

Annex A2

Dust Emission Rate Calculation (For Annual Average)

Annex A2(a). Emission Rates Calculation (For annual average)

A. Shenzhen River Regulation Stage 4

1 Construction Works Area A1 to A7, B1 to B8, C1 to C5, D1 to D6	Heavy construction 2.69 Mg/hectare/month of activity 10.5 % of area actively operating 90 % of dust suppression 25 Working days per month 10 Working hours a day 3.1383E-05 E (g/m2/s) 3.14E-06 E (g/m2/s)	AP-42, S13.2.3 1/95 ed. Assume 10.5% works area for heavy construction for calculating annual TSP average 90% dust suppression (reference to Control of Open Fugitive Dust Sources, Section 3.3.3) From Engineer 8am to 6 pm Unmitigated Mitigated - 90% reduction (see Note 1)
	Wind Erosion 0.85 Mg/hectare/yr 10.5 % of area actively operating 2.83E-07 E (g/m2/s)	AP-42, Table 11.9-4, 7/98 ed. Assume 10% works area for heavy construction Unmitigated (Nighttime)
2 Stockpiling Areas SP11, SP12, SP21, SP31, SP32, SP41 & SP42	Earth Handling / Loading & unloading $E = k \times (0.0016) \times ((U/2.2)^{1.3}) / (M/2)^{1.4}$ 0.74 k, particle size multiplier 1.9 U, average wind speed 4.8 M, materials moisture content (%) 2.87E-04 E (kg/Mg) 30 % 8.62E-05 E (kg/Mg)	AP-42, S13.24, 11/06 ed. AP-42, S13.24, 11/06 ed. Annual mean wind speed record at TKL weather station in 2008 From engineer (Most of the materials are excavated from the river and therefore high moisture content is assumed) Unmitigated Emission Rate Percentage open stockpile area Mitigated (ie 70% reduction by watering at least 8 times a day)
	SP11, SP12 10823 m3 77.9 Mg/hour 0.006218 g/s 0.001865 g/s 2369 m2 2.63E-06 g/m2/s 7.88E-07 g/m2/s	Maximum Monthly Excavation Rate for Works Area 1 (From Engineer) Assume 25 working days a month and 10 working hours a day, density of soil = 1,800kg/m3 Unmitigated Emission Rate Mitigated Emission Rate Area of SP11 and SP12 Unmitigated Mitigated
	SP21 11871 m3 85.5 Mg/hour 0.006820 g/s 0.002046 g/s 3150 m2 2.17E-06 g/m2/s 6.50E-07 g/m2/s	Maximum Monthly Excavation Rate for Works Area 2 (From Engineer) Assume 25 working days a month and 10 working hours a day, density of soil = 1,800kg/m3 Unmitigated Emission Rate Mitigated Emission Rate Area of SP21 Unmitigated Mitigated
	SP31, SP32 21373 m3 153.9 Mg/hour 0.012280 g/s 0.003684 g/s 1872 m2 6.56E-06 g/m2/s 1.97E-06 g/m2/s	Maximum Monthly Excavation Rate for Works Area 3 (From Engineer) Assume 25 working days a month and 10 working hours a day, density of soil = 1,800kg/m3 Unmitigated Emission Rate Mitigated Emission Rate Area of SP31 and SP32 Unmitigated Mitigated
	SP41, SP42 6933 m3 49.9 Mg/hour 0.003983 g/s 0.001195 g/s 1110 m2 3.59E-06 g/m2/s 1.08E-06 g/m2/s	Maximum Monthly Excavation Rate for Works Area 4 (From Engineer) Assume 25 working days a month and 10 working hours a day, density of soil = 1,800kg/m3 Unmitigated Emission Rate Mitigated Emission Rate Area of SP41 and SP42 Unmitigated Mitigated
	Wind Erosion 0.85 Mg/hectare/yr 30 % 2.70E-06 E (g/m2/s) 8.09E-07 E (g/m2/s)	AP-42, Table 11.9-4, 7/98 ed. Percentage open stockpile area Unmitigated Mitigated (ie 70% reduction by watering at least 8 times a day)

