Appendix 3-1

Calculation of Odour Emission Rate

Facilities No.	Source	Emission Factors		Parameters		
1	**Odour Control Unit 1**	**Unmitigated**	8.93973E+02	Total flow rate of each vent pipe (m^3/s)	7.75	*from Engineer*
	(MIT)	OU/s		Emission Height, (m)	6.58	*from Engineer*
	(OD1 & OD2)	(one control unit)		Diameter of the stack, (m)	1.0	*from Engineer*
	Both OD1 & OD2 are designed for all below facilities, thus each emission rate would be half of the total emission			Stack velocity, (m/s)	9.87	*calculated*
				Mitigation %	90	
	Enclosed Facilities:					
	Solids Handling Building	OU/s	3.4971E+03	Odour Emission Rate (OU/s)	E = DF x A x (V/3600) x Ct	
				Dilution factor, DF (OU/m3)	6595	*from HATS2A*
				Air volume of the emission source, A (m3)	97	*assumed (1*Surface Area)*
				Total Exposed Area (m2)	97	*from Engineer*
				Ventilation rate, V (air changes per hour)	15	*from Engineer*
				Correction factor, Ct	1.31	*Temperature correction factor*
	Low Lift and Returns Pumping Station	OU/s	3.0586E+02	Odour Emission Rate (OU/s)	E = DF x A x (V/3600)	
				Dilution factor, DF (OU/m3)	1915	*calculated, $DF = 1.6 \times (T/10)^{4.9} \times (ORP + 200)^{-0.59}$*
				Temperature of sewage, T (F)	86	*assumed*
				Oxidation-reduction potential of sewage, ORP (mV)	150	*assumed*
				Air volume of the emission source, A (m3)	115	*assumed (1*Surface Area)*
				Total Exposed Area (m2)	115	*from Engineer*
				Ventilation rate, V (air changes per hour)	5	*assumed 5 air changes per hour*
	Flash Mixing and Flocculation Tanks	OU/s	3.3459E+03	Odour Emission Rate (OU/s)	E = DF x A x (V/3600)	
				Dilution factor, DF (OU/m3)	1915	*calculated, $DF = 1.6 \times (T/10)^{4.9} \times (ORP + 200)^{-0.59}$*
				Temperature of sewage, T (F)	86	*assumed*
				Oxidation-reduction potential of sewage, ORP (mV)	150	*assumed*
				Air volume of the emission source, A (m3)	1258	*assumed (1*Surface Area)*
				Total Exposed Area (m2)	1258	*from Engineer*
				Ventilation rate, V (air changes per hour)	5	*assumed 5 air changes per hour*
	Sedimentation Tank (Weir Zone)	OU/s	3.6616E+03	Odour Emission Rate at weir (OU/s/m)	$E = 7.16 \times 10^{-4} \times OP \times F_{weir} \times h \times K_{pH}$	
	(PR01)			Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Weir loading rate, Fweir (m3/m/h)	122.45	*from Engineer*
				Height of drops of liquid flow at weirs, h (m)	0.12	*from Engineer*
				pH correction coefficient, KpH	1.17	*pH=7, from DSD,*
				Surface Area of weir, m2)	225	*from Engineer*
				Weir width per each tank(m)	2.5	*from Engineer*
				Weir length per each tank (m)	10	*from Engineer*
				Dry Weather Flow in Phase 2 (m3/d)	246000	*from DSD*
				No. of Tanks	9	
				Mitigation %	0	*Odour reduction*
	Sedimentation Tank Effluent Channel	OU/s	7.0946E+02	Odour Emission Rate (OU/s/m2)	$Eton = 4 \times 10^{-3}(0.0103V_{wind}^{1.42} + 2.93\ V_{liquid}) \times OP$	
				Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Velocity of liquid, V_{liquid} (m/s)	8.1331E-02	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	6.5278E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Total Surface Area of Sedimentation Tank Effluent Channel, (m2)	225	*from Engineer*
	Inlet Chamber of **Outfall Pumping Station - A**	OU/s	3.9039E+02	Odour Emission Rate (OU/s/m2)	$Eton = 4 \times 10^{-3}(0.0103V_{wind}^{1.42} + 2.93\ V_{liquid}) \times OP$	
				Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Velocity of liquid, V_{liquid} (m/s)	1.1997E-01	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	1.9444E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Total Exposed Area of Outfall Pumping Station, (m2)	84	*from Engineer*

Facilities No.	Source	Emission Factors		Parameters		
	Inlet Chamber of **Outfall Pumping Station - B**	OU/s	2.8602E+02	Odour Emission Rate (OU/s/m2)	Eton = 4 x 10^{-3}(0.0103$V_{wind}^{1.42}$ + 2.93 V_{liquid}) x OP	
				Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Velocity of liquid, V_{liquid} (m/s)	1.1997E-01	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	2.5139E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Total Exposed Area of Outfall Pumping Station, (m2)	62	*from Engineer*
	Screw Pumps of Outfall Pumping Station	OU/s	9.3546E+02	Odour Emission Rate (OU/s/m2)	Eton = 4 x 10^{-3}(0.0103$V_{wind}^{1.42}$ + 2.93 V_{liquid}) x OP	
				Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Velocity of liquid, V_{liquid} (m/s)	1.1997E-01	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	2.0556E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Total Exposed Area of Outfall Pumping Station, (m2)	201	*from Engineer*
	Wet Well of Outfall Pumping Station	OU/s	1.6593E+03	Odour Emission Rate (OU/s/m2)	Eton = 4 x 10^{-3}(0.0103$V_{wind}^{1.42}$ + 2.93 V_{liquid}) x OP	
				Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Velocity of liquid, V_{liquid} (m/s)	1.1997E-01	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	2.9167E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Total Exposed Area of Outfall Pumping Station, (m2)	357	*from Engineer*
	Inlet Chamber/Influent Channel, (IN01 - IN04) **Screw Pumps, Wet Wells of Inlet Pumping Station**	OU/s	1.0105E+03	Odour Emission Rate (OU/s)	E = DF x A x (V/3600)	
				Dilution factor, DF (OU/m3)	1915	*calculated, DF = 1.6 x $(T/10)^{4.9}$ x $(ORP + 200)^{-0.59}$*
				Temperature of sewage, T (F)	86	*assumed*
				Oxidation-reduction potential of sewage, ORP (mV)	150	*assumed*
				Air volume of the emission source, A (m3)	380	*screw pump:(0.2 (the freeboard) * Surface Area); the other facilities assumed (1*Surface Area)*
				Total Exposed Area of Inlet Pumping Station (m2)	581	*from Engineer*
				Ventilation rate, V (air changes per hour)	5	*assumed 5 air changes per hour*
	Coarse Screens and Common Flow Channel (SC01 - SC04)	OU/s	5.7449E+02	Odour Emission Rate (OU/s)	E = DF x A x (V/3600)	
				Dilution factor, DF (OU/m3)	1915	*calculated, DF = 1.6 x $(T/10)^{4.9}$ x $(ORP + 200)^{-0.59}$*
				Temperature of sewage, T (F)	86	*assumed*
				Oxidation-reduction potential of sewage, ORP (mV)	150	*assumed*
				Air volume of the emission source, A (m3)	216	*assumed (1*Surface Area)*
				Total Exposed Area (m2)	216	*from Engineer*
				Ventilation rate, V (air changes per hour)	5	*assumed 5 air changes per hour*
	Aerated Grit Channel and Common Flow Channel (GR01)	OU/s	9.1626E+02	Odour Emission Rate (OU/s)	E = DF x A x (V/3600)	
				Dilution factor, DF (OU/m3)	1915	*calculated, DF = 1.6 x $(T/10)^{4.9}$ x $(ORP + 200)^{-0.59}$*
				Temperature of sewage, T (F)	86	*assumed*
				Oxidation-reduction potential of sewage, ORP (mV)	150	*assumed*
				Air volume of the emission source, A (m3)	345	*assumed (1*Surface Area)*
				Total Exposed Area (m2)	345	*from Engineer*
				Ventilation rate, V (air changes per hour)	5	*assumed 5 air changes per hour*
	Fine Screen and Common Flow Channel after Fine Screens (FSC01 - FSC06)	OU/s	5.8713E+02	Odour Emission Rate (OU/s)	E = DF x A x (V/3600)	
				Dilution factor, DF (OU/m3)	1915	*calculated, DF = 1.6 x $(T/10)^{4.9}$ x $(ORP + 200)^{-0.59}$*
				Temperature of sewage, T (F)	86	*assumed*
				Oxidation-reduction potential of sewage, ORP (mV)	150	*assumed*
				Air volume of the emission source, A (m3)	221	*assumed (1*Surface Area)*
				Total Exposed Area (m2)	221	*from Engineer*
				Ventilation rate, V (air changes per hour)	5	*assumed 5 air changes per hour*

Facilities No.	Source	Emission Factors		Parameters		
2	**Sedimentation Tanks**	**Unmitigated**	2.0651E-02	Odour Emission Rate (OU/s/m2)	Eton = 4 x 10^{-3}(0.0103$V_{wind}^{1.42}$ + 2.93 V_{liquid}) x OP	
	(Quiescent Zone)	OU/s/m2		Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
	(PR02)			Velocity of liquid, V_{liquid} (m/s)	4.8611E-04	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	4.7917E-02	*from Engineer*
		OLD	1.8990E-02 (max. rate)			
		OU/s/m2		**For surface roughness Zo = 1.0m**		
		$E_{quiescent\ zone}$- class A	1.8904E-02	Wind Speed at emission source, V_{wind} (m/s)	U_z = (U* / k) x [ln(Z_1 / Z_o)-ψ_M(Z_1/L)+(ψ_M(Z_0/L)] from Komari et al.,	
		$E_{quiescent\ zone}$- class B	1.8956E-02	Wind Speed at emission source, $V_{wind\text{-}A}$ (m/s)	5.0559E-03	*calculated (for stability class A)*
		$E_{quiescent\ zone}$- class C	1.8990E-02	Wind Speed at emission source, $V_{wind\text{-}B}$ (m/s)	7.3288E-03	*calculated (for stability class B)*
		$E_{quiescent\ zone}$- class D	1.8988E-02	Wind Speed at emission source, $V_{wind\text{-}C}$ (m/s)	8.6707E-03	*calculated (for stability class C)*
		$E_{quiescent\ zone}$- class E	1.8922E-02	Wind Speed at emission source, $V_{wind\text{-}D}$ (m/s)	8.5910E-03	*calculated (for stability class D)*
		$E_{quiescent\ zone}$- class F	1.8854E-02	Wind Speed at emission source, $V_{wind\text{-}E}$ (m/s)	5.9022E-03	*calculated (for stability class E)*
				Wind Speed at emission source, $V_{wind\text{-}F}$ (m/s)	2.3421E-03	*calculated (for stability class F)*
				Friction velocity, U_A* (m/s)	2.4129E-01	*calculated, (for stability class A)*
				Friction velocity, U_B* (m/s)	3.2070E-01	*calculated, (for stability class B)*
				Friction velocity, U_C* (m/s)	3.6008E-01	*calculated, (for stability class C)*
				Friction velocity, U_D* (m/s)	3.5399E-01	*calculated, (for stability class D)*
				Friction velocity, U_E* (m/s)	2.4083E-01	*calculated, (for stability class E)*
				Friction velocity, U_F* (m/s)	8.8850E-02	*calculated, (for stability class F)*
				Mean Obukov length, L_A (m)	-1.8357E+01	*calculated, (for stability class A)*
				Mean Obukov length, L_B (m)	-5.7207E+01	*calculated, (for stability class B)*
				Mean Obukov length, L_C (m)	-5.0458E+02	*calculated, (for stability class C)*
				Mean Obukov length, L_D (m)	1.0000E+08	*calculated, (for stability class D)*
				Mean Obukov length, L_E (m)	5.0458E+02	*calculated, (for stability class E)*
				Mean Obukov length, L_F (m)	5.7207E+01	*calculated, (for stability class F)*
				Karman constant, k	0.41	
				Z_1 , (m)	1.01	
				Z_0, (m)	1	
3	**Odour Control Unit**	**Unmitigated**	9.39526E+02	Total flow rate of each vent pipe (m^3/s)	11.28	*from Engineer*
		OU/s		Emission Height, (m)	6.81	*from Engineer*
	(OD3 & OD4)	(one control unit)		Diameter of the stack, (m)	1.0	*from Engineer*
				Stack velocity, (m/s)	14.36	*calculated*
	Both OD3 & OD4 deodorized for below facilities, thus each emission rate would be half of the total emission			Mitigation %	90	
				Odour Emission Rate (OU/s)	E = DF x A x (V/3600) x Ct	
				Dilution factor, DF (OU/m3)	7603	*measured max. odour concentration, oum^{-3} of fresh dewatered sludge at Stonecutter Island STW*
				Ventilation rate, V (air changes per hour)	5	*for Raw Sludge Holding Tanks, Sludge Pumping Station, Return Liqour Pumping Station*
				Ventilation rate, V (air changes per hour)	15	*for Septic Waste Area, Sludge Dewatering Building*
				Correction factor, Ct	1.31	*Temperature correction factor*
	Septic Waste Area	OU/s	6.0756E+02	Air volume of the emission source, A (m3)	15	*assumed (1*Surface Area)*
				Total Exposed Area of Septic Waste Area, (m2)	15	*from Engineer*
	Raw Sludge Holding Tanks	OU/s	1.0043E+04	Air volume of the emission source, A (m3)	726	*assumed (1*Surface Area)*
				Total Exposed Area of Raw Sludge Holding Tanks, (m2)	726	*from Engineer*
	Sludge Pumping Station	OU/s	4.9800E+02	Air volume of the emission source, A (m3)	36	*assumed (1*Surface Area)*
				Total Exposed Area of Sludge Pumping Station, (m2)	36	*from Engineer*
	Return Liqour Pumping Station	OU/s	4.1500E+02	Air volume of the emission source, A (m3)	30	*assumed (1*Surface Area)*
				Total Exposed Area of Return Liquor Pumping Station, (m2)	30	*from Engineer*
	Sludge Dewatering Building	OU/s	3.6453E+03	Air volume of the emission source, A (m3)	88	*assumed (1*Surface Area)*
				Total Exposed Area of Sludge Dewatering Building, (m2)	88	*from Engineer*
	Centrifuge	OU/s	3.3200E+02	Air volume of the emission source, A (m3)	24	*assumed (1*Surface Area)*
				Total Exposed Area of Centrifuge, (m2)	24	*from Engineer*

Facilities No.	Source	Emission Factors		Parameters		
	Fine Screens Influent Channel	OU/s	1.0208E+02	Odour Emission Rate (OU/s/m2)	Eton = 4 x 10^{-3}(0.0103$V_{wind}^{1.42}$ + 2.93 V_{liquid}) x OP	
	(for disinfection facilities)			Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
	(FIS01)			Velocity of liquid, V_{liquid} (m/s)	8.1331E-02	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	1.5000E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Exposed Area of Fine Screen Influent Channel (m2)	32.4	*from Engineer*
	Fine Screens	OU/s	2.0164E+02	Odour Emission Rate (OU/s/m2)	Eton = 4 x 10^{-3}(0.0103$V_{wind}^{1.42}$ + 2.93 V_{liquid}) x OP	
	(for disinfection facilities)			Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
	(FIS02-FIS03)			Velocity of liquid, V_{liquid} (m/s)	8.1331E-02	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	1.1111E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Exposed Area of Fine Screen (m2)	64	*from Engineer*
	UV Tank Influent Channel	OU/s	6.4932E+01	Odour Emission Rate (OU/s/m2)	Eton = 4 x 10^{-3}(0.0103$V_{wind}^{1.42}$ + 2.93 V_{liquid}) x OP	
	(UV01)			Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Velocity of liquid, V_{liquid} (m/s)	7.6248E-03	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	5.0556E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Total Exposed Area (m2)	218	*from Engineer*
	UV Tank	OU/s	2.2555E+03	Odour Emission Rate (OU/s/m2)	Eton = 4 x 10^{-3}(0.0103$V_{wind}^{1.42}$ + 2.93 V_{liquid}) x OP	
	(UV02-UV03)			Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Velocity of liquid, V_{liquid} (m/s)	7.3198E-02	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	3.4514E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Exposed Area of UV Tanks (m2)	795.2	*from Engineer*
	UV Tank Effluent Channel	OU/s	6.2551E+02	Odour Emission Rate (OU/s/m2)	Eton = 4 x 10^{-3}(0.0103$V_{wind}^{1.42}$ + 2.93 V_{liquid}) x OP	
	(UV04-UV06)			Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Velocity of liquid, V_{liquid} (m/s)	7.3198E-02	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	1.0194E-01	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Exposed Area of UV Effluent Channel (m2)	220.2	*from Engineer*

Facilities No.	Source	Emission Factors		Parameters		
1	**Odour Control Unit 1**	**Mitigated**	6.0026E+02	Total flow rate of each vent pipe (m^3/s)	10.86	*from Engineer*
	(MIT)	OU/s		Emission Height, (m)	6.81	*from Engineer*
	(OD1, OD2 & OD5)	(one control unit)		Diameter of the stack, (m)	1.0	*from Engineer*
	Enclosed Facilities no. 2			Stack velocity, (m/s)	13.82	*calculated*
				Mitigation %	90	
	Both OD1, OD2 & OD5 are designed					
	for all below facilities, thus each			Odour Emission Rate (OU/s)	E = DF x A x (V/3600)	
	emission rate would be one third of			Dilution factor, DF (OU/m3)	1915	*calculated, $DF = 1.6 \times (T/10)^{4.9} \times (ORP + 200)^{-0.59}$*
	the total emission			Temperature of sewage, T (F)	86	*assumed*
				Oxidation-reduction potential of sewage, ORP (mV)	150	*assumed*
				Ventilation rate, V (air changes per hour)	5	*assumed 5 air changes per hour*
				Ventilation rate, V (air changes per hour)	15	*for Solids Handling Building*
	Enclosed Facilities:					
	Inlet Chamber/Influent Channel,	OU/s	1.0105E+03	Air volume of the emission source, A (m3)	380	*screw pump:(0.2 (the freeboard) * Surface Area); the other facilities assumed (1*Surface Area)*
	(IN01 - IN04)			Total Exposed Area of Inlet Pumping Station (m2)	581	*from Engineer*
	Screw Pumps and Wet Wells of Inlet Pumping Station					
	Coarse Screens and	OU/s	5.7449E+02	Air volume of the emission source, A (m3)	216	*assumed (1*Surface Area)*
	Common Flow Channel			Total Exposed Area (m2)	216	*from Engineer*
	(SC01 - SC04)					
	Aerated Grit Channel and	OU/s	9.1626E+02	Air volume of the emission source, A (m3)	345	*assumed (1*Surface Area)*
	Common Flow Channel			Total Exposed Area (m2)	345	*from Engineer*
	(GR01)					
	Fine Screen and Common Flow	OU/s	5.8713E+02	Air volume of the emission source, A (m3)	221	*assumed (1*Surface Area)*
	Channel after Fine Screens			Total Exposed Area (m2)	221	*from Engineer*
	(FSC01 - FSC06)					
	Solids Handling Building	OU/s	3.4971E+03	Odour Emission Rate (OU/s)	E = DF x A x (V/3600) x Ct	
				Dilution factor, DF (OU/m3)	6595	*from HATS2A measurement data (max odour concentration of screens)*
				Air volume of the emission source, A (m3)	97	*assumed (1*Surface Area)*
				Total Exposed Area (m2)	97	*from Engineer*
				Temperature Correction factor, Ct	1.31	*Temperature correction factor*
	Low Lift and Returns	OU/s	3.0586E+02	Air volume of the emission source, A (m3)	115	*assumed (1*Surface Area)*
	Pumping Station			Total Exposed Area (m2)	115	*from Engineer*
	Flash Mixing and	OU/s	3.3459E+03	Air volume of the emission source, A (m3)	1258	*assumed (1*Surface Area)*
	Flocculation Tanks			Total Exposed Area (m2)	1258	*from Engineer*
	Sedimentation Tanks	OU/s	1.2824E+02	Odour Emission Rate (OU/s/m2)	$Eton = 4 \times 10^{-3}(0.0103V_{wind}^{1.42} + 2.93\ V_{liquid}) \times OP$	
	(Quiescent Zone)		1.4719E+02	Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
	(PR02)			Velocity of liquid, V_{liquid} (m/s)	4.8611E-04	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	4.7917E-02	*from Engineer*
				Covered Area, (m^2)	6210	*covered all sedimentation tanks*
				Mitigation %	0	*Odour reduction*
	Sedimentation Tank (Weir Zone)	E_{weir}	3.6616E+03	Odour Emission Rate at weir (OU/s/m)	$E = 7.16 \times 10^{-4} \times OP \times F_{weir} \times h \times K_{pH}$	
	(PR01)	OU/s		Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Weir loading rate, Fweir (m3/m/h)	122.45	*from Engineer*
				Height of drops of liquid flow at weirs, h (m)	0.12	*from Engineer*
				pH correction coefficient, KpH	1.17	*pH=7, from DSD,*
				Surface Area of weir, m2)	225	*from Engineer*
				Weir width per each tank(m)	2.5	*from Engineer*
				Weir length per each tank (m)	10	*from Engineer*
				Dry Weather Flow in Phase 2 (m3/d)	246000	*from DSD*
				No. of Tanks	9	
				Mitigation %	0	*Odour reduction*

Facilities No.	Source	Emission Factors		Parameters		
	Sedimentation Tank Effluent Channel	OU/s	7.0946E+02 7.1053E+02	Odour Emission Rate (OU/s/m2)	$Eton = 4 \times 10^{-3}(0.0103V_{wind}^{1.42} + 2.93\ V_{liquid}) \times OP$	
				Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Velocity of liquid, V_{liquid} (m/s)	8.1331E-02	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	6.5278E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Total Surface Area of Sedimentation Tank Effluent Channel, (m^2)	225	*from Engineer*
				Mitigation %	0	
	Inlet Chamber of **Outfall Pumping Station - A**	OU/s	3.9039E+02	Odour Emission Rate (OU/s/m2)	$Eton = 4 \times 10^{-3}(0.0103V_{wind}^{1.42} + 2.93\ V_{liquid}) \times OP$	
				Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Velocity of liquid, V_{liquid} (m/s)	1.1997E-01	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	1.9444E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Total Exposed Area of Outfall Pumping Station, (m2)	84	*from Engineer*
				Mitigation %	0	
	Inlet Chamber of **Outfall Pumping Station - B**	OU/s	2.8602E+02	Odour Emission Rate (OU/s/m2)	$Eton = 4 \times 10^{-3}(0.0103V_{wind}^{1.42} + 2.93\ V_{liquid}) \times OP$	
				Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Velocity of liquid, V_{liquid} (m/s)	1.1997E-01	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	2.5139E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Total Exposed Area of Outfall Pumping Station, (m2)	62	*from Engineer*
				Mitigation %	0	
	Screw Pumps of Outfall Pumping Station	OU/s	9.3546E+02	Odour Emission Rate (OU/s/m2)	$Eton = 4 \times 10^{-3}(0.0103V_{wind}^{1.42} + 2.93\ V_{liquid}) \times OP$	
				Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Velocity of liquid, V_{liquid} (m/s)	1.1997E-01	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	2.0556E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Total Exposed Area of Outfall Pumping Station, (m2)	201	*from Engineer*
				Mitigation %	0	
	Wet Well of Outfall Pumping Station	OU/s	1.6593E+03	Odour Emission Rate (OU/s/m2)	$Eton = 4 \times 10^{-3}(0.0103V_{wind}^{1.42} + 2.93\ V_{liquid}) \times OP$	
				Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Velocity of liquid, V_{liquid} (m/s)	1.1997E-01	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	2.9167E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Total Exposed Area of Outfall Pumping Station, (m2)	357	*from Engineer*
				Mitigation %	0	
2	**Odour Control Unit**	**Mitigated**	9.39525E+02	Total flow rate of each vent pipe (m^3/s)	11.28	*from Engineer*
	(mit)	OU/s		Emission Height, (m)	6.81	*from Engineer*
	(OD3 & OD4)	(one control unit)		Diameter of the stack, (m)	1.0	*from Engineer*
	Both OD3 & OD4 deodorized for			Stack velocity, (m/s)	14.36	*calculated*
	below facilities, thus each			Mitigation %	90	
	emission rate would be half of					
	the total emission					
	Enclosed Facilities:					
	Fine Screens Influent Channel	OU/s	1.0208E+02	Odour Emission Rate (OU/s/m2)	$Eton = 4 \times 10^{-3}(0.0103V_{wind}^{1.42} + 2.93\ V_{liquid}) \times OP$	
	(for disinfection facilities)			Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
	(FIS01)			Velocity of liquid, V_{liquid} (m/s)	8.1331E-02	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	1.5000E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Exposed Area of Fine Screen Influent Channel (m2)	32.4	*from Engineer*
				Mitigation %	0	

Facilities No.	Source	Emission Factors		Parameters		
	Fine Screens	OU/s	2.0164E+02	Odour Emission Rate (OU/s/m2)	Eton = 4 x $10^{-3}(0.0103V_{wind}^{1.42} + 2.93\ V_{liquid})$ x OP	
	(for disinfection facilities)			Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
	(FIS02-FIS03)			Velocity of liquid, V_{liquid} (m/s)	8.1331E-02	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	1.1111E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Exposed Area of Fine Screen (m2)	64	*from Engineer*
				Mitigation %	0	
	UV Tank Influent Channel	OU/s	6.4932E+01	Odour Emission Rate (OU/s/m2)	Eton = 4 x $10^{-3}(0.0103V_{wind}^{1.42} + 2.93\ V_{liquid})$ x OP	
	(UV01)			Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Velocity of liquid, V_{liquid} (m/s)	7.6248E-03	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	5.0556E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Total Exposed Area (m2)	218	*from Engineer*
				Mitigation %	0	
	UV Tank	OU/s	2.2555E+03	Odour Emission Rate (OU/s/m2)	Eton = 4 x $10^{-3}(0.0103V_{wind}^{1.42} + 2.93\ V_{liquid})$ x OP	
	(UV02-UV03)			Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Velocity of liquid, V_{liquid} (m/s)	7.3198E-02	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	3.4514E-02	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Exposed Area of UV Tanks (m2)	795.2	*from Engineer*
				Mitigation %	0	
	UV Tank Effluent Channel	OU/s	6.2551E+02	Odour Emission Rate (OU/s/m2)	Eton = 4 x $10^{-3}(0.0103V_{wind}^{1.42} + 2.93\ V_{liquid})$ x OP	
	(UV04-UV06)			Odour potential, OP (OU/m3)	3305	*from Yang & Hobson*
				Velocity of liquid, V_{liquid} (m/s)	7.3198E-02	*from Engineer*
				Wind Velocity, V_{wind} (m/s)	1.0194E-01	*from Engineer*
				Odour Emission Reduction after UV process (%)	0	*from Engineer*
				Exposed Area of UV Effluent Channel (m2)	220.2	*from Engineer*
				Mitigation %	0	
	Sludge Facilities			Odour Emission Rate (OU/s)	E = DF x A x (V/3600) x Ct	
				Dilution factor, DF (OU/m3)	7603	*measured max. odour concentration, oum^{-3} of fresh dewatered sludge at Stonecutter Island STW*
				Ventilation rate, V (air changes per hour)	5	*for Raw Sludge Holding Tanks, Sludge Pumping Station, Return Liqour Pumping Station*
				Ventilation rate, V (air changes per hour)	15	*for Septic Waste Area, Sludge Dewatering Building*
				Temperature Correction factor, Ct	1.31	*Temperature correction factor*
	Septic Waste Area	OU/s	6.0756E+02	Air volume of the emission source, A (m3)	15	*assumed (1*Surface Area)*
				Total Exposed Area of Septic Waste Area, (m2)	15	*from Engineer*
	Raw Sludge Holding Tanks	OU/s	1.0043E+04	Air volume of the emission source, A (m3)	726	*assumed (1*Surface Area)*
				Total Exposed Area of Raw Sludge Holding Tanks, (m2)	726	*from Engineer*
	Sludge Pumping Station	OU/s	4.9800E+02	Air volume of the emission source, A (m3)	36	*assumed (1*Surface Area)*
				Total Exposed Area of Sludge Pumping Station, (m2)	36	*from Engineer*
	Return Liqour Pumping Station	OU/s	4.1500E+02	Air volume of the emission source, A (m3)	30	*assumed (1*Surface Area)*
				Total Exposed Area of Return Liquor Pumping Station, (m2)	30	*from Engineer*
	Sludge Dewatering Building	OU/s	3.6453E+03	Air volume of the emission source, A (m3)	88	*assumed (1*Surface Area)*
				Total Exposed Area of Sludge Dewatering Building, (m2)	88	*from Engineer*
	Centrifuge	OU/s	3.3200E+02	Air volume of the emission source, A (m3)	24	*assumed (1*Surface Area)*
				Total Exposed Area of Centrifuge, (m2)	24	*from Engineer*