CIC - Googong Potable + Non-Potable Reservoirs - Maximum Demand Estimation (Rev. C)

Item No.	Reservoirs	(P1) Rating per Unit kW	FLC, (A) per Drive or Equip	Motor Eff, (%)	pf	No of Units	No of Units running	Sub Total FLC, (A)	Diversity Factor	Total Current Drawn with Diversity Factor (A)	Total Power Absorbed, kW	Total Power Absorbed, kVA	Starting Method	Comment
1	Mixers (0.55 load - use standard motor - 0.55kW for estimate)	0.55	1.45	72	0.74	4	4	5.78	1.0	5.78	3.08	4.16	DOL	
2	Actuated Inlet Control Valves	0.75	1.78	83	0.71	6	6	10.69	1.0	10.69	5.45	7.68	DOL	
3	Chemical Dosing Facility (0.55 load - use standard motor - 0.55kW for estimate)	1.50	3.07	72	0.95	1	1	3.07	1.0	3.07	2.10	2.21	VSD	
4	Lighting and General Power Supply	2.00	3.44	90	0.9	1	1	3.44	0.5	1.72	1.11	1.23		
	Total:									**21.26**	**11.74**	**15.28**		
	Total (with 30% Spare Capacity):									**27.64**	**15.26**	**19.87**		

Estimated power capacity required is approximately (Includes 30% spare capacity)	**20**	**kVA**	**or**	**15**	**kW**

Formulas

Total Power Absorbed (kW) = 1.732 x Line Voltage x (FLC per drive) x pf x (No of Units running) x (Diversity Factor) / 1000
Total Power absorbed (kVA) = 1.732 x Line Voltage x (FLC per drive) x (No of Units running) x (Diversity Factor) / 1000
FLC per drive = (kW Rating per Unit) x 1000 / 1.732 / Line Voltage / [(Motor Eff) /100] / pf
Sub Total FLC = (kW Rating per Unit) x 1000 / 1.732 / Line Voltage / [Motor Eff/100] / pf x (No of Units running)

Assumption:

1. For DOL drive, the power factor is estimated to be same as the motor if there is insufficient information provided for the motor drive (the above estimate is based on TECO motor data)
2. For VSD drive, the power factor is estimated to be 0.95 if there is insufficient information provided for the motor drive
3. For Soft Starter drive, the power factor is estimated to be 0.90 if there is insufficient information provided for the motor drive
4. Assumption has been made on the diversity factor that duty/standby arrangement of identical motor drives will be configurated amongst MCC/SCA.
5. Miscellaneous single phase loads are assumed to be connected across 3 phases in a balanced loads configuration.

CIC - Googong High Level Reservoir (Potable + Non-Potable) - Maximum Demand Estimation (Rev. C)

Item No.	Reservoirs	(P1) Rating per Unit kW	FLC, (A) per Drive or Equip	Motor Eff, (%)	pf	No of Units	No of Units running	Sub Total FLC, (A)	Diversity Factor	Total Current Drawn with Diversity Factor (A)	Total Power Absorbed, kW	Total Power Absorbed, kVA	Starting Method	Comment
1	Pump 1	5.50	10.19	91	0.83	1	1	10.19	1.0	10.19	6.08	7.32	DOL	
2	Pump 2	5.50	10.19	91	0.83	1	0	0.00	0.0	0	0.00	0.00	DOL	
3	Pump 3	30.00	50.77	95	0.87	1	1	50.77	1.0	50.77	31.75	36.49	DOL	
4	Pump 4	30.00	50.77	95	0.87	1	0	0.00	0.0	0	0.00	0.00	DOL	
5	Chemical Dosing Facility (0.55 load - use standard motor - 0.55kW for estimate)	1.50	3.07	72	0.95	1	1	3.07	1.0	3.07	2.10	2.21	VSD	
6	Actuated Inlet Control Valves	0.75	1.78	83	0.71	2	2	3.56	1.0	3.56	1.82	2.56	DOL	
7	Lighting and General Power Supply	2.00	3.44	90	0.9	1	1	3.44	0.5	1.72	1.11	1.23		
	Total:									**69.31**	**42.85**	**49.82**		
	Total (with 30% Spare Capacity):									**90.10**	**55.71**	**64.76**		

Estimated power capacity required is approximately (Includes 30% spare capacity)	**65**	**kVA**	**or**	**56**	**kW**

Formulas

Total Power Absorbed (kW) = 1.732 x Line Voltage x (FLC per drive) x pf x (No of Units running) x (Diversity Factor) / 1000
Total Power absorbed (kVA) = 1.732 x Line Voltage x (FLC per drive) x (No of Units running) x (Diversity Factor) / 1000
FLC per drive = (kW Rating per Unit) x 1000 / 1.732 / Line Voltage / [(Motor Eff) /100] / pf
Sub Total FLC = (kW Rating per Unit) x 1000 / 1.732 / Line Voltage / [Motor Eff/100] / pf x (No of Units running)

Assumption:

1. For DOL drive, the power factor is estimated to be same as the motor if there is insufficient information provided for the motor drive (the above estimate is based on TECO motor data)
2. For VSD drive, the power factor is estimated to be 0.95 if there is insufficient information provided for the motor drive
3. For Soft Starter drive, the power factor is estimated to be 0.90 if there is insufficient information provided for the motor drive
4. Assumption has been made on the diversity factor that duty/standby arrangement of identical motor drives will be configurated amongst MCC/SCA.
5. Miscellaneous single phase loads are assumed to be connected across 3 phases in a balanced loads configuration.

CIC - Googong BWPS- Maximum Demand Estimation (Rev. D)

Item No.	BWPS	(P1) Rating per Unit kW	FLC, (A) per Drive or Equip	Motor Eff, (%)	pf	No of Units	No of Units running	Sub Total FLC, (A)	Diversity Factor	Total Current Drawn with Diversity Factor (A)	Total Power Absorbed, kW	Total Power Absorbed, kVA	Starting Method	Comment
1	Potable Supply Pump 1 (60kW pumpset)	60.00	91.24	96	0.95	1	1	91.24	1.0	91.24	62.31	65.58	VSD	
2	Potable Supply Pump 2 (60kW pumpset)	60.00	91.24	96	0.95	1	1	91.24	1.0	91.24	62.31	65.58	VSD	
3	Potable Supply Pump 3 (60kW pumpset)	60.00	91.24	96	0.95	1	0	0.00	0.0	0	0.00	0.00	VSD	
4	Potable Top Up of Recycled Pump 1 (75kW pumpset)	75.00	114.06	96	0.95	1	1	114.06	1.0	114.06	77.88	81.98	VSD	
5	Potable Top Up of Recycled Pump 2 (75kW pumpset)	75.00	114.06	96	0.95	1	1	114.06	1.0	114.06	77.88	81.98	VSD	
6	Potable Top Up of Recycled Pump 3 (75kW pumpset)	75.00	114.06	96	0.95	1	0	0.00	0.0	0	0.00	0.00	VSD	
7	Lighting and General Power Supply	2.00	3.44	90	0.9	1	1	3.44	0.5	1.72	1.11	1.23		
8	Air Conditioning	20.00	34.35	90	0.9	1	1	34.35	1.0	34.35	22.22	24.69	DOL	
	Total:									**446.67**	**303.71**	**321.06**		
	Total (with 30% Spare Capacity):									**580.67**	**394.82**	**417.37**		

Estimated power capacity required is approximately (Includes 30% spare capacity)	**417**	**kVA**	**or**	**395**	**kW**

Formulas

Total Power Absorbed (kW) = 1.732 x Line Voltage x (FLC per drive) x pf x (No of Units running) x (Diversity Factor) / 1000
Total Power absorbed (kVA) = 1.732 x Line Voltage x (FLC per drive) x (No of Units running) x (Diversity Factor) / 1000
FLC per drive = (kW Rating per Unit) x 1000 / 1.732 / Line Voltage / [(Motor Eff) /100] / pf
Sub Total FLC = (kW Rating per Unit) x 1000 / 1.732 / Line Voltage / [Motor Eff/100] / pf x (No of Units running)

Assumption:

1. For DOL drive, the power factor is estimated to be same as the motor if there is insufficient information provided for the motor drive (the above estimate is based on TECO motor data)
2. For VSD drive, the power factor is estimated to be 0.95 if there is insufficient information provided for the motor drive
3. For Soft Starter drive, the power factor is estimated to be 0.90 if there is insufficient information provided for the motor drive
4. Assumption has been made on the diversity factor that duty/standby arrangement of identical motor drives will be configurated amongst MCC/SCA.
5. Miscellaneous single phase loads are assumed to be connected across 3 phases in a balanced loads configuration.

Googong WRP - Maximum Demand Estimation (Rev. D) - Stage 4 Ultimate Stage

Item No.	This calculation is to determine the maximum power consumption of the site in Ultimate	(P1) Rating per Unit kW	FLC, (A) per Drive or Equip	Motor Eff, (%)	pf	No of Units	No of Units running	Sub Total FLC, (A)	Diversity Factor	Total Current Drawn with Diversity Factor (A)	Total Power Absorbed (kW)	Total Power Absorbed (kVA)	Starting Method	Comment
1	6mm Screen	1.10	2.03	86	0.88	2	1	2.03	1.0	2.0	1.3	1.5	DOL	
2	1 mm Sceen	1.10	2.03	86	0.88	2	1	2.03	1.0	2.0	1.3	1.5	DOL	
3	Screw Washpress	1.50	3.12	87	0.77	2	1	3.12	1.0	3.1	1.7	2.2	DOL	
4	Outloading conveyor / launder channel	2.20	4.17	89	0.83	1	1	4.17	1.0	4.2	2.5	3.0	DOL	
5	Automatic Penstocks	0.18	0.56	64	0.70	4	2	1.13	1.0	1.1	0.6	0.8	DOL	(0.16kW pumpset - use TECO standard Motor size - 0.18kW for estimate)
6	Screenings Bins	1.50	3.12	87	0.77	2	1	3.12	1.0	3.1	1.7	2.2	DOL	
7	Grit Removal Blower	2.20	4.17	89	0.83	1	1	4.17	1.0	4.2	2.5	3.0	DOL	
8	Grit Classifier	1.50	3.12	87	0.77	1	1	3.12	1.0	3.1	1.7	2.2	DOL	
9	Ferric Sulphate Dosing Pumps	1.10	1.87	86	0.95	2 x 3	4	7.49	1.0	7.5	5.1	5.4	VSD	
10	Carbon dosing (liquid sugar) Dosing Pumps	0.55	1.13	72	0.95	2 x 3	4	4.51	1.0	4.5	3.1	3.2	VSD	
11	Magnesium Hydroxide Dosing Pumps	0.55	1.13	72	0.95	2 x 3	4	4.51	1.0	4.5	3.1	3.2	VSD	
12	Citric Acid Dosing Pumps	0.37	0.99	75	0.70	2	1	0.99	1.0	1.0	0.5	0.7	DOL	(0.25kW pumpset - use TECO standard Motor size - 0.37kW for estimate)
13	Citric Acid Dosing Pumps 2	0.37	0.99	75	0.70	1	1	0.99	1.0	1.0	0.5	0.7	DOL	(0.25kW pumpset - use TECO standard Motor size - 0.37kW for estimate)
14	Sodium Hypochlorite Dosing Pumps	0.55	1.13	72	0.95	3	2	2.25	1.0	2.3	1.5	1.6	VSD	
15	Polymer Transfer Pump	0.37	0.99	75	0.70	1	1	0.99	1.0	1.0	0.5	0.7	DOL	(0.25kW pumpset - use TECO standard Motor size - 0.37kW for estimate)
16	Polymer Blending Pump	0.37	0.99	75	0.70	1	1	0.99	1.0	1.0	0.5	0.7	DOL	(0.25kW pumpset - use TECO standard Motor size - 0.37kW for estimate)
17	Polymer Dosing Pump	0.37	0.73	75	0.95	2 x 2	2	1.45	1.0	1.5	1.0	1.0	VSD	(0.25kW pumpset - use TECO standard Motor size - 0.37kW for estimate)
18	A-MLR pumps	2.20	3.64	89	0.95	4	4	14.56	1.0	14.6	9.9	10.5	VSD	
19	S MLR pumps (Membrane Feed Pump)	4.00	6.51	90	0.95	4 x 2	4	26.04	1.0	26	18	19	VSD	
20	Permeate Pumps	5.50	8.85	91	0.95	2 x 3	4	35.40	1.0	35	24	25	VSD	
21	Aeration Blowers	37.00	57.04	95	0.95	3 each per 2 bioreactors	4	228.15	1.0	228	156	164	VSD	
22	Membrane Blowers	37.00	57.04	95	0.95	2 each per 2 bioreactors	2	114.07	1.0	114	78	82	VSD	
23	WAS pumps	1.50	3.12	87	0.77	2	1	3.12	1.0	3.1	1.7	2.2	DOL	
24	Scum Scraper	1.10	2.03	86	0.88	4	2	4.07	1.0	4.1	2.6	2.9	DOL	
25	Scum Pump	1.10	2.03	86	0.88	4	2	4.07	1.0	4.1	2.6	2.9	DOL	
26	Mixers	0.18	0.56	64	0.70	16	16	9.01	1.0	9.0	4.5	6.5	DOL	(0.12kW Mixer - use TECO standard Motor size - 0.18kW for estimate)
27	Membrane Tank Drain Pumps	0.75	1.64	85	0.76	2	1	1.64	1.0	1.6	0.9	1.2	DOL	
28	UV disinfection	7.50	12.20	90	0.95	4	4	48.82	1.0	49	33	35	DOL	(5.9kW loads - assume to use standard 7.5kW DOL starter
29	CCT Mixers	0.18	0.56	64	0.70	4	4	2.25	1.0	2.3	1.1	1.6	DOL	(0.12kW Mixer - use TECO standard Motor size - 0.18kW for estimate)
30	RE pumps	30.00	46.49	95	0.95	2	1	46.49	1.0	46	32	33	VSD	
31	WRP Pumps	185.00	283.69	96	0.95	2	1	283.69	1.0	284	194	204	VSD	(175kW pumpset - use TECO standard Motor size - 185kW for estimate)
32	Basin No.1 Pumps	55.00	84.34	96	0.95	2	1	84.34	1.0	84	58	61	VSD	
33	Digester Mixers	0.55	1.45	72	0.74	8	8	11.57	1.0	11.6	6.2	8.3	DOL	

Googong WRP - Maximum Demand Estimation (Rev. D) - Stage 4 Ultimate Stage

Item No.	This calculation is to determine the maximum power consumption of the site in Ultimate	(P1) Rating per Unit kW	FLC, (A) per Drive or Equip	Motor Eff, (%)	pf	No of Units	No of Units running	Sub Total FLC, (A)	Diversity Factor	Total Current Drawn with Diversity Factor (A)	Total Power Absorbed (kW)	Total Power Absorbed (kVA)	Starting Method	Comment
34	Flocculation Mixer	0.37	0.73	75	0.95	1	1	0.73	1.0	0.7	0.5	0.5	VSD	(0.25kW pumpset - use TECO standard Motor size - 0.37kW for estimate)
35	Rotary Drum Thickener	0.75	1.64	85	0.76	2	1	1.64	1.0	1.6	0.9	1.2	DOL	
36	Centrifuge Feed pumps	0.75	1.64	85	0.76	3	2	3.27	1.0	3.3	1.8	2.4	DOL	
37	Dewatering Centrifuges - Main	18.00	31.34	94	0.85	2	1	31.34	1.0	31	19	23	DOL	(18kW load - use TECO standard Motor size - 18.5kW for estimate)
38	Dewatering Centrifuge - Back	3.00	5.98	90	0.78	2	1	5.98	1.0	6.0	3.4	4.3	DOL	
39	Digester Blowers	3.00	4.91	90	0.95	3	2	9.82	1.0	9.8	6.7	7.1	VSD	
40	Allowance for automatic valves	0.75	1.64	85	0.76	30	15	24.53	1.0	25	13	18	DOL	
41	Potable Water Booster Pumps	5.50	9.89	91	0.85	2	1	9.89	1.0	9.9	6.0	7.1	DOL	
42	Compressor (incl. Air dryer)	4.00	6.95	90	0.89	2	1	6.95	1.0	7.0	4.4	5.0	DOL	
43	First Flush Pumps	0.18	0.56	64	0.70	2	1	0.56	1.0	0.6	0.3	0.4	DOL	(0.12kW Pumpset - use TECO standard Motor size - 0.18kW for estimate)
44	Foul Water Return Pumps	0.55	1.45	72	0.74	2	1	1.45	1.0	1.5	0.8	1.0	DOL	
45	Recirculation Pumps	0.18	0.56	64	0.70	4	2	1.13	1.0	1.1	0.6	0.8	DOL	(0.09kW Pumpset - use TECO standard Motor size - 0.18kW for estimate)
46	Nutrient Dosing Pumps	0.18	0.56	64	0.70	2	1	0.56	1.0	0.6	0.3	0.4	DOL	(0.12kW Pumpset - use TECO standard Motor size - 0.18kW for estimate)
47	Heater	75.00	115.01	96	0.95	1	1	115.01	1.0	115	79	83	VSD	
48	Fans	37.00	57.04	95	0.95	3	2	114.07	1.0	114	78	82	VSD	
49	Uninterruptible Power Supply (UPS)	80.00	123.32	95	0.95	1	1	123.32	1.0	123	84	89		
50	Lighting and General Power Supply	60.00	103.06	90	0.9	1	1	103.06	0.5	51.53	33.33	37.04		
51	Air Conditioning	150.00	257.64	90	0.9	1	1	257.64	1.0	257.64	166.67	185.19	DOL	
	Total:									**1724**	**1149**	**1239**		
	Total (with 30% contingency):									**2241**	**1494**	**1611**		

Estimated power capacity required is approximately (Includes 30% contingency)	**1611**	**kVA**	or	**1494**	**kW**

Formulas

Total Power Absorbed (kW) = 1.732 x Line Voltage x (FLC per drive) x pf x (No of Units running) x (Diversity Factor) / 1000
Total Power absorbed (kVA) = 1.732 x Line Voltage x (FLC per drive) x (No of Units running) x (Diversity Factor) / 1000
FLC per drive = (kW Rating per Unit) x 1000 / 1.732 / Line Voltage / [(Motor Eff) /100] / pf
Sub Total FLC = (kW Rating per Unit) x 1000 / 1.732 / Line Voltage / [Motor Eff/100] / pf x (No of Units running)

Assumption:

1. For DOL drive, the power factor is estimated to be same as the motor if there is insufficient information provided for the motor drive
2. For VSD drive, the power factor is estimated to be 0.95 if there is insufficient information provided for the motor drive
3. For Soft Starter drive, the power factor is estimated to be 0.90 if there is insufficient information provided for the motor drive
4. Assumption has been made on the diversity factor that duty/standby arrangement of identical motor drives will be configurated amongst MCC/SCA.
5. Miscellaneous single phase loads are assumed to be connected across 3 phases in a balanced loads configuration.

Notes:

1. The available kW capacity of the transformer could be improved through the use of local automatic power factor correction at each MCC/SCA.

Googong WRP - Maximum Demand Estimation (Rev. C) - Stage 2B

Item No.	This calculation is to determine the maximum power consumption of the site in Stage 1	(P1) Rating per Unit kW	FLC, (A) per Drive or Equip	Motor Eff, (%)	pf	No of Units	No of Units running	Sub Total FLC, (A)	Diversity Factor	Total Current Drawn with Diversity Factor (A)	Total Power Absorbed (kW)	Total Power Absorbed (kVA)	Starting Method	Comment
1	6mm Screen	1.10	2.03	86	0.88	2	1	2.03	1.0	2.0	1.3	1.5	DOL	
2	1 mm Sceen	1.10	2.03	86	0.88	2	1	2.03	1.0	2.0	1.3	1.5	DOL	
3	Screw Washpress	1.50	3.12	87	0.77	1	1	3.12	1.0	3.1	1.7	2.2	DOL	
4	Outloading conveyor / launder channel	2.20	4.17	89	0.83	4	4	16.67	1.0	16.7	9.9	12.0	DOL	
5	Automatic Penstocks	0.18	0.56	64	0.70	4	2	1.13	1.0	1.1	0.6	0.8	DOL	(0.16kW pumpset - use TECO standard Motor size - 0.18kW for estimate)
6	Screenings Bins	1.50	3.12	87	0.77	2	1	3.12	1.0	3.1	1.7	2.2	DOL	
7	Grit Removal Blower	2.20	4.17	89	0.83	1	1	4.17	1.0	4.2	2.5	3.0	DOL	
8	Grit Classifier	1.50	3.12	87	0.77	1	1	3.12	1.0	3.1	1.7	2.2	DOL	
9	Ferric Sulphate Dosing Pumps	1.10	1.87	86	0.95	2 x 2	2	3.75	1.0	3.8	2.6	2.7	VSD	
10	Carbon dosing (liquid sugar) Dosing Pumps	0.55	1.13	72	0.95	2 x 2	2	2.25	1.0	2.3	1.5	1.6	VSD	
11	Magnesium Hydroxide Dosing Pumps	0.55	1.13	72	0.95	2 x 2	2	2.25	1.0	2.3	1.5	1.6	VSD	
12	Citric Acid Dosing Pumps	0.37	0.99	75	0.70	2	1	0.99	1.0	1.0	0.5	0.7	DOL	(0.25kW pumpset - use TECO standard Motor size - 0.37kW for estimate)
13	Citric Acid Dosing Pumps 2	0.37	0.99	75	0.70	1	1	0.99	1.0	1.0	0.5	0.7	DOL	(0.25kW pumpset - use TECO standard Motor size - 0.37kW for estimate)
14	Sodium Hypochlorite Dosing Pumps	0.55	1.13	72	0.95	2	1	1.13	1.0	1.1	0.8	0.8	VSD	
15	Polymer Transfer Pump	0.37	0.99	75	0.70	1	1	0.99	1.0	1.0	0.5	0.7	DOL	(0.25kW pumpset - use TECO standard Motor size - 0.37kW for estimate)
16	Polymer Blending Pump	0.37	0.99	75	0.70	1	1	0.99	1.0	1.0	0.5	0.7	DOL	(0.25kW pumpset - use TECO standard Motor size - 0.37kW for estimate)
17	Polymer Dosing Pump	0.37	0.73	75	0.95	2 x 2	2	1.45	1.0	1.5	1.0	1.0	VSD	(0.25kW pumpset - use TECO standard Motor size - 0.37kW for estimate)
18	A-MLR pumps	2.20	3.64	89	0.95	1	1	3.64	1.0	3.6	2.5	2.6	VSD	
19	S MLR pumps (Membrane Feed Pump)	4.00	6.51	90	0.95	2	1	6.51	1.0	6.5	4.4	4.7	VSD	
20	Permeate Pumps	5.50	8.85	91	0.95	3	2	17.70	1.0	18	12	13	VSD	
21	Aeration Blowers	37.00	57.04	95	0.95	3	2	114.07	1.0	114	78	82	VSD	
22	Membrane Blowers	37.00	57.04	95	0.95	2	1	57.04	1.0	57	39	41	VSD	
23	WAS pumps	1.50	3.12	87	0.77	2	1	3.12	1.0	3.1	1.7	2.2	DOL	
24	Scum Scraper	1.10	2.03	86	0.88	1	1	2.03	1.0	2.0	1.3	1.5	DOL	
25	Scum Pump	1.10	2.03	86	0.88	1	1	2.03	1.0	2.0	1.3	1.5	DOL	
26	Mixers	0.18	0.56	64	0.70	4	4	2.25	1.0	2.3	1.1	1.6	DOL	(0.12kW Mixer - use TECO standard Motor size - 0.18kW for estimate)
27	Membrane Tank Drain Pumps	0.75	1.64	85	0.76	2	1	1.64	1.0	1.6	0.9	1.2	DOL	
28	UV disinfection	7.50	12.20	90	0.95	2	2	24.41	1.0	24	17	18	DOL	(5.9kW loads - assume to use standard 7.5kW DOL starter
29	CCT Mixers	0.18	0.56	64	0.70	2	2	1.13	1.0	1.1	0.6	0.8	DOL	(0.12kW Mixer - use TECO standard Motor size - 0.18kW for estimate)
30	RE pumps	30.00	46.49	95	0.95	2	1	46.49	1.0	46	32	33	VSD	
31	WRP Pumps	185.00	283.69	96	0.95	2	1	283.69	1.0	284	194	204	VSD	(175kW pumpset - use TECO standard Motor size - 185kW for estimate)
32	Basin No.1 Pumps	55.00	84.34	96	0.95	2	1	84.34	1.0	84	58	61	VSD	
33	Digester Mixers	0.55	1.45	72	0.74	4	4	5.78	1.0	5.8	3.1	4.2	DOL	