B. Liantang Boundary Control Point (based on the latest best available information from the project team of LT/HYW BCP)

1 Boundary Control Point - Cut & Cover Area	BCP1 - BCP3, BCP 4a & 4b, BCP5 Heavy Construction Wind Erosion 2.994E-06 g/m2/s 2.695E-07 g/m2/s	Mitigated 100% active area
	BC6 Material Handling and Storage Piles Wind Erosion 1.775E-07 g/m2/s 5.391E-07 g/m2/s	Mitigated 20% active area (ie 80% stockpiling area is covered by impervious sheets)
	BC7 Slope Cutting Works Wind Erosion 2.994E-06 g/m2/s 2.695E-07 g/m2/s	Mitigated 100% active area
2 Connecting Road to BCP	NCR1, NCR2a & 2b, NCR3 - NCR8, LMH 1 - LMH4 Heavy Construction Wind Erosion 2.994E-06 g/m2/s 2.695E-07 g/m2/s	Mitigated 100% active area

Note 1:

% dust suppression is estimated with reference to Eq. 3-2 in Section 3.3.3 of *Control of Open Fugitive Dust Sources – Final Report* by USEPA
 $C = 100 - (0.8 \cdot p \cdot d^4) / i$
 $i = 0.64 \text{ litre/m}^2$
 $t = 1 \text{ hr}$
 $p = 0.235 \text{ mm/hr}$ (reference to HKO data)
 $d = 34 \text{ truck per hours}$

Annex A2(b)
Dust Emission Sources
Annual Average TSP (Refer to Figure A3)

Sources ID	Description	Type of Emission	Emission Rate (g/m/s)		Coordinates				Emission Height (m)	Rotation Angle (o)
			Day Time	Night Time	x co-ordinate (starting)	y co-ordinate (starting)	x co-ordinate (ending)	y co-ordinate (ending)		
Emission Sources from Shenzhen River Regulation Stage 4										
UNMITIGATED										
A1	Heavy Construction	Area	3.14E-05	0	834803	846734	48	186	0	19
A2	Heavy Construction	Area	3.14E-05	0	834714	846864	48	114	0	57
A3	Heavy Construction	Area	3.14E-05	0	834565	846820	218	48	0	42
A4	Heavy Construction	Area	3.14E-05	0	834425	846652	190	48	0	56
A5	Heavy Construction	Area	3.14E-05	0	834293	846360	438	48	0	68
A6	Heavy Construction	Area	3.14E-05	0	834838	846618	28	100	0	20
A7	Heavy Construction	Area	3.14E-05	0	834916	846576	28	120	0	83
B1	Heavy Construction	Area	3.14E-05	0	834178	846140	75	40	0	30
B2	Heavy Construction	Area	3.14E-05	0	834050	846118	208	40	0	30
B3	Heavy Construction	Area	3.14E-05	0	833842	846098	40	238	0	72
B4	Heavy Construction	Area	3.14E-05	0	833685	845891	270	65	0	85
B5	Heavy Construction	Area	3.14E-05	0	833610	845695	128	56	0	38
B6	Heavy Construction	Area	3.14E-05	0	833530	845600	105	58	0	54
B7	Heavy Construction	Area	3.14E-05	0	833693	846088	75	48	0	50
B8	Heavy Construction	Area	3.14E-05	0	833800	846041	132	50	0	19
C1	Heavy Construction	Area	3.14E-05	0	833478	845397	40	270	0	3
C2	Heavy Construction	Area	3.14E-05	0	833533	845284	72	269	0	3
C3	Heavy Construction	Area	3.14E-05	0	833651	845283	150	250	0	3
C4	Heavy Construction	Area	3.14E-05	0	833465	845029	276	48	0	52
C5	Heavy Construction	Area	3.14E-05	0	833508	845478	33	100	0	3
D1	Heavy Construction	Area	3.14E-05	0	833350	844870	100	48	0	75
D2	Heavy Construction	Area	3.14E-05	0	833350	844750	48	117	0	12
D3	Heavy Construction	Area	3.14E-05	0	833152	844630	420	45	0	12
D4	Heavy Construction	Area	3.14E-05	0	832918	844635	45	80	0	12
D5	Heavy Construction	Area	3.14E-05	0	832794	844684	45	210	0	88
D6	Heavy Construction	Area	3.14E-05	0	832757	844630	40	90	0	5
A1	Wind Erosion	Area	2.70E-07	2.70E-07	834803	846734	48	186	0	19
A2	Wind Erosion	Area	2.70E-07	2.70E-07	834714	846864	48	114	0	57
A3	Wind Erosion	Area	2.70E-07	2.70E-07	834565	846820	218	48	0	42
A4	Wind Erosion	Area	2.70E-07	2.70E-07	834425	846652	190	48	0	56
A5	Wind Erosion	Area	2.70E-07	2.70E-07	834293	846360	438	48	0	68
A6	Wind Erosion	Area	2.70E-07	2.70E-07	834838	846618	28	100	0	20
A7	Wind Erosion	Area	2.70E-07	2.70E-07	834916	846576	28	120	0	83
B1	Wind Erosion	Area	2.70E-07	2.70E-07	834178	846140	75	40	0	30
B2	Wind Erosion	Area	2.70E-07	2.70E-07	834050	846118	208	40	0	30
B3	Wind Erosion	Area	2.70E-07	2.70E-07	833842	846098	40	238	0	72
B4	Wind Erosion	Area	2.70E-07	2.70E-07	833685	845891	270	65	0	85
B5	Wind Erosion	Area	2.70E-07	2.70E-07	833610	845695	128	56	0	38
B6	Wind Erosion	Area	2.70E-07	2.70E-07	833530	845600	105	58	0	54
B7	Wind Erosion	Area	2.70E-07	2.70E-07	833693	846088	75	48	0	50
B8	Wind Erosion	Area	2.70E-07	2.70E-07	833800	846041	132	50	0	19
C1	Wind Erosion	Area	2.70E-07	2.70E-07	833478	845397	40	270	0	3
C2	Wind Erosion	Area	2.70E-07	2.70E-07	833533	845284	72	269	0	3
C3	Wind Erosion	Area	2.70E-07	2.70E-07	833651	845283	150	250	0	3
C4	Wind Erosion	Area	2.70E-07	2.70E-07	833465	845029	276	48	0	52
C5	Wind Erosion	Area	2.70E-07	2.70E-07	833508	845478	33	100	0	3
D1	Wind Erosion	Area	2.70E-07	2.70E-07	833350	844870	100	48	0	75
D2	Wind Erosion	Area	2.70E-07	2.70E-07	833350	844750	48	117	0	12
D3	Wind Erosion	Area	2.70E-07	2.70E-07	833152	844630	420	45	0	12
D4	Wind Erosion	Area	2.70E-07	2.70E-07	832918	844635	45	80	0	12
D5	Wind Erosion	Area	2.70E-07	2.70E-07	832794	844684	45	210	0	88
D6	Wind Erosion	Area	2.70E-07	2.70E-07	832757	844630	40	90	0	5
SP11	Material handling	Area	2.63E-06	0	834190	846208	93	18	0	68
SP12	Material handling	Area	2.63E-06	0	834158	846178	38	20	0	68
SP21	Material handling	Area	2.17E-06	0	833750	846065	70	45	0	24
SP31	Material handling	Area	6.56E-06	0	833325	844722	21	66	0	3
SP32	Material handling	Area	6.56E-06	0	833275	844683	81	6	0	15
SP41	Material handling	Area	3.59E-06	0	832956	844670	10	75	0	3
SP42	Material handling	Area	3.59E-06	0	832940	844728	10	36	0	47
SP11	Wind Erosion	Area	2.70E-06	2.70E-06	834190	846208	93	18	0	68
SP12	Wind Erosion	Area	2.70E-06	2.70E-06	834158	846178	38	20	0	68
SP21	Wind Erosion	Area	2.70E-06	2.70E-06	833750	846065	70	45	0	24
SP31	Wind Erosion	Area	2.70E-06	2.70E-06	833325	844722	21	66	0	3
SP32	Wind Erosion	Area	2.70E-06	2.70E-06	833275	844683	81	6	0	15
SP41	Wind Erosion	Area	2.70E-06	2.70E-06	832956	844670	10	75	0	3
SP42	Wind Erosion	Area	2.70E-06	2.70E-06	832940	844728	10	36	0	47
MITIGATED										
A1	Heavy Construction	Area	3.14E-06	0	834803	846734	48	186	0	19
A2	Heavy Construction	Area	3.14E-06	0	834714	846864	48	114	0	57
A3	Heavy Construction	Area	3.14E-06	0	834565	846820	218	48	0	42
A4	Heavy Construction	Area	3.14E-06	0	834425	846652	190	48	0	56
A5	Heavy Construction	Area	3.14E-06	0	834293	846360	438	48	0	68
A6	Heavy Construction	Area	3.14E-06	0	834838	846618	28	100	0	20
A7	Heavy Construction	Area	3.14E-06	0	834916	846576	28	120	0	83
B1	Heavy Construction	Area	3.14E-06	0	834178	846140	75	40	0	30
B2	Heavy Construction	Area	3.14E-06	0	834050	846118	208	40	0	30
B3	Heavy Construction	Area	3.14E-06	0	833842	846098	40	238	0	72
B4	Heavy Construction	Area	3.14E-06	0	833685	845891	270	65	0	85
B5	Heavy Construction	Area	3.14E-06	0	833610	845695	128	56	0	38
B6	Heavy Construction	Area	3.14E-06	0	833530	845600	105	58	0	54
B7	Heavy Construction	Area	3.14E-06	0	833693	846088	75	48	0	50
B8	Heavy Construction	Area	3.14E-06	0	833800	846041	132	50	0	19
C1	Heavy Construction	Area	3.14E-06	0	833478	845397	40	270	0	3
C2	Heavy Construction	Area	3.14E-06	0	833533	845284	72	269	0	3
C3	Heavy Construction	Area	3.14E-06	0	833651	845283	150	250	0	3
C4	Heavy Construction	Area	3.14E-06	0	833465	845029	276	48	0	52
C5	Heavy Construction	Area	3.14E-06	0	833508	845478	33	100	0	3
D1	Heavy Construction	Area	3.14E-06	0	833350	844870	100	48	0	75
D2	Heavy Construction	Area	3.14E-06	0	833350	844750	48	117	0	12
D3	Heavy Construction	Area	3.14E-06	0	833152	844630	420	45	0	12
D4	Heavy Construction	Area	3.14E-06	0	832918	844635	45	80	0	12
D5	Heavy Construction	Area	3.14E-06	0	832794	844684	45	210	0	88
D6	Heavy Construction	Area	3.14E-06	0	832757	844630	40	90	0	5
A1	Wind Erosion	Area	2.70E-07	2.70E-07	834803	846734	48	186	0	19

Annex A2(b)
Dust Emission Sources
Annual Average TSP (Refer to Figure A3)

Sources ID	Description	Type of Emission	Emission Rate (g/m/s)		Coordinates				Emission Height (m)	Rotation Angle (o)
			Day Time	Night Time	x co-ordinate (starting)	y co-ordinate (starting)	x co-ordinate (ending)	y co-ordinate (ending)		
A2	Wind Erosion	Area	2.70E-07	2.70E-07	834714	846864	48	114	0	57
A3	Wind Erosion	Area	2.70E-07	2.70E-07	834565	846820	218	48	0	42
A4	Wind Erosion	Area	2.70E-07	2.70E-07	834425	846652	190	48	0	56
A5	Wind Erosion	Area	2.70E-07	2.70E-07	834293	846360	438	48	0	68
A6	Wind Erosion	Area	2.70E-07	2.70E-07	834838	846618	28	100	0	20
A7	Wind Erosion	Area	2.70E-07	2.70E-07	834916	846576	28	120	0	83
B1	Wind Erosion	Area	2.70E-07	2.70E-07	834178	846140	75	40	0	30
B2	Wind Erosion	Area	2.70E-07	2.70E-07	834050	846118	208	40	0	30
B3	Wind Erosion	Area	2.70E-07	2.70E-07	833842	846098	40	238	0	72
B4	Wind Erosion	Area	2.70E-07	2.70E-07	833685	845891	270	65	0	85
B5	Wind Erosion	Area	2.70E-07	2.70E-07	833610	845695	128	56	0	38
B6	Wind Erosion	Area	2.70E-07	2.70E-07	833530	845600	105	58	0	54
B7	Wind Erosion	Area	2.70E-07	2.70E-07	833693	846088	75	48	0	50
B8	Wind Erosion	Area	2.70E-07	2.70E-07	833800	846041	132	50	0	19
C1	Wind Erosion	Area	2.70E-07	2.70E-07	833478	845397	40	270	0	3
C2	Wind Erosion	Area	2.70E-07	2.70E-07	833533	845284	72	269	0	3
C3	Wind Erosion	Area	2.70E-07	2.70E-07	833651	845283	150	250	0	3
C4	Wind Erosion	Area	2.70E-07	2.70E-07	833465	845029	276	48	0	52
C5	Wind Erosion	Area	2.70E-07	2.70E-07	833508	845478	33	100	0	3
D1	Wind Erosion	Area	2.70E-07	2.70E-07	833350	844870	100	48	0	75
D2	Wind Erosion	Area	2.70E-07	2.70E-07	833350	844750	48	117	0	12
D3	Wind Erosion	Area	2.70E-07	2.70E-07	833152	844630	420	45	0	12
D4	Wind Erosion	Area	2.70E-07	2.70E-07	832918	844635	45	80	0	12
D5	Wind Erosion	Area	2.70E-07	2.70E-07	832794	844684	45	210	0	88
D6	Wind Erosion	Area	2.70E-07	2.70E-07	832757	844630	40	90	0	5
SP11	Material handling	Area	7.88E-07	0	834190	846208	93	18	0	68
SP12	Material handling	Area	7.88E-07	0	834158	846178	38	20	0	68
SP21	Material handling	Area	6.50E-07	0	833750	846065	70	45	0	24
SP31	Material handling	Area	1.97E-06	0	833325	844722	21	66	0	3
SP32	Material handling	Area	1.97E-06	0	833275	844683	81	6	0	15
SP41	Material handling	Area	1.08E-06	0	832956	844670	10	75	0	3
SP42	Material handling	Area	1.08E-06	0	832940	844728	10	36	0	47
SP11	Wind Erosion	Area	8.09E-07	8.09E-07	834190	846208	93	18	0	68
SP12	Wind Erosion	Area	8.09E-07	8.09E-07	834158	846178	38	20	0	68
SP21	Wind Erosion	Area	8.09E-07	8.09E-07	833750	846065	70	45	0	24
SP31	Wind Erosion	Area	8.09E-07	8.09E-07	833325	844722	21	66	0	3
SP32	Wind Erosion	Area	8.09E-07	8.09E-07	833275	844683	81	6	0	15
SP41	Wind Erosion	Area	8.09E-07	8.09E-07	832956	844670	10	75	0	3
SP42	Wind Erosion	Area	8.09E-07	8.09E-07	832940	844728	10	36	0	47
Emission Sources from LT/HYW BCP Project										
BCP1	Heavy Construction	Area	2.99E-06	0	833915	845982	236	105	0	0
BCP2	Heavy Construction	Area	2.99E-06	0	833814	845857	205	146	0	0
BCP3	Heavy Construction	Area	2.99E-06	0	833814	845724	205	120	0	0
BCP4a	Heavy Construction	Area	2.99E-06	0	833713	845585	179	158	0	0
BCP4b	Heavy Construction	Area	2.99E-06	0	833891	845585	178	158	0	0
BCP5	Heavy Construction	Area	2.99E-06	0	833659	845458	207	95	0	0
BCP6	Heavy Construction	Area	1.77E-07	0	833978	845797	123	266	0	0
BCP7	Heavy Construction	Area	2.99E-06	0	833801	845441	122	30	0	57
LMH1	Heavy Construction	Area	2.99E-06	0	833706	845087	28	13	0	67
LMH2A	Heavy Construction	Area	2.99E-06	0	833661	844975	212	15	0	65
LMH2B	Heavy Construction	Area	2.99E-06	0	833569	844784	213	15	0	65
LMH3	Heavy Construction	Area	2.99E-06	0	833470	844624	140	15	0	49
LMH4	Heavy Construction	Area	2.99E-06	0	833394	844540	84	15	0	54
NCR1	Heavy Construction	Area	2.99E-06	0	833752	845298	43	220	0	10
NCR2A	Heavy Construction	Area	2.99E-06	0	833761	845144	21	98	0	1.5
NCR2B	Heavy Construction	Area	2.99E-06	0	833764	845043	21	104	0	1.5
NCR3	Heavy Construction	Area	2.99E-06	0	833796	845166	18	56	0	1.5
NCR4	Heavy Construction	Area	2.99E-06	0	833822	845104	7	87	0	43
NCR5	Heavy Construction	Area	2.99E-06	0	833947	845099	131	16	0	16
NCR6	Heavy Construction	Area	2.99E-06	0	833790	844917	21	150	0	21
NCR7	Heavy Construction	Area	2.99E-06	0	833874	844771	42	183	0	40
NCR8	Heavy Construction	Area	2.99E-06	0	834024	844609	29	255	0	48
BCP1	Wind Erosion	Area	2.70E-07	2.70E-07	833915	845982	236	105	0	0
BCP2	Wind Erosion	Area	2.70E-07	2.70E-07	833814	845857	205	146	0	0
BCP3	Wind Erosion	Area	2.70E-07	2.70E-07	833814	845724	205	120	0	0
BCP4a	Wind Erosion	Area	2.70E-07	2.70E-07	833713	845585	179	158	0	0
BCP4b	Wind Erosion	Area	2.70E-07	2.70E-07	833891	845585	178	158	0	0
BCP5	Wind Erosion	Area	2.70E-07	2.70E-07	833659	845458	207	95	0	0
BCP6	Wind Erosion	Area	5.39E-07	5.39E-07	833978	845797	123	266	0	0
BCP7	Wind Erosion	Area	2.70E-07	2.70E-07	833801	845441	122	30	0	57
LMH1	Wind Erosion	Area	2.70E-07	2.70E-07	833706	845087	28	13	0	67
LMH2A	Wind Erosion	Area	2.70E-07	2.70E-07	833661	844975	212	15	0	65
LMH2B	Wind Erosion	Area	2.70E-07	2.70E-07	833569	844784	213	15	0	65
LMH3	Wind Erosion	Area	2.70E-07	2.70E-07	833470	844624	140	15	0	49
LMH4	Wind Erosion	Area	2.70E-07	2.70E-07	833394	844540	84	15	0	54
NCR1	Wind Erosion	Area	2.70E-07	2.70E-07	833752	845298	43	220	0	10
NCR2A	Wind Erosion	Area	2.70E-07	2.70E-07	833761	845144	21	98	0	1.5
NCR2B	Wind Erosion	Area	2.70E-07	2.70E-07	833764	845043	21	104	0	1.5
NCR3	Wind Erosion	Area	2.70E-07	2.70E-07	833796	845166	18	56	0	1.5
NCR4	Wind Erