

Appendix 3.06 Calculation of Odour Emission Rate of CSTW

Interim Stage
Table A - Design Flow Rate to Deodourisation System No.1

20-Jun-16

Location	No. of Units (Duty)	Air Phase Height (m)	Internal Dimension (Unit)		Air Phase Volume (m ³)	Aeration Rate (Unit) (m ³ /h)	Air Exchange Rate (Air Changes/hr)(Z)	Odour Emission Area (m ²)	Equivalent Sample Location ID	SOER from measurement (oum ² /s)	Calculated SOER without 55% nitrate (oum ² /s)	Unmitigated Odour Emission Rate (ou/s)	Air Flow to Deodourization Unit (m ³ /hr)		
			Length (m)	Width (m)									Diameter (m)	Based on ACH	Rate adopted in design
Preliminary Treatment															
Inlet Chamber	1	1	6.7	16.5	N/A	110.6	3	111	F1	5.42	1.332	332	-	332	
Inlet Channel	0	1			N/A	0.0	3	0	F1	5.42	0	0	-	0	
Distribution Channel to Fine Screen	0	1			N/A	0.0	3	0	F1	5.42	0	0	-	0	
Fine Screen	4	1	7	2	N/A	56.0	3	56	F1	5.42	12.04	674	-	168	
Fine Screen By Pass	1	1	16.5	1.5	N/A	24.8	3	25	F1	5.42	12.04	298	-	74	
Fine Screen Screenings Handling Area	1	2.5	6	5	N/A	75.0	3	30	F2	3.83	8.51	255	-	225	
Fine Screen Outlet Channel	1	1	14.2	4.5	N/A	63.9	3	64	F1	5.42	12.04	770	-	192	
Distribution Channel 1	1	1	26.25	2.5	N/A	65.6	3	66	F1	5.42	12.04	790	-	197	
Distribution Channel 2	1	1	13.5	7	N/A	94.5	3	95	F1	5.42	12.04	1,138	-	284	
Aerated Grit Channels	5	1	15.00	4.00	N/A	300.0	3	300	F3	2.71	6.02	1,807	2,640	2,640	
Grit Handling Area	4	2	4.5	3.5	N/A	126.0	3	63	F2	3.83	8.51	556	-	378	
Aerated Grit Channel Outlet Channel	2	1	17	2.25	N/A	76.5	3	77	F4	3.41	7.58	580	-	230	
Header Channel to Primary Sedimentation Tank	2	1	259	2	N/A	1036.0	4.500	3	F4	3.41	7.58	7,851	4,950	4,950	
Header Distribution Channel to Primary Sedimentation Tank 1	8	1	7.4	2	N/A	118.4	3	118	F4	3.41	7.58	897	-	355	
Header Distribution Channel to Primary Sedimentation Tank 2	4	1	28	2.5	N/A	280.0	3	280	F4	3.41	7.58	2,122	-	840	
Primary Treatment															
Primary Sedimentation Tank	9	1	51	9	N/A	4131.0	3	4,131	F5	2.90	6.44	26,622	-	12,393	
Primary Sedimentation Weir	4	1	28	2	N/A	224.0	3	224	F5	2.90	6.44	1,444	-	672	
Primary Sedimentation Tank Outlet Channel	4	1	15	2	N/A	120.0	3	120	F6	4.82	10.71	1,285	-	360	
Header Channel to Biological	2	1	227.5	2	N/A	910.0	4.500	3	F6	4.82	10.71	9,747	4,950	4,950	
Storm Tank	0	1			N/A	0.0	3	0	F3	2.71	6.02	0	-	0	
													Sub-Total	58,148	
														Sub-Total	29,239
														Chemical Removal Rate	-
														Total	32,163

Table B - Design Flow Rate to Deodourisation System No.2

Sludge Treatment															
Thickening Facilities	3	2.2	6.5	2	N/A	86	3	39	S-02-DO3	-	26.42	1,030	-	257	257
Thickened Primary Sludge Buffer Tank	1	1	7	8	N/A	0	3	0	S-02-DO3	-	0	0	-	0	0
Thickened Sludge Holding Tank No.1	1	1			N/A	354	3	354	S-02-DO3	-	26.42	9,353	-	1,062	1,062
Thickened Sludge Holding Tank No.2	0	1			N/A	0	3	298	S-02-DO3	-	26.42	0	-	0	0
Direct Dewatering Facilities	7	3.2	10	3.6	N/A	806	3	252	S-02-DO3	-	26.42	6,658	-	2,419	2,419
Sludge Room No. 1	7	1.5	6	2.4	N/A	151	3	101	S-02-DO3	-	26.42	2,663	-	454	454
													Sub-Total	19,704	19,704
														Total	4,192
														Chemical Removal Rate	-
														Total	4,611

Table C - Design Flow Rate to Deodourisation System No.3

Dewatering Treatment															
Primary Sludge Holding Tank	1	1	18	9.4	N/A	169	3	169	S-02-DO3	-	26.42	4,470	-	508	508
Thickening Centrate Tank	1	1	10	9.4	N/A	94	3	94	S-02-DO3	-	26.42	2,483	-	282	282
Direct Dewatering Facilities	7	3.2	10	3.6	N/A	806	3	252	S-02-DO3	-	26.42	6,658	-	2,419	2,419
Dewatering Centrate Tank	0	1	14	5	N/A	0	3	0	S-02-DO3	-	26.42	0	-	0	0
Thickened Sludge Holding Tank No.3	7	1.5	6	2.4	N/A	151	3	101	S-02-DO3	-	26.42	2,663	-	454	454
Final Treatment															
UV Distribution Channel	1	1	10.5	8.1	N/A	85	3	85	F9F10	0.03	0.07	6	-	255	255
UV	5	1	12.4	3	N/A	186	3	186	F9F10	0.03	0.07	12	-	558	558
UV Outlet Channel	2	1	12.7	2.2	N/A	56	3	56	F9F10	0.03	0.07	4	-	168	168
UV Outlet Channel	1	1	34.9	1.7	N/A	59	3	59	F9F10	0.03	0.07	4	-	178	178
													Sub-Total	16,300	16,300
														Total	4,821
														Chemical Removal Rate	-
														Total	5,303

Table D - Design Flow Rate to Deodourisation System No.4

Secondary Treatment															
Biological Tank															
Header Distribution to Biological - Anoxic Zone	5	1	117.9	2	N/A	1179.0	3	1,179	F7	0.140	0.31	367	-	3,537	3,537
Biological Outlet Channel	29	1	10.2	13.75	N/A	4067.3	3	4,067	F7	0.140	0.31	1,265	-	12,202	12,202
Header Channel to DAF	5	1	145.5	2	N/A	1455.0	3	1,455	F7	0.14	0.31	453	-	4,365	4,365
Header Distribution to DAF	2	1	226.3	2	N/A	905.2	3	905	F7	0.14	0.31	282	-	2,716	2,716
Final Treatment															
DAF Units	17	1	8	11	N/A	1496.0	3	1,496	F9F10	0.03	0.07	100	-	4,488	4,488
DAF Outlet	4	1	77.75	2	N/A	622.0	3	622	F9F10	0.03	0.07	41	-	1,866	1,866
Header Channel to UV	2	1	233.35	2	N/A	933.4	3	933	F9F10	0.03	0.07	62	-	2,800	2,800
Header Distribution to UV	1	1	9.8	2	N/A	19.6	3	20	F9F10	0.03	0.07	1	-	59	59
													Sub-Total	3,525	3,525
														Total	107,595
														Chemical Removal Rate	-
														Total	118,133

Note:
 (1) Average and Maximum H₂S concentration of secondary / sludge treatment facilities are assumed with reference to Shatin STW; and
 (2) Air Exchange Rate for "Worker inaccessible areas" is 3-4 ACH while "Worker accessible areas" is 12-15 ACH
 (3) With reference to the Stonecutters Island STW design practice, the odor extraction rate for the aerated grit channel/ aerobic tank/ membrane tank / digester is estimated to be the 110% of the total air capacity of air blower in order to achieve slightly negative pressure inside these tanks.

Table 10.7 – Typical and Recommended Ventilation Rates

Odour Source	Ventilation Rates in ACH unless stated otherwise				
	A	B	C	D	E
Pumping station - wet well	1	>1	5 - 10	-	Proposed for SCISTW 3
Primary sedimentation tank	0.5 - 1	1	15 - 30	2m ³ /m ² /hr	6
Screenings and grits handling areas	3 - 4	-	15 - 30	7	15
Sludge storage tank	1 or 2	1	5 - 10	3m ³ /m ² /hr	6
Sludge centrifuge	10	20	5 - 10	2	-
Sludge conveyor	15	20	-	7	-
Sludge centrate tank	>1	1	-	-	6
Sludge cake storage/silo	1 or 2	2	5 - 10	-	6
Sludge loading bay	3	6	-	-	9
Sludge dewatering areas	3 - 6	3	5 - 10	-	6

Note: A = referenced from UK Water Company
 B = referenced from UK Water Company
 C = referenced from DSD Sewerage Manual of HKSAR
 D = referenced from Japanese Standard
 E = based on Sha Tin STW's ventilation design

Air Flow to Deodourization Unit (m ³ /hr)	160,209.88
Air Flow to Deodourization Unit (m ³ /s)	44.50
Total Unmitigated Odour Emission (ou/s)	97,677
Unmitigated Odour Emission to DOU 1-3 (ou/s)	94,152
Odour Emission of DOU 1-3 (97% Removal) (ou/s)	2,825
Unmitigated Odour Emission to DOU 4 (ou/s)	3,525
Odour Emission of DOU 4 (80% Removal) (ou/s)	705
Total Odour Emission (ou/s)	3,530