Googong WRP - Maximum Demand Estimation (Rev. C) - Stage 2B

Item No.	This calculation is to determine the maximum power consumption of the site in Stage 1	(P1) Rating per Unit kW	FLC, (A) per Drive or Equip	Motor Eff, (%)	pf	No of Units	No of Units running	Sub Total FLC, (A)	Diversity Factor	Total Current Drawn with Diversity Factor (A)	Total Power Absorbed (kW)	Total Power Absorbed (kVA)	Starting Method	Comment
34	Flocculation Mixer	0.37	0.73	75	0.95	1	1	0.73	1.0	0.7	0.5	0.5	VSD	(0.25kW pumpset - use TECO standard Motor size - 0.37kW for estimate)
35	Rotary Drum Thickener	0.75	1.64	85	0.76	1	1	1.64	1.0	1.6	0.9	1.2	DOL	
36	Centrifuge Feed pumps	0.75	1.64	85	0.76	2	1	1.64	1.0	1.6	0.9	1.2	DOL	
37	Dewatering Centrifuges - Main	18.50	32.21	94	0.85	1	1	32.21	1.0	32	20	23	DOL	(18kW load - use TECO standard Motor size - 18.5kW for estimate)
38	Dewatering Centrifuge - Back	3.00	5.98	90	0.78	1	1	5.98	1.0	6.0	3.4	4.3	DOL	
39	Digester Blowers	3.00	4.91	90	0.95	2	1	4.91	1.0	4.9	3.4	3.5	VSD	
40	Allowance for automatic valves	0.75	1.64	85	0.76	30	10	16.36	1.0	16.4	8.9	11.8	DOL	
41	Potable Water Booster Pumps	5.50	9.89	91	0.85	2	1	9.89	1.0	9.9	6.0	7.1	DOL	
42	Compressor (incl. Air dryer)	4.00	6.95	90	0.89	2	1	6.95	1.0	7.0	4.4	5.0	DOL	
43	First Flush Pumps	0.18	0.56	64	0.70	2	1	0.56	1.0	0.6	0.3	0.4	DOL	(0.12kW Pumpset - use TECO standard Motor size - 0.18kW for estimate)
44	Foul Water Return Pumps	0.55	1.45	72	0.74	2	1	1.45	1.0	1.5	0.8	1.0	DOL	
45	Recirculation Pumps	0.18	0.56	64	0.70	2	1	0.56	1.0	0.6	0.3	0.4	DOL	(0.09kW Pumpset - use TECO standard Motor size - 0.18kW for estimate)
46	Nutrient Dosing Pumps	0.18	0.56	64	0.70	2	1	0.56	1.0	0.6	0.3	0.4	DOL	(0.12kW Pumpset - use TECO standard Motor size - 0.18kW for estimate)
47	Heater	75.00	115.01	96	0.95	1	1	115.01	1.0	115	79	83	SCR	
48	Fans	37.00	57.04	95	0.95	2	1	57.04	1.0	57	39	41	VSD	
49	Uninterruptible Power Supply (UPS)	50.00	77.08	95	0.95	1	1	77.08	1.0	77	53	55		
50	Lighting and General Power Supply	50.00	85.88	90	0.9	1	1	85.88	0.5	42.94	27.78	30.86		
51	Air Conditioning	100.00	171.76	90	0.9	1	1	171.76	1.0	171.76	111.11	123.46	DOL	
	Total:	**170**								**1253**	**834**	**901**		
	Total (with 30% contingency):	**200**								**1629**	**1085**	**1171**		

Estimated power capacity required is approximately (Includes 30% contingency)	**1171**	**kVA**	or	**1085**	**kW**

Formulas

Total Power Absorbed (kW) = 1.732 x Line Voltage x (FLC per drive) x pf x (No of Units running) x (Diversity Factor) / 1000
Total Power absorbed (kVA) = 1.732 x Line Voltage x (FLC per drive) x (No of Units running) x (Diversity Factor) / 1000
FLC per drive = (kW Rating per Unit) x 1000 / 1.732 / Line Voltage / [(Motor Eff) /100] / pf
Sub Total FLC = (kW Rating per Unit) x 1000 / 1.732 / Line Voltage / [Motor Eff/100] / pf x (No of Units running)

Assumption:

1. For DOL drive, the power factor is estimated to be same as the motor if there is insufficient information provided for the motor drive
2. For VSD drive, the power factor is estimated to be 0.95 if there is insufficient information provided for the motor drive
3. For Soft Starter drive, the power factor is estimated to be 0.90 if there is insufficient information provided for the motor drive
4. Assumption has been made on the diversity factor that duty/standby arrangement of identical motor drives will be configurated amongst MCC/SCA.
5. Miscellaneous single phase loads are assumed to be connected across 3 phases in a balanced loads configuration.

Notes:

1. The available kW capacity of the transformer could be improved through the use of local automatic power factor correction at each MCC/SCA.

CIC - Googong SPS 2 - Maximum Demand Estimation (Rev. C)

Item No.	SPS 2 - Outdoor Kiosk	(P1) Rating per Unit kW	FLC, (A) per Drive or Equip	Motor Eff, (%)	pf	No of Units	No of Units running	Sub Total FLC, (A)	Diversity Factor	Total Current Drawn with Diversity Factor (A)	Total Power Absorbed, kW	Total Power Absorbed, kVA	Starting Method	Comment
1	Pump 1	37.00	57.34	95	0.95	1	1	57.34	1.0	57.34	39.15	41.21	VSD	
2	Pump 2	37.00	57.34	95	0.95	1	1	57.34	1.0	57.34	39.15	41.21	VSD	
3	Pump 3	37.00	57.34	95	0.95	1	0	0.00	0.0	0	0.00	0.00	VSD	
4	Chemical Dosing Facility	1.50	2.95	75	0.95	1	1	2.95	1.0	2.95	2.01	2.12	VSD	
5	Lighting and General Power Supply	2.00	3.44	90	0.9	1	1	3.44	0.5	1.72	1.11	1.23		
	Total:									**119.35**	**81.43**	**85.78**		
	Total (with 30% Spare Capacity):									**155.16**	**105.86**	**111.52**		

Estimated power capacity required is approximately (Includes 30% spare capacity)	**112**	**kVA**	**or**	**106**	**kW**

Formulas

Total Power Absorbed (kW) = 1.732 x Line Voltage x (FLC per drive) x pf x (No of Units running) x (Diversity Factor) / 1000
Total Power absorbed (kVA) = 1.732 x Line Voltage x (FLC per drive) x (No of Units running) x (Diversity Factor) / 1000
FLC per drive = (kW Rating per Unit) x 1000 / 1.732 / Line Voltage / [(Motor Eff) /100] / pf
Sub Total FLC = (kW Rating per Unit) x 1000 / 1.732 / Line Voltage / [Motor Eff/100] / pf x (No of Units running)

Assumption:

1. For DOL drive, the power factor is estimated to be same as the motor if there is insufficient information provided for the motor drive (the above estimate is based on TECO motor data)
2. For VSD drive, the power factor is estimated to be 0.95 if there is insufficient information provided for the motor drive
3. For Soft Starter drive, the power factor is estimated to be 0.90 if there is insufficient information provided for the motor drive
4. Assumption has been made on the diversity factor that duty/standby arrangement of identical motor drives will be configurated amongst MCC/SCA.
5. Miscellaneous single phase loads are assumed to be connected across 3 phases in a balanced loads configuration.

Notes:

1. The available kW capacity of the transformer could be improved through the use of local automatic power factor correction at each MCC/SCA.

APPENDIX G.
Biosolids Management

Introduction

The biosolids produced by the proposed WRP may follow a number of different life-cycles. The biosolids are intended to be reused for agricultural applications due to the nutrients which they contain such as nitrates and phosphates (EPA, 1997).

In order to be reused, biosolids, which report as a waste stream from the treatment of wastewater, must be treated to ensure they are safe to use where environmental damage, primarily through human contact, is possible. Namely, the reduction of volatile organic matter, pathogens and vector attractors is required in order to commercially reuse biosolids (NRMMC, 2004).

The level of treatment will depend on the classification of biosolids required. In the case of the Googong project, the two options which were explored were Grade A and Grade B. The treatment of biosolids has been well documented as one of the most resource intensive unit operations in a secondary WTP which dictates that consideration must be placed on the level of treatment included in the WRP (M&E, 04).

Quality Indicators

Significant properties associated with biosolids reuse include microbial, chemical and vector attraction components and are summarized below:

Microbial

Pathogenic organisms will be present in sewage sludge including viruses, bacteria, protozoa and helminthes (worms). Pathogens are generally indicated by the presence of E.Coli and faecal coliforms

Chemical

Chemical contaminants will be present as they are removed in the MBR. Chemical contaminants include metals, chlorinated organic compounds and pesticides (NRMMC, 2004). Chemical compounds are of significant concern in bio-solids reuse as they are likely to be introduced into the water table through land applications along with being included in crops and agricultural products for human consumption.

Vector attraction

Insect vectors such as mosquitos, flies and rodents are attracted to non-stabilised sewage sludge and may cause the spread of pathogens. Potential for vector attraction must be minimised to limit the concerns associated with the use of biosolids where human contact is possible (EPA, 1997).

Classifications

Grade classifications of biosolids are used to provide an objective measure of the properties of biosolids. The two grades of biosolids which are being considered in this CDR are Grade A and Grade B. The grade classifications of biosolids dictate the various permissible reuse options, as outlined in **Table G-1** gives the requirements for contaminant concentrations and stability associated with each reuse pathway.

Table G-1 Permissible land application uses of biosolids (EPA, 1997)

Classification	Allowable Use	Minimum Quality Grades	
		Contaminant	Stabilisation
Unrestricted Use	Residential	A	A
	Public Contact Sites		
	Urban Landscaping		
	Agriculture		
	Forestry		
	Soil and site rehabilitation		
	Landfill		
	Surface land disposal		
Restricted Use 1	Public contact sites	B	A
	Urban Landscaping		
	Agriculture		
	Forestry		
	Soil and site rehabilitation		
	Landfill		
	Surface land disposal		
Restricted Use 2	Agriculture	C	B
	Forestry		
	Soil and site rehabilitation		
	Landfill		
	Surface Land disposal		

An understanding of the local options for the reuse of biosolids is essential in deciding on a preferred treatment option between Grade A and Grade B product.

The contaminant levels associated with each grade of biosolids are given in **Table G-2**. The classifications for stabilisation, in terms of pathogen reduction and vector attraction reduction, are given in **Table G-1**.

Table G-2 Maximum contaminant Levels in various biosolids grades (EPA,1997)

Contaminant	Grade A (mg.kgdry weight)	Grade B (mg.kgdry weight)
Arsenic	20	20
Cadmium	3	5
Chromium	100	250
Copper	100	375
Lead	150	150
Mercury	1	4
Nickel	60	125
Selenium	5	8
Zinc	200	700
DDT/DDD/DDE*	0.5	0.5
Aldrin	0.02	0.2
Dieldrin	0.02	0.2
Chlordane	0.02	0.2
Heptachlor	0.02	0.2
HCB**	0.02	0.2
Lindane	0.02	0.2
BHC***	0.02	0.2
PCBs****	0.3	0.3

*DDT/DDD/DDE Common synthetic pesticides and breakdown structures (DichloroDiphenylTrichloroethane/DichloroDiphenyl Dichlorodiphenyldichloroethylene

**HexaChloroBenzene

***BenzenHexaChloride

****Polychlorinated biphenyls

Table G-3 Biosolids Stabilisation Requirements (EPA, 1997)

Pathogen Reduction Process	Vector Attraction Reduction Requirements
Stabilisation Grade A	
1. Thermal Treatment • Temp of at least 50°C for a number of days specified by the treatment Temp used. 2. High pH, high Temp. Process • pH of 12 for 72 hours with a period of heating above 52°C for 12 hours. Followed by drying to a solids content >50%	1. Mass of volatile solids reduced by a minimum of 38% 2.Must contain no more than 17% volatile solids reduction when incubated under anaerobic conditions at a bench scale for 40 days at 30-37°C 3. Must contain no more than 15% volatile solids reduction when incubated under aerobic conditions at a bench scale for 30 days at 20°C 4. O_2 uptake rate <1.5 mg O_2/hour/gram at 20°C 5. Biosolids must be able to maintain a pH of 12 for 2 hours and then 11.5 for an additional 22 hours 6. Dry solids > 75% 7. Biosolids containing primary treatment waste must contain dry solids > 90% 8. Must be aerobically digested for at least 14 days, T > 40°C
Stabilisation Grade B	
1. Anaerobic Digestion 2. Aerobic Digestion 3. Air Drying 4. Composting 5. Lime stabilisation 6. Extended Aeration 7. Other EPA accepted processes	1. At least 20 days aeration including aerobic digestion time followed by 6 months storage of bio-solids. 2. Biosolids to be injected below the surface upon land application 3. Biosolids applied to the land surface must be incorporated within 6 hours of application.
Stabilisation Grade C	
Not meeting any of the Grade A or B requirements	

Treatment

WAS produced in an MBR is generally treated by means of an aerobic digestion process, which has been used in the case of this CDR. This level of treatment is accepted to be adequate to ensure a Grade B biosolids standard will be met for both contaminant and stabilisation levels.

In order to produce Grade A biosolids one of the treatments outlined in **Table G-3** must be utilised for both Pathogen reduction and Vector Attraction reduction. Upgrading the WRP to produce Grade A biosolids dictates a significant increase in energy requirement due to the requirement of extended periods of treatment.

The NRMMS guideline stipulates that a pathogen reduction phase of heating and drying or composting above 53°C for 5 days is required to meet that low pathogen levels required for Grade A biosolids production. The NRMMC guidelines specify that the only major restriction on the use of Grade B biosolids in agriculture is the addition to salad plant crops and root crops. Under standard aerobic digestion, the Grade B biosolids which result only meet the Grade B standard, limiting the application to pastoral land and land used for crops to be cooked/processed.

The Googong site falls within the high-rainfall zone which is associated with the production of prime lamb, wool and beef (ABARE, 06). Grade B biosolids are appropriate for these applications. Forestry is also prevalent in the region which supports the reuse of Grade B biosolids.

Sampling

Sampling and subsequent analysis is required to ensure the biosolids being reused meet the associated grade criteria.

The contaminant sampling frequency is the same for all biosolids grades. However, the sampling frequency is dictated by the how close the actual measured contaminant values are to contaminant values as given in **Table G-2**.

Sampling to assess stability is described by separate regimes for Grade A and Grade B biosolids. As defined by the DECCW (former EPA) guideline, Grade B biosolids require annual sampling to ensure process biosolids meet the grade criteria. Grade A biosolids require a maximum sampling frequency of 1 sample per 40 dry solid tonnes (dst). This would require monthly sampling based on the WAS production of 1.2 t/day TSS, as specified by the MBR design calculations Stability sampling must be carried out by DECCW approved laboratories, following Australian standards.

Biosolids Grade Recommendation

There are significant Grade B reuse options available given the pastural and agricultural industries surrounding the Googong site. It has been identified that a significant increase in process resources (heat, time and footprint) would be required to upgrade WAS treatment to produce Grade A biosolids. It is considered, in this case, that an upgrade to the production of Grade A biosolids would involve a significant increase in the resources required to operate the WRP facility for no appreciable gain. Hence, the CDR outlines a WAS treatment process to produce Grade B biosolids.

References:

ABARE (2006), Agriculture in Australia, Canberra, Australian Bureau of Agricultural and Resource Economics

M&E (2004), METCALF & EDDY, Wastewater Engineering Treatment and Reuse, 4th Edition, New York, McGraw Hill

NRMMC (2004), Guidelines For Sewerage Systems – Biosolids Management, Natural Resource Management Ministerial Council, Canberra

NSW EPA (1997), Environmental Guidelines - Use and Disposal of Biosolids Products, Sydney, Environment Protection Authority

APPENDIX H.
Population Forecast

Googong Sewer EP Calculation

			Neighbourhood 1A (ha)					Neighbourhood 3 (ha)					Neighbourhood 4 (ha)					Neighbourhood 1B (ha)					Neighbourhood 5 (ha)				
Gross area				**119.1**					**86.1**					**77.8**					**58.7**					**105.9**			
School				5.1					0.0					9.0					0.0					0.0			
Recreation				5.9					11.8					0.0					0.0					0.0			
Drainage reserve				6.5					0.6					0.0					0.5					1.4			
Other				0.0					5.1					1.9					1.5					0.0			
GSA				**101.6**					**68.6**					**66.9**					**56.7**					**104.6**			
Road reserve allocation		**30%**		30.36					20.6					20.1					11.0					17.2			
Public Open Space				4.91					2.4					2.4					0.3					2.1			
Neighbourhood/Club				1.20					0.7					1.0					0.0					0.7			
Rural lot R5 allocation				0.4					0.0					0.0					20.0					47.2			
Rural E2 Zone				0.0					0.0					0.0					0.0					0.0			
(Sewered Catchment Area)						**101.76**					**66.18**					**73.50**					**56.40**					**102.51**	
NRA (Excl R5/E2 Zone)				**64.73**					**44.89**					**43.43**					**25.43**					**37.37**			
GRA breakdown	**Occupancy per dwelling**	**Lot size (m2)**	**N'hood 1 land composition**	**Sub Area (ha)**	**No. of Dwellings**	**Population**	**Dwelling composition**	**N'hood 3 land composition**	**Sub Area (ha)**	**No. of Dwellings**	**Population**	**Dwelling composition**	**N'hood 4 land composition**	**Sub Area (ha)**	**No. of Dwellings**	**Population**	**Dwelling composition**	**N'hood 1B land composition**	**Sub Area (ha)**	**No. of Dwellings**	**Population**	**Dwelling composition**	**N'hood 5 land composition**	**Sub Area (ha)**	**No. of Dwellings**	**Population**	**Dwelling composition**
Commercial allocation						90					53					75					0					53	
School Students						1,500										750											
Apartments (A)	1.8	125	0.5%	0.3	26	47	2%	1.0%	0.4	36	65	4%	0.5%	0.2	17	31	2%	0.0%	0.0	0	-	0%	0.0%	0.0	0	-	0%
Townhouse / Terrace (B1+B2)	1.9	189	1.5%	1.0	51	98	4%	1.5%	0.7	36	68	4%	2.0%	0.9	46	87	6%	1.0%	0.3	13	26	3%	2.3%	0.8	44	85	6%
Small Courtyard (C)	2.25	368	12.0%	7.8	211	475	17%	6.5%	2.9	79	178	9%	6.5%	2.8	77	173	9%	4.0%	1.0	28	62	6%	8.0%	3.0	81	183	12%
Large Courtyard (D)	2.75	464	21.0%	13.6	293	806	23%	22.0%	9.9	213	585	25%	22.0%	9.6	206	566	25%	21.0%	5.3	115	317	26%	21.5%	8.0	173	476	25%
Single Lot (E)	3.25	544	38.0%	24.6	452	1,470	35%	39.0%	17.5	322	1,046	38%	39.0%	16.9	311	1,012	38%	39.0%	9.9	182	593	41%	38.8%	14.5	266	865	38%
Large Lot (F)	3.25	720	27.0%	17.5	243	789	19%	23.0%	10.3	143	466	17%	23.0%	10.0	139	451	17%	27.0%	6.9	95	310	21%	22.0%	8.2	114	371	16%
Estate Homes	3.25	1500	0.0%	0.0	0	-	0%	7.0%	3.1	21	68	2%	7.0%	3.0	20	66	2%	8.0%	2.0	14	44	3%	7.5%	2.8	19	61	3%
Totals			**100.0%**	**64.7**	**1276**	**3685**	**100%**	**100.0%**	**44.9**	**850**	**2476**	**100%**	**100.0%**	**43.4**	**816**	**2386**	**100%**	**100.0%**	**25.4**	**447**	**1352**	**100%**	**100.0%**	**37.4**	**698**	**2041**	**100%**
Rural (Zone y hamlet)	**3.25**	**15000**		**0.4**	**0**	**1**													**20.0**	**13**	**43**			**47.2**	**31**	**102**	
Hamlet (Zone U)	**3.25**	**1000**																									
Flow Design Population Equivalent						**4076**					**2529**					**2611**					**1395**					**2196**	

