pits.

7.4 Operation

7.4.1 Operating Requirements in Remote/Auto Mode

Bridge Drive is running.

Scum Pump available & no fault.

The Scum pump Limit switch is activated

No emergency stop activated.

No flow alarm is not activated.

Flow meter reading is valid

7.4.2 Interlocks

In auto mode, the scum pumps are indirectly linked to the bridge's operation. The scum pumps are activated due to bridges rotation.

.

7.4.3 Failure responses

Drive Unavailable

If a Scum Pump becomes unavailable, due to any of the basic operating requirements not being met, the Scum Pump will stop. Once all the operating requirements are met again, the Scum Pump is ready for operation and will operate according to the description for the mode that it is in.

PLC Failure

PLC failure results in the loss of the monitoring and alarming functionality that is provided by the PLC and SCADA. The Scum Pumps will remain operational while the bridge is rotating.

7.4.4 Operating Modes

The Scum Pump can be operated in one of three modes – Local/Manual, Remote/Manual, or Remote/Auto.

7.4.4.1 Local/Manual Mode

Local/Manual operation is achieved by setting the Local/Remote selector to Local.
The pump can now be started and stopped via the local pushbuttons without any PLC control. When the selector is in Local/Manual mode, the Manual/Auto toggle on the SCADA screen will be “greyed-out”.

7.4.4.2 Remote / Manual Mode

When the Control Mode Selector is set to “Remote”, the operator can set the remote control mode to either Manual or Auto. Note: the previous setting, either Manual, or Auto, must be remembered by the system when it is returned to Remote after having been set to Local/Manual.

In Remote/Manual mode, the pumps can be started and stopped via buttons on the SCADA screen.

All fault protection will be available in Remote/Manual Mode to stop the pump should it develop a fault, however the pump will not start after a power outage.

7.4.4.3 Remote / Auto Operation

Remote/Auto mode is the normal operating mode for the scum pumps, when Remote/Auto mode is selected, and the drive is “healthy”, the Scum pump will run whenever the relevant limit switches are activated, with each full rotation triggering the pump's operation twice. When power returns after a power outage, the pumps will start automatically. (Refer to the section 9.8)

7.4.5 Alarms per pump (4 off)

	Alarm Description	Source	Latched	Action	Alarm Catagory
1.	Pump Fault Alarm	"Overload" input turns on	Latched	Inhibit pump operation	?
2.	Failed to Start	"Running" signal not received within 5 sec of request to start	Latched	Inhibit pump operation	?
3.	Control Power Unavailable	"Control Power Available" input turns off	Not latched	Inhibit pump operation	?
4.	Excessive run time	Excessive run time	Not Latched	Inhibit pump operation	?
5.	No Run	No activation detected after one full bridge rotation			?
6.	Failed to Stop	"Running" signal still on after run request removed	Latched	Inhibit pump operation	?

Table 18: Scum Pump Alarms

7.4.6 Flow Meter alarm

Low flow alarm, when flow rate is less than TBA L/s and pump is running.

One alarm for each pump. (2 off per FST)

7.5 SCADA Information

7.5.1 SCADA Display

For Each Scum Pump: (2 off per FST)

Scum pump operating mode: Local/Manual, Remote/Manual or Remote/Auto

Scum pump status: Running / Fault

Scum pump operating time

For Scum Flow meter:

Scum flow rate (L/s)

Scum Flow total KL today

Scum Flow total KL yesterday

7.5.2 Tags

Tag	R/W	PLC Address	Description	Type	Ctl	Alm	Trn	NOTES
BY AIT	R	BY AIT						
LEGEND: see section 2.5.2.								

Table 19: Scum pump & Scum flow meter Tag List

7.5.3 SCADA Control

For each scum pump (4 OFF) :

- Auto / Manual select
- If Remote manual mode is selected: Start / Stop
- Fault Reset

7.6 PLC information

7.6.1 Related IO

PLC Address	Description	Notes
%I009	Scum pump Control Power	MF71

Gibson Island WRP Capacity upgrade – Final Settling Tanks 7&8 Functional Specification

	Available	
%I010	Scum pump Overload	MF71
%I011	Scum pump Reset	MF71
%I012	Scum pump Running	MF71
%I013	Scum pump Remote Selected	MF71
%I014	Scum pump Isolator Healthy	MF71
%I017	Scum pump Control Power Available	MF72
%I018	Scum pump Overload	MF72
%I019	Scum pump Reset	MF72
%I020	Scum pump Running	MF72
%I021	Scum pump Remote Selected	MF72
%I022	Scum pump Isolator Healthy	MF72
%I065	Scum pump Control Power Available	MF81
%I066	Scum pump Overload	MF81
%I067	Scum pump Reset	MF81
%I068	Scum pump Running	MF81
%I069	Scum pump Remote Selected	MF81
%I070	Scum pump Isolator Healthy	MF81
%I073	Scum pump Control Power Available	MF82
%I074	Scum pump Overload	MF82
%I075	Scum pump Reset	MF82
%I076	Scum pump Running	MF82
%I077	Scum pump Remote Selected	MF82

%I078	Scum pump Local Selected	MF82
%I037	Limit Switch Input for MF71	FST 7
%I038	Limit Switch Input for MF72	FST 7
%I045	Limit Switch Input for MF81	FST 8
%I046	Limit Switch Input for MF82	FST 8
%Q009	Scum Pump Run Command	MF71
%Q010	Scum Pump Fault Reset	MF71
%Q011	Scum Pump Run Command	MF72
%Q012	Scum Pump Fault Reset	MF72
%Q013	Scum Pump Run Command	MF81
%Q014	Scum Pump Fault Reset	MF81
%Q015	Scum Pump Run Command	MF82
%Q016	Scum Pump Fault Reset	MF82
%AI009	Scum Flow Meter (4-20mA)	FIT_0617-006
%I121	Scum Flow Meter Forward	FIT_0617-006
%I122	Scum Flow Meter Reverse	FIT_0617-006

Table 20: List of I/Os Associated with Scum Pumps & Scum Flow Meter

8. FLOW METER PIT NO. 2

8.1 Process Overview

Effluent overflow from FST's 7&8 flows to meter pit No.2, where the flow rate is measured via an electromagnetic flow meter. There is no PLC control required.

A sump pump is installed in the flow meter pit to discharge any collected rain water or accidental spillage at the flow meter connection. It is controlled by integrated float switches, and the level is indicated on SCADA via a multi-trode level controller.

8.2 Equipment

Equipment	Tag	Process Media	Location
Flow Transmitter	FIT_0610-003	Effluent	Flow Meter Pit No2
Flow Chamber No 2 Sump Pump	PU_0610-001	Sump Water	Flow Meter Pit No2
Multi-trode Probe	LT_0610-001	Sump Water	Flow Meter Pit No2

Table 21: Flow Meter Pit No.2 Equipment List

8.3 Control System Overview

PLC Monitors the effluent flow rate only.

The 240V sump pump is designed to operate specifically via the float switches.

8.4 Operation

8.4.1 Interlocks

There are no interlocks with any other equipment in any mode of operation.

8.4.2 Flow Meter Control

The PLC monitors the flow rate data continually via an analogue input 4-20mA DC proportional to the flow rate. Flow data is alarmed when the effluent flow set points are reached. The set points are Low/Low, Low, High, High/High and are adjustable in SCADA. The alarm is indicative only.

8.4.3 Sump Pump Control

The 240V sump pump is designed to specifically operate via the float switches.

Level indication/monitoring will be provided via a multi-trode level controller which would also provide indication on SCADA.

8.4.4 Alarms

8.4.4.1 Flow Meter Alarms

An alarm is active when flow meter reading is not available.

Flow meter reading is invalid (outside of the 4 – 20mA range)

Flow alarms are active when the flow rate reaches four operator adjustable setpoints, (low/low, low, high and high/high alarms)..

Flow meter detects a reverse flow.

8.4.4.2 Sump Pump Alarms

Level indication/monitoring will be provided via a multi-trode level controller which would also provide indication on SCADA. (High & high/high alarms)

8.5 SCADA Information

8.5.1 SCADA Display

- Effluent Flow Rate (l/s)
- Effluent Flow Total Today (kL)
- Effluent Flow Total Yesterday (kL)
- High Level - when sump water in pit reaches high level.
- High high Level - when sump water in pit reaches high high level.

8.5.2 Tags

Tag	R/W	PLC Address	Description	Type	Ctl	Alm	Trn	NOTES
BY AIT	R	BY AIT						
LEGEND: see section 2.5.2.								

Table 22: Flow Meter Pit No 2 Tag List

8.5.3 SCADA Control

No control via SCADA

8.6 PLC information

8.6.1 Related IO

PLC Address	Description	Notes
%I027	LEVEL High	Multi-Trode
%I028	LEVEL High/High	Multi-Trode
%AI011	Effluent FLOW Meter (4-20mA)	FIT 0610-003
%I123	Flow Meter Forward Counter	FIT 0610-003
%I124	Flow Meter Reverse Counter	FIT 0610-003

Table 23: List of I/Os Associated with Flow Meter Pit No 2

9. PLC MISCELLANEOUS UTILITIES

9.1 Total Drive Run Hours

Drive Run and Valve open/close Hours totalisation is carried out in the PLC for each of the following devices:

- Mixed Liquor Slide gate Valve SG_0511-001 (open/closed)
- Mixed Liquor Slide gate Valve SG_0512-001 (open/closed)
- Scum Pump MF71
- Scum Pump MF72
- Scum Pump MF81
- Scum Pump MF82
- FST Bridge Drive 7 MV71
- FST Bridge Drive 8 MV81
- RAS Flow Control Valve 1 FCV_0617-001 (open/closed)
- RAS Flow Control Valve 2 FCV_0618-001 (open/closed)

All values are to be retentive in the SCADA when power failure occurs.

9.1.1 Daily Run Hours

The Daily Drive Run Hours are to be incremented while the drive is running, and stored retentively via the PLC to a resolution of 1 second. Values to be available for reading by the SCADA are:

- Current Day Run Hours (INT 0 to 24)
- Current Day Run Minutes (INT 0 to 59)
- Previous Day Run Hours (INT 0 to 24)
- Previous Day Run Minutes (INT 0 to 59)

At midnight a pulse will be auto generated by the SCADA, the PLC will copy the Current Day values to the Previous Day values, and then clear the Current Day values to zero.

9.2 Total Operations Counter

Equipment Operations (Number of Starts) totalisation is carried out in the PLC for each of the devices listed in section 9.1Drive Run Hours Totalisation.

All values are retentive in the SCADA when power failure occurs.

9.2.1 Daily Total Operations Counter

At each start of a drive, its Daily Total Operations Counter is to be incremented by 1. Values to be available for reading by the SCADA are:

- Current Day Total Operations (INT 0 to 1,000)
- Previous Day Total Operations (INT 0 to 1,000)

At midnight a pulse will be auto generated by the SCADA, the PLC will copy the Current Day values to the Previous Day values, and then clear the Current Day values to zero.

(Flow totalisation will be carried out in the PLC by integrating the Analogue Flow signal)

9.3 Flow Totalisation

Flow totalisation is carried out in the PLC for each of the following flow meters:

- Mixed Liquor Bioreactor 1
- Mixed Liquor Bioreactor 2
- RAS Flow Meter 1
- RAS Flow Meter 2
- Scum Flow Meter
- Effluent Flow Meter

All values are to be retentive in the SCADA when power is cycled.

- Current Day Total Flow (REAL 0 to XXXX kL)
- Previous Day Total Flow (REAL 0 to XXXX kL)

At midnight a pulse will be auto generated by the SCADA, the PLC will copy the Current Day values to the Previous Day values, and then clear the Current Day values to zero.

9.4 Power Monitoring

Siemens SENTRON PAC3200 power monitoring device indicates the power consumption for the FST 7 & 8 MCC and performs important measurements such as voltage, current, power, power factor and other power parameters.

Via an Ethernet communication interface, FST 7&8 MCC power data is transferred to the PLC. Power data is to be retentive in SCADA.

The Ethernet Address is 192.168.151.085

SCADA is to display and trend the following:

- KW
- KVA
- KVAR
- PF
- KW max
- KWH
- V per phase
- I per phase
- Total daily KWH

Values for kW, KVar, and kVA are to be totalised each day.

At midnight a pulse will be auto generated by the SCADA, the PLC will copy the Current Day values to the Previous Day values, and then clear the Current Day values to zero.

The under voltage relay installed on the incomer also monitors the phase voltage, it has a normally closed contact input to the PLC, which is for indication only.

9.5 Lighting Control

Dusk till Dawn information is provided from existing PLC 3. (PE cell)

SCADA Display:

- Lighting: On/Off/Auto

SCADA Control:

- Auto / Manual
- In Manual Mode: On/Off Switch

9.6 Standard PLC alarms

PLC automatically generates 27 standard alarms such as: Lo Battery, Failed Battery and CPU Hardware Fault etc. These are to be displayed on the SCADA.

9.7Alarm Discrimination

The PLC is to detect a Power Failure to the switchboard by monitoring the 24VDC Power Supply and the Phase Failure Relay. If a power failure is detected, then all drives are to be stopped, and all alarms from the PLC inhibited. A single alarm will be sent to the Operator indicating a Power Failure.

In addition alarm discrimination is to be included in all PLC logic, so that multiple alarms are not generated from a single fault. For example if the Main Circuit Breaker for a drive is tripped, then only a single alarm for the drive will be generated – "Control Power Unavailable". All other alarms are masked on a time delay.

Details of the alarm category refer to QUU document "Citect HMI Standards v2.5.doc".

9.8 Drive start sequence

On power restoration the system is to generate a RESET to all drives and PLC logic after a time delay of 30 seconds to enable all devices to power up.

When system restart after a power failure event, PLC to resume the drive operation following the sequence table below:

Drive Tag	Drive Description	Time-delay
MV71	FST Bridge 7 Drive	65 s
MV81	FST Bridge 8 Drive	70 s
FCV_0617	RAS Flow Control Valve 1	75 s
FCV_0618	RAS Flow Control Valve 2	80 s
MF71	FST 7 Scum Pump 1	85 s
MF72	FST 7 Scum Pump 2	90 s
MF81	FST 7 Scum Pump 1	95 s
MF82	FST 7 Scum Pump 2	100 s

Table 24: Drive start sequence table

9.9 PLC Standard Blocks

QUU requires the standard PLC blocks which have been developed for the Rx3i PLC to be used for all motors, valves and analogue devices.

All drives are to use the BWDRIVE block

All analogs are to use the BWANALOG BLOCK

All valves are to use either the BWCVALVE, BWPVALVE or BWBiVALVE BLOCKs.

All PID's are to use the bwPID block

All alarms are to use the BWALARM block

A copy of the blocks is available from QUU.

9.9.1 Tag Naming Convention

The standard tag naming conventions shall be as follows.

DddddEeeeeTtXxxxx

Where Ddddd = Device/Area Identification (ID) (eg. BR001 = Bioreactor 1, BR2Z4 = Bio 2 Zone 4 etc)

Eeeee= Equipment Indentification (ID) (eg PU001 for pump No.1, MX001 for Mixer No.1 etc)

tt= Tag Type (eg. 'ds' for status, 'dq' for digital output, 'as' for analog status etc)

Xxxxx = Tag Name (eg ThermalOLoad etc up to 15 characters)

Tag naming Rules

- Total tag name cannot exceed 27 characters. (5 characters representing the site ID are prefixed when the Citect Tags are generated to give a total of 32 characters).
- For the newer sides (e.g. BWEA/New BW Ellipse Naming conventions) the Equipment number must match the P&ID's/Ellipse number. In this case the DeviceId (Ddddd) can be dropped and just the equipment number used in the PLC program. The Device/PLC must be reinstated when developing the Citect tags. (E.g. Fairfield Inlet PLC tag would be FV0520005.dsOpen, Citect Tag becomes ST002INL01 FV0520005dsOpen)
- The use of upper and lower case to split up the tag name is allowed. Eg. ST032Tnk01Vlv01dsFault

- Devices and Equipment can be split up to include more information if required (eg. BR3Z4 = Bioreactor 3 Zone 4, or AEREQ = Aeration Equipment etc).
- Tag name and description of digital Variable tags shall relate to the tag in the 'ON' (1) state (eg ...VLV01dsOpen)
- All variable tags must have an appropriate comment included.
- Under no circumstance are raw inputs on the PLC to be mapped directly to SCADA. All inputs are to be mapped to 'ds' registers for use in SCADA. This is required to code for consequential alarming.

Some examples are:

> *(ST034)* HYP01PU002dsRunning = Karana Hypo System No.1 Pump No.2 Running status
>
> *(ST012)* SCN01FLW03asVolume = Wynnum Screen No.1 Flow meter No.3 Volume
>
> *(ST002BIO01)* FV0520005dsOpen = Fairfield Bioreactor 1 Valve FV0520005 Open Status

The Citect screen is to be approved by Queensland Urban Utilities, who use standard **genies** for flow direction, pipe sizes, colour, and popup boxes. The existing Citect pages on site are to be used as a guide.

All analog displays are to use the "BW AI Test Right + Super Genie Popup"

All motors are to use the "BW Motor 2 Genie + Super Genie Popup"

The SCADA tags are to be the same as the PLC Tags, except with the addition of the site number "ST032" at the front of each tag.

9.10 PLC Time Update

The PLC time and date is to be displayed on the SCADA. The SCADA system will send a pulse each day at 12:30PM to synchronise the PLC times.

9.11 PLC Fault Tables

The Rx3i PLC has a controller fault table and an IO Fault Table. The fault tables are able to be reset from SCADA in the event of a fault.

9.12 Emergency Stops

There are a total of nine emergency stops installed either on the FSTs or around the FST 7&8 Area. All emergency stops are hardwired to the allocated drive/panel, if activated it will stop the drive without the involvement from the PLC.
However, the PLC monitors the status of each emergency stop, and will generate an alarm when any of the emergency stops are activated. In particular, the switchboard emergency stop will stop all operations on FST 7&8, which will be a category 1 alarm.

9.12.1 Related IO

PLC Address	Description	Alarms
%I057	Emergency Stop Switchboard	1
%I058	Emergency Stop Scum Pump 71	?
%I059	Emergency Stop Scum Pump 72	?
%I060	Emergency Stop Scum Pump 81	?
%I061	Emergency Stop Scum Pump 82	?
%I062	FST 7 Emergency Stop 1 & 2	?
%I063	FST 8 Emergency Stop 1 & 2	?

Table 25: List of I/Os Associated with Emergency Stops

10. PLC COMMUNICATIONS (PLC 15)

10.1 Overview

All PLC Peer to Peer is done via the GE Ethernet COMM_REQ Protocol. Messages are produced and received between peer PLCs via a 1GB fibre optic network.

10.2 Inter-PLC Communications

The PLC's communicate with each other via the 1Gigabit Fibre network. The network itself consists of a fibre ring topology with Moxa ethernet switches stationed at each PLC. Each Moxa switch has eight copper ethernet ports, one of which is at 1 gigabit. Each main PLC rack contains one or more Ethernet cards, each with two ports. The Ethernet card for FST 7&8 PLC is configured with the following address:

PLC 15 IP address	192.168.151.065
MOXA IP address	192.168.151.045
SIEMENS POWER METER	192.168.151.085

Full network allocation table see Appendix A.

These addresses are available to the whole Queensland Urban Utilities Network and are connected to the OWS located in the control room.

10.2.1 SCADA standard data blocks

Each PLC does not transmit data to other PLCs. Instead, each PLC packages specific data into a block of 100 registers. It is then up to the other PLCs on the network to retrieve the block of data and extract what they require from it locally. The retrieving of data is performed using COMM_REQ blocks.

Each PLC has address ranges reserves for each data type and is consistent throughout all PLCs, the allocated address refers to address allocation spreadsheet attached to this document.

10.2.2 Inter-PLC Communications Alarm

The first integer in the Integer Array is the watchdog counter. The counter is incremented every second and reset to 0 when it reaches 32767. All PLC's that retrieve data from another PLC check to see that the PLC's watchdog is changing. If the watchdog does not change within 5 seconds a communications alarm is raised.

10.3 Peer to Peer Communications

10.3.1 Data Produced for other PLC's

Each PLC parcels the data for communications to other PLC's into a group of 100 registers. Details refer to QUU document "GibsonIslandPLC-PLCComms.xls". PLC 15 flow data is packaged for PLC05.

10.3.2 Data Retrieved from other PLC's

Each PLC then reads what information it requires from each PLC as necessary. Details refer to QUU document "GibsonIslandPLC-PLCComms.xls". PLC 15 retrieved PE-Cell info from PLC03 for lighting control.

11. Replacement of the existing Mixed Liquor Flow meters

11.1 Overview

The entrapped air in mixed liquor to the existing FST train is currently causing problems at the flow meters that result in process control problems at the plant. Two de-aeration chambers, one on each mixed liquor line shall be designed and constructed to facilitate removal of entrapped air in mixed liquor.

The construction of the de-aeration chambers requires removal of the two existing flow meters. The replacement flow meters are positioned downstream of the de-aeration chamber.

11.2 Equipment

Equipment	Tag	Process Media	Location

Flow Meter	FIT_0511-002	Mix Liquor	De-aeration
Flow Meter	FIT_0512-002	Mix Liquor	De-aeration

Table 26: Replacement Mixed Liquor Equipment List

11.3 Control

The replaced flow meter is to resume link to the existing RAS PLC (PLC05).

……………………End of the Document …………………………

4. Appropriate Records

Filename	Issue	Rev Status	23 Nov '10
GIO&M Manual 5.doc	1	Final	

QUEENS AND UrbanUtilities

GIBSON ISLAND WATER RECLAMATION PLANT CAPACITY UPGRADE

EFFLUENT LINE CUT IN – SHUTDOWN PROCEDURE

DOCUMENT APPROVAL

NAME	SECTION	SIGNATURE
MICHEAL BARTON	QUU PRINCIPAL OPERATIONS ENGINEER	
PHILIP GOODING	T&C PROJECT MANAGER	
PAUL FISHER	QUU CONTACTS MANAGER	

SHUTDOWN PROCEDURE – EFFLUENT LINE CUT IN

1 SHUTDOWN PROCEDURE – EFFLUENT LINE CUT IN

1.1 PURPOSE

This procedure outlines how to temporarily stop sewage feed to the Bioreactor at the Gibson Island Waste Water Treatment Plant and perform the effluent line cut in for FST 7 & 8.

QUU will manage the operational aspects of the partial shutdown; T&C will manage the construction works associated with the cut in.

1.2 SCOPE OF WORK

Scope of Work:

- Isolation of flow – Stop Raw Sewage feed to plant and related plant processes - QUU
- Complete effluent line Cut In – T&C
- Reinstate flow – Start raw sewage feed to plant and related plant processes - QUU

1.3 RISK MANAGEMENT PLAN

Reference: Safe Work Method Statement (SWMS)

Permit to work

1.4 KEY TASKS

Activity	Date/Time	Description	Who
Preparation			
A1	Week before	Notify the following representatives of anticipated shutdown (shutdown period and date): - Sewage Networks (Keane White) - Gibson Island AWTP (Bradley Rhodes) - Tanker Reuse Facility (Tan Trieu) - ATC North Reuse Facility (Don Crook) - Trade Waste Customers (Russell Miller)	QUU Process Engineer
B1	3 days before day of work	Check weather forcast, consider cancellation in the event of significant rainfall - Notify Process Engineer.	Operator
C1	1 Day before day of work	Check weather forcast, consider cancellation in the event of significant rainfall - Notify Process Engineer.	Operator
C2	1 Day before day of work	Check flow into plant and if greater than ADWF – consider cancellation of job	Process Engineer
C3	1 Day before day of work	If no rain forcast, **DISABLE flow smoothing control** for scheduled shutdown (for extra buffer capacity in Wet Well)	Operator

Shutdown Sequence			
D2	Night of Work	T&C to complete permit to work and provide a SWMS/JSEA prior to commencing shutdown	T&C
D3	Night of Work	Notify the following representatives of confirmed shutdown: - **Sewage Networks** (Control Room) - **Gibson Island AWTP** (Control Room)	Operator
D4	Night of Work	**Equipment shutdown:** • **Belt Filter Presses** – Shutdown Belt Filter Presses by changing Belt Press Availability on Citect SCADA to ZERO (0) • **ATC North Facility** – Shutdown ATC North Facility by clicking **shutdown mode** on Citect SCADA. • **Tanker Reuse facility may require shutdown and SMS sent if storage used up during shutdown**.	Operator
D5	Night of Work	**Raw Sewage Pumps:** • **Raw Sewage Pumps (1-3)** – Shutdown pumps by placing in local manual and shutdown. Place out of service tags on all pump Auto/Manual switches. T&C representative also to place out of service tags.	Operator/T&C
D6	Night of Work	**RAS Pump Station:** • **RAS Inlet Control Valves** – Place Inlet Control Valve 1&2 in manual and close. Place out of service tags on	Operator

		both valve Auto/Manual switches. • **RAS Pumps (1-3)** – Allow the RAS pumps to run until the stop on low level. Place 1 pump into manual and operate until RAS pit is adequately drained. Switch off pumps and place out of service tags on all pump Auto/Manual switches.	
D7	Night of Work	• **Isolate scum sprays to both bioreactors**	
D8	Night of Work	**Monitoring checks during shutdown:** • **Monitor Inlet Sewer Wet Well level –** Citect SCADA trends to monitor sewer surcharge levels. **All works should be suspended once the wet well reaches 45%** to allow plant to be operational before surcharge imminent level of 57%. Remain in communication with T&C regarding work progress and well levels. Forewarn T&C if the plant is needed to be brought back online prior to job compeletion. • **Monitor blower and DO controls –** The aeration system should shutdown online blowers and ramp down to 1 HV turbo blower at relatively closed IGV position. There is potential for high header pressures and maybe necessary to put blower control into **fixed pressure control** and **adjust header pressure setpoint to 50kPa**. This will result in single blower operating at minimum output and prevent over aeration. • **Monitor FST tanks–** Ensure there is no evidence of rising sludge if so then the shutdown is to be terminated.	Operator

Restart Sequence			
E1	Morning of Work	**Screenings & Raw Sewage Pumps:** • **Screenings** – Ensure the screenings system is available • **Raw Sewage Pumps (1-3)** – Ensure the 3Q and 4Q modes of RS Pump Station control are inhibited. Remove out of service tags on all pump Auto/Manual switches. Reinstate pumps to Auto operation.	Operator
E2	Morning of Work	**FST Tank Checks:** • **FST Tank Level** – Check the level in all FSTs and confirm effluent flow is relatively constant over the v-notch weirs before starting RAS pumps • **FST Syphon pumps** – Confirm pumps have been primed	Operator
E3	Morning of Work	**RAS Pump Station:** • **RAS Pumps (1-3)** – Remove out of service tags on all pump Auto/Manual switches. Place pumps into Auto. • **RAS Inlet Control Valves** – Remove out of service tags on both valve Auto/Manual switches. Place valves into remote manual mode and slowly open RAS control valves. Wait and monitor RAS flow until it has reached approx. 200L/s. Check updraft tubes on all FSTs and ensure syphon primed. When RAS flows from FSTs are steady, place RAS valves into auto (**RAS flows will continue to open till 290L/s is reached**)	Operator
E4	Morning of Work	**Aeration Control:** • **Blower and DO control:** Leave the blower in fixed header control and wait until system is operating at reasonable DO control. When this is achieved, revert all blowers and aeration control valves into **Auto/Cascade mode** and operating in **floating/optimised Header Pressure** control	Operator
E5	Morning of Work	**Equipment restart:** • **Scum Harvesters** – Restart scum harvesters • **Belt Filter Presses** – Restart Belt Filter Presses by changing Belt Press Availability on Citect SCADA to required operational levels (all 3 presses running) • **ATC North Facility** – **Turn on all pumps and place them into auto**. Restart ATC North Facility by clicking **Reset shutdown mode** on Citect SCADA.	Operator
E6	Morning of Work	Notify the following representatives of confirmed restart:	Operator

		- **Sewage Networks** (Control Room) - **Gibson Island AWTP** (Control Room) - **Tanker Reuse Facility** (Tan Trieu) - **ATC North Reuse Facility** (Don Crook) - **Trade Waste Customers** (Russell Miller)	
E7	Following Day	**Monitoring checks after restart:** • **Monitor FST blankets** – Monitor blanket levels and ensure there is no evidence of rising sludge • **Inlet Sewer Wet Well level** – If blankets are steady, output of Raw Sewage Pump can be increased towards 800L/s. Pumps should operate under normal control. Continue to monitor well levels. • **Monitor RAS flows** – Continue to monitor RAS flows on FSTs to ensure good updraft and syphon. • **Monitor blower and DO controls** – Check that DO control is returning to normal operation	Operator

1.5 COMMUNICATION PLAN

Phone contact numbers

Gibson Island WRP Operator	07 3407 8811
Area Controller (North) - Tony Murphy	0404 086 127
Process Operations Engineer – Andy Constantinou	0488 734 830
M&E Foreman - Dylan Jones	0419 666 940
QUU WH&S Officer	0439671679 / 0416013860
QUU Contract Manager	0414576380

Other useful numbers: BY QUU

Name	Company	Contact
Keane White	BCC WD – Sewage Networks	0413 723 741
Bradley Rhodes	Veolia - Gibson Island AWTP	0439 414 223
Tan Trieu	BCC WD – Product Water Quality (Tanker Reuse)	0419 707 051
Don Crook	BCC WD – Business Management (ATC customers)	0407 111 640
Russell Miller	BCC WD – Trade Waste (GI WRP catchment)	0419 707 059

1.6 METHODOLOGY

1.6.1 Construction Phase

Construction of the effluent chamber will follow the following methodology and require several key components; The most critical part of the construction procedure is the support of the pipe while the base of the chamber is being constructed. To do this 4-off, 200mm wide, 25mm thick, PE straps will used. It is envisaged that the pipe will be completely exposed in 4 places to allow the insertion of these straps. Four steel supports will be constructed using 200mm I-beams, and placed above these PE straps. These steel supports will be braced to ensure stability. The straps will be connected to the steel supports by way of ratchet come alongs and slings. This will enable adjustment to ensure all straps are taking an equal amount of the weight. The remaining soil will be removed and the base formed up. The PE straps will be left in place and the concrete poured around them, thus giving the pipe complete support until the concrete cures.

Once the base has been poured and cured, the steel supports and come alongs can be removed. The PE straps will be trimmed off level with the floor.

The walls will be formed up and poured.

The lid will be now constructed on site as per the design drawings and fitted as a lock down lid.

Activity	Description	Who	Materials
	Construction Phase		
1	Bulk excavation	Setlow	Excavator
2	Remove soil from under pipe in 4 locations	Setlow	Shovel
3	Place steel supports	Setlow	Lifting equipment
4	Install sacrificial PE straps around the pipe in 6 locations	Setlow	
5	Take weight of pipe with ratchet come alongs.	Setlow	Come alongs, slings
6	Complete excavation around pipe.	Setlow	Excavator, shovel
7	Pour concrete 'blinder' slab	Setlow	
8	Form up and lay steel work for base.	Setlow	
9	Pour concrete base.	Setlow	

10	Once concrete has cured, remove come alongs and steel supports.	Setlow	
11	Form up and lay steel work for the walls.	Setlow	
12	Pour concrete walls	Setlow	
13	Fit Lid		

1.6.2 Cut In Phase

Activity	Description	Who	Time
	Cut In Phase		
1	Set up equipment for access into effluent outfall chamber	Setlow	.5hr
2	Lower equipment into effluent outfall chamber	Setlow	.5hr
3	Mark out area to be cut	Setlow	.5hr
4	Commence cutting of pipe.	Setlow	3hr
5	Remove cut out section of pipe from effluent outfall chamber	Setlow	.5hr
6	Clean debris from inside effluent outfall pipe.	Setlow	.5hr
7	Remove all equipment and place lid	Setlow	.5hr
8	Hand back permits to QUU	Setlow	
	Total Time		**6hrs**

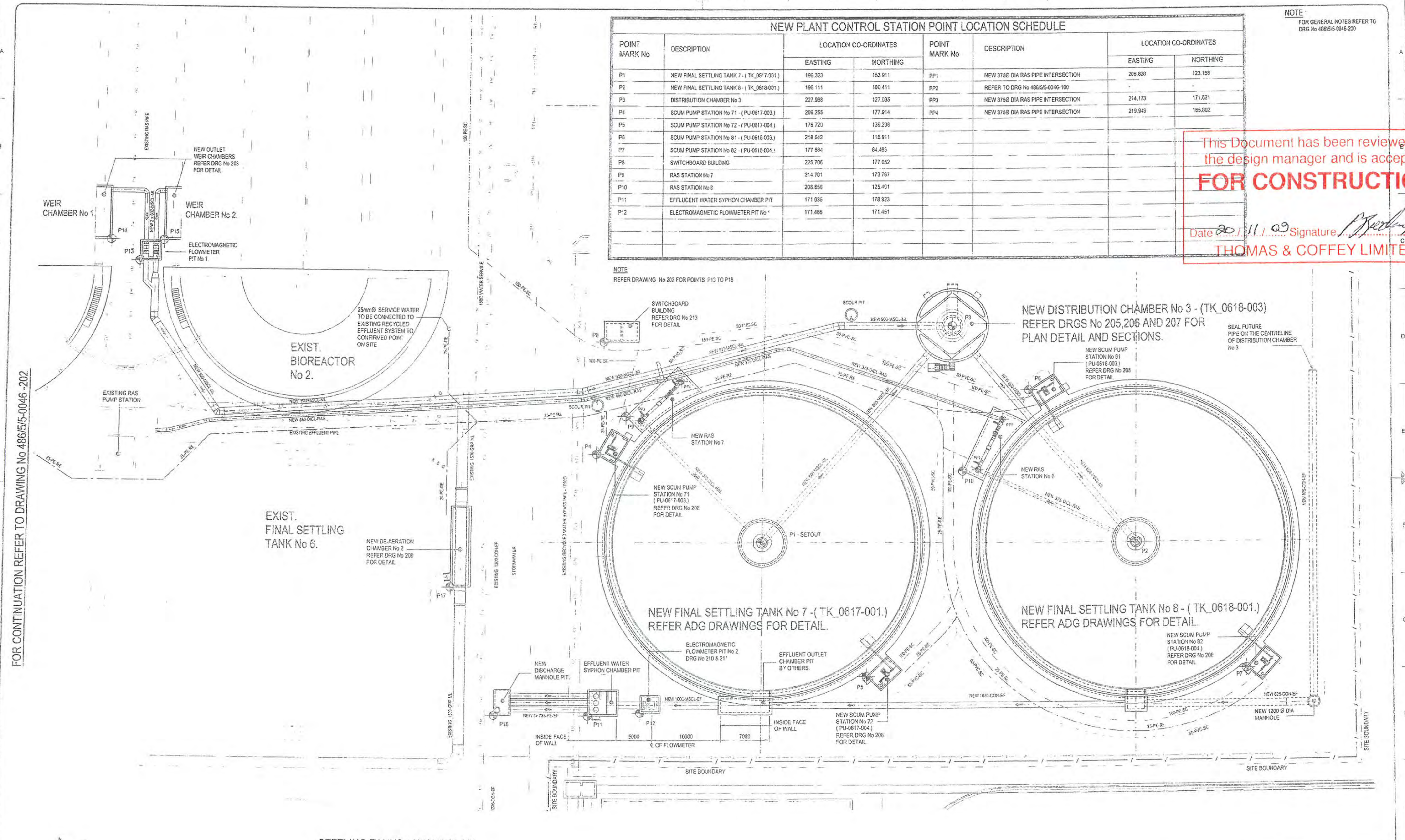
1.7 RELEVANT DOCUMENTATION

To assist in the successful delivery of the shutdown the following documents should be used in conjunction with this document;

Thomas and Coffey Safe Work Method Statement.

Drawing 486/5/5-0046-201 Amend O: *General Arrangement*

Drawing 486/5/5-0046-210 Amend O: *Effluent Water Syphon Pit and Sections*



NOTE
FOR GENERAL NOTES REFER TO DRG No 486/5/5-0046-200

NEW PLANT CONTROL STATION POINT LOCATION SCHEDULE

POINT MARK No	DESCRIPTION	LOCATION CO-ORDINATES EASTING	LOCATION CO-ORDINATES NORTHING	POINT MARK No	DESCRIPTION	LOCATION CO-ORDINATES EASTING	LOCATION CO-ORDINATES NORTHING
P1	NEW FINAL SETTLING TANK 7 - (TK_0617-001.)	195.323	153.911	PP1	NEW 375Ø DIA RAS PIPE INTERSECTION	206.828	123.158
P2	NEW FINAL SETTLING TANK 8 - (TK_0618-001.)	196 111	100.411	PP2	REFER TO DRG No 486/5/5-0046-100	-	-
P3	DISTRIBUTION CHAMBER No 3	227.968	127.035	PP3	NEW 375Ø DIA RAS PIPE INTERSECTION	214.173	171.621
P4	SCUM PUMP STATION No 71 - (PU-0617-003.)	209.255	177.914	PP4	NEW 375Ø DIA RAS PIPE INTERSECTION	219.948	165.802
P5	SCUM PUMP STATION No 72 - (PU-0617-004.)	176.720	139.238				
P6	SCUM PUMP STATION No 81 - (PU-0618-003.)	218 542	115.911				
P7	SCUM PUMP STATION No 82 - (PU-0618-004.)	177 534	84.463				
P8	SWITCHBOARD BUILDING	225.706	177.052				
P9	RAS STATION No 7	214.701	173 787				
P10	RAS STATION No 8	206.658	125.401				
P11	EFFLUCENT WATER SYPHON CHAMBER PIT	171 035	178 923				
P12	ELECTROMAGNETIC FLOWMETER PIT No 1	171.466	171.451				

NOTE
REFER DRAWING No 202 FOR POINTS P13 TO P18

This Document has been reviewed by the design manager and is accepted
FOR CONSTRUCTION
Date 20 / 11 / 09 Signature
THOMAS & COFFEY LIMITED

SETTLING TANKS LAYOUT PLAN

SCALE 1 : 250

NOTE
1 FOR ALL PIPE LEVELS REFER DETAIL DRAWINGS AND HYDRAULIC PROFILES
2 ALL SETOUT POINTS AND PIPE RUNS TO BE VERIFIED ON SITE. ADJUSTMENT MAY NEED TO BE MADE FOR UNKNOWN SERVICES NOT SHOWN ON B.W. DRAINAGE OR LOCATED BY THE SURVEYOR
3 ALL PIPES TO BE DICL - U.N.O

FOR CONSTRUCTION

No.	DATE	AMENDMENT	DRAFTED	APPROVED
P5	5.8.09	SCUM LOCATIONS REVISED	KIM.J.S	B.B
P4	24.7.09	SCUM LOCATIONS REVISED	KIM.J.S	B.B
P3	17.7.09	LOCATION POINTS P11 & P12 REVISED	KIM.J.S	B.B.
0	19.10.09	ISSUED FOR CONSTRUCTION	KIM	B.B.
P6	21.8.09	REVISED FOR FINAL APPROVAL	MJD	B.B

Certified By Company HENRY & HYMAS
Engineer BRUCE BRADNAM
Signature
Date 19-10-2009
RPEQ No. 4568

Simmonds & Bristow Pty. Ltd

thomas & coffey
UNIT 3, 11 PARINGA RD MURARRIE QLD 4172 PHONE: 07 3009 8000

HENRY & HYMAS
16 VALE STREET WILSTON QLD 4172
HH-REF: 08561

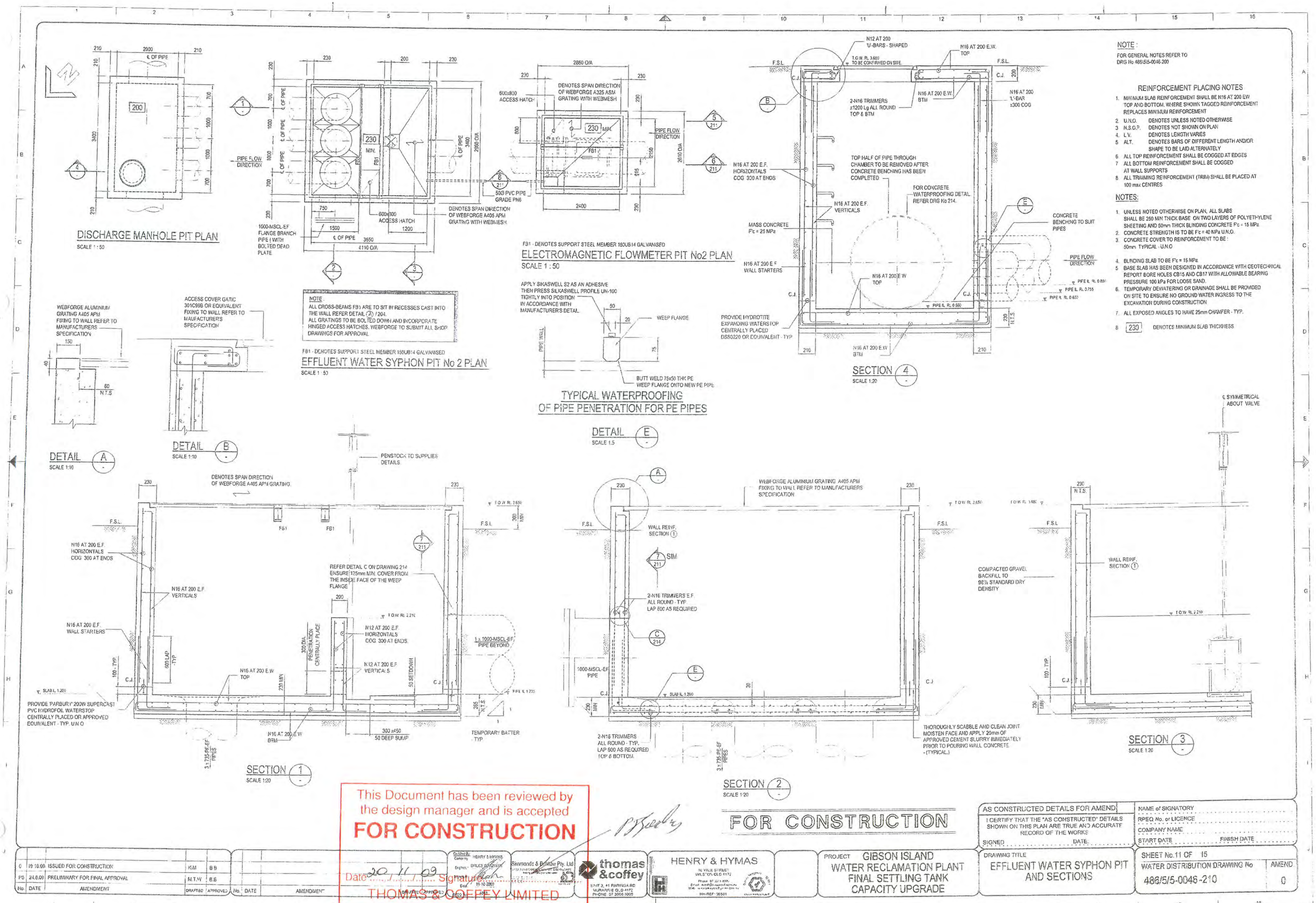
AS CONSTRUCTED DETAILS FOR AMEND
I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE TRUE AND ACCURATE RECORD OF THE WORKS
SIGNED .... DATE ....

NAME of SIGNATORY ....
RPEQ No or LICENCE ....
COMPANY NAME ....
START DATE .... FINISH DATE ....

PROJECT GIBSON ISLAND WATER RECLAMATION PLANT FINAL SETTLING TANK CAPACITY UPGRADE

DRAWING TITLE SETTLING TANKS GENERAL ARRANGEMENT

SHEET No. 2 OF 15
WATER DISTRIBUTION DRAWING No. 486/5/5-0046-201
AMEND. 0


DISCHARGE MANHOLE PIT PLAN
SCALE 1:50
EFFLUENT WATER SYPHON PIT No 2 PLAN
SCALE 1:50
ELECTROMAGNETIC FLOWMETER PIT No2 PLAN
SCALE 1:50
FB1 - DENOTES SUPPORT STEEL MEMBER 150UB14 GALVANISED
NOTE
ALL CROSS-BEAMS FB1 ARE TO SIT IN RECESSES CAST INTO THE WALL REFER DETAIL / 204.
ALL GRATINGS TO BE BOLTED DOWN AND INCORPORATE HINGED ACCESS HATCHES, WEBFORGE TO SUBMIT ALL SHOP DRAWINGS FOR APPROVAL
TYPICAL WATERPROOFING OF PIPE PENETRATION FOR PE PIPES
APPLY SIKASWELL S2 AS AN ADHESIVE THEN PRESS SIKASWELL PROFILE UN-100 TIGHTLY INTO POSITION IN ACCORDANCE WITH MANUFACTURER'S DETAIL
WEEP FLANGE
BUTT WELD 75x50 THK PE WEEP FLANGE ONTO NEW PE PIPE
DETAIL A
SCALE 1:10
DETAIL B
SCALE 1:10
DETAIL E
SCALE 1:5
SECTION 4
SCALE 1:20
SECTION 1
SCALE 1:20
SECTION 2
SCALE 1:20
SECTION 3
SCALE 1:20
NOTE:
FOR GENERAL NOTES REFER TO DRG No 486/5/5-0046-200
REINFORCEMENT PLACING NOTES
1. MINIMUM SLAB REINFORCEMENT SHALL BE N16 AT 200 EW TOP AND BOTTOM, WHERE SHOWN TAGGED REINFORCEMENT REPLACES MINIMUM REINFORCEMENT
2. U.N.O. DENOTES UNLESS NOTED OTHERWISE
3. N.S.O.P. DENOTES NOT SHOWN ON PLAN
4. L.V. DENOTES LENGTH VARIES
5. ALT. DENOTES BARS OF DIFFERENT LENGTH AND/OR SHAPE TO BE LAID ALTERNATELY
6. ALL TOP REINFORCEMENT SHALL BE COGGED AT EDGES
7. ALL BOTTOM REINFORCEMENT SHALL BE COGGED AT WALL SUPPORTS
8. ALL TRIMMING REINFORCEMENT (TRIM) SHALL BE PLACED AT 100 max CENTRES
NOTES:
1. UNLESS NOTED OTHERWISE ON PLAN, ALL SLABS SHALL BE 250 MIN THICK BASE ON TWO LAYERS OF POLYETHYLENE SHEETING AND 50mm THICK BLINDING CONCRETE F'c = 15 MPa
2. CONCRETE STRENGTH IS TO BE F'c = 40 MPa U.N.O.
3. CONCRETE COVER TO REINFORCEMENT TO BE: 50mm TYPICAL - U.N.O
4. BLINDING SLAB TO BE F'c = 15 MPa
5. BASE SLAB HAS BEEN DESIGNED IN ACCORDANCE WITH GEOTECHNICAL REPORT BORE HOLES CB15 AND CB17 WITH ALLOWABLE BEARING PRESSURE 100 kPa FOR LOOSE SAND.
6. TEMPORARY DEWATERING OR DRAINAGE SHALL BE PROVIDED ON SITE TO ENSURE NO GROUND WATER INGRESS TO THE EXCAVATION DURING CONSTRUCTION
7. ALL EXPOSED ANGLES TO HAVE 25mm CHAMFER - TYP.
8. 230 DENOTES MINIMUM SLAB THICKNESS
This Document has been reviewed by the design manager and is accepted
FOR CONSTRUCTION
Date 20/11/09 Signature
THOMAS & COFFEY LIMITED
FOR CONSTRUCTION
AS CONSTRUCTED DETAILS FOR AMEND
I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE TRUE AND ACCURATE RECORD OF THE WORKS
0 19.10.09 ISSUED FOR CONSTRUCTION
P0 24.8.09 PRELIMINARY FOR FINAL APPROVAL
HENRY & HYMAS
thomas &coffey
PROJECT GIBSON ISLAND
WATER RECLAMATION PLANT
FINAL SETTLING TANK
CAPACITY UPGRADE
DRAWING TITLE
EFFLUENT WATER SYPHON PIT AND SECTIONS
SHEET No. 11 OF 15
WATER DISTRIBUTION DRAWING No
486/5/5-0046-210
AMEND
0

QUEENS AND UrbanUtilities

GIBSON ISLAND WASTE WATER RECLAMATION PLANT

CAPACITY UPGRADE

MIXED LIQUOR LINE CUT IN – SHUTDOWN PROCEDURE

DOCUMENT APPROVAL

NAME	SECTION	SIGNATURE
MICHEAL BARTON	QUU PRINCIPAL OPERATIONS ENGINEER	
PHILIP GOODING	T&C PROJECT MANAGER	
PAUL FISHER	QUU CONTRACTS MANAGER	

SHUTDOWN PROCEDURE – MIXED LIQUOR LINE CUT IN

1 SHUTDOWN PROCEDURE – MIXED LIQUOR LINE CUT IN

1.1 PURPOSE

This procedure outlines how to temporarily stop sewage feed to the Bioreactor at the Gibson Island Waste Water Treatment Plant and perform the Mixed Liquor line cut in for FST 7 & 8.

QUU will manage the operational aspects of the partial shutdown; T&C will manage the construction works associated with the cut in.

1.2 SCOPE OF WORK

Scope of Work:

- Isolation of flow – Stop Raw Sewage feed to plant and related plant processes - QUU
- Complete mixed liquor line Cut In – T&C
- Reinstate flow – Start raw sewage feed to plant and related plant processes - QUU

1.3 RISK MANAGEMENT PLAN

Reference: Safe Work Method Statement (SWMS)

Permit to work

1.4 KEY TASKS

Activity	Date/Time	Description	Who
Preparation			
A1	Week before	Notify the following representatives of anticipated shutdown (shutdown period and date): - Sewage Networks (Keane White) - Gibson Island AWTP (Bradley Rhodes) - Tanker Reuse Facility (Tan Trieu) - ATC North Reuse Facility (Don Crook) - Trade Waste Customers (Russell Miller)	QUU Process Engineer
B1	3 days before day of work	Check weather forcast, consider cancellation in the event of significant rainfall - Notify Process Engineer.	Operator
C1	1 Day before day of work	Check weather forcast, consider cancellation in the event of significant rainfall - Notify Process Engineer.	Operator
C2	1 Day before day of work	Check flow into plant and if greater than ADWF – consider cancellation of job	Process Engineer
C3	1 Day before day of work	If no rain forcast, **DISABLE flow smoothing control** for scheduled shutdown (for extra buffer capacity in Wet Well)	Operator

Shutdown Sequence			
D2	Night of Work	T&C to complete permit to work and provide a SWMS/JSEA prior to commencing shutdown	T&C
D3	Night of Work	Notify the following representatives of confirmed shutdown: - **Sewage Networks** (Control Room) - **Gibson Island AWTP** (Control Room)	Operator
D4	Night of Work	**Equipment shutdown:** • **Belt Filter Presses** – Shutdown Belt Filter Presses by changing Belt Press Availability on Citect SCADA to ZERO (0) • **ATC North Facility** – Shutdown ATC North Facility by clicking **shutdown mode** on Citect SCADA. • **Tanker Reuse facility may require shutdown and SMS sent if storage used up during shutdown.**	Operator
D5	Night of Work	**Raw Sewage Pumps:** • **Raw Sewage Pumps (1-3)** – Shutdown pumps by placing in local manual and shutdown. **Place out of service tags on all pump Auto/Manual switches. T&C representative also to place out of service tags.**	Operator/T&C
D6	Night of Work	**RAS Pump Station:** • **RAS Inlet Control Valves –** Place Inlet Control Valve 1&2 in manual and close. **Place out of service tags on**	Operator

		both valve Auto/Manual switches. • **RAS Pumps (1-3)** – Allow the RAS pumps to run until the stop on low level. Place 1 pump into manual and operate until RAS pit is adequately drained. **Switch off pumps and place out of service tags on all pump Auto/Manual switches.**	
D7	Night of Work	• **Isolate scum sprays to both bioreactors**	
D8	Night of Work	**Monitoring checks during shutdown:** • **Monitor Inlet Sewer Wet Well level** – Citect SCADA trends to monitor sewer surcharge levels. **All works should be suspended once the wet well reaches 45%** to allow plant to be operational before surcharge imminent level of 57%. **Remain in communication with T&C regarding work progress and well levels. Forewarn T&C if the plant is needed to be brought back online prior to job compeletion.** • **Monitor blower and DO controls** – The aeration system should shutdown online blowers and ramp down to 1 HV turbo blower at relatively closed IGV position. There is potential for high header pressures and maybe necessary to put blower control into **fixed pressure control** and **adjust header pressure setpoint to 50kPa**. This will result in single blower operating at minimum output and prevent over aeration. • **Monitor FST tanks**– Ensure there is no evidence of rising sludge if so then the shutdown is to be terminated.	Operator

Restart Sequence			
E1	Morning of Work	**Screenings & Raw Sewage Pumps:** • **Screenings** – Ensure the screenings system is available • **Raw Sewage Pumps (1-3)** – Ensure the 3Q and 4Q modes of RS Pump Station control are inhibited. **Remove out of service tags on all pump Auto/Manual switches.** Reinstate pumps to Auto operation.	Operator
E2	Morning of Work	**FST Tank Checks:** • **FST Tank Level** – Check the level in all FSTs and confirm effluent flow is relatively constant over the v-notch weirs before starting RAS pumps • **FST Syphon pumps** – Confirm pumps have been primed	Operator
E3	Morning of Work	**RAS Pump Station:** • **RAS Pumps (1-3) – Remove out of service tags on all pump Auto/Manual switches.** Place pumps into Auto. • **RAS Inlet Control Valves – Remove out of service tags on both valve Auto/Manual switches.** Place valves into remote manual mode and slowly open RAS control valves. Wait and monitor RAS flow until it has reached approx. 200L/s. Check updraft tubes on all FSTs and ensure syphon primed. When RAS flows from FSTs are steady, place RAS valves into auto (**RAS flows will continue to open till 290L/s is reached**)	Operator
E4	Morning of Work	**Aeration Control:** • **Blower and DO control:** Leave the blower in fixed header control and wait until system is operating at reasonable DO control. When this is achieved, revert all blowers and aeration control valves into **Auto/Cascade mode** and operating in **floating/optimised Header Pressure** control	Operator
E5	Morning of Work	**Equipment restart:** • **Scum Harvesters** – Restart scum harvesters • **Belt Filter Presses** – Restart Belt Filter Presses by changing Belt Press Availability on Citect SCADA to required operational levels (all 3 presses running) • **ATC North Facility – Turn on all pumps and place them into auto**. Restart ATC North Facility by clicking **Reset shutdown mode** on Citect SCADA.	Operator
E6	Morning of Work	Notify the following representatives of confirmed restart:	Operator

		- **Sewage Networks** (Control Room) - **Gibson Island AWTP** (Control Room) - **Tanker Reuse Facility** (Tan Trieu) - **ATC North Reuse Facility** (Don Crook) - **Trade Waste Customers** (Russell Miller)	
E7	Following Day	**Monitoring checks after restart:** • **Monitor FST blankets –** Monitor blanket levels and ensure there is no evidence of rising sludge • **Inlet Sewer Wet Well level –** If blankets are steady, output of Raw Sewage Pump can be increased towards 800L/s. Pumps should operate under normal control. Continue to monitor well levels. • **Monitor RAS flows –** Continue to monitor RAS flows on FSTs to ensure good updraft and syphon. • **Monitor blower and DO controls –** Check that DO control is returning to normal operation	Operator

1.5 COMMUNICATION PLAN

Phone contact numbers

Gibson Island WRP Operator	07 3407 8811
Area Controller (North) - Tony Murphy	0404 086 127
Process Operations Engineer – Andy Constantinou	0488 734 830
M&E Foreman - Dylan Jones	0419 666 940
QUU WH&S Officer	0439671679 / 0416013860
QUU Contract Manager	0414576380

Other useful numbers: BY QUU

Name	Company	Contact
Keane White	BCC WD – Sewage Networks	0413 723 741
Bradley Rhodes	Veolia - Gibson Island AWTP	0439 414 223
Tan Trieu	BCC WD – Product Water Quality (Tanker Reuse)	0419 707 051
Don Crook	BCC WD – Business Management (ATC customers)	0407 111 640
Russell Miller	BCC WD – Trade Waste (GI WRP catchment)	0419 707 059

1.6 METHODOLOGY

1.6.1 Construction Phase

Construction of the dearation chambers will follow the following methodology and require several key components;

The most critical part of the construction procedure is the support of the pipe while the base of the chamber is being constructed. To do this 5, 300mm wide, 6mm thick, PE straps will be used. It is envisaged that the pipe will be completely exposed in 5 places to allow the insertion of these straps. I beams will be used across the shoring box and supported outside the shoring box by other I beams and welded to the shoring box. The straps will be connected to the steel supports by way of come alongs and slings. This will enable adjustment to ensure all straps are taking an equal amount of the weight. The remaining soil will be removed and the base formed up. The PE straps will be left in place and the concrete poured around them, thus giving the pipe complete support until the concrete cures.

Once the base has been poured and cured, the steel supports and come alongs can be removed. The PE straps will be trimmed off level with the floor.

Activity	Description	Who	Materials
Construction Phase			
1	Bulk excavation	Setlow	Excavator
2	Place shoring box		
3	Back fill around shoring box and compact		
4	Place "I" beams parrallel to the shoring box. 1 each side		
5	Place "I" beams across the shoring and weld to the shoring box. At 1200mm centers.		
6	Remove soil from under pipe in 5 locations	Setlow	Shovel
7	Where joint is exposed seal joint with fibreglass	Rapid Fibreglass	
8	Install sacrificial PE straps around the pipe in 5 locations, incuding 1 as close as possible to exposed joint	Setlow	
9	Take weight of pipe with come alongs.	Setlow	Come alongs, slings
10	Wrap 2t strap around pipe and sacrificial PE straps. Take weight		
11	Complete excavation around pipe.	Setlow	Excavator,

			shovel
12	Install fibre glass puddle flange	Rapid Fibreglass	Grinder, fibre cloth, and resin
13	Pour concrete blinder	Setlow	
14	Form up and lay steel work for base.	Setlow	
15	Pour concrete base. Including all costruction joints	Setlow	
16	Once concrete has cured, remove come alongs and steel supports.	Setlow	
17	Form up and install steel work for the walls.	Setlow	
18	Pour concrete walls	Setlow	

1.6.2 Cut In Phase

Activity	Description	Who	Task Time
Cut In Phase			
1	Set up equipment for access into dearation chamber	Setlow	Pre- cutin task
2	Lower equipment into dearation chamber	Setlow	.5
3	Mark out area to be cut	Setlow	.25
4	Commence cutting of pipe.	Setlow	3hrs
5	Remove cut out section of pipe from dearation chamber	Setlow	.25
6	Clean debris from inside Mixed Liquer pipe.	Setlow	.25
7	Apply Acatone and sealant to newly cut pipe	Setlow	1.5hr
8	Remove all equipment	Setlow	.25
9	Hand back permits to QUU	Setlow	

1.7 RELEVANT DOCUMENTATION

To assist in the successful delivery of the shutdown the following documents should be used in conjunction with this document;

Thomas and Coffey Safe Work Method Statement.

Drawing 486/5/5-0046-201 Amend O: *General Arrangement*

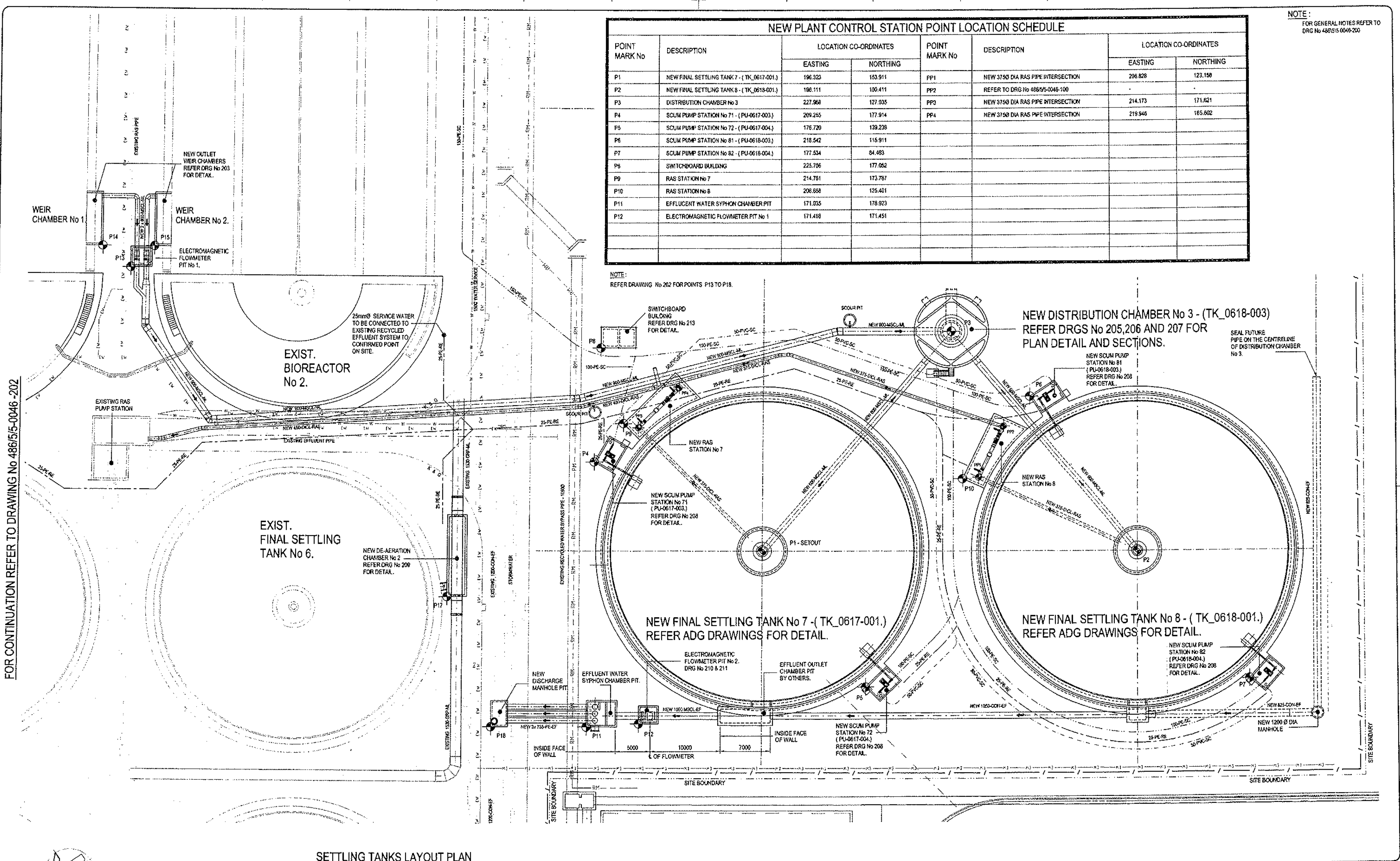
Drawing 486/5/5-0046-209 Amend O: *De-Aeration Chamber Layout Plan and Sections*

NOTE :
FOR GENERAL NOTES REFER TO DRG No 486/5/5-0046-200

NEW PLANT CONTROL STATION POINT LOCATION SCHEDULE

POINT MARK No	DESCRIPTION	LOCATION CO-ORDINATES		POINT MARK No	DESCRIPTION	LOCATION CO-ORDINATES	
		EASTING	NORTHING			EASTING	NORTHING
P1	NEW FINAL SETTLING TANK 7 - (TK_0617-001.)	196.323	153.911	PP1	NEW 375Ø DIA RAS PIPE INTERSECTION	206.828	123.158
P2	NEW FINAL SETTLING TANK 8 - (TK_0618-001.)	198.111	100.411	PP2	REFER TO DRG No 486/5/5-0046-100	-	-
P3	DISTRIBUTION CHAMBER No 3	227.968	127.035	PP3	NEW 375Ø DIA RAS PIPE INTERSECTION	214.173	171.621
P4	SCUM PUMP STATION No 71 - (PU-0617-003.)	209.255	177.914	PP4	NEW 375Ø DIA RAS PIPE INTERSECTION	219.946	165.602
P5	SCUM PUMP STATION No 72 - (PU-0617-004.)	176.720	139.238				
P6	SCUM PUMP STATION No 81 - (PU-0618-003.)	218.542	115.911				
P7	SCUM PUMP STATION No 82 - (PU-0618-004.)	177.534	84.463				
P8	SWITCHBOARD BUILDING	225.706	177.052				
P9	RAS STATION No 7	214.781	173.787				
P10	RAS STATION No 8	206.658	125.401				
P11	EFFLUCENT WATER SYPHON CHAMBER PIT	171.035	178.923				
P12	ELECTROMAGNETIC FLOWMETER PIT No 1	171.469	171.451				

NOTE :
REFER DRAWING No 202 FOR POINTS P13 TO P18.



SETTLING TANKS LAYOUT PLAN

SCALE 1 : 250

NOTE :

1. FOR ALL PIPE LEVELS REFER DETAIL DRAWINGS AND HYDRAULIC PROFILES.
2. ALL SETOUT POINTS AND PIPE RUNS TO BE VERIFIED ON SITE. ADJUSTMENT MAY NEED TO BE MADE FOR UNKNOWN SERVICES NOT SHOWN ON B.W. DRAINAGE OR LOCATED BY THE SURVEYOR
3. ALL PIPES TO BE DICL - U.N.O.

FOR CONSTRUCTION

No.	DATE	AMENDMENT	DRAFTED	APPROVED
P5	5.8.09	SCUM LOCATIONS REVISED	KIM.J.S.	B.B.
P4	24.7.09	SCUM LOCATIONS REVISED	KIM.J.S.	B.B.
P3	17.7.09	LOCATION POINTS P11 & P12 REVISED	KIM.J.S.	B.B.

No.	DATE	AMENDMENT	DRAFTED	APPROVED
0	19.10.09	ISSUED FOR CONSTRUCTION	KIM	B.B.
P6	21.8.09	REVISED FOR FINAL APPROVAL	MJO	B.B.

Certified By: Company: HENRY & HYMAS
Engineer: BRUCE BRADNAM
Signature:
Date: 19-10-2009
RPEQ No: 4568

Simmonds & Bristow Pty. Ltd.

thomas &coffey
UNIT 3, 41 PARINGA RD
MURARRIE QLD 4172
PHONE: 07 3908 5000

HENRY & HYMAS
16 VALE STREET
WILSTON QLD 4172
HH-REF: 06561

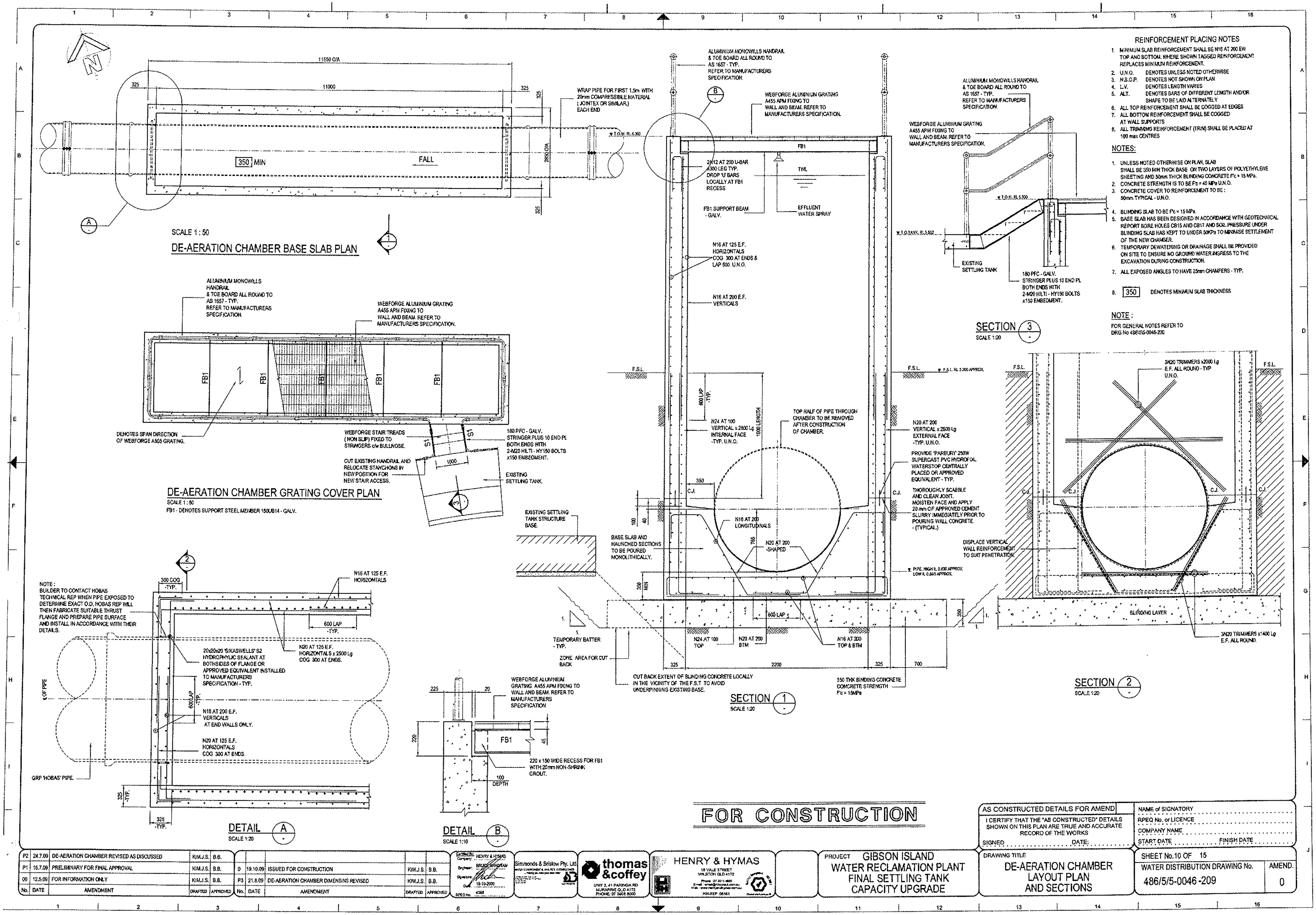
PROJECT: GIBSON ISLAND WATER RECLAMATION PLANT FINAL SETTLING TANK CAPACITY UPGRADE

AS CONSTRUCTED DETAILS FOR AMEND
I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE TRUE AND ACCURATE RECORD OF THE WORKS
SIGNED .... DATE: ....

NAME of SIGNATORY ....
RPEQ No. or LICENCE ....
COMPANY NAME ....
START DATE .... FINISH DATE ....

DRAWING TITLE: SETTLING TANKS GENERAL ARRANGEMENT

SHEET No. 2 OF 15
WATER DISTRIBUTION DRAWING No. 486/5/5-0046-201
AMEND. 0



DE-AERATION CHAMBER BASE SLAB PLAN
SCALE 1 : 50
11550 O/A
11000
350 MIN
FALL
WRAP PIPE FOR FIRST 1.5m WITH 20mm COMPRESSIBLE MATERIAL (JOINTEX OR SIMILAR) EACH END
DE-AERATION CHAMBER GRATING COVER PLAN
SCALE 1 : 50
FB1 - DENOTES SUPPORT STEEL MEMBER 150UB14 - GALV.
ALUMINIUM MONOWILLS HANDRAIL & TOE BOARD ALL ROUND TO AS 1657 - TYP. REFER TO MANUFACTURERS SPECIFICATION.
WEBFORGE ALUMINIUM GRATING A455 APM FIXING TO WALL AND BEAM. REFER TO MANUFACTURERS SPECIFICATION.
DENOTES SPAN DIRECTION OF WEBFORGE A505 GRATING.
WEBFORGE STAIR TREADS (NON SLIP) FIXED TO STRINGERS c/w BULLNOSE.
CUT EXISTING HANDRAIL AND RELOCATE STANCHIONS IN NEW POSITION FOR NEW STAIR ACCESS.
180 PFC - GALV. STRINGER PLUS 10 END PL BOTH ENDS WITH 2-M20 HILTI - HY150 BOLTS x150 EMBEDMENT.
EXISTING SETTLING TANK.
SECTION 1
SCALE 1:20
SECTION 2
SCALE 1:20
SECTION 3
SCALE 1:20
DETAIL A
SCALE 1:20
DETAIL B
SCALE 1:10
FOR CONSTRUCTION
REINFORCEMENT PLACING NOTES
1. MINIMUM SLAB REINFORCEMENT SHALL BE N16 AT 200 EW TOP AND BOTTOM. WHERE SHOWN TAGGED REINFORCEMENT REPLACES MINIMUM REINFORCEMENT.
2. U.N.O. DENOTES UNLESS NOTED OTHERWISE
3. N.S.O.P. DENOTES NOT SHOWN ON PLAN
4. L.V. DENOTES LENGTH VARIES
5. ALT. DENOTES BARS OF DIFFERENT LENGTH AND/OR SHAPE TO BE LAID ALTERNATELY
6. ALL TOP REINFORCEMENT SHALL BE COGGED AT EDGES
7. ALL BOTTOM REINFORCEMENT SHALL BE COGGED AT WALL SUPPORTS
8. ALL TRIMMING REINFORCEMENT (TRM) SHALL BE PLACED AT 100 max CENTRES
NOTES:
1. UNLESS NOTED OTHERWISE ON PLAN, SLAB SHALL BE 350 MIN THICK BASE ON TWO LAYERS OF POLYETHYLENE SHEETING AND 50mm THICK BLINDING CONCRETE F'c = 15 MPa.
2. CONCRETE STRENGTH IS TO BE F'c = 40 MPa U.N.O.
3. CONCRETE COVER TO REINFORCEMENT TO BE: 50mm TYPICAL - U.N.O.
4. BLINDING SLAB TO BE F'c = 15 MPa.
5. BASE SLAB HAS BEEN DESIGNED IN ACCORDANCE WITH GEOTECHNICAL REPORT BORE HOLES CB15 AND CB17 AND SOIL PRESSURE UNDER BLINDING SLAB HAS KEPT TO UNDER 50KPa TO MINIMISE SETTLEMENT OF THE NEW CHAMBER.
6. TEMPORARY DEWATERING OR DRAINAGE SHALL BE PROVIDED ON SITE TO ENSURE NO GROUND WATER INGRESS TO THE EXCAVATION DURING CONSTRUCTION.
7. ALL EXPOSED ANGLES TO HAVE 25mm CHAMFERS - TYP.
8. 350 DENOTES MINIMUM SLAB THICKNESS
NOTE: FOR GENERAL NOTES REFER TO DRG No 486/5/5-0046-200
NOTE: BUILDER TO CONTACT HOBAS TECHNICAL REP WHEN PIPE EXPOSED TO DETERMINE EXACT O.D. HOBAS REP WILL THEN FABRICATE SUITABLE THRUST FLANGE AND PREPARE PIPE SURFACE AND INSTALL IN ACCORDANCE WITH THEIR DETAILS.
GRP 'HOBAS' PIPE
AS CONSTRUCTED DETAILS FOR AMEND
I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE TRUE AND ACCURATE RECORD OF THE WORKS
SIGNED DATE:
NAME of SIGNATORY
RPEQ No. or LICENCE
COMPANY NAME
START DATE FINISH DATE
P2 24.7.09 DE-AERATION CHAMBER REVISED AS DISCUSSED
P1 15.7.09 PRELIMINARY FOR FINAL APPROVAL
00 12.5.09 FOR INFORMATION ONLY
0 19.10.09 ISSUED FOR CONSTRUCTION
P3 21.8.09 DE-AERATION CHAMBER DIMENSIONS REVISED
Simmonds & Bristow Pty. Ltd
thomas &coffey
HENRY & HYMAS
PROJECT GIBSON ISLAND WATER RECLAMATION PLANT FINAL SETTLING TANK CAPACITY UPGRADE
DRAWING TITLE DE-AERATION CHAMBER LAYOUT PLAN AND SECTIONS
SHEET No.10 OF 15
WATER DISTRIBUTION DRAWING No. 486/5/5-0046-209
AMEND. 0

QUEENSLAND UrbanUtilities

GIBSON ISLAND WASTE WATER RECLAMATION PLANT

CAPACITY UPGRADE

RAS PIT CUT IN – SHUTDOWN PROCEDURE

DOCUMENT APPROVAL

NAME	SECTION	SIGNATURE
MICHEAL BARTON	QUU PRINCIPAL OPERATIONS ENGINEER	
PHILIP GOODING	T&C PROJECT MANAGER	
PAUL FISHER	QUU CONTACTS MANAGER	

SHUTDOWN PROCEDURE – RAS PIT CUT IN

1 SHUTDOWN PROCEDURE – RAS PIT CUT IN

1.1 PURPOSE

This procedure outlines how to temporarily stop sewage feed to the Bioreactor at the Gibson Island Waste Water Treatment Plant and perform the RAS pit cut in for FST 7 & 8.

QUU will manage the operational aspects of the partial shutdown; T&C will manage the construction works associated with the cut in.

1.2 SCOPE OF WORK

Scope of Work:

- Isolation of flow – Stop Raw Sewage feed to plant and related plant processes - QUU
- Complete RAs pit cut In – T&C
- Reinstate flow – Start raw sewage feed to plant and related plant processes - QUU

1.3 RISK MANAGEMENT PLAN

Reference: Safe Work Method Statement (SWMS)

Permit to work

1.4 KEY TASKS

Activity	Date/Time	Description	Who
		Preparation	
A1	Week before	Notify the following representatives of anticipated shutdown (shutdown period and date): - Sewage Networks (Keane White) - Gibson Island AWTP (Bradley Rhodes) - Tanker Reuse Facility (Tan Trieu) - ATC North Reuse Facility (Don Crook) - Trade Waste Customers (Russell Miller)	QUU Process Engineer
B1	3 days before day of work	Check weather forcast, consider cancellation in the event of significant rainfall - Notify Process Engineer.	Operator
C1	1 Day before day of work	Check weather forcast, consider cancellation in the event of significant rainfall - Notify Process Engineer.	Operator
C2	1 Day before day of work	Check flow into plant and if greater than ADWF – consider cancellation of job	Process Engineer
C3	1 Day before day of work	If no rain forcast, **DISABLE flow smoothing control** for scheduled shutdown (for extra buffer capacity in Wet Well)	Operator

		Shutdown Sequence	
D2	Night of Work	T&C to complete permit to work and provide a SWMS/JSEA prior to commencing shutdown	T&C
D3	Night of Work	Notify the following representatives of confirmed shutdown: - **Sewage Networks** (Control Room) - **Gibson Island AWTP** (Control Room)	Operator
D4	Night of Work	**Equipment shutdown:** • **Belt Filter Presses** – Shutdown Belt Filter Presses by changing Belt Press Availability on Citect SCADA to ZERO (0) • **ATC North Facility** – Shutdown ATC North Facility by clicking **shutdown mode** on Citect SCADA. • **Tanker Reuse facility may require shutdown and SMS sent if storage used up during shutdown.**	Operator
D5	Night of Work	**Raw Sewage Pumps:** • **Raw Sewage Pumps (1-3)** – Shutdown pumps by placing in local manual and shutdown. **Place out of service tags on all pump Auto/Manual switches. T&C representative also to place out of service tags.**	Operator/T&C
D6	Night of Work	**RAS Pump Station:** • **RAS Inlet Control Valves** – Place Inlet Control Valve 1&2 in manual and close. **Place out of service tags on**	Operator

		both valve Auto/Manual switches. • **RAS Pumps (1-3) –** Allow the RAS pumps to run until the stop on low level. Place 1 pump into manual and operate until RAS pit is adequately drained. **Switch off pumps and place out of service tags on all pump Auto/Manual switches.**	
D7	Night of Work	• **Isolate scum sprays to both bioreactors**	
D8	Night of Work	**Monitoring checks during shutdown:** • **Monitor Inlet Sewer Wet Well level –** Citect SCADA trends to monitor sewer surcharge levels. **All works should be suspended once the wet well reaches 45%** to allow plant to be operational before surcharge imminent level of 57%. **Remain in communication with T&C regarding work progress and well levels. Forewarn T&C if the plant is needed to be brought back online prior to job compeletion.** • **Monitor blower and DO controls –** The aeration system should shutdown online blowers and ramp down to 1 HV turbo blower at relatively closed IGV position. There is potential for high header pressures and maybe necessary to put blower control into **fixed pressure control** and **adjust header pressure setpoint to 50kPa**. This will result in single blower operating at minimum output and prevent over aeration. • **Monitor FST tanks–** Ensure there is no evidence of rising sludge if so then the shutdown is to be terminated.	Operator

Restart Sequence			
E1	Morning of Work	**Screenings & Raw Sewage Pumps:** • **Screenings** – Ensure the screenings system is available • **Raw Sewage Pumps (1-3)** – Ensure the 3Q and 4Q modes of RS Pump Station control are inhibited. **Remove out of service tags on all pump Auto/Manual switches**. Reinstate pumps to Auto operation.	Operator
E2	Morning of Work	**FST Tank Checks:** • **FST Tank Level** – Check the level in all FSTs and confirm effluent flow is relatively constant over the v-notch weirs before starting RAS pumps • **FST Syphon pumps** – Confirm pumps have been primed	Operator
E3	Morning of Work	**RAS Pump Station:** • **RAS Pumps (1-3)** – **Remove out of service tags on all pump Auto/Manual switches.** Place pumps into Auto. • **RAS Inlet Control Valves** – **Remove out of service tags on both valve Auto/Manual switches.** Place valves into remote manual mode and slowly open RAS control valves. Wait and monitor RAS flow until it has reached approx. 200L/s. Check updraft tubes on all FSTs and ensure syphon primed. When RAS flows from FSTs are steady, place RAS valves into auto (**RAS flows will continue to open till 290L/s is reached**)	Operator
E4	Morning of Work	**Aeration Control:** • **Blower and DO control:** Leave the blower in fixed header control and wait until system is operating at reasonable DO control. When this is achieved, revert all blowers and aeration control valves into **Auto/Cascade mode** and operating in **floating/optimised Header Pressure** control	Operator
E5	Morning of Work	**Equipment restart:** • **Scum Harvesters** – Restart scum harvesters • **Belt Filter Presses** – Restart Belt Filter Presses by changing Belt Press Availability on Citect SCADA to required operational levels (all 3 presses running) • **ATC North Facility** – **Turn on all pumps and place them into auto**. Restart ATC North Facility by clicking **Reset shutdown mode** on Citect SCADA.	Operator
E6	Morning of Work	Notify the following representatives of confirmed restart:	Operator

		- **Sewage Networks** (Control Room) - **Gibson Island AWTP** (Control Room) - **Tanker Reuse Facility** (Tan Trieu) - **ATC North Reuse Facility** (Don Crook) - **Trade Waste Customers** (Russell Miller)	
E7	Following Day	**Monitoring checks after restart:** • **Monitor FST blankets** – Monitor blanket levels and ensure there is no evidence of rising sludge • **Inlet Sewer Wet Well level** – If blankets are steady, output of Raw Sewage Pump can be increased towards 800L/s. Pumps should operate under normal control. Continue to monitor well levels. • **Monitor RAS flows** – Continue to monitor RAS flows on FSTs to ensure good updraft and syphon. • **Monitor blower and DO controls** – Check that DO control is returning to normal operation	Operator

1.5 COMMUNICATION PLAN

Phone contact numbers

Gibson Island WRP Operator	07 3407 8811
Area Controller (North) - Tony Murphy	0404 086 127
Process Operations Engineer – Andy Constantinou	0488 734 830
M&E Foreman - Dylan Jones	0419 666 940
QUU WH&S Officer	0439671679 / 0416013860
QUU Contract Manager	0414576380

Other useful numbers: BY QUU

Name	Company	Contact
Keane White	BCC WD – Sewage Networks	0413 723 741
Bradley Rhodes	Veolia - Gibson Island AWTP	0439 414 223
Tan Trieu	BCC WD – Product Water Quality (Tanker Reuse)	0419 707 051
Don Crook	BCC WD – Business Management (ATC customers)	0407 111 640
Russell Miller	BCC WD – Trade Waste (GI WRP catchment)	0419 707 059

1.6 METHODOLOGY

1.6.1 Cut In Phase

The cut in to the RAS pit will need to undertaken over the period of 2 shutdowns. The first shutdown will be the only time that the works will ***not*** be able to be suspended before the hold point. As a result of this it will be necessary to check for the possibility of rain immediately prior to cutting through the wall of the RAS pit. It will also be prudent to keep a check on the weather at half hourly intervals; this can be done by either the designated QUU operator or the T&C representative.

Thomas and Coffey will endeavour to complete as many tasks as possible prior to the first shutdown, including core drilling half way through the RAS wall during the day before the shut down. (Size of core 700mm in diameter)

Once the hole is cut and the RAS pit cleaned the 450DICL pipe complete with puddle flange will be installed. A stainless steel split yoke will then be fitted to seal the pipe and the wall. There will be the need to install dynabolts to hold this to the wall. Once this is complete the plant will then be able to be put back on line if needed.

Thomas and Coffey recognise the importance of minimising the number of plant shut downs, and with this in mind we would complete some of the tasks from shutdown 2 if possible.

Once the puddle flange is in the correct location the grout will poured as per the specification, from the outside.

During the second shutdown it will be possible to suspend the works at any time. The remaining works are the installation of the 2 bends inside the RAS pit and the installation of the curved baffle.

Activity	Description	Who	Materials
Pre Cut In Phase			
1	Excavate 450mm diameter RAS line trench	Setlow	Excavator
2	Set up concrete core drill		
3	Core drill half way through wall. Physical stop must be employed to ensure correct depth.		
4	Leave core drill attached to wall for shut down.		

1.6.2 Cut In Phase – Shutdown Number 1

Activity	Description	Who	Task time
	Cut In Phase		
1	Clean inside of RAS Pit	QUU	1hr
2	Check weather Radar for possible rain event immediately prior to continuing the core drilling	QUU, T&C	
3	Continue core drilling RAS wall	Setlow	2hrs
4	Remove core drill	Setlow	½ hr
5	Install pipe work, including sealing yoke & pipe blank.	Setlow	¾ hr
	Possible Hold Point		3.25 hrs
6	Pour grout from outside.	Setlow	
7	Install piping and valve outside		
8	Hand back permits to QUU	Setlow	

Note: All timings are estimations only

Cut In Phase – Shut down Number 2

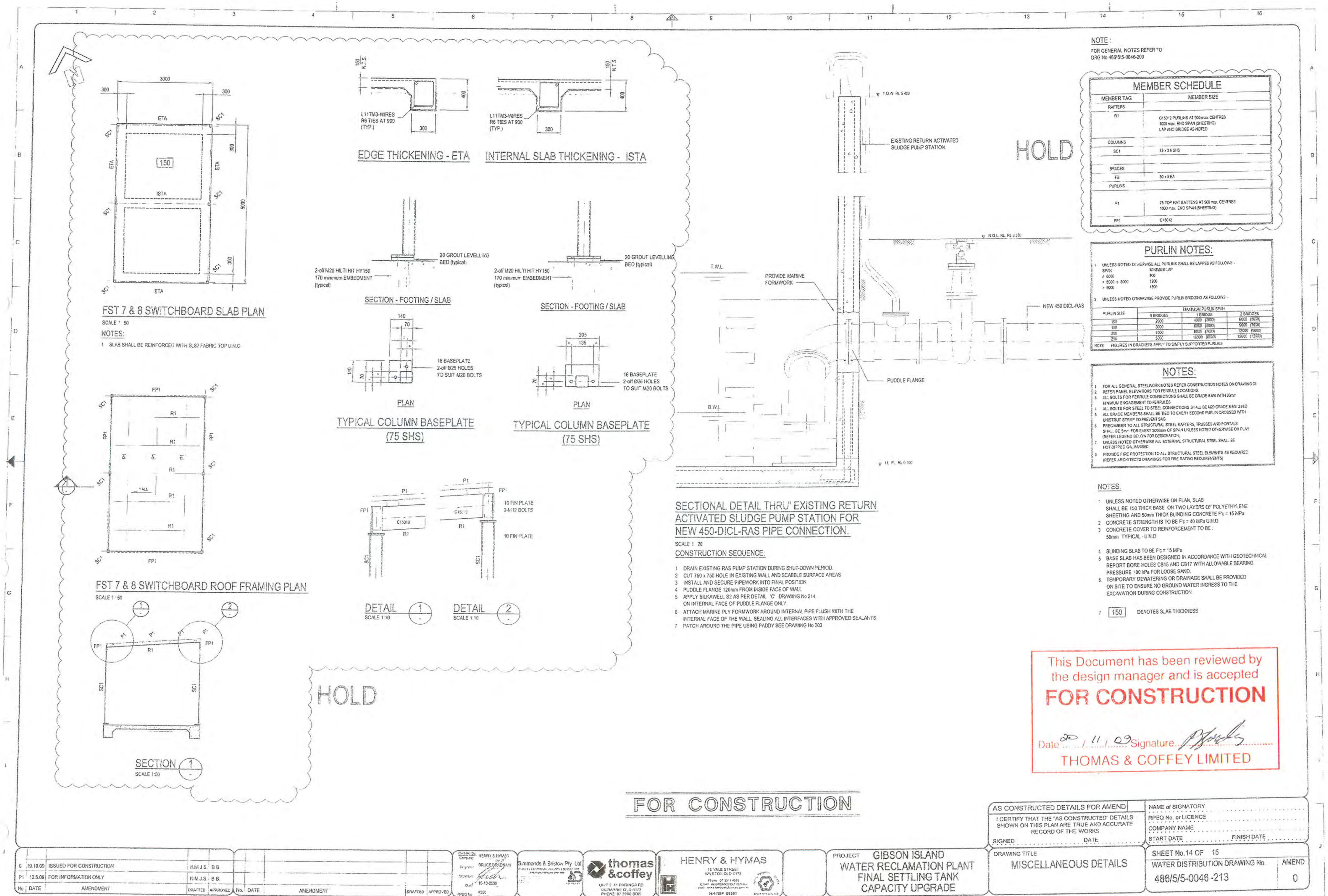
Activity	Description	Who	Task Time
	Cut In Phase		
1	Clean inside of RAS Pit	QUU,Setlow	1hr
2	Place pre cast concrete sacrfical pad.	Setlow	½ hr
3	Install pipe work on inside of RAS pit	Setlow	2 hrs
4	Place stainless steel baffle and drill holes	Setlow	1 hr
5	Install dyna bolts and tighten	Setlow	1 hr
8	Remove all equipment	Setlow	1/2
9	Hand back permits to QUU	Setlow	
	Total Time		6 hrs

1.7 RELEVANT DOCUMENTATION

To assist in the successful delivery of the shutdown the following documents should be used in conjunction with this document;

Thomas and Coffey Safe Work Method Statement.

Drawing 486/5/5-0046-213 Amend O: *Miscellaneous Details*


FST 7 & 8 SWITCHBOARD SLAB PLAN
SCALE 1:50
NOTES:
1 SLAB SHALL BE REINFORCED WITH SL82 FABRIC TOP U.N.O
EDGE THICKENING - ETA
INTERNAL SLAB THICKENING - ISTA
SECTION - FOOTING / SLAB
20 GROUT LEVELLING BED (typical)
2-off M20 HILTI HIT HY150 170 minimum EMBEDMENT (typical)
16 BASEPLATE 2-off Ø26 HOLES TO SUIT M20 BOLTS
PLAN
TYPICAL COLUMN BASEPLATE (75 SHS)
FST 7 & 8 SWITCHBOARD ROOF FRAMING PLAN
SCALE 1:50
DETAIL 1 SCALE 1:10
DETAIL 2 SCALE 1:10
SECTION 1 SCALE 1:50
HOLD
EXISTING RETURN ACTIVATED SLUDGE PUMP STATION
PROVIDE MARINE FORMWORK
NEW 450 DICL-RAS
PUDDLE FLANGE
SECTIONAL DETAIL THRU' EXISTING RETURN ACTIVATED SLUDGE PUMP STATION FOR NEW 450-DICL-RAS PIPE CONNECTION.
SCALE 1:20
CONSTRUCTION SEQUENCE:
1 DRAIN EXISTING RAS PUMP STATION DURING SHUT-DOWN PERIOD.
2 CUT 750 x 750 HOLE IN EXISTING WALL AND SCABBLE SURFACE AREAS
3 INSTALL AND SECURE PIPEWORK INTO FINAL POSITION
4 PUDDLE FLANGE 120mm FROM INSIDE FACE OF WALL
5 APPLY SILKAWELL S2 AS PER DETAIL 'C' DRAWING No 214. ON INTERNAL FACE OF PUDDLE FLANGE ONLY
6 ATTACH MARINE PLY FORMWORK AROUND INTERNAL PIPE FLUSH WITH THE INTERNAL FACE OF THE WALL, SEALING ALL INTERFACES WITH APPROVED SEALANTS
7 PATCH AROUND THE PIPE USING PADDY SEE DRAWING No 203
NOTE:
FOR GENERAL NOTES REFER TO DRG No 486\5\5-0046-200
MEMBER SCHEDULE
MEMBER TAG | MEMBER SIZE
RAFTERS
R1 | C15012 PURLINS AT 900 max. CENTRES 1000 max. END SPAN (SHEETING) LAP AND BRIDGE AS NOTED
COLUMNS
SC1 | 75 x 3.0 SHS
BRACES
FB | 50 x 5 EA
PURLINS
P1 | 75 TOP HAT BATTENS AT 900 max. CENTRES 1000 max. END SPAN (SHEETING)
FP1 | C15012
PURLIN NOTES:
1 UNLESS NOTED OTHERWISE ALL PURLINS SHALL BE LAPPED AS FOLLOWS:-
SPAN | MINIMUM LAP
≤ 6000 | 900
> 6000 ≤ 8000 | 1200
> 8000 | 1500
2 UNLESS NOTED OTHERWISE PROVIDE PURLIN BRIDGING AS FOLLOWS:-
PURLIN SIZE | MAXIMUM PURLIN SPAN: 0 BRIDGES | 1 BRIDGE | 2 BRIDGES
100 | 2000 | 4000 (3000) | 6000 (5000)
150 | 3000 | 6000 (5000) | 9000 (7000)
200 | 4000 | 8000 (7000) | 12000 (9000)
250 | 5000 | 10000 (8000) | 15000 (12000)
NOTE FIGURES IN BRACKETS APPLY TO SIMPLY SUPPORTED PURLINS
NOTES:
1 FOR ALL GENERAL STEELWORK NOTES REFER CONSTRUCTION NOTES ON DRAWING 01
2 REFER PANEL ELEVATIONS FOR FERRULE LOCATIONS.
3 ALL BOLTS FOR FERRULE CONNECTIONS SHALL BE GRADE 8.8/S WITH 30mm MINIMUM ENGAGEMENT TO FERRULES
4 ALL BOLTS FOR STEEL TO STEEL CONNECTIONS SHALL BE M20 GRADE 8.8/S U.N.O
5 ALL BRACE MEMBERS SHALL BE TIED TO EVERY SECOND PURLIN CROSSED WITH UNISTRUT STRAP TO PREVENT SAG
6 PRECAMBER TO ALL STRUCTURAL STEEL RAFTERS, TRUSSES AND PORTALS SHALL BE 5mm FOR EVERY 2000mm OF SPAN UNLESS NOTED OTHERWISE ON PLAN (REFER LEGEND BELOW FOR DESIGNATION)
7 UNLESS NOTED OTHERWISE ALL EXTERNAL STRUCTURAL STEEL SHALL BE HOT DIPPED GALVANISED.
8 PROVIDE FIRE PROTECTION TO ALL STRUCTURAL STEEL ELEMENTS AS REQUIRED (REFER ARCHITECTS DRAWINGS FOR FIRE RATING REQUIREMENTS)
NOTES.
1 UNLESS NOTED OTHERWISE ON PLAN, SLAB SHALL BE 150 THICK BASE ON TWO LAYERS OF POLYETHYLENE SHEETING AND 50mm THICK BLINDING CONCRETE F'c = 15 MPa
2 CONCRETE STRENGTH IS TO BE F'c = 40 MPa U.N.O
3 CONCRETE COVER TO REINFORCEMENT TO BE: 50mm TYPICAL - U.N.O
4 BLINDING SLAB TO BE F'c = 15 MPa
5 BASE SLAB HAS BEEN DESIGNED IN ACCORDANCE WITH GEOTECHNICAL REPORT BORE HOLES CB15 AND CB17 WITH ALLOWABLE BEARING PRESSURE 100 kPa FOR LOOSE SAND.
6 TEMPORARY DEWATERING OR DRAINAGE SHALL BE PROVIDED ON SITE TO ENSURE NO GROUND WATER INGRESS TO THE EXCAVATION DURING CONSTRUCTION.
7 150 DENOTES SLAB THICKNESS
This Document has been reviewed by the design manager and is accepted
FOR CONSTRUCTION
Date 20 / 11 / 09 Signature
THOMAS & COFFEY LIMITED
FOR CONSTRUCTION
AS CONSTRUCTED DETAILS FOR AMEND
I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE TRUE AND ACCURATE RECORD OF THE WORKS
SIGNED DATE
NAME of SIGNATORY
RPEQ No. or LICENCE
COMPANY NAME
START DATE FINISH DATE
0 19.10.09 ISSUED FOR CONSTRUCTION KM.J.S. B.B.
P1 12.5.09 FOR INFORMATION ONLY KM.J.S. B.B.
No DATE AMENDMENT DRAFTED APPROVED
Simmonds & Bristow Pty Ltd
thomas &coffey
HENRY & HYMAS
PROJECT GIBSON ISLAND WATER RECLAMATION PLANT FINAL SETTLING TANK CAPACITY UPGRADE
DRAWING TITLE MISCELLANEOUS DETAILS
SHEET No. 14 OF 15
WATER DISTRIBUTION DRAWING No. 486/5/5-0046-213
AMEND 0

5. Appendices

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