Googong Sewer EP Calculation

			Neighbourhood 2 Town Centre (ha)						Total core (ha)	Hamlet East (ha)					Hamlet West (ha)						Grand total land (ha)
Gross area				**120.3**					**567.8**		**50.45**					**42.2**					**660.44**
School				6.0					**20.1**		0.00					0.0					**20.1**
Recreation				0.0					**17.7**		0.00					0.0					**17.7**
Drainage reserve				1.0					**9.9**		4.07					0.0					**13.9**
Other				6.6					**15.1**		0.07					3.2					**18.4**
GSA				**106.8**					**505.1**		**46.31**					**39.0**					**590.4**
Road reserve allocation		**30%**		32.03					**131.3**		3.67					3.5					**138.5**
Public Open Space				3.8					**15.9**		0.00					0.0					**15.9**
Neighbourhood/Club				10.8					**14.4**		0.00					0.0					**14.4**
Rural lot R5 allocation				0.0					**67.6**		20.76					20.1					**108.4**
Rural E2 Zone				0.0					**0.0**		21.88					15.4					**37.2**
(Sewered Catchment Area)						**108.96**							**24.43**					**23.62**			
NRA (Excl R5/E2 Zone)				**60.17**					**276.0**		**0.00**					**-0.01**					**276.0**
GRA breakdown	**Occupancy per dwelling**	**Lot size (m2)**	**N'hood 2/TC land composition (m2)**	**Sub Area (ha)**	**No. of Dwellings**	**Population**	**Dwelling composition**	**Total Core Population**	**Total Core No. of Dwellings**	**N'hood 6 land composition**	**Sub Area (ha)**	**No. of Dwellings**	**Population**	**Dwelling composition**	**N'hood 6 land composition**	**Sub Area (ha)**	**No. of Dwellings**	**Population**	**Dwelling composition**	**Grand Total Core Population**	**Grand Total No. of Dwellings**	**Grand Dwelling Composition**	**Grand Dwelling Composition - N2 Town Centre**
Commercial allocation						**807**		**1078**												**1078**			
School Students						**750**		**3000**												**3000**			
Apartments (A)	1.8	125	7.0%	4.2	487	877	26%	**1020**	**566**	0%	0.00	0	-	0%	0%	0.0	0	-	0%	**1020**	**566**	10%	2%
Townhouse / Terrace (B1+B2)	1.9	189	9.0%	5.4	287	544	16%	**908**	**477**	0%	0.00	0	-	0%	0%	0.0	0	-	0%	**908**	**477**	8%	5%
Small Courtyard (C)	2.25	368	23.0%	13.8	376	846	20%	**1917**	**852**	0%	0.00	0	-	0%	0%	0.0	0	-	0%	**1917**	**852**	14%	12%
Large Courtyard (D)	2.75	464	24.0%	14.4	311	856	17%	**3606**	**1311**	0%	0.00	0	-	0%	0%	0.0	0	-	0%	**3606**	**1311**	22%	24%
Single Lot (E)	3.25	544	27.0%	16.2	299	971	16%	**5957**	**1833**	0%	0.00	0	-	0%	0%	0.0	0	-	0%	**5957**	**1833**	31%	38%
Large Lot (F)	3.25	720	10.0%	6.0	84	272	5%	**2659**	**818**	0%	0.00	0	-	0%	0%	0.0	0	-	0%	**2659**	**818**	14%	18%
Estate Homes	3.25	1500	0.0%	0.0	0	-	0%	**239**	**73**	0%	0.00	0	-	0%	0%	0.0	0	-	0%	**239**	**73**	1%	2%
Totals			**100.0%**	**60.2**	**1843**	**4366**	**100%**	**16306**	**5931**	**0.0%**	**0.00**	**0**	**0**	**0%**	**0.0%**	**0.0**	**0**	**0**	**0%**	**16306**	**5931**	**100%**	**100%**
Rural (Zone y hamlet)	**3.25**	**15000**		**0.0**	**0**	**0**		**146**	**45**							**20.1**	**13**	**44**		**190**	**58**		
Hamlet (Zone U)	**3.25**	**1000**						**0**	**0**		**21**	**208**	**675**							**675**	**208**		
Flow Design Population Equivalent						**5323**							**675**					**44**					
																				17171	**Excl Commercial & Schools**		
																				18849	**Incl Commercial & Schools**		

Assumptions

Road land take - assumed to be 30% of GSA
Lot size - as indicated
Shop top apartments - 180 shop top apartments included in N2 - TC - see mixed use flat worksheet for logic
Dwelling composition/mix - utilises latest numbers from RD - approximately equates to final CIC Feb workshop mix except for N2 - town centre which is considerably more dense
Please see RD masterplan map for land uses and sizes

Commercial PE based on 75 per gross hectare

Common Areas, including Aquatics centre have been excluded from design flow calculations

Assume 750 students per school, EP based on 0.2 EP per student

Glossary

GSA = Gross Suburban Area
GRA = Gross Residential Area

APPENDIX I.
WRP Process Calculation Summary

Googong Water Recycling Plant
Job Number: A1081402
PROCESS DESIGN SUMMARY (reference case)

MWH

Googong STP Process Design Criteria

Parameter	Ultimate Stage (Stage 4)	Stage 1	Stage 2a	Stage 2b	Stage 3b	Units
EP	18850	1000	2350	4700	9400	
Design Influent Flows						
Design ADWF	3.4	0.2	0.4	0.8	1.7	ML/d
fraction of ultimate flow		0.053	0.125	0.249	0.499	
Design PWWF	11.9	0.9	2.1	4.2	8.5	ML/d
COD	667	-	-	-	-	mg/L
BOD	339	-	-	-	-	mg/L
Total N	56	-	-	-	-	mg/L
TKN	72	-	-	-	-	mg/L
TP	14	-	-	-	-	mg/L
Design Effluent Quality (50 %ile)						
BOD	10	-	-	-	-	mg/L
SS	10	-	-	-	-	mg/L
Total N	< 5	-	-	-	-	mg/L
Total P	< 0.2	-	-	-	-	mg/L
Faecal Coliforms*	< 1	-	-	-	-	cfu/100ml
Total Coliforms	< 10	-	-	-	-	cfu/100ml
Virus	< 2	-	-	-	-	cells/50L
Parasites	< 1	-	-	-	-	cells/50L
Turbidity	2	-	-	-	-	NTU
pH	6.5-8.0	-	-	-	-	
Colour	< 15	-	-	-	-	TCU
Free Chlorine Residual	< 0.5	-	-	-	-	mg/L

* 95%ile

Inlet Works

Inlet Screens	Ultimate Stage (Stage 4)	Stage 1	Stage 2a	Stage 2b	Stage 3b	Units
Maximum Flow	137.44	10.42	24.48	48.96	97.92	L/s
ADWF	39.3	2.1	4.9	9.8	19.6	L/s
Type of Screen	3mm perforated screen					
PFT Wet Screenings Capture	2375	126	296	592	1184	kg Wet Screenings / Day
ADWF Wet Screenings Capture	679	36	85	169	338	kg Wet Screenings / Day
Screenings Concentration	15%					ds
PFT Screenings Volume	2.6	0.1	0.3	0.7	1.3	m3/d
ADWF Screenings Volume	0.8	0.0	0.1	0.2	0.4	m3/d
Type of Screen	1mm perforated screen					
PFT Wet Screenings Capture	792	42	99	197	395	kg Wet Screenings /d
ADWF Wet Screenings Capture	226	12	28	56	113	kg Wet Screenings /d
Screenings Concentration	15%					ds
PFT Screenings Volume	0.9	0.0	0.1	0.2	0.4	m3/d
ADWF Screenings Volume	0.3	0.0	0.0	0.1	0.1	m3/d
Screenings Press						
Selected Capacity	0.5	0.1	0.1	0.5	0.5	m3/hr
Number Required	2			2	2	Units
Estimated Length of Conveyor	8			8	8	m
Output Screenings concentration	30-40	30-40	30-40	30-40	30-40	%ds
Screenings Outloading Conveyor						
Selected Capacity	0.5	0.1	0.1	0.5	0.5	m3/hr
Number Required	1	1	1	1	1	Units
Estimated Length of Conveyor	6			6	6	m
Screenings Storage Bin						
Number of Screening bins	2	1	1	2	2	units
Screenings Bin Volume	5	1	1	5	5	m3/unit
Actual Residence Time (ADWF)	10	24	10	40	20	days

MBR Summary

5-stage Bardenpho with Membranes

Anoxic & Aerobic Zones	Ultimate Stage (Stage 4)	Stage 1	Stage 2a	Stage 2b	Stage 3b	Units
Number of process trains	4	1	1	1	2	trains
Aerobic Zone Volume	154	33	77	154	154	m3/train
Primary anoxic zone volume	150	32	75	150	150	m3/train
Aeration zone volume	498	105	248	498	498	m3/train
De-areation	48	10	24	48	48	m3/train
Secondary anoxic	176	37	88	176	176	m3/train
Membrane Tank	80	17	40	80	80	m3/train
Total Volume	1106	234	551	1106	1106	m3/train
MLR Pumps - a recycle						
Number of a-MLR Pumps per train	3	3	3	3	3	Duty/Duty/Standby for 2 Bioreactors
a-MLR Pump Maximum Capacity (per pump)	70	20	35	70	70	L/s
a-MLR Pump estimated differential head required	1.0	1.0	1.0	1.0	1.0	m
Selected a-MLR Pump Motor Size	2.2	0.6	1.1	2.2	2.2	kW
MBR Feed Pumps (s-MLR pumps)						
Number of s-MLR Pumps per train	3	3	3	3	3	Duty/Duty/Standby for 2 Bioreactors
s-MLR Pump Maximum Capacity (per pump)	140	30	70	140	140	L/s
s-MLR Pump estimated differential head required	1.0	1.0	1.0	1.0	1.0	m
Selected s-MLR Pump Motor Size	4.0	1.1	2.2	4.0	4.0	kW
Selected Turndown	2	2	2	2	2	:1
MLR bio P pumps - R-MLR pumps						
Number of R-MLR pumps per train	2	2	2	2	2	Duty/Standby
R-MLR Pump max capacity	35	10	20	35	35	L/s
R-MLR Pump estimated differential head required	1.0	1.0	1.0	1.0	1.0	m
Selected R-MLR Pump Motor Size	1.1	0.4	0.6	1.1	1.1	kW
Permeate Pumps						
Number of Permeate Pumps	12	4	4	4	6	duty/duty/standby
Permeate Pump ADWF Capacity	10	3	5	10	10	L/s
Selected Permeate Pump Capacity	35	15	35	35	35	L/s
Estimated Permeate Pump Discharge Head required	16	16	16	16	16	m
Permeate Pump Power requirements	2	0.4	0.8	2	2	kW
Permeate Pump Efficiency	40	40	40	40	40	%
Permeate Pump Motor Efficiency	95	95	95	95	95	%
Required Permeate Motor Size	4.3	1.1	2.2	4.3	4.3	kW
Selected Permeate Pump Motor Size	5.5	1.1	2.2	5.5	5.5	kW

MBR Summary

Anoxic & Aerobic Zones	Ultimate Stage (Stage 4)	Stage 1	Stage 2a	Stage 2b	Stage 3b	Units
WAS Pumps						
Number of WAS Pumps (total)	2	2	2	2	2	Duty / Standby
Capacity of WAS Pumps	6	0.3	0.6	6	6	L/s
WAS Pump estimated differential head required	8	8	8	8	8	m
WAS Pump Power requirements	0.47	0.02	0.05	0.47	0.47	kW
WAS Pump Efficiency	40	40	40	40	40	%
WAS Pump Motor Efficiency	95	95	95	95	95	%
Required WAS Motor Size	1.24	0.06	0.12	1.24	1.24	kW
Selected WAS Pump Motor Size	1.50	0.09	0.12	1.50	1.50	kW
Process Blower Requirements						
Air Volume required at Average flow @ STP	961	51	120	240	479	m3/hr.Train
Air Volume required at Peak flow @ STP	2,113	112	263	527	1,054	m3/hr.Train
Air Volume required at Low flow @ STP	320	17	40	80	160	m3/hr.Train
Air Volume required at Average flow @ NTP	1,031	55	129	257	514	m3/hr.Train
Air Volume required at Peak flow @ NTP	2,268	120	283	566	1,131	m3/hr.Train
Air Volume required at Low flow @ NTP	344	18	43	86	171	m3/hr.Train
Discharge Pressure	150	150	150	150	150	kPa
Number of blowers required/Train	3	3	3	3	3	Duty/Assist/Standby
Turndown Required	6.6	6.6	6.6	6.6	6.6	:1
Blower Size	37	2	5	9	18	kW
Process Summary						
Design Sludge Age	20	20	20	20	20	days
Total Mass of Waste Biological Sludge	208	44	104	208	208	kg TSS/day.Train
Total Mass of Waste Chemical Sludge	64	14	32	64	64	kg TSS/day.Train
Total Mass of Waste Sludge	272	58	136	272	272	kg TSS/day.Train
Total Mass of Waste Sludge	1088	58	136	272	544	kg TSS/day
Reactor HRT (Excluding MBR & Deaeration Zone)	18					hours

Sludge Wasting

Parameter	Ultimate Stage (Stage 4)	Stage 1	Stage 2a	Stage 2b	Stage 3b	Units
Total Chemical Sludge	64	14	32	64	64	kg TSS/day.Train
Biological Sludge Production	208	44	104	208	208	kg TSS/day.Train
Total Sludge Production	34	7	17	34	34	m3/day.Train

UV Disinfection

Obtain from suppliers

Parameter	Ultimate Stage (Stage 4)	Stage 1	Stage 2a	Stage 2b	Stage 3b	Units
Peak flow Rate	143	8	18	36	71	L/s
Received/Applied Dose	45	45	45	45	45	mJ/cm2.s
Minimum Transmissivity	50	50	50	50	50	%
Required log removal	>4	>4	>4	>4	>4	log
Number of Banks	7	2	2	4	5	uty / Duty / Standby / Stand Duty/

Chlorine Contact Pipeline

Parameter	Ultimate Stage (Stage 4)	Stage 1	Stage 2a	Stage 2b	Stage 3b	Units
Chlorine Contact Pipeline Volume	466	40	306	306	466	m3
Required volume	495	38	88	176	353	m3
Actual Length	4220	943	2770	2770	4220	m

Chemical Dosing Facilitie

Additional Carbon Source

	Acetic Acid	Stage 1	Stage 2a	Stage 2b	Stage 3b	Units
Solution strength	75%	75%	75%	75%	75%	%
Required amount of neat solution	0.4	0.02	0.05	0.1	0.2	m3/d
Required storage time	30	30	30	30	30	days
Selected storage volume	40	0.8	40.0	40	40	m3

Ferric Sulphate Dosing

To Inlet Works For Odour Control	Ultimate Stage (Stage 4)	Stage 1	Stage 2a	Stage 2b	Stage 3b	Units
Assumed Influent Sulphide Concentration	5.0	5.0	5.0	5.0	5.0	mg/L
Fe:S molar Ratio	3.5	3.5	3.5	3.5	3.5	:1
Dose Rate of Ferric Sulphate	62	62	62	62	62	mg Fe2(SO4)3/L
Amount of Ferric Sulphate Required	**74**	**37**	**37**	**74**	**74**	L Fe2(SO4)3 /d.train
Storage Volume Required	30					days
Selected Dosing Pump Capacity	35					L/hr
Chemical Ferric Sludge Production	33	7	16	33	33	kg/d.Train

To Bioreactor for P Removal	Ultimate Stage (Stage 4)	Stage 1	Stage 2a	Stage 2b	Stage 3b	Units
Target Effluent P Concentration	0.2					mg/L
Fe:P molar Ratio	5.0					:1
Dose Rate of Ferric Sulphate	67					mg Fe2(SO4)3/L
Amount of Ferric Sulphate Required	**71**	**15**	**36**	**71**	**71**	L Fe2(SO4)3 /d.train
Storage Volume Required	30					days
Selected Dosing Pump Capacity	20					L/hr
Chemical Ferric Sludge Production	31	7	15	31	31	kg/d.Train

Chemical Sludge Product	Ultimate Stage (Stage 4)	Stage 1	Stage 2a	Stage 2b	Stage 3b	Units
Total Chemical Ferric Sludge Production	63.7	13.5	31.8	63.7	63.7	kg/d.Train
Total Chemical Ferric Sludge Production	254.7	13.5	31.8	63.5	127.0	kg/d
Chemical Ferric Sludge Production	18.0					kg/d

Selected Ferric Sulphate Tank Capacity	35,000					L

Magnesium Hydroxide Dosing Facili

Parameter	Ultimate Stage (Stage 4)	Stage 1	Stage 2a	Stage 2b	Stage 3b	Units
Mg(OH)2 dose rate required	120					mg Mg(OH)2 (100%) /L
Solution Strength	58					Wt%
Dose Rate Required	206					mg Mg(OH)2 / L
Solution specific gravity	1500					kg/m3
Selected Pump Capacity	60					L/h
Required storage Time	30					days
Required Tank Capacity	14,004					L
Selected Tank Capacity	25,000					L

Chemical Dosing Facilities continue

Polymer for dewatering centrifuge

Parameter	Ultimate Stage (Stage 4)	Stage 1	Stage 2a	Stage 2b	Stage 3b	Units
Maximum Polymer Dose Rate	10					kg/TDS
Dewatering Capacity	0.39					TDS/hr
Polymer Dosing Capacity	3.9					kg Polymer /hr
Primary Polymer Dilution Concentration	0.5					%
Selected Polymer Dose Pump Capacity	500					L/hr @ 0.5 %
Selected Polymer Dilute Dose concetration	0.2					%
Dilute Polymer Flowrate (0.2%)	1219	65	152	304	608	L/hr
Reclaimed Effluent Required for Post Dilution	731	39	91	182	365	L/hr

MBR Cleaning Chemicals: Sodium Hypochlorite

Parameter	Ultimate Stage (Stage 4)	Stage 1	Stage 2a	Stage 2b	Stage 3b	Units
FOR INFORMATION ONLY, VENDOR TO SUPPLY						
Volume required for chemical cleans	1157					m3
Volume of tank installed	8					m3
Volume required per maintenance clean	30					L/clean
Pump rate required for maintenance clean						L/hr
Volume required per recovery clean	643					L/clean
Pump rate required for recovery clean						L/hr

MBR cleaning chemicals: Citric Acid

Parameter	Ultimate Stage (Stage 4)	Stage 1	Stage 2a	Stage 2b	Stage 3b	Units
FOR INFORMATION ONLY, VENDOR TO SUPPLY						
Volume of tank installed	1.0					m3
Volume required per maintenance clean	30					L/clean
Pump rate required for maintenance clean						L/hr
Volume required per recovery clean	321.6					L/clean
Pump rate required for recovery clean						L/hr

Sludge Treatment Process

WAS Thickening

Parameter	Ultimate Stage (Stage 4)					Units
Average Hydraulic Load per unit	5.7					m3/hr
Peak Hydraulic load per unit	17.0					m3/hr
Selected Thickening Unit Capacity	20.0					m3/hr
	Based on Midi (or Maxi) Aldrum Drum Thickener					
Total Number of Units Required	2					Duty/Standby
Solids Capture rate	95%					
Average Thickened Sludge	1033.6	54.8	128.9	257.7	515.4	kg/d
Peak Thickened Sludge	1033.6	54.8	128.9	257.7	515.4	kg/d
Minimum thickened Sludge Concentration	3.0%					%ds
Average Thickened Sludge Concentration	3.5%					%ds
Average Thickened Sludge Volume	29.5					m3/d
Peak Thickened Sludge Volume	34.5					m3/d
Average Filtrate Volume	101.8	5.4	12.7	25.4	50.7	m3/day
Peak Filtrate Volume	107.5	5.7	13.4	26.8	53.6	m3/day
Selected Filtrate Pipe Size	50					mm
Filtrate Return Velocity	1.9					m/s
Average Filtrate Concentration	178					mg/L

Sludge Treatment Process

Aerobic Digester

Parameter	Ultimate Stage (Stage 4)					Units
Aerobic Digester						
Selected VSS Destruction in Digester	22					%
Required Digester Solids Retention Time	11					days
Total Digester Volume	399					m3
Number of Digester Trains	2					
Number of Zones per Bioreactor	4					
Aerobic Digester Zone 1						
Aerobic Digester Zone 1 Digester Volume per Digester	49.9					m3
Aerobic Digester Zone 1 Digester Depth	4					m
Aerobic Digester zone 1 Length	3.5					m
Aerobic Digester zone 1 Width	3.5					m
Aerobic Digester Zone 1 Mixer	0.55					kW
Aerobic Digester Zone 4 Airflow rate Required Minimum (NTP) per bioreactor	79.6					m3 Air (NTP)/hr
Aerobic digester Zone 4 Airflow rate Required Average (NTP) per bioreactor	143.2					m3 Air (NTP)/hr
Aerobic Digester Zone 4 Airflow rate Required MAX (NTP) per bioreactor	179.0					m3 Air (NTP)/hr
Aerobic Digester Zone 2						
Aerobic Digester Zone 2 Digester Volume per Digester	49.9					m3
Aerobic Digester Zone 2 Depth	4					m
Aerobic Digester Zone 2 Width	3.5					m
Aerobic Digester Zone 2 Length	3.5					m
Aerobic Digester Zone 2 Mixer	0.55					kW
Aerobic Digester Zone 4 Airflow rate Required Minimum (NTP) per bioreactor	50.6					m3 Air (NTP)/hr
Aerobic digester Zone 4 Airflow rate Required Average (NTP) per bioreactor	91.0					m3 Air (NTP)/hr
Aerobic Digester Zone 4 Airflow rate Required MAX (NTP) per bioreactor	113.8					m3 Air (NTP)/hr
Aerobic Digester Zone 3						
Aerobic Digester Zone 3 Digester Volume per Digester	49.9					m3
Aerobic Digester Zone 3 Depth	4					m
Aerobic Digester Zone 3 Width	3.5					m
Aerobic Digester Zone 3 Length	3.5					m
Aerobic Digester Zone 3 Mixer	0.55					kW
Aerobic Digester Zone 4 Airflow rate Required Minimum (NTP) per bioreactor	81.1					m3 Air (NTP)/hr
Aerobic digester Zone 4 Airflow rate Required Average (NTP) per bioreactor	146.0					m3 Air (NTP)/hr
Aerobic Digester Zone 4 Airflow rate Required MAX (NTP) per bioreactor	182.5					m3 Air (NTP)/hr

Sludge Treatment Process

Parameter	Ultimate Stage (Stage 4)					Units
Aerobic Digester Zone 4						
Aerobic Digester Zone 3 Digester Volume per Digester	49.9					m3
Selected Digester Depth	4					m
Aerobic Digester Zone 4 Width	3.5					m
Aerobic Digester Zone 4 Length	3.5					m
Aerobic Digester Zone 4 Mixer	0.55					kW
Aerobic Digester Zone 4 Airflow rate Required Minimum (NTP) per bioreactor	22.6					m3 Air (NTP)/hr
Aerobic digester Zone 4 Airflow rate Required Average (NTP) per bioreactor	40.6					m3 Air (NTP)/hr
Aerobic Digester Zone 4 Airflow rate Required MAX (NTP) per bioreactor	50.8					m3 Air (NTP)/hr
Aerobic Digester Blower						
Total Airflow Aerating 1 & 4 Simultaneously (Minimum)	102.1					m3 Air (NTP)/hr
Total Airflow Aerating 1 & 4 Simultaneously (Maximum)	229.8					m3 Air (NTP)/hr
Total Airflow Aerating 2 & 3 Simultaneously (Minimum)	131.7					m3 Air (NTP)/hr
Total Airflow Aerating 2 & 3 Simultaneously (Maximum)	296.3					m3 Air (NTP)/hr
Selected Design Blower Airflow (Minimum)	131.7					m3 Air (NTP)/hr
Selected Design Blower Airflow (Maximum)	296.3					m3 Air (NTP)/hr
Required Blower Motor Size per Blower	3					kw
Number of Blowers	3					Duty/Duty/Standby

Sludge Dewatering

Parameter	Ultimate Stage (Stage 4)					Units
Centrifuge Feed Pumps						
Selected Centrifuge Feed Pump Capacity	5.0					L/s
Number of Centrifuge Feed Pumps	2					Duty / Standby
Centrifuge Feed Pump Drive	VSD					
Dewatering Centrifuge						
Number of Centrifuges Required	1					
Selected Centrifuge Capacity	13					m3/hr
	Based on Alfa Laval Decanter Model G2-45					
Weekly Sludge Feed	241.2					m3/week
Daily Sludge Feed	34.5					m3/day
Average Sludge Flow	0.4					L/s
Sludge Feed Concentration	3					%
Required Dewatering Run time	18.6					hrs/Week
Estimated Dewatered Sludge Concentration	20					%
Density of dewatered cake	1050					kg/m3
Wet Solids Produced	36.2					m3/week
Dry Solids Production	7.2					TDS/week
Weight of sludge cake produced	38.0					tonnes/wk
Maximum Dewatered Solids Produced	2.0					m3/hr
Maximum Solids Production @ 15%	2.0					tonnes/hr
Dewatering Skip						
Selected Skip Bin Effective Size	20					m3
Total Skip Bin Volume	26.7					m3
Weekly Dewatered Sludge	36.2					m3/week
Bin Movements	1.8					Bins per week

Reclaimed Effluent System

Assuming stand alone RE pumps. Alternative option to have a bleed from Non-Potable water supply pumps

Parameter	Ultimate Stage (Stage 4)					Units
RE Storage Volume	120					m3
Number of Duty RE Pumps	2					Duty / Standby
Pump Flowrate	19					L/s
Head required	75					m
Pump Efficiency	60					%
Motor Efficiency	95					%
Selected Motor Size	30					kW

Foul Water Tank

This data taken from Balancing Tank Spreadsheet

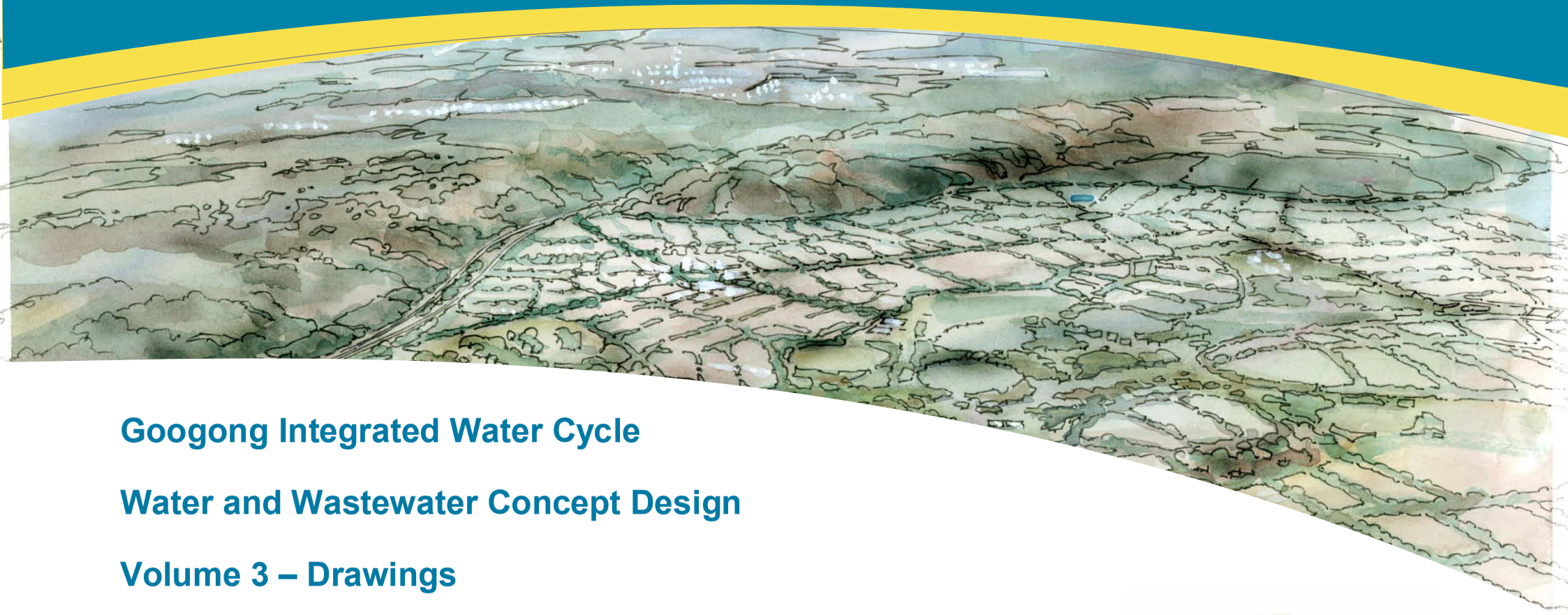
Parameter	Ultimate Stage (Stage 4)					Units
Foul Water Tank Volume	100					m3
Number of Foul Water Pumps	2					Duty/Standby
Pump Flowrate	5					L/s
Head Required	2					m

First Flush Tank

Parameter	Ultimate Stage (Stage 4)					Units
Detention for runoff	10					mm
First Flush Pump capacity	2					L/s
Number of Pumps Required	2					1 Duty / 1 Standby
First Flush Tank Capacity	150					m3
Selected Tank Depth	3					m
Tank Diameter	8.0					m
Freeboard	0.5					m
Total Tank Depth	3.5					m

MWH

BUILDING A BETTER WORLD



Googong Integrated Water Cycle

Water and Wastewater Concept Design

Volume 3 – Drawings

Prepared for CIC Australia

11 October 2010

CIC AUSTRALIA

Communities in the making

GOOGONG INTERGRATED WATER CYCLE
DRAWING LIST

PROCESS FLOW DIAGRAMS

A1081402-P101	PFD - WATER RECYCLING PLANT ULTIMATE FLOWS-STAGE 1
A1081402-P102	PFD - WATER RECYCLING PLANT ULTIMATE FLOWS-STAGE 2A
A1081402-P103	PFD - WATER RECYCLING PLANT ULTIMATE FLOWS-STAGE 2B

PIPING AND INSTRUMENT DIAGRAMS

A1081402-P201	P & I D - WATER RECYCLING PLANT SYMBOL SHEET 1 OF 2
A1081402-P202	P & I D - WATER RECYCLING PLANT SYMBOL SHEET 2 OF 2
A1081402-P203	P & I D - WATER RECYCLING PLANT LEGEND AND ABBREVIATIONS
A1081402-P204	P & I D - WATER RECYCLING PLANT SCREENS SHEET 1 OF 2
A1081402-P205	P & I D - WATER RECYCLING PLANT SCREENS SHEET 2 OF 2
A1081402-P206	P & I D - WATER RECYCLING PLANT SCREENINGS HANDLING SYSTEM
A1081402-P207	P & I D - WATER RECYCLING PLANT FLOW DISTRIBUTION CHAMBER
A1081402-P208	P & I D - WATER RECYCLING PLANT ANOXIC / AERATION TANK 1
A1081402-P209	P & I D - WATER RECYCLING PLANT DEAERATION/SECONDARY ANOXIC TANK 1
A1081402-P210	P & I D - WATER RECYCLING PLANT DEAERATION-SECONDARY ANOXIC TANK NO. 1
A1081402-P211	P & I D - WATER RECYCLING PLANT MEMBRANE TANK NO. 2
A1081402-P212	P & I D - WATER RECYCLING PLANT AERATION BLOWERS
A1081402-P213	P & I D - WATER RECYCLING PLANT MEMBRANE BLOWERS
A1081402-P214	P & I D - WATER RECYCLING PLANT PERMEATE / BACKPULSE PUMP SYSTEM
A1081402-P215	P & I D - WATER RECYCLING PLANT UV SYSTEM
A1081402-P216	P & I D - WATER RECYCLING PLANT CHLORINE CONTACT TANK
A1081402-P217	P & I D - WATER RECYCLING PLANT RECLAIMED EFFLUENT STORAGE
A1081402-P218	P & I D - WATER RECYCLING PLANT RECLAIMED EFFLUENT STORAGE
A1081402-P219	P & I D - WATER RECYCLING PLANT WAS THICKENING
A1081402-P220	P & I D - WATER RECYCLING PLANT WAS THICKENING
A1081402-P221	P & I D - WATER RECYCLING PLANT SLUDGE DEWATERING - CENTRIFUGES
A1081402-P222	P & I D - WATER RECYCLING PLANT SLUDGE DEWATERING - OUTLOADING
A1081402-P223	P & I D - WATER RECYCLING PLANT FERRIC SULPHATE DOSING SHEET 1 OF 2
A1081402-P224	P & I D - WATER RECYCLING PLANT FERRIC SULPHATE DOSING SHEET 2 OF 2
A1081402-P225	P & I D - WATER RECYCLING PLANT MAGNESIUM HYDROXIDE SYSTEM
A1081402-P226	P & I D - WATER RECYCLING PLANT POLYMER DOSING SYSTEM
A1081402-P227	P & I D - WATER RECYCLING PLANT CITRIC ACID DOSING SYSTEM
A1081402-P228	P & I D - WATER RECYCLING PLANT SODIUM HYPOCHLORITE DOSING SYSTEM
A1081402-P229	P & I D - WATER RECYCLING PLANT SUPPLEMENTARY CARBON DOSING
A1081402-P231	P & I D - WATER RECYCLING PLANT FOUL WATER TANK
A1081402-P233	P & I D - WATER RECYCLING PLANT COMPRESSED AIR SYSTEM
A1081402-P234	P & I D -WATER RECYCLING PLANT AMENITIES BUILDING PUMPING STATION
A1081402-P235	P & I D -WATER RECYCLING PLANT POTABLE WATER
A1081402-P236	P & I D - WATER RECYCLING PLANT BIOTRICKLING FILTER (TYPICAL)
A1081402-P237	P & I D - WATER RECYCLING PLANT DUAL BED ACTIVATED CARBON FILTER (TYPICAL)
A1081402-P238	P & I D - WATER RECYCLING PLANT ODOUR CONTROL FACILITY OVERVIEW FANS AND DISCHARGE STACK
A1081402-P239	P & I D - GRIT REMOVAL
A1081402-P306	P & I D - WATER RECYCLING PLANT RECLAIMED EFFLUENT STORAGE OPTION TO DISHARGE THROUGH BASIN 4

GENERAL DRAWINGS

A1081402-G001	WATER RECYCLING PLANT GENERAL SCHEME LAYOUT
A1081402-G002	SEWAGE PUMPSTATION CATCHMENT PLAN

SKETCHES

A1081402-SK001	POTABLE AND RECYCLED WATER NETWORK INITIAL STAGE FOR NH1A (ST 1-2)
A1081402-SK002	POTABLE AND RECYCLED WATER NETWORK NH1A (STAGE 3-6) AND START RECYCLED WATER
A1081402-SK003	POTABLE AND RECYCLED WATER NETWORK 50% DEVELOPMENT UPGRADE
A1081402-SK004	POTABLE AND RECYCLED WATER NETWORK 100% DEVELOPMENT UPGRADE
A1081402-SK301	RESERVOIR - SITE LAYOUT
A1081402-SK302	RESERVOIR - GENERAL SITE ELEVATION
A1081402-SK303	GOOGONG INTERIM RESERVIOR - SITE LAYOUT - PLAN
A1081402-SK304	GOOGONG INTERIM RESERVIOR - SITE LAYOUT - ELEVATION
A1081402-SK601	BULK WATER PUMPING STATION GENERAL SITE LAYOUT PLAN COMMONWEALTH SITE - PLAN STAGE 1
A1081402-SK602	BULK WATER PUMPING STATION GENERAL SITE LAYOUT PLAN COMMONWEALTH SITE - PLAN STAGE 2
A1081402-SK608	WATER RECYCLING PLANT -BIOREACTOR STAGING - PLAN AND ELEVATION
A1081402-SK701	WATER RECYCLING PLANT- GENERAL SITE LAYOUT - STAGE 1 (1000EP)
A1081402-SK702	WATER RECYCLING PLANT- GENERAL SITE LAYOUT - STAGE 2A (2350EP)
A1081402-SK703	WATER RECYCLING PLANT- GENERAL SITE LAYOUT - STAGE 2B (4700EP)
A1081402-SK704	WATER RECYCLING PLANT- GENERAL SITE LAYOUT - STAGE 3 (9400EP)
A1081402-SK705	WATER RECYCLING PLANT- GENERAL SITE LAYOUT - STAGE 4 (18849EP)

REV.	DATE	DESCRIPTION	INITIAL	DATE	INITIAL	DATE
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A	11.10.10	ISSUED FOR CONCEPT DESIGN REPORT	AW	11.10.10	PP	11.10.10

REV.	DATE	DESCRIPTION	INITIAL	DATE	INITIAL	DATE
			CHECKED		APPROVED	

REVIEW	NAME	SIGNATURE	DATE
DRAWN	-		-
DRAWING CHECK	-		DRFTCHK_D
DESIGN	-		DSN_D
DESIGN CHECK	-		DSNCHK_D
PROJ. MANAGER	-		PROJ_M_D

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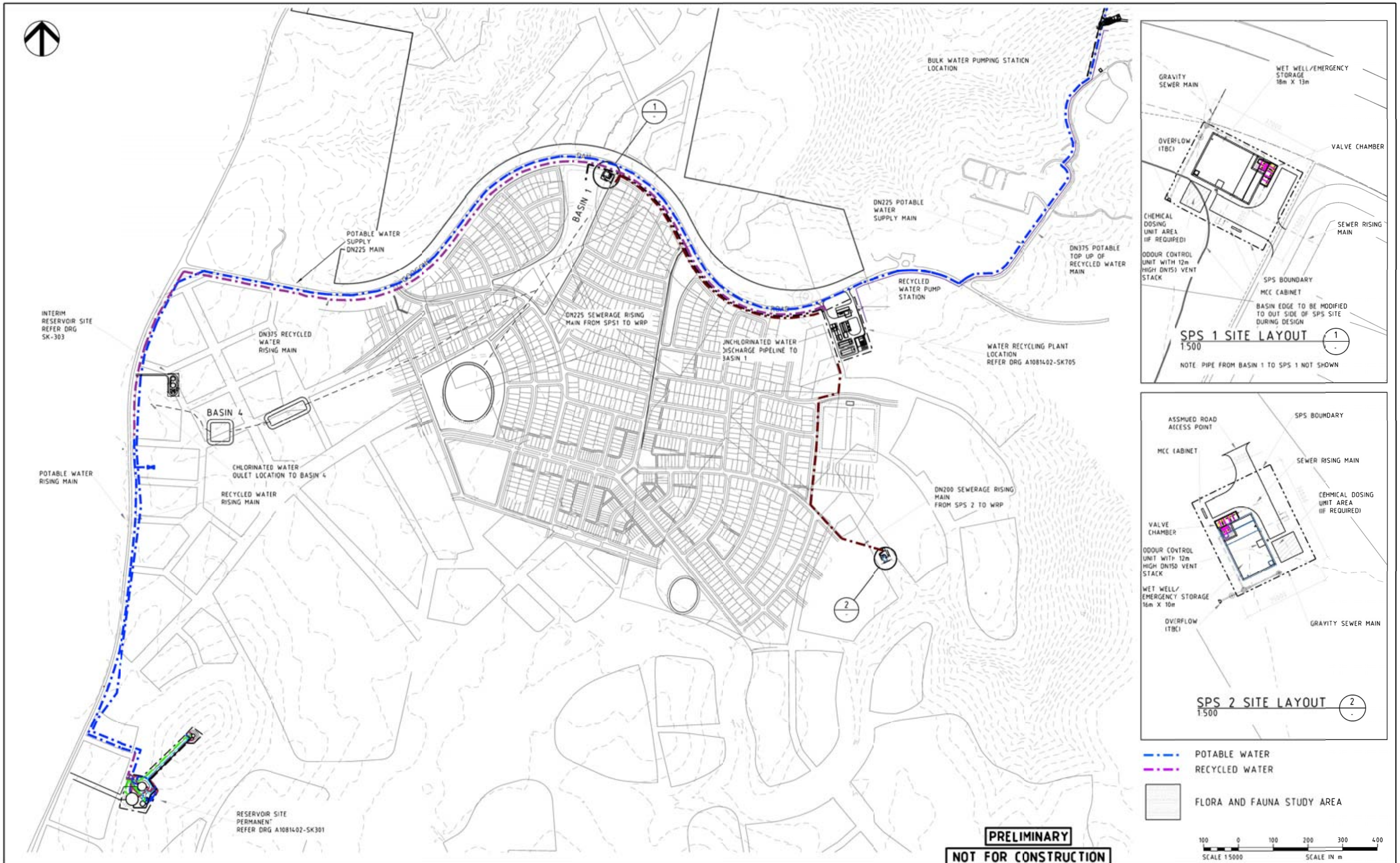
CLIENT :
AUSTRALIA
Communities in the making

PROJECT: GOOGONG INTEGRATED WATER CYCLE

TITLE: INTEGRATED WATER CYCLE DRAWING LIST

SIZE:	SCALE:	DRAWING No.:	REV.
A1	NTS	A1081402-G-000	A



PRELIMINARY

NOT FOR CONSTRUCTION

REVIEW	NAME	SIGNATURE	DATE
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DRAWING CHECK	-		DRFTCHK_D
DESIGN	-		DSN_D
DESIGN CHECK	-		DSNCHK_D
PROJ. MANAGER	-		PROJ_M_D

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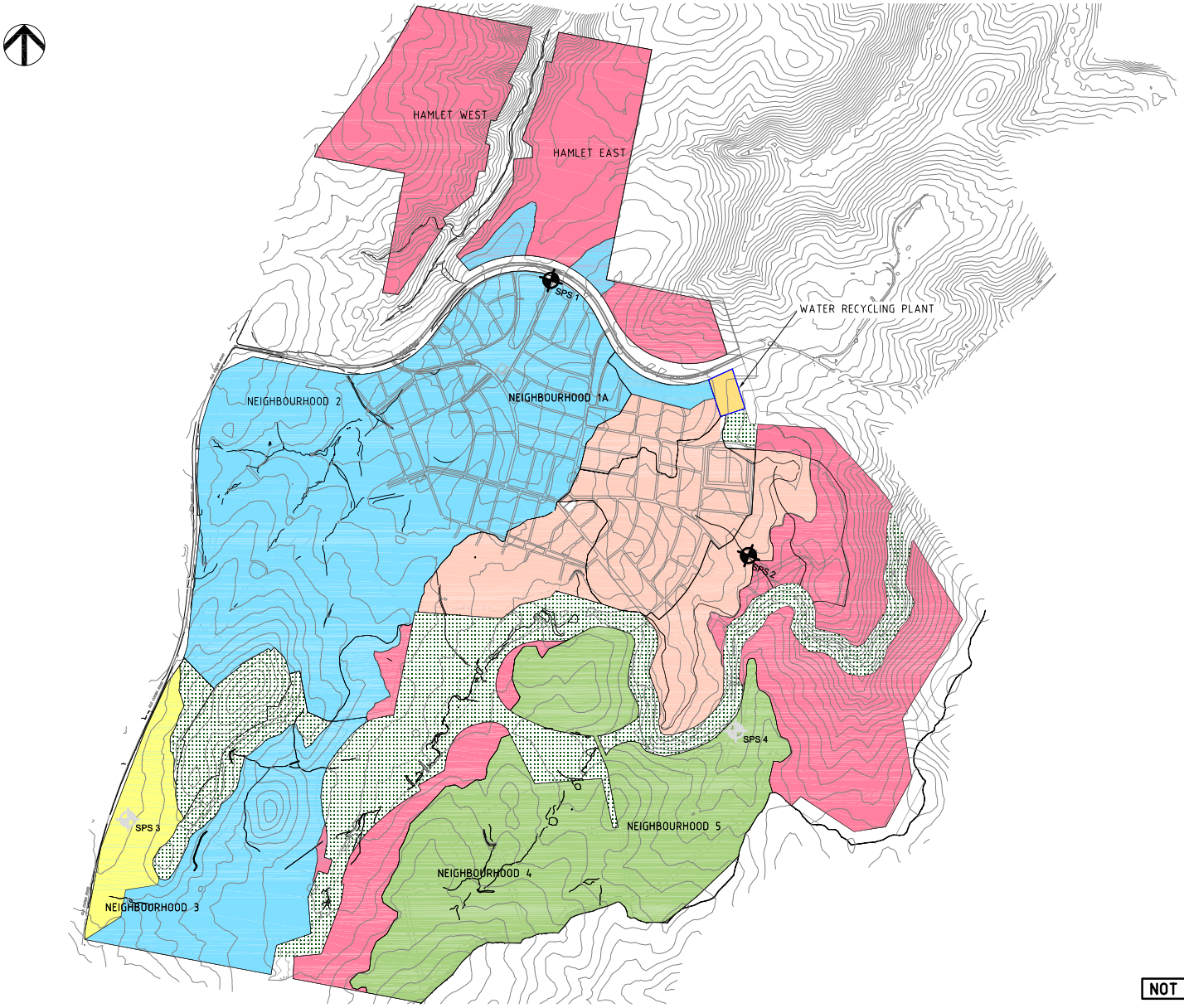
PROJECT
GOOGONG INTEGRATED WATER CYCLE

TITLE
INTEGRATED WATER CYCLE
GENERAL SCHEME LAYOUT
PLAN

SIZE	SCALE	DRAWING No.	REV.
A1	1:5000	A1081402-G-001	C

REV.	DATE	DESCRIPTION	INITIAL (CHECKED)	DATE (CHECKED)	INITIAL (APPROVED)	DATE (APPROVED)



AREA NOT SEWERED

GRAVITY SEWER NETWORK TO SPS 1

GRAVITY SEWER NETWORK TO SPS 2

GRAVITY SEWER NETWORK TO SPS 3

GRAVITY SEWER NETWORK TO SPS 4

LOW LYING AREA POSSIBLE PSS NETWORK

NEIGHBORHOOD 1 SEWAGE PUMPING STATION

FUTURE SEWAGE PUMPING STATION

NOTES

1. SEWERAGE CATCHMENTS BASED ON SEWERAGE NETWORK LAID AT MINIMUM GRADE OF 0.5%.
2. ALL CATCHMENT BOUNDARIES AND SPS LOCATIONS TO BE CONFIRMED DURING DETAIL DESIGN.

100 0 100 200 300 400

SCALE 1:5000 SCALE IN m

PRELIMINARY
NOT FOR CONSTRUCTION

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B	20.07.10	ISSUED FOR REVIEW	PP	20.07.10		
A	03.11.09	ISSUED FOR CONCEPT DESIGN REPORT				

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DRAWING CHECK	-		-
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DESIGN CHECK	-		-
PROJ. MANAGER	-		-

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GOOGONG INTEGRATED WATER CYCLE

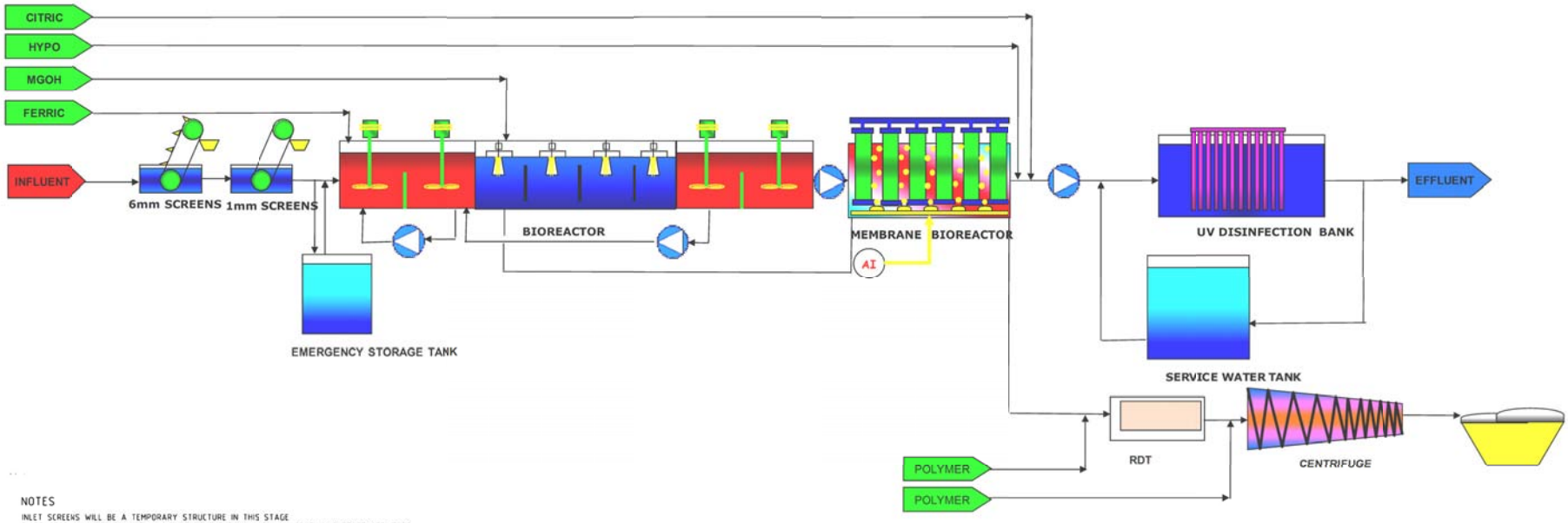
SEWAGE PUMP STATION CATCHMENT PLAN

SIZE:	SCALE:	DRAWING No.:	REV.
A1	NTS	A1081402-G002	B

CAD FILE NAME:

GOOGONG PROCESS FLOW DIAGRAM

Stage 1



NOTES

INLET SCREENS WILL BE A TEMPORARY STRUCTURE IN THIS STAGE
BIOREACTOR WILL OCCUPY A SMALL PART OF ONE TANK AND WILL CONTAIN SURFACE AERATORS
NO RECYCLED WATER, THEREFORE CHLORINATION NOT INSTALLED YET
CHEMICALS WILL BE STORED IN BULKY BINS IN THIS STAGE
2 MEMBRANE TANKS PROVIDED IN ONE ULTIMATE TANK TO ALLOW FOR BACKWASHING
2 NO UV UNITS PROVIDED
ODOUR CONTROL WILL BE PROVIDED IN THE FORM OF BIOTRICKLING FILTER AND CARBON UNIT

PRELIMINARY NOT FOR CONSTRUCTION

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DRAWING CHECK			
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DESIGN CHECK			
PROJ. MANAGER			

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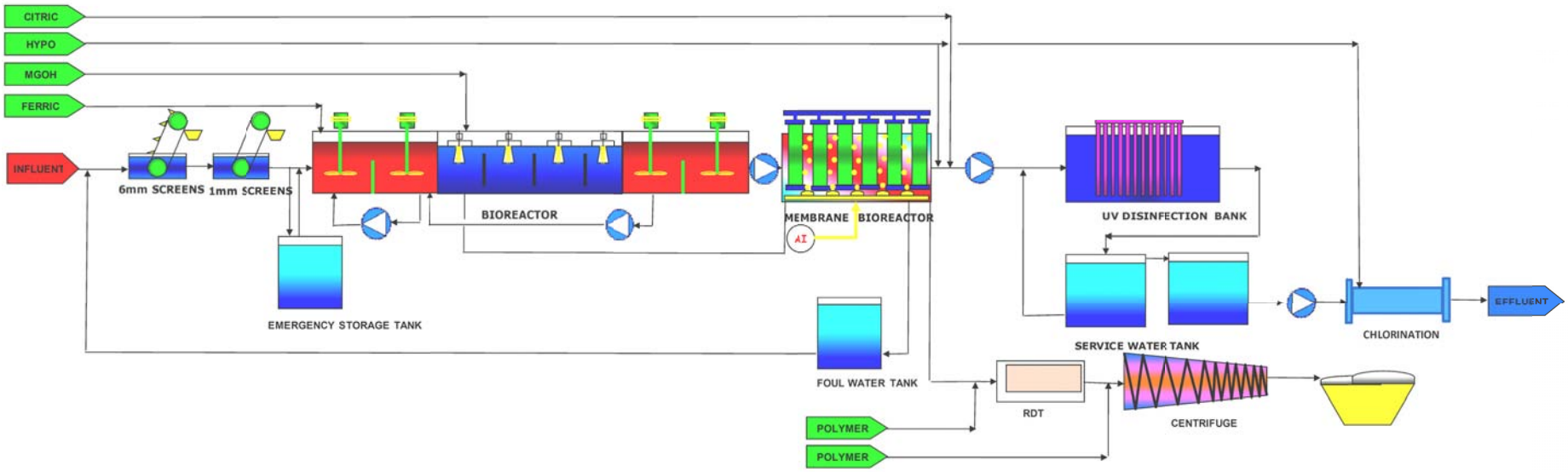
PROJECT
GOOGONG INTEGRATED WATER CYCLE

TITLE
PROCESS FLOW DIAGRAM
WATER RECYCLING PLANT ULTIMATE FLOWS
STAGE 1

SIZE	SCALE	DRAWING No.	REV.
A1	NTS	A1081402-P101	A



NOTES

INLET SCREENS WILL BE A TEMPORARY STRUCTURE IN THIS STAGE
BIOREACTOR WILL OCCUPY A HALF OF ONE TANK AND WILL CONTAIN SURFACE AERATORS
CHEMICAL STORAGE AREA WILL BE PROVIDED IN THIS STAGE
2 MEMBRANE TANKS PROVIDED IN ONE ULTIMATE TANK TO ALLOW FOR BACKWASHING
3 NO UV UNITS
ODOUR CONTROL WILL BE PROVIDED IN THE FORM OF BIOTRICKLING FILTER AND CARBON UNIT

PRELIMINARY **NOT FOR CONSTRUCTION**

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DRAWING CHECK			
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DESIGN CHECK			
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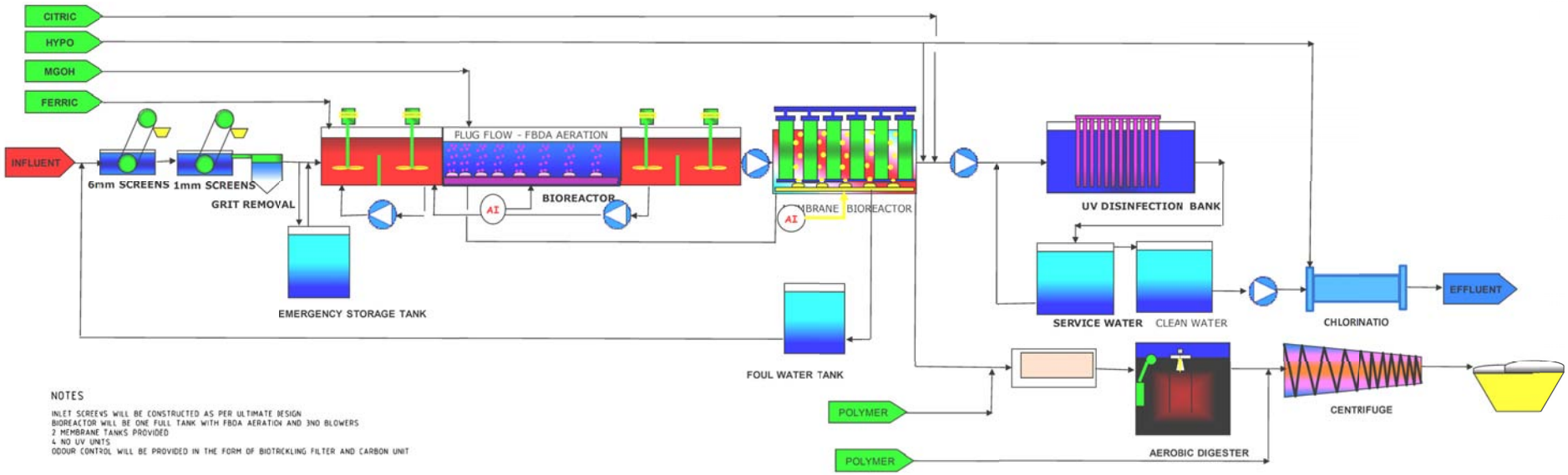
PROJECT
GOOGONG INTEGRATED WATER CYCLE

TITLE
PROCESS FLOW DIAGRAM
WATER RECYCLING PLANT ULTIMATE FLOWS
STAGE 2A

SIZE	SCALE	DRAWING No.	REV.
A1	NTS	A1081402-P102	A

Stage 2B



NOTES

INLET SCREEVS WILL BE CONSTRUCTED AS PER ULTIMATE DESIGN
BIOREACTOR WILL BE ONE FULL TANK WITH FBDA AERATION AND 3ND BLOWERS
2 MEMBRANE TANKS PROVIDED
4 NO UV UNITS
ODOUR CONTROL WILL BE PROVIDED IN THE FORM OF BIOTRICKLING FILTER AND CARBON UNIT

PRELIMINARY **NOT FOR CONSTRUCTION**

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PROJECT
GOOGONG INTEGRATED WATER CYCLE

TITLE
PROCESS FLOW DIAGRAM
WATER RECYCLING PLANT ULTIMATE FLOWS
STAGE 2B

SIZE	SCALE	DRAWING No.	REV.
A1	NTS	A1081402-P103	A

PUMP, CENTRIFUGAL
PUMP, SUBMERSIBLE
PUMP, AXIAL
PUMP, PERISTALTIC
PUMP, SUBMERGED SUCTION
PUMP, POSITIVE DISPLACEMENT
PUMP, METERING
PUMP, ROTARY LOBE
BLOWER OR FAN
AIR COMPRESSOR GENERAL
COMPRESSOR POSITIVE DISPLACEMENT
COMPRESSOR CENTRIFUGAL
CENTRIFUGE
STATIC MIXER
VIBRATOR
MACERATOR
HEATING/COOLING COIL
AIR HEATER
AIR COOLER
FLOATING SURFACE AERATOR
FIXED SURFACE AERATOR
MIXER
CYCLONE
SCREW CONVEYOR
BELT CONVEYOR
SCREEN

FAN/PROPELLER
SCUM SCRAPER
TELESCOPIC BELLMOUTH
WEIR
DECANTER
FLUME
PULSATION DAMPENER
SILENCER
SPRAY NOZZLE
AIR DIFFUSER
CHEMICAL DIFFUSER
HUMIDIFIER
WEIGHTED NON-RETURN INLET DAMPER
DAMPER
FIRE DAMPER
INJECTOR
EDUCTOR
AIR FILTER
MEMBRANE FILTER
STRAINER
Y STRAINER
BUCKET STRAINER
STEAM TRAP
FLEXIBLE COUPLING
EXPANSION JOINT
CONCENTRIC REDUCER
ECCECTRIC REDUCER
FLEXIBLE HOSE
FLANGE
CAP FLANGE
HOSE COUPLING
ORIFICE PLATE
SPADE BLIND

RUPTURE DISC
VACUUM BREAKER
RODDING POINT
AIR AUTO CONDENSATE DRAIN TRAP
AIR AUTO CONDENSATE DRAIN TRAP WITH FILTER
AIR FILTER
VERMIN PROOF MESH
FLAME ARRESTER
STRAIGHTENING VANES
CALIBRATION CYLINDER
AUTO SAMPLER
PENSTOCK
STOPBOARD FRAME
STOPBOARD/BULKHEAD GATE (NORMALLY OPEN)
STOPBOARD/BULKHEAD GATE (NORMALLY CLOSED)
VALVE - GENERIC
VALVE - NORMALLY CLOSED
BALL VALVE
GATE VALVE
KNIFE EDGE GATE VALVE
BUTTERFLY VALVE
GLOBE VALVE
BACKFLOW PREVENTER (RPZ)
REFLUX VALVE
DIAPHRAGM VALVE
PLUG VALVE
ECCENTRIC PLUG VALVE
NEEDLE VALVE
SAFETY/RELIEF VALVE
PRESSURE & VACUUM RELIEF VALVE
FLAP VALVE
FOOT VALVE
SLIDE VALVE
PRESSURE REGULATING VALVE (SELF CONTAINED PRV OR PSV)

THREE PORT VALVE
FOUR PORT VALVE W/ SOLENOID
SOLENOID ACTUATED VALVE
BACK PRESSURE VALVE
STATICALLY LOADED
SPRING LOADED
WEIGHT ACTUATOR
FLOAT ACTUATOR
MANUAL OPERATED VALVE - GENERIC
MOTOR OPERATED VALVE - GENERIC
CONTROL VALVE OPENS ON FAILURE OF ACTUATING ENERGY
CONTROL VALVE CLOSES ON FAILURE OF ACTUATING ENERGY
CONTROL VALVE RETAINS POSITION ON FAILURE OF ACTUATING ENERGY
PNEUMATIC CYLINDER ACTUATOR (GENERIC - SINGLE ACTUATING)
PNEUMATIC CYLINDER ACTUATOR (SINGLE ACTUATING, SPRING RETURN) OPENS ON FAILURE OF ACTUATING ENERGY
PNEUMATIC CYLINDER ACTUATOR (SINGLE ACTUATING, SPRING RETURN) CLOSES ON FAILURE OF ACTUATING ENERGY
PNEUMATIC CYLINDER ACTUATOR (SINGLE ACTUATING, SPRING RETURN) RETAINS POSITION ON FAILURE OF ACTUATING ENERGY
PNEUMATIC CYLINDER ACTUATOR (GENERIC - DOUBLE ACTUATING)
PNEUMATIC CYLINDER ACTUATOR (DOUBLE ACTUATING) OPENS ON FAILURE OF ACTUATING ENERGY
PNEUMATIC CYLINDER ACTUATOR (DOUBLE ACTUATING) CLOSES ON FAILURE OF ACTUATING ENERGY
PNEUMATIC CYLINDER ACTUATOR (DOUBLE ACTUATING) RETAINS POSITION ON FAILURE OF ACTUATING ENERGY
MASS FLOWMETER
ULTRASONIC FLOWMETER
MAGNETIC FLOWMETER
TURBINE FLOWMETER
ROTAMETER OR GAP METER
TARGET FLOWMETER
AVERAGING PITOT TUBE FLOWMETER
POSITIVE DISPLACEMENT FLOWMETER

INSTRUMENT, LOCALLY MOUNTED
INSTRUMENT, FRONT MOUNTED IN CENTRAL PANEL
INSTRUMENT, REAR MOUNTED IN CENTRAL PANEL
INSTRUMENT, FRONT MOUNTED IN LOCAL PANEL
INSTRUMENT, REAR MOUNTED IN LOCAL PANEL
COMPUTER INTERFACE WITH SHARED FUNCTIONS FOR DISPLAY & CONTROL LOCALLY MOUNTED
COMPUTER INTERFACE WITH SHARED FUNCTIONS FOR DISPLAY & CONTROL CENTRAL PANEL MOUNTED
COMPUTER INTERFACE WITH SHARED FUNCTIONS FOR DISPLAY & CONTROL LOCAL PANEL MOUNTED
STATUS INDICATOR LOCALLY MOUNTED
STATUS INDICATOR, FRONT MOUNTED IN CENTRAL PANEL
STATUS INDICATOR, REAR MOUNTED IN CENTRAL PANEL
STATUS INDICATOR, FRONT MOUNTED IN LOCAL PANEL
STATUS INDICATOR, REAR MOUNTED IN LOCAL PANEL
COMPUTER INTERFACE OPERATOR LOCALLY MOUNTED
COMPUTER INTERFACE OPERATOR CENTRAL PANEL MOUNTED
COMPUTER INTERFACE OPERATOR LOCAL PANEL MOUNTED
PLC
MOTOR CONTROL CENTRE
INTERLOCK
I = UNDEFINED LOGIC
OR = LOGICAL OR
& = LOGICAL AND
NOT = LOGICAL NOT
VARIABLE SPEED DRIVE
MOTOR
MOTOR - SUBMERSIBLE
DIAPHRAGM SEAL
SENSING ELEMENT MICROSWITCH LOCATOR

OPEN VENT
DISCHARGE TO ATMOSPHERE
INTAKE FROM ATMOSPHERE INDUCT VENT
DRAIN
SYPHON DRAIN
HOSE REEL
FIRE HYDRANT
SAFETY SHOWER C/W EYE WASH
EARTH
KLAXON
SERVICE SUPPLY
TIE-IN POINT
CONTINUATION TAG
LIMIT OF CONTRACT/ SPEC. CHANGE
DIRECTION OF FALL
PRIMARY PROCESS LINE
SECONDARY PROCESS/ SERVICE LINE
CHANNEL
FUTURE EQUIPMENT
EXISTING EQUIPMENT
VENDOR PACKAGE
INSULATION - ACOUSTIC
INSULATION - THERMAL
HEAT TRACING
INSTRUMENT CONNECTION TO A PROCESS
ELECTRIC SIGNAL (4-20mA)
PCDAS SOFTWARE LINK
PNEUMATIC SIGNAL (20-100 kPa)
CAPILLARY TUBING
HYDRAULIC SIGNAL
FIELD-PLC DELINIATION
ELECTROMAGNETIC OR SONIC SIGNAL

PRELIMINARY

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REVIEW	NAME	SIGNATURE	DATE
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DRAWING CHECK			
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DESIGN CHECK			
PROJ. MANAGER			

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CLIENT :
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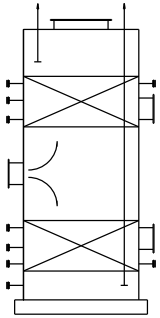
Communities in the making

PROJECT: GOOGONG INTEGRATED WATER CYCLE

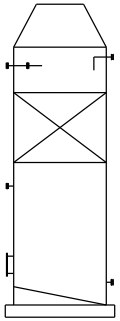
TITLE: PIPING AND INSTRUMENTATION DIAGRAM
WATER RECYCLING PLANT
SYMBOLS
SHEET 1 OF 2

SIZE:	SCALE:	DRAWING No.:	REV.
A1	NTS	A1081402-P201	A

STORAGE VESSEL

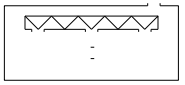


DUAL BED ACTIVATED CARBON FILTER

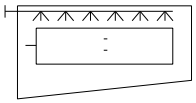


DISCHARGE STACK

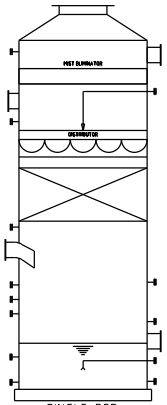
STORAGE TANK



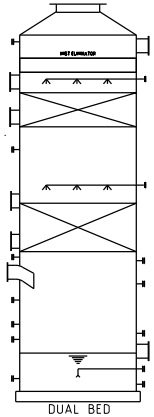
SCREENINGS BIN



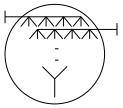
ROTARY DRUM THICKENER



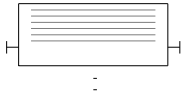
SINGLE BED PACKED TOWER



DUAL BED PACKED TOWER



DRUM SCREEN



ULTRAVIOLET UNIT

PRELIMINARY **NOT FOR CONSTRUCTION**

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A	03.11.09	ISSUED FOR CONCEPT DESIGN REPORT	SK	03.11.09	RP	03.11.09

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REVIEW	NAME	SIGNATURE	DATE
DRAWN			
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DESIGN			
DESIGN CHECK			
PROJ. MANAGER			

MWH
BUILDING A BETTER WORLD
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CLIENT :
AUSTRALIA
Communities in the making

PROJECT:
GOOGONG INTEGRATED WATER CYCLE

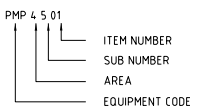
TITLE:
PIPING AND INSTRUMENTATION DIAGRAM
WATER RECYCLING PLANT
SYMBOLS
SHEET 2 OF 2

SIZE:	SCALE:	DRAWING No.:	REV.
A1	NTS	A1081402-P202	A

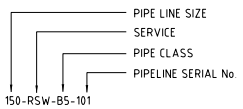
EQUIPMENT PREFIXES

BIN	BIN(SILO or HOPPER)
BLR	BLOWER
CFG	CENTRIFUGE
CHN	CHANNEL
CLR	CLARIFIER
CON	CONVEYOR
CPR	COMPRESSOR
CRN	CRANE MOTORISED FIXED MONORAIL
CRX	POST JIB CRANE/MONORAIL /FIXED DAVIT/MOBILE
CYL	CALIBRATION CYLINDER
DEC	DECANTER
DIF	DIFFUSER
DIG	DIGESTER
DIS	DISTRIBUTION BOARD
DMP	DAMPER
DRM	DRUM THICKENER
EJR	EJECTOR
FAN	FAN
FAR	FLAME ARRESTOR
FCV	FLOW CONTROL VALVE
FEX	FLOW ELEMENT
FFQ	FIRE FIGHTING EQUIPMENT
FLT	FILTER
FTP	FIELD TERMINATION PANEL
HSE	EMERGENCY STOP OR PULL WIRE
HSX	HAND STATION OR SELECTOR SWITCH
HTR	HEATER OR BOILER
HVD	HIGH VOLTAGE DISTRIBUTION
HVS	HIGH VOLTAGE STARTER
HXR	HEAT EXCHANGER
HYV	HYDRANT (VALVE
KLX	KLAXON/SIREN/HOOTER/BELL
LCP	LOCAL CONTROL PANEL
LIS	LOCAL ISOLATING SWITCH
LVD	LOW VOLTAGE DISTRIBUTION
LVS	LOW VOLTAGE STARTER
MAC	MACERATOR
MHL	MANHOLE
MIX	MIXER/FLOCCULATOR OR AGITATOR
MTR	MOTOR
NRV	NON RETURN VALVE
OZG	OZONE GENERATOR
PCV	PRESSURE CONTROL VALVE
PEN	PENSTOCK
PLC	PROGRAMMABLE LOGIC CONTROLLER
PLP	PLC PANEL
PMP	PUMP (VARIABLE OR FIXED SPEED)
PRS	PRESS
PST	PRIMARY SEDIMENTATION TANK
PRV	PRESSURE RELIEF VALVE
ROU	REVERSE OSMOSIS UNIT
RPZ	REDUCED PRESSURE ZONE DEVICE (BACKFLOW PREVENTER)
RTU	REMOTE TELEMETRY UNIT
SBD	STOPBOARD (STOP LUGS)
SCA	SWITCHGEAR CONTROL ASSEMBLY
SCB	SCRUBBER
SCN	SCREEN
SCP	SCRAPER
SCV	SCOUR VALVE
SCW	SCREW CONVEYOR
SEQ	SAFETY EQUIPMENT
SIL	SILENCER
SKM	SKIMMER
SMP	SUMP
SMR	SAMPLER
SOV	SOLENOID OPERATED VALVE
STN	STRAINER
SVC	SOLENOID VALVE CLOSED SOLENOID
SVL	VALVE LOWER SOLENOID VALVE
SVO	OPEN
SWR	SWITCHROOM
TBA	TRAVELING BRIDGE MOTOR 1
TBB	TRAVELING BRIDGE MOTOR 2
TBG	TRAVELING BRIDGE
TEP	TELEMETRY PANEL
TNK	TANK, WELL OR VESSEL
TRF	TRANSFORMER
TRP	TRAP
UPS	UNINTERRUPTED POWER SUPPLY
UTY	UTILITY STATION - ALL TYPES
UVB	ULTRA VIOLET BANK
VAP	VACUUM PUMP
VEH	VEHICLE
VEN	VENTILATION PANEL OR SYSTEM
VLV	VALVE
VSD	VARIABLE SPEED DRIVE PRESSURE
VSL	VESSEL
VTX	VIBRATION TRANSMITTER
WBR	WEIGHBRIDGE
WER	WEIR

EQUIPMENT TAG NAME STRUCTURE:



LINE NUMBERING SYSTEM



INSTRUMENT PREFIXES

AAM	AMMONIA TRANSMITTER
ACD	CARBON DIOXIDE TRANSMITTER
ACL	CHLORINE TRANSMITTER
ACM	CARBON MONOXIDE TRANSMITTER
ADO	DISSOLVED OXYGEN TRANSMITTER
AEX	ANALYSER ELEMENT
AHS	HYDROGEN SULPHIDE TRANSMITTER
AIX	ANALYSER INDICATOR
AMN	METHANE TRANSMITTER
ANI	NITRATE TRANSMITTER
AOP	ORTHO-PHOSPHATE TRANSMITTER
AOR	OXIDATION REDUCTION TRANSMITTER
AOX	OXYGEN TRANSMITTER
APH	pH TRANSMITTER
ARC	RESIDUAL CHLORINE TRANSMITTER
ASB	SLUDGE BLANKET LEVEL TRANSMITTER
ASC	CHLORINE LEAK DETECTOR SWITCH
ASO	OZONE LEAK DETECTOR SWITCH
ASS	SUSPENDED SOLIDS TRANSMITTER
ATP	TOTAL PHOSPHORUS TRANSMITTER
ATU	TURBIDITY TRANSMITTER
ATX	ANALYZER TRANSMITTER
AUI	ULTRA VIOLET INTENSITY TRANSMITTER
BEA	BEACON, WARNING OR ALARM LAMP
BNS	FLAME SENSOR
BSX	SMOKE OR FIRE DETECTOR CONDUCTIVITY TRANSMITTER
CAN	CHLORINE GAS PROTECTION PANEL
CGP	DENSITY TRANSMITTER
DTX	EVACUATION INDICATION PANEL
EIP	CURRENT TRANSMITTER
ETC	FLOW ELEMENT
FEX	FIRE INDICATOR PANEL
FIP	FLOW INDICATOR OR GAUGE
FIX	FLOW SWITCH
FSH/FSL	FLOW TRANSMITTER
FTX	GAS DETECTION PANEL
GDP	EMERGENCY STOP OR PULL WIRE
HSE	HANDSTATION OR SELECTOR SWITCH
HSX	KLAXON, SIREN, HOOTER BELL
KLX	LOCAL CONTROL PANEL
LCP	LEVEL ELEMENT
LEX	LOCAL ISOLATING SWITCH
LIS	LEVEL INDICATOR OR SIGHT GLASS
LIX	LEVEL SWITCH
LSH/LSL	LEVEL TRANSMITTER
LTX	MOTOR CONTROL CENTER
MCC	MOISTURE SWITCH (SEAL FAILURE)
MSH	MOISTURE TRANSMITTER
MTX	OFF GAS DETECTOR
OGD	PRESSURE INDICATOR OR GAUGE
PIX	PROGRAMMABLE LOGIC CONTROLLER
PLC	PLC PANEL
PLP	PERSON MACHINE INTERFACE
PMI	PRESSURE SWITCH
PSH/PSL	PRESSURE TRANSMITTER
PTX	REMOTE INPUT/OUTPUT RACK
RIO	REMOTE TELEMETRY UNIT
RTU	SYSTEM/SEQUENCE TAG
SEQ	SPEED INDICATOR
SIX	SPEED SWITCH
SSH/SSL	SPEED TRANSMITTER
STX	TELEMETRY PANEL
TEP	TEMPERATURE ELEMENT
TEX	TEMPERATURE INDICATOR OR GAUGE
TIX	TEMPERATURE SWITCH
TSH/TSL	TEMPERATURE TRANSMITTER
TTX	VIBRATION TRANSMITTER
VTX	WEIGHBRIDGE
WBR	WEIGHTBRIDGE
WSH	TORQUE SWITCH
WTX	WEIGHT TRANSMITTER
ZEX	POSITION ELEMENT
ZSA	LIMIT SWITCH (AS DEFINED)
ZSB	LIMIT SWITCH (AS DEFINED)
ZSC	LIMIT SWITCH CLOSED
ZSH	BELT DRIVE SWITCH
ZSL	LIMIT SWITCH LOWERED
ZSO	LIMIT SWITCH OPEN
ZSP	LIMIT SWITCH PARKED
ZSR	LIMIT SWITCH RAISED
ZSX	POSITION SWITCH
ZTX	POSITION TRANSMITTER

FLUIDS ABBREVIATION

AA	AGITATION AIR
AEA	AERATION AIR
ALS	ALUM SOLUTION
CN	CENTRATE
CS	CHLORINE SOLUTION
DM	DILUTED METHANOL
DS	DIGESTED SLUDGE
EF	EFFLUENT
FA	FOUL AIR
FC	FERRIC CHLORIDE
FE	FILTERED EFFLUENT
FLT	FILTRATE
FM	FIRE MAIN
FS	FERMENTED SLUDGE
FSN	FERMENTER SUPERNATANT
FW G	FOUL WATER
IA	GRIT
LP	INSRUMENT AIR
MH	LIME POWDER
ML	MAGNESIUM HYDROXIDE
MLR	MIXED LIQUOR
OF	MIXED LIQUOR RECYCLE
PE	OVERFLOW
PES	PRIMARY EFFLUENT POLYMER SOLUTION
PS	PRIMARY SLUDGE
PW	POTABLE WATER
RAS	RETURN ACTIVATED SLUDGE
RE	RECLAIMED EFFLUENT
RSW	RAW SEWAGE
SB	SODIUM BISULPHITE
SC	SCUM
SCN	SCREENINGS
SE	SECONDARY EFFLUENT
SH	SODIUM HYPOCHLORITE
SL	SLUDGE
SPL	SPENT PICKLE LIQUOR
SPN	SUPERNATANT
SS	SCREENED SEWAGE
SW	STORM WATER
TD	TANK DRAIN
TE	TERTIARY EFFLUENT
TSW	TREATED STORM WATER
UM	UNDILUTED METHANOL
WAS	WASTE ACTIVATED SLUDGE

POWER AND PURGE FLUID SUPPLIES

CAS	COMPRESSED AIR SUPPLY
ES	ELECTRICITY SUPPLY (NOTE 2)
IA	INSTRUMENT AIR SUPPLY
IW	INDUSTRIAL WATER
PW	POTABLE WATER

LOCATION ABBREVIATIONS

AG	ABOVE GROUND
UG	UNDER GROUND

NOTE:

1. PLC SOFTWARE FUNCTIONS SHOWN ON DRAWINGS ARE MINIMAL. FULL DETAILS ARE CONTAINED IN THE PLAIN ENGLISH FUNCTIONAL SPECIFICATION.
2. POWER SUPPLY ONLY NOTED WHEN A UPS OR A SEGREGATED SUPPLY IS REQUIRED.

PIPING MATERIAL CODE

CODE	PIPE
A1	COPPER, AS1432, TYPE B, ANNEALED TEMPER.
A2	COPPER, AS1432, TYPE B, AS DRAWN TEMPER.
B1	STEEL, AS1579, SCH 40 PIPE OR EQUIVALENT. FLANGED/WELDED/ RUBBER RING JOINTS, EPOXY COATED INTERNALLY.
B2	STEEL, AS1579, SCH 40 PIPE OR EQUIVALENT. FLANGED/WELDED JOINTS HOT DIP GALVANISED AND CEMENT LINED WHERE INDICATED.
B3	CARBON STEEL, AS4041, SCH 40 PIPE.
B4	STAINLESS STEEL TUBE, ASTM A269, GRADE 316, FLANGED/WELDED JOINTS.
B5	SPIRAL WELDED STAINLESS STEEL, ASTM A240, GRADE 316.
B6	SPIRAL WELDED STAINLESS STEEL, ASTM A240, GRADE 304.
B7	SPIRAL WELDED STAINLESS STEEL, ASTM A240, GRADE 316, EPOXY, COATED INTERNALLY.
C1	DUCTILE IRON, RUBBER RING JOINT - AS2280 CLASS K9 CEMENT LINED INTERNALLY.
C2	DUCTILE IRON, FLANGED - AS2280 CLASS K9 CEMENT LINED INTERNALLY.
C3	DUCTILE IRON, RUBBER RING JOINT - AS2280 CLASS K12 CEMENT LINED INTERNALLY.
C4	DUCTILE IRON, FLANGED - AS2280 CLASS K12 CEMENT LINED INTERNALLY.
C5	DUCTILE IRON, RUBBER RING JOINT - AS2280 CLASS K9 EPOXY COATED INTERNALLY.
C6	DUCTILE IRON, FLANGED - AS2280 CLASS K9 EPOXY COATED INTERNALLY.
C7	DUCTILE IRON, RUBBER RING JOINT - AS2280 CLASS K9 EPOXY COATED INTERNALLY.
C8	DUCTILE IRON, FLANGED - AS2280 CLASS K9 EPOXY COATED INTERNALLY.
D1	PLASTIC ABS, AS3518 CLASS 9
D2	PLASTIC ABS, AS3518 CLASS 12
D3	PLASTIC ABS, AS3518 CLASS 15
D4	uPVC (UNPLASTICISED PVC), AS1477, CLASS 9
D5	uPVC (UNPLASTICISED PVC), AS1477, CLASS 12
D6	uPVC (UNPLASTICISED PVC), AS1477, CLASS 16
D7	uPVC (UNPLASTICISED PVC), AS1477, CLASS 18
D8	uPVC (UNPLASTICISED PVC), AS1477, CLASS 20
D9	uPVC (UNPLASTICISED PVC), AS1245, STORMWATER PIPE.
D10	uPVC (UNPLASTICISED PVC), AS1260, SEWER PIPE.
D11	POLYETHYLENE (PE) AS4130, CLASS PN8
D12	POLYETHYLENE (PE) AS4130, CLASS PN10
D13	POLYETHYLENE (PE) AS4130, CLASS PN12
D14	POLYETHYLENE (PE) AS4130, CLASS PN16
D15	POLYETHYLENE (PE) AS4130, CLASS PN18
D16	PVC-M MODIFIED POLY VINYL CHLORIDE PRESSURE PIPE, AS4765-2000, CLASS PN9
D17	PVC-M MODIFIED POLY VINYL CHLORIDE PRESSURE PIPE, AS4765-2000, CLASS PN12
D18	PVC-M MODIFIED POLY VINYL CHLORIDE PRESSURE PIPE, AS4765-2000, CLASS PN16
D19	PVC-M MODIFIED POLY VINYL CHLORIDE PRESSURE PIPE, AS4765-2000, CLASS PN20
D20	PVC HOSE, REINFORCED CLEAR.
E1	REINFORCED CONCRETE DRAINAGE PIPE, AS4058, RUBBER RING JOINT.
E2	REINFORCED CONCRETE SEWER PIPE, AS4058, RUBBER RING JOINT.
F1	VITRIFIED CLAY PIPE, AS1741, RUBBER RING JOINTS.
G1	GLASS FIBRE REINFORCED EPOXY PIPE (GRE), ASTM D-1599, PRESSURE CLASS 1000KPa.
G2	GLASS FIBRE REINFORCED EPOXY PIPE (GRE), ASTM D-1599, PRESSURE CLASS 1200KPa.
G3	GLASS FIBRE REINFORCED EPOXY PIPE (GRE), ASTM D-1599, PRESSURE CLASS 1600KPa.
G4	GLASS FIBRE REINFORCED EPOXY PIPE (GRE), ASTM D-1599, PRESSURE CLASS 2000KPa.
G5	GLASS REINFORCED THERMOSETTING PLASTIC PIPE (GRP), AS3571, PRESSURE CLASS 4
G6	GLASS REINFORCED THERMOSETTING PLASTIC PIPE (GRP), AS3571, PRESSURE CLASS 6
G7	GLASS REINFORCED THERMOSETTING PLASTIC PIPE (GRP), AS3571, PRESSURE CLASS 10
G8	GLASS REINFORCED THERMOSETTING PLASTIC PIPE (GRP), AS3571, PRESSURE CLASS 12.5
G9	GLASS REINFORCED THERMOSETTING PLASTIC PIPE (GRP), AS3571, PRESSURE CLASS 16
G10	GLASS REINFORCED THERMOSETTING PLASTIC PIPE (GRP), AS3571, PRESSURE CLASS 20
G11	GLASS REINFORCED THERMOSETTING PLASTIC PIPE (GRP), AS3571, PRESSURE CLASS 25

PRELIMINARY

NOT FOR CONSTRUCTION

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CLIENT :

CIC AUSTRALIA
Communities in the making

PROJECT: GOOGONG INTEGRATED WATER CYCLE

TITLE: PIPING AND INSTRUMENTATION DIAGRAM
WATER RECYCLING PLANT
LEGEND AND ABBREVIATIONS

SIZE:	SCALE:	DRAWING No.:	REV.
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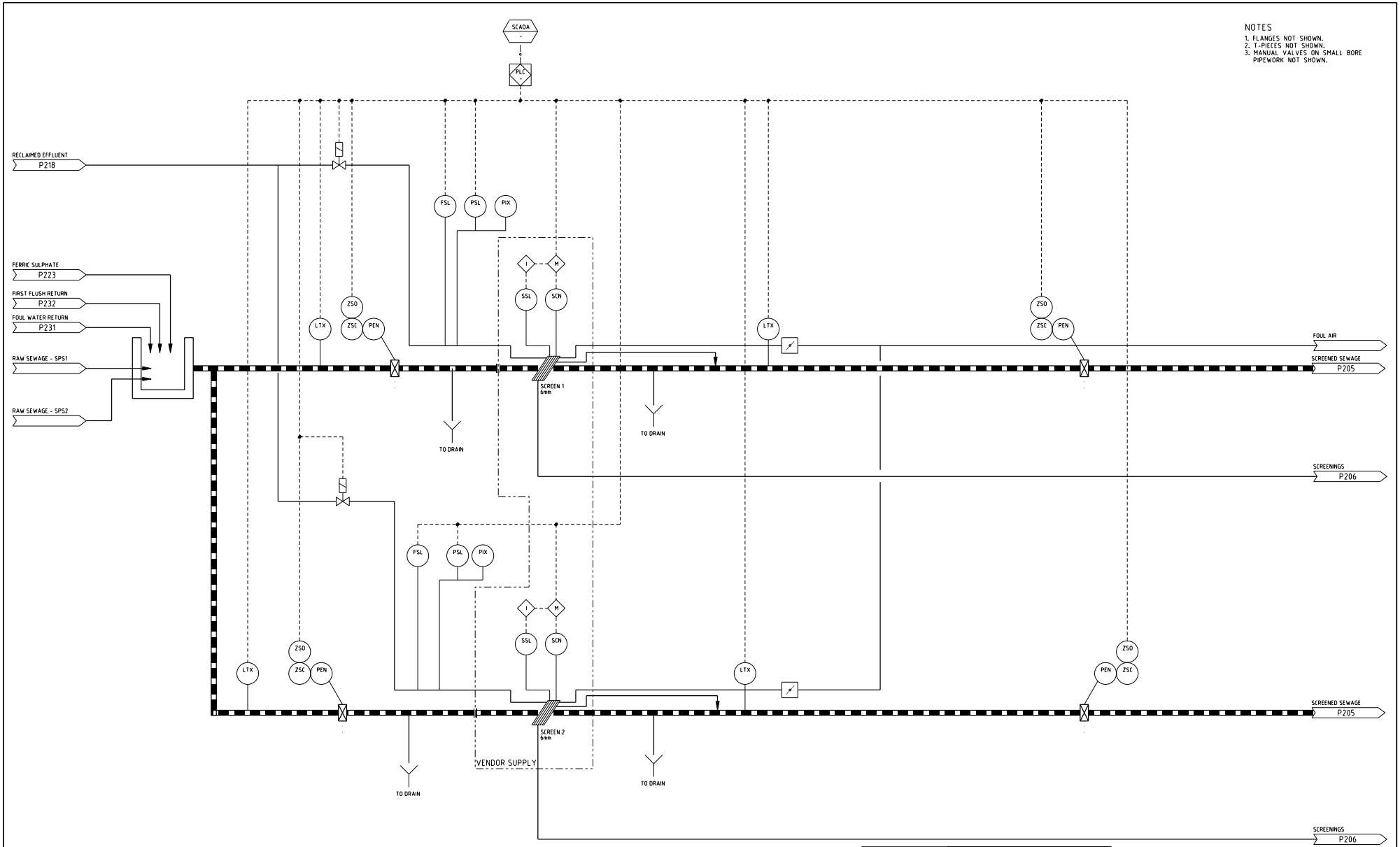

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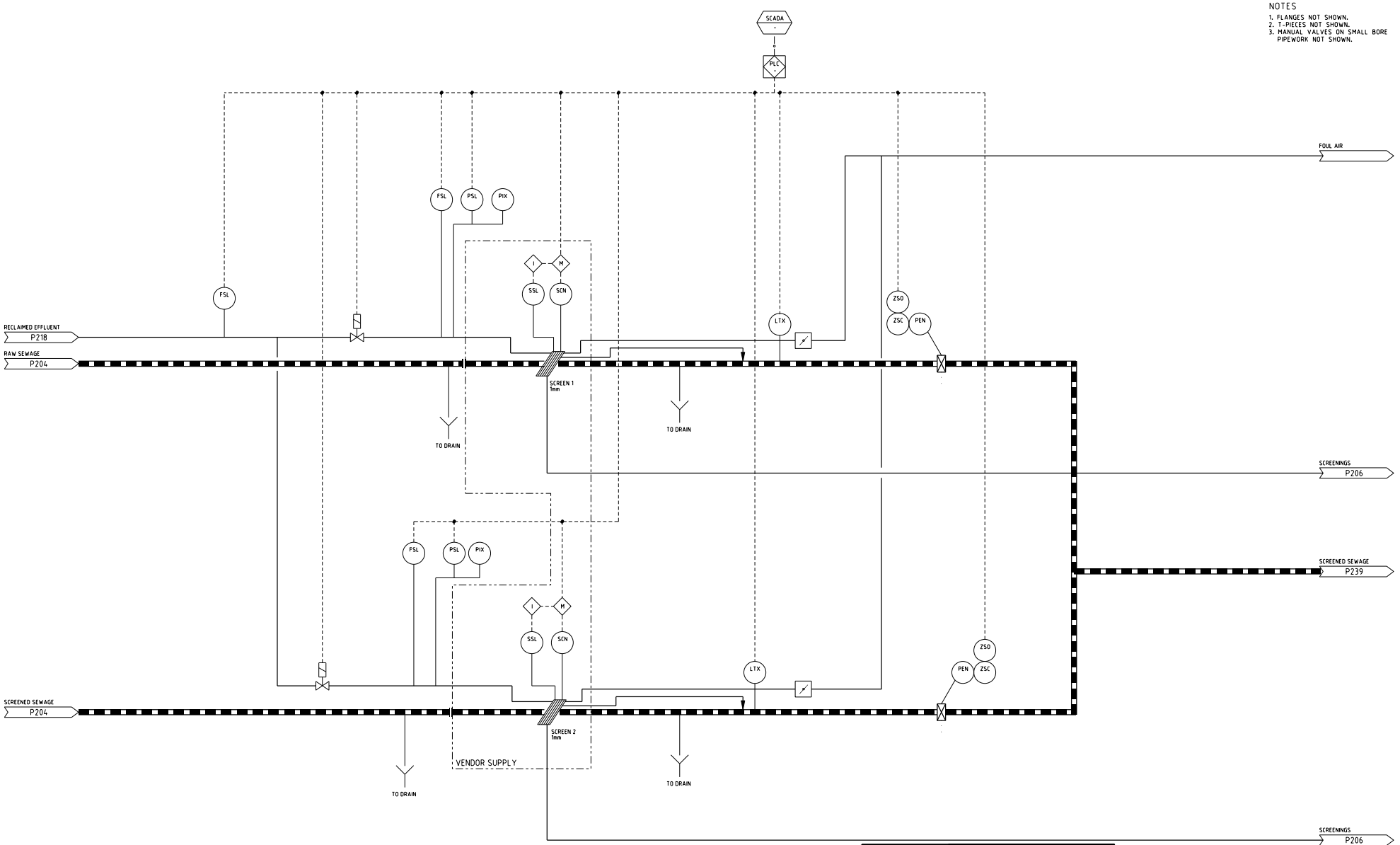
PROJECT:
GOOGONG INTEGRATED WATER CYCLE

TITLE:
PIPING AND INSTRUMENTATION DIAGRAM
WATER RECYCLING PLANT
SCREENS
SHEET 1 OF 2

SIZE:	SCALE:	DRAWING No.:	REV.
A1	NTS	A1081402-P204	A

NOTES
1. FLANGES NOT SHOWN.
2. T-PIECES NOT SHOWN.
3. MANUAL VALVES ON SMALL BORE PIPEWORK NOT SHOWN.



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WATER RECYCLING PLANT
SCREENS
SHEET 2 OF 2

SIZE:	SCALE:	DRAWING No.:	REV.
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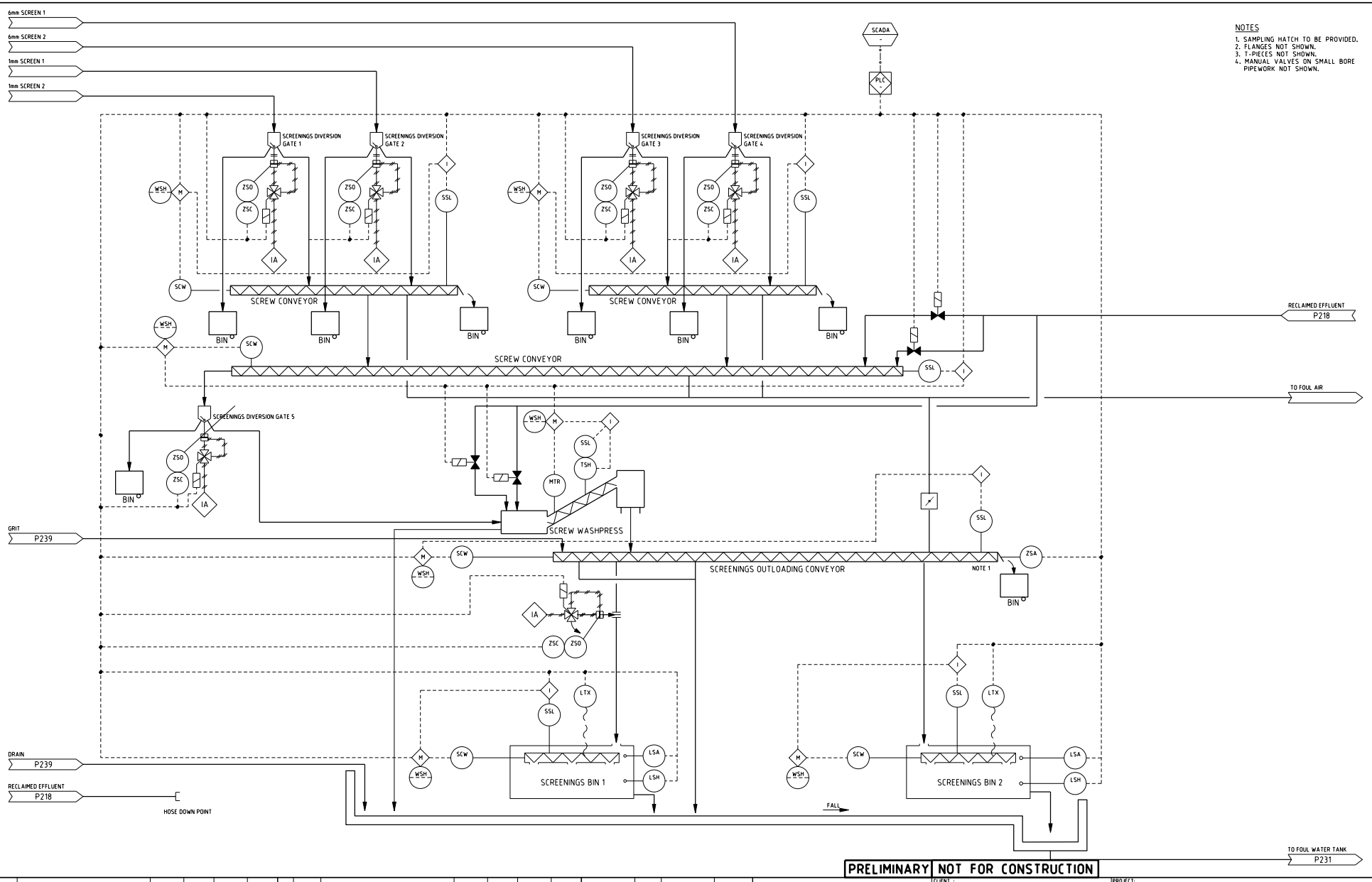

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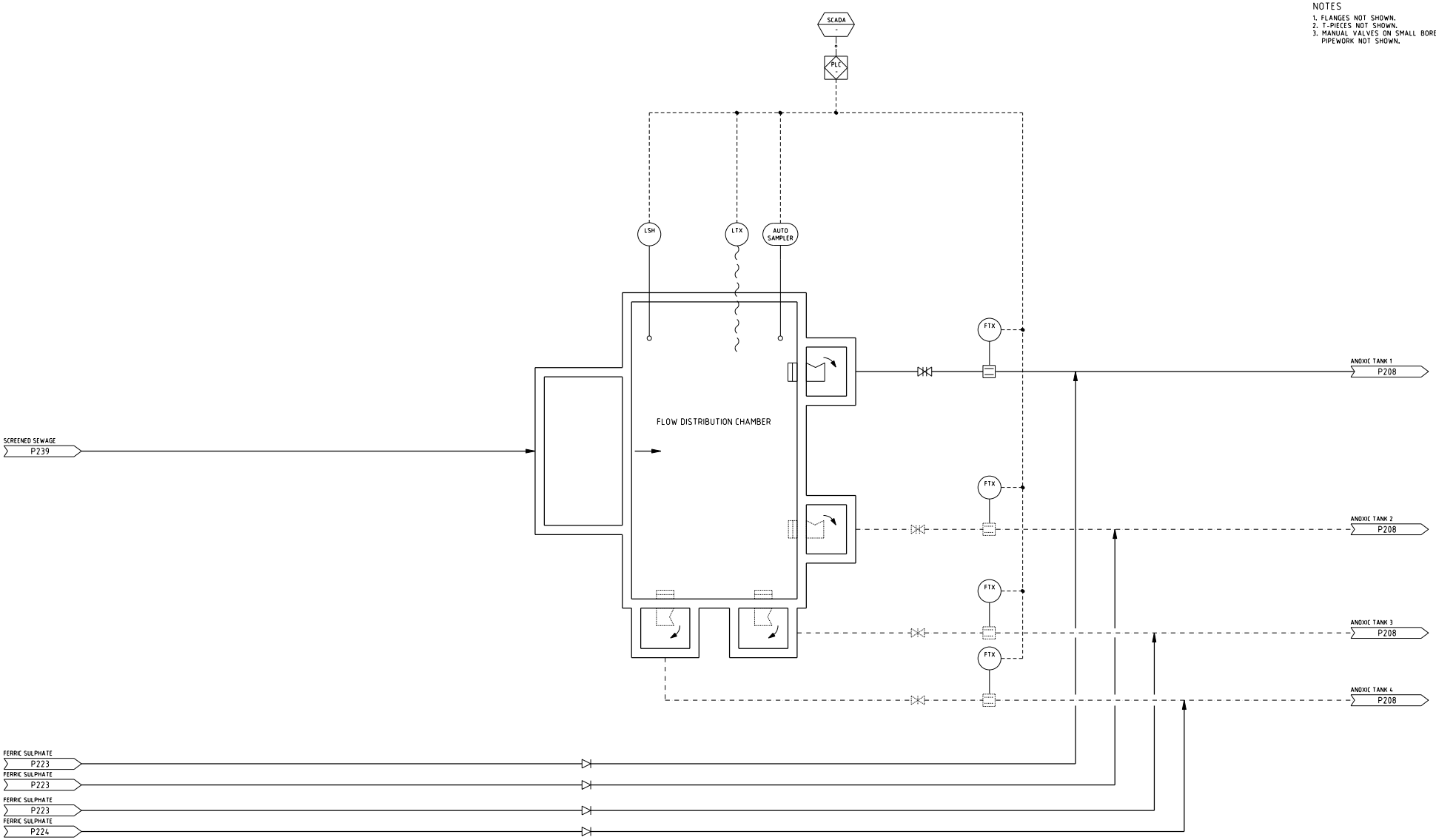
TITLE:
PIPING AND INSTRUMENTATION DIAGRAM
WATER RECYCLING PLANT
SCREENINGS HANDLING SYSTEM

SIZE:	SCALE:	DRAWING No.:	REV.
A1	NTS	A1081402-P206	A

NOTES
1. FLANGES NOT SHOWN.
2. T-PIECES NOT SHOWN.
3. MANUAL VALVES ON SMALL BORE PIPEWORK NOT SHOWN.



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PIPING AND INSTRUMENTATION DIAGRAM
WATER RECYCLING PLANT
FLOW DISTRIBUTION CHAMBER

SIZE:	SCALE:	DRAWING No.:	REV.
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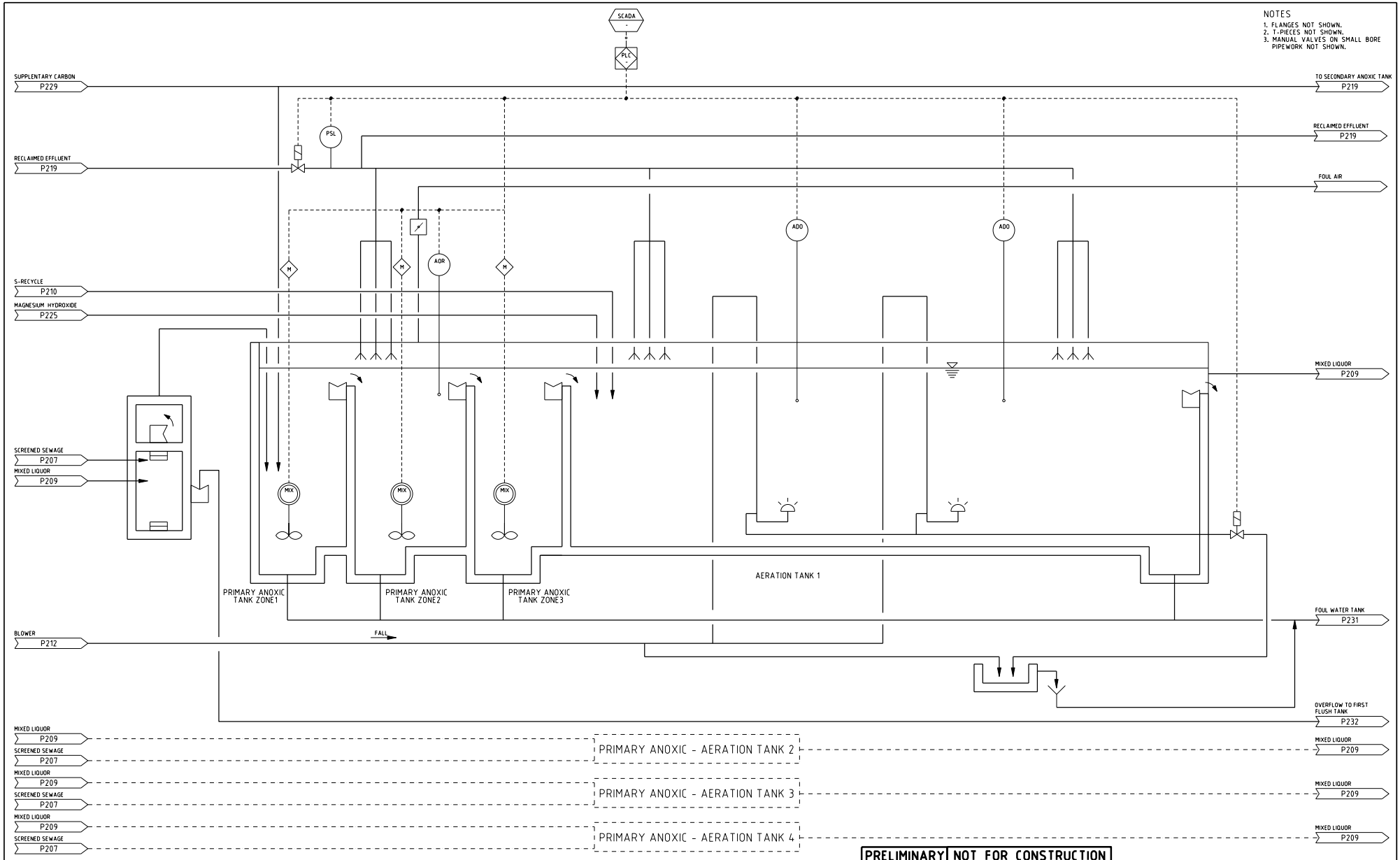

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ANOXIC-AERATION TANK 1

SIZE:	SCALE:	DRAWING No.:	REV.
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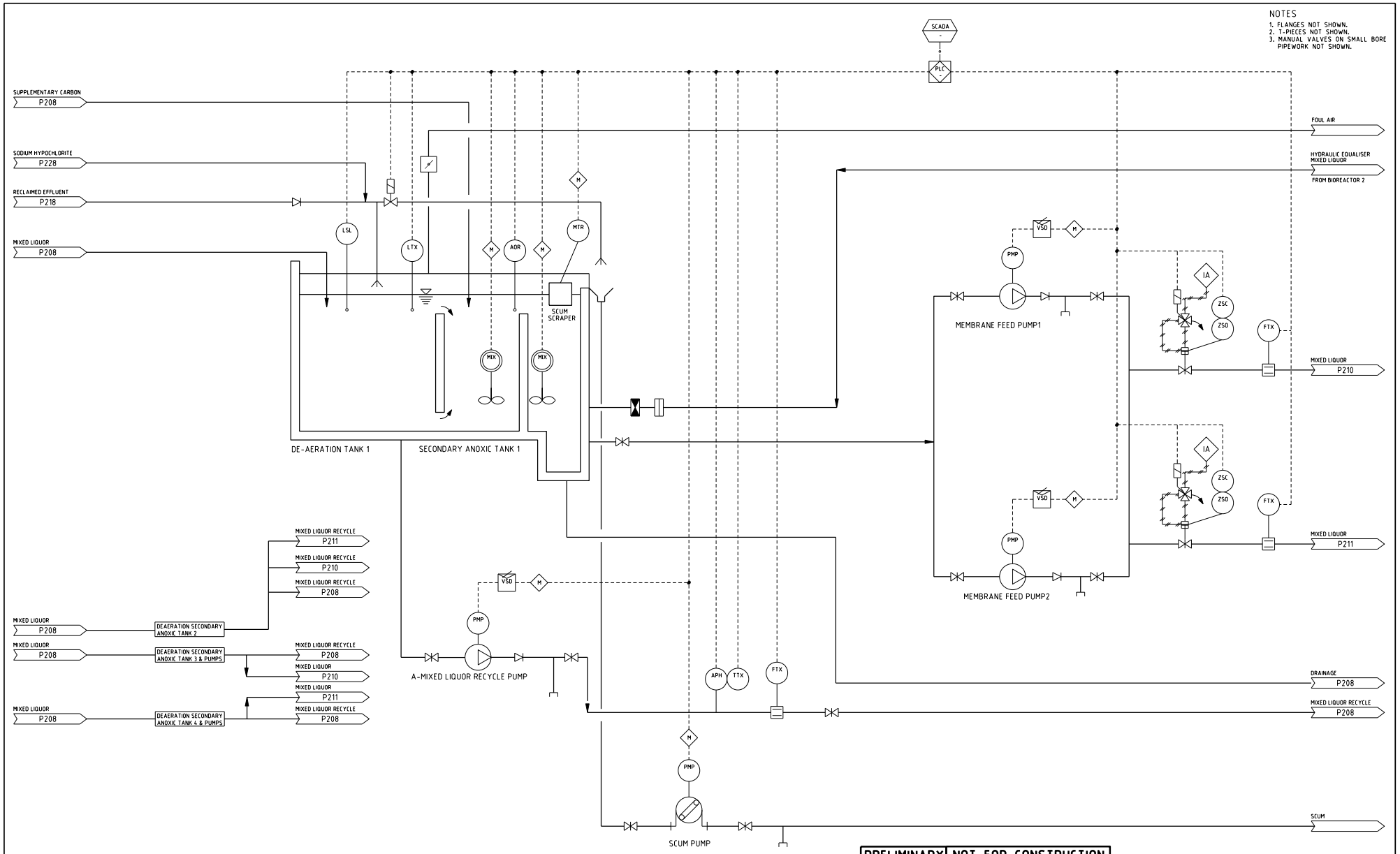

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DEAERATION-SECONDARY ANOXIC TANK 1

SIZE:	SCALE:	DRAWING No.:	REV.
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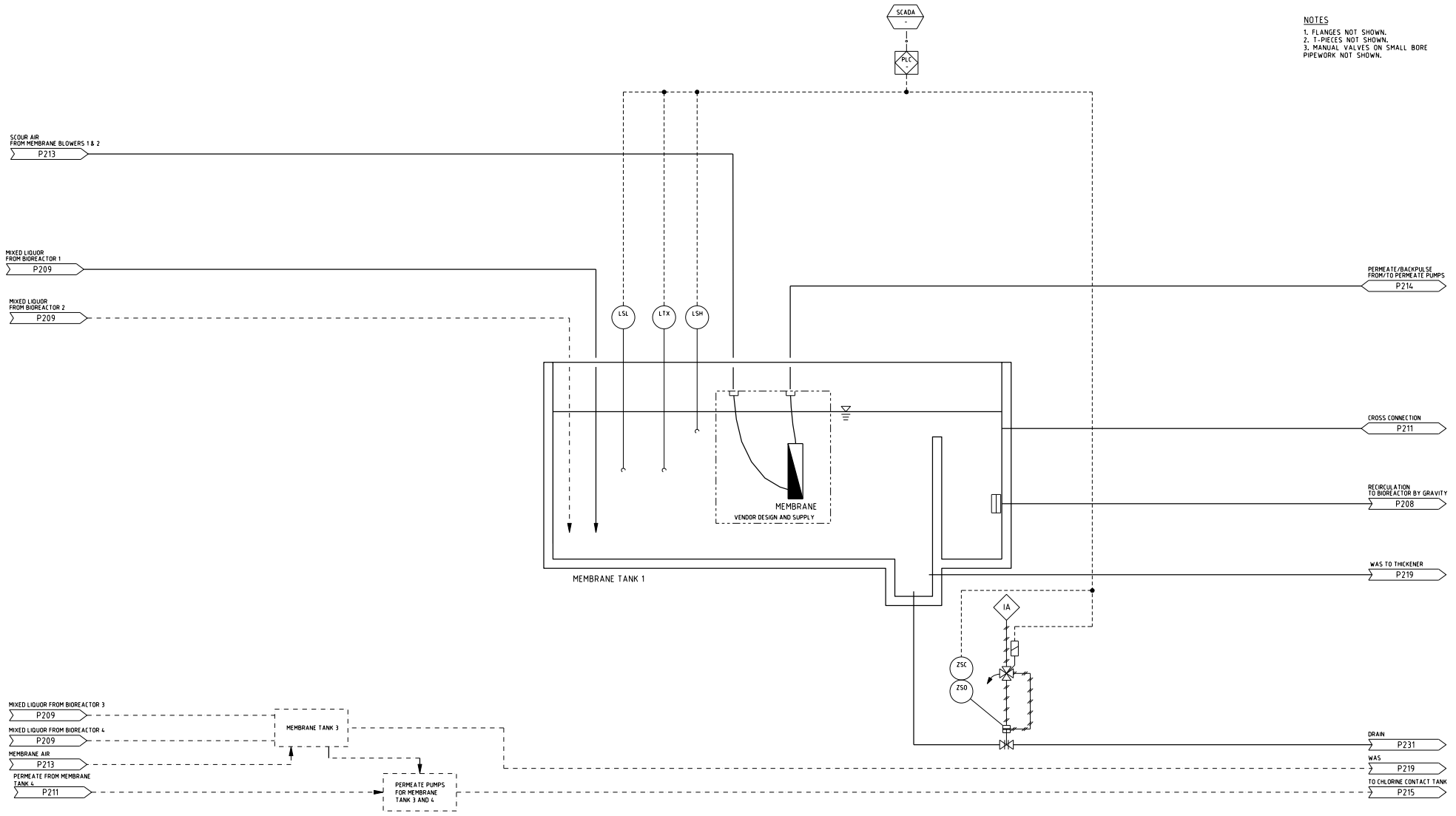

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A	03.11.09	ISSUED FOR CONCEPT DESIGN REPORT	SK	03.11.09	RP	03.11.09

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REVIEW	NAME	SIGNATURE	DATE
DRAWN			
DRAWING CHECK			
DESIGN			
DESIGN CHECK			
PROJ. MANAGER			

MWH
BUILDING A BETTER WORLD
ABN : 53 085 776 601
39-41 CHANDOS STREET
ST. LEONARDS. NSW 2065. AUSTRALIA
TEL: 02 493 9700 FAX: 02 9493 9799

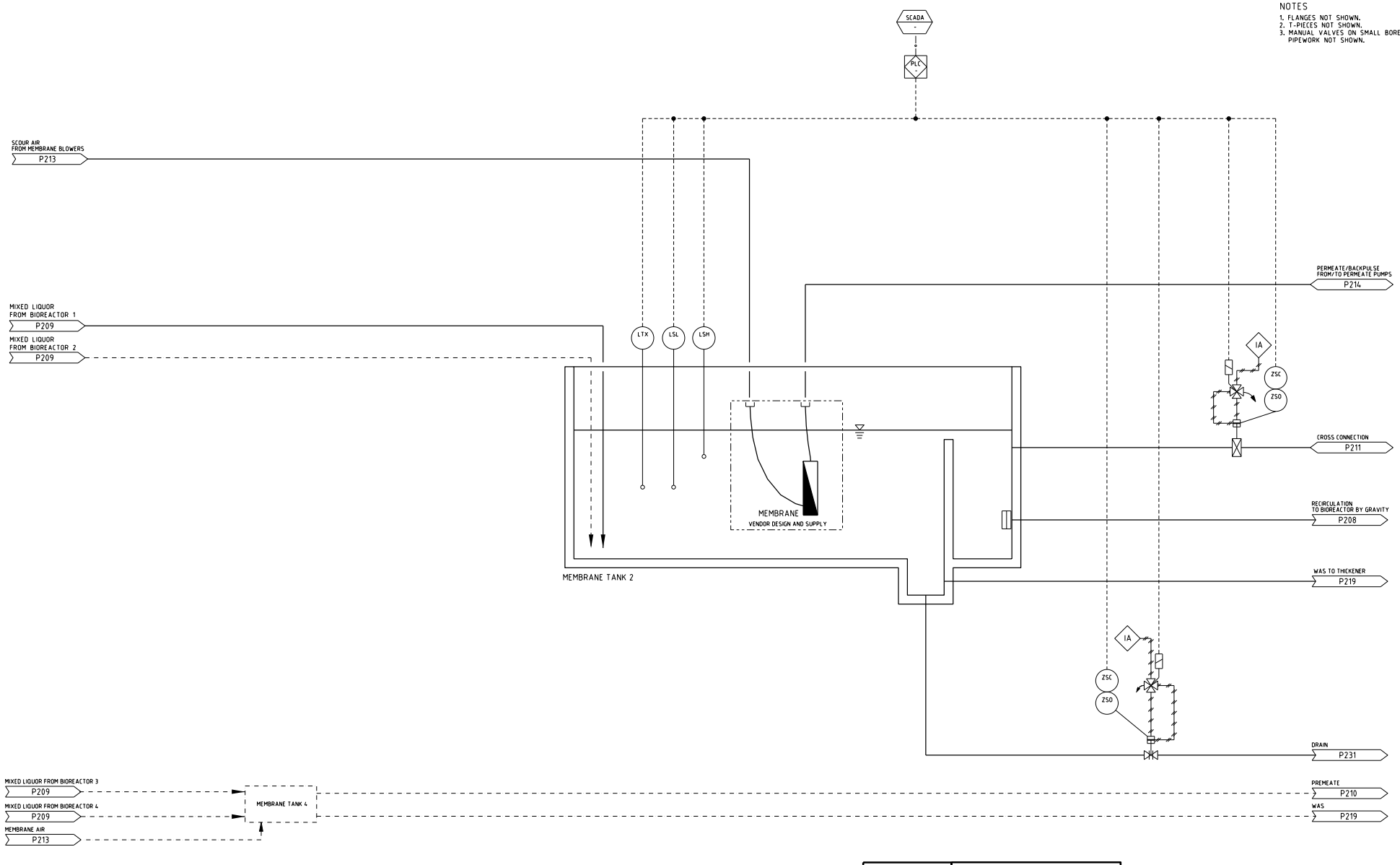
CLIENT :
AUSTRALIA
Communities in the making

PROJECT:
GOOGONG INTEGRATED WATER CYCLE

TITLE:
PIPING AND INSTRUMENTATION DIAGRAM
WATER RECYCLING PLANT
MEMBRANE TANK No.1

SIZE:	SCALE:	DRAWING No.:	REV.
A1	NTS	A1081402-P210	A

NOTES
1. FLANGES NOT SHOWN.
2. T-PIECES NOT SHOWN.
3. MANUAL VALVES ON SMALL BORE PIPEWORK NOT SHOWN.



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PROJ. MANAGER			

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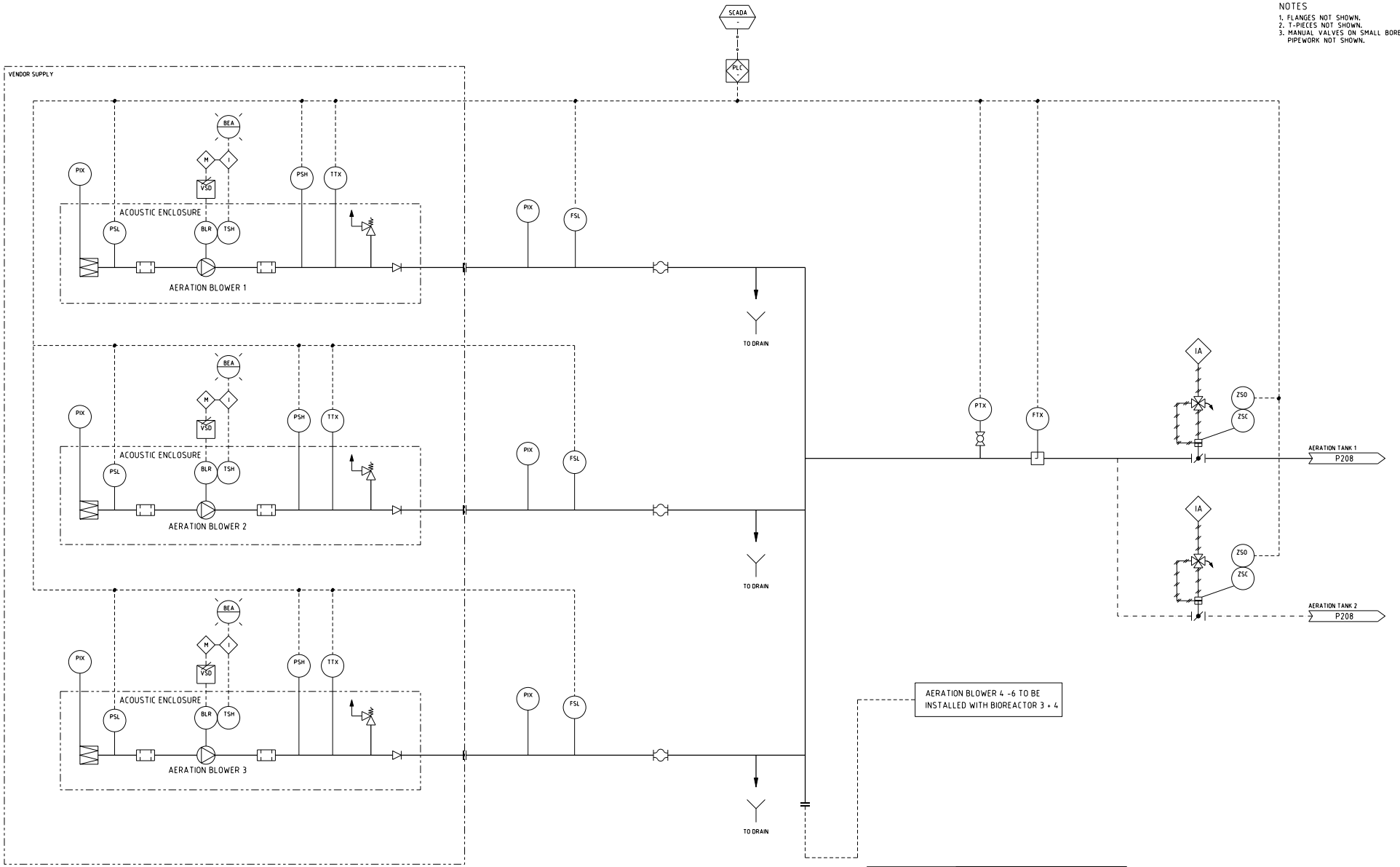
CIC AUSTRALIA
Communities in the making

PROJECT:
GOOGONG INTEGRATED WATER CYCLE

TITLE:
PIPING AND INSTRUMENTATION DIAGRAM
WATER RECYCLING PLANT
MEMBRANE TANK No.2

SIZE:	SCALE:	DRAWING No.:	REV.
A1	NTS	A1081402-P211	A

NOTES
1. FLANGES NOT SHOWN.
2. T-PIECES NOT SHOWN.
3. MANUAL VALVES ON SMALL BORE PIPEWORK NOT SHOWN.



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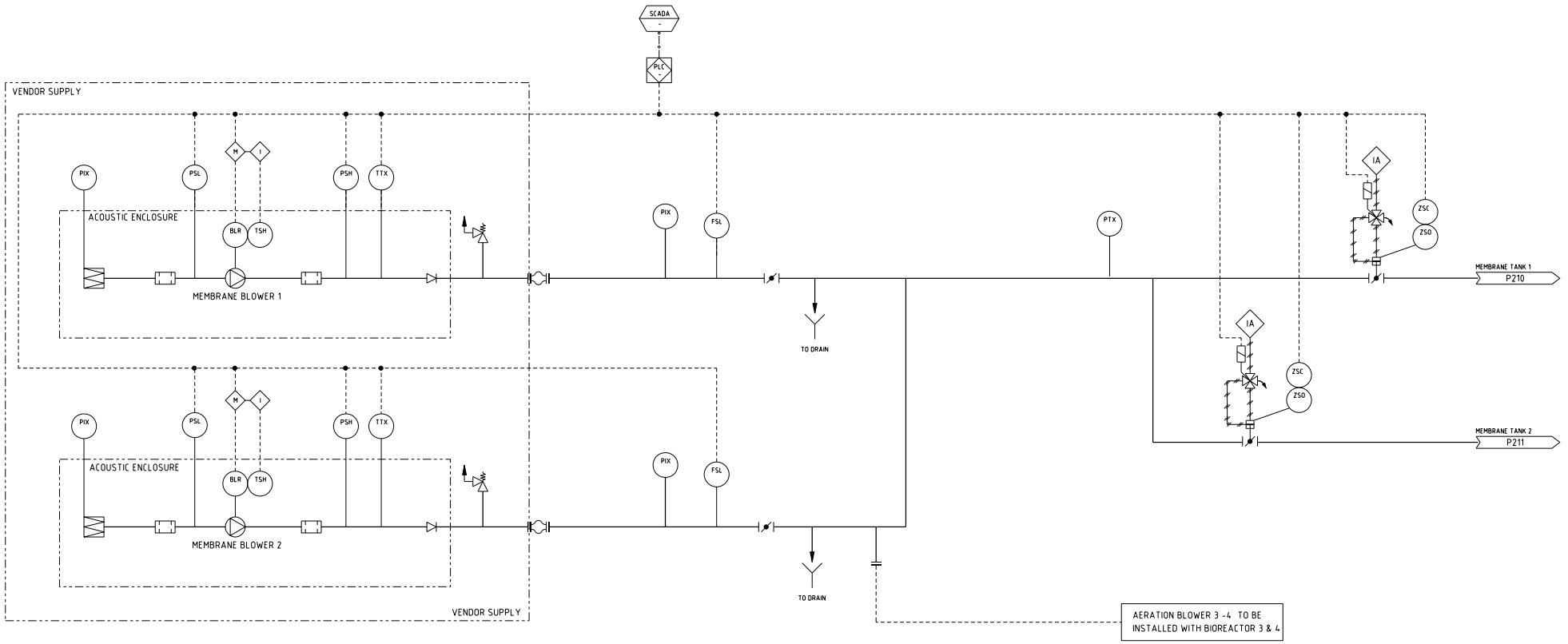
Communities in the making

PROJECT:
GOOGONG INTEGRATED WATER CYCLE

TITLE:
PIPING AND INSTRUMENTATION DIAGRAM
WATER RECYCLING PLANT
AERATION BLOWERS

SIZE:	SCALE:	DRAWING No.:	REV.
A1	NTS	A1081402-P212	A

NOTES
1. FLANGES NOT SHOWN.
2. T-PIECES NOT SHOWN.
3. MANUAL VALVES ON SMALL BORE PIPEWORK NOT SHOWN.



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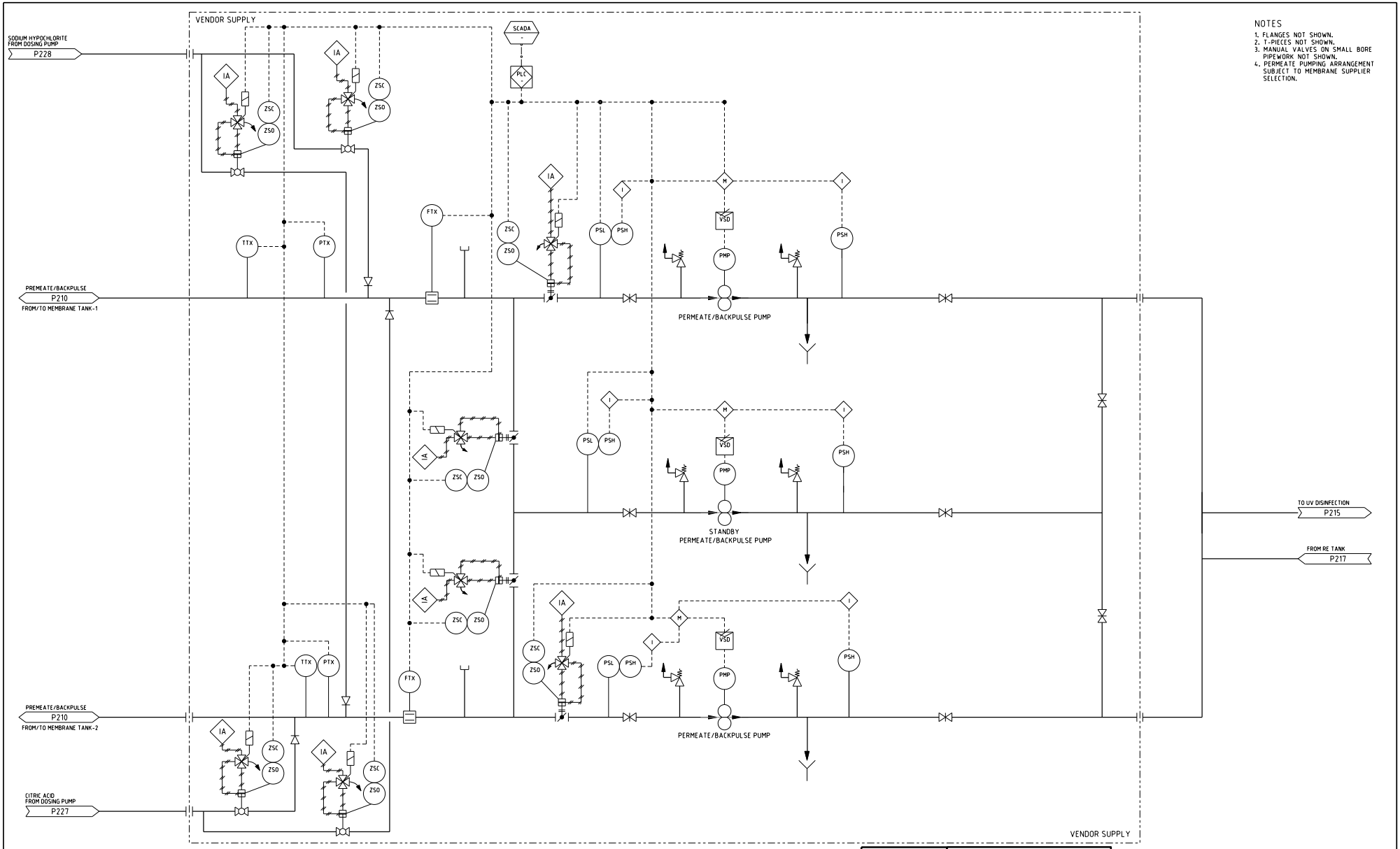
PROJECT:
GOOGONG INTEGRATED WATER CYCLE

TITLE:
PIPING AND INSTRUMENTATION DIAGRAM
WATER RECYCLING PLANT
MEMBRANE BLOWERS

SIZE:	SCALE:	DRAWING No.:	REV.
A1	NTS	A1081402-P213	A



NOTES

1. FLANGES NOT SHOWN.
2. T-PIECES NOT SHOWN.
3. MANUAL VALVES ON SMALL BORE PIPEWORK NOT SHOWN.
4. PERMEATE PUMPING ARRANGEMENT SUBJECT TO MEMBRANE SUPPLIER SELECTION.

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Communities in the making

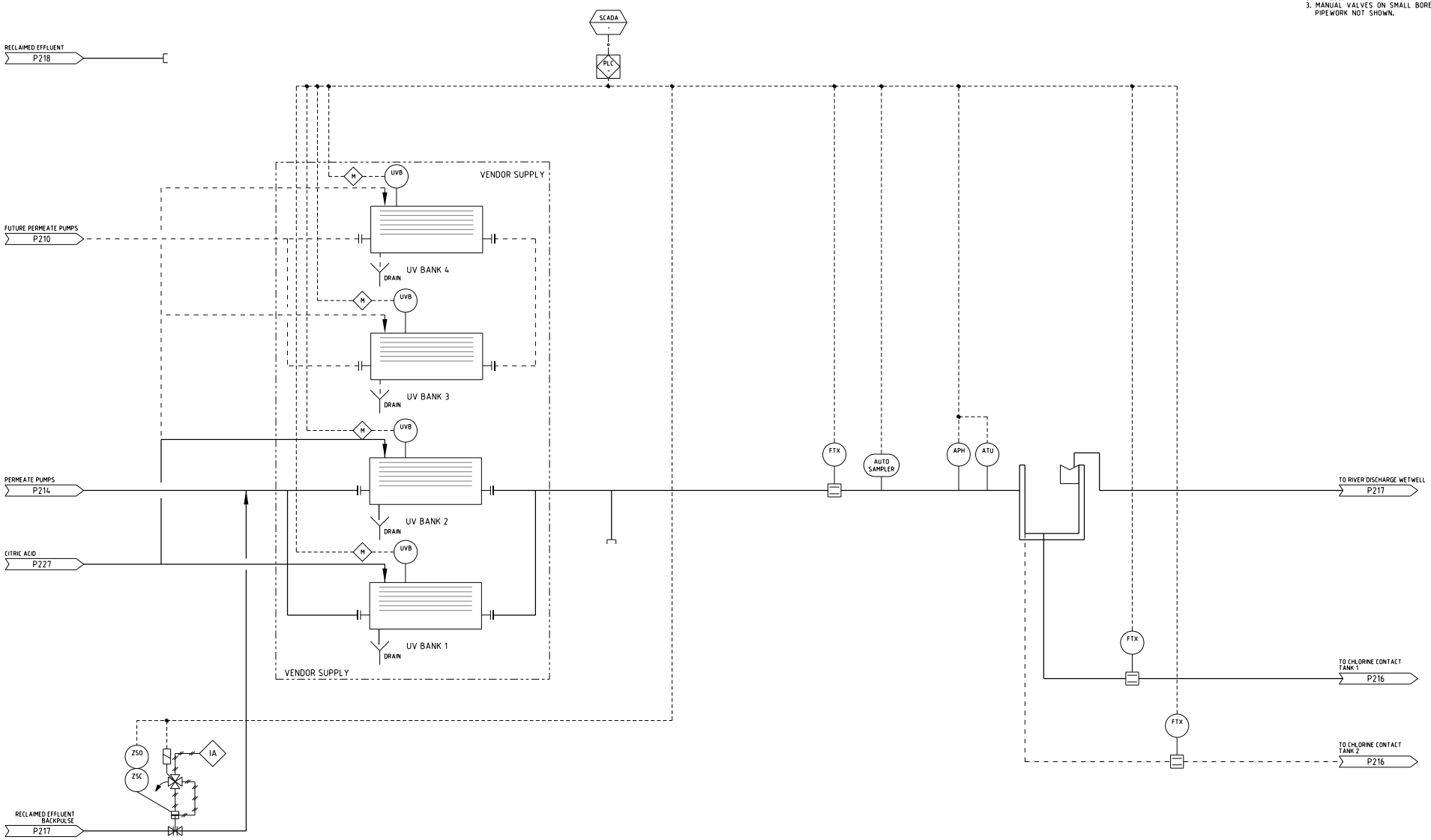
PROJECT: GOOGONG INTEGRATED WATER CYCLE

TITLE: PIPING AND INSTRUMENTATION DIAGRAM
WATER RECYCLING PLANT
PERMEATE-BACKPULSE PUMP SYSTEM

SIZE:	SCALE:	DRAWING No.:	REV.
A1	NTS	A1081402-P214	A

NOTES

1. FLANGES NOT SHOWN.
2. T-PIECES NOT SHOWN.
3. MANUAL VALVES ON SMALL BORE PIPEWORK NOT SHOWN.



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AUSTRALIA
Communities in the making

PROJECT:
GOOGONG INTEGRATED WATER CYCLE

TITLE:
PIPING AND INSTRUMENTATION DIAGRAM
WATER RECYCLING PLANT
UV SYSTEM

SIZE:	SCALE:	DRAWING No.:	REV.
A1	NTS	A1081402-P215	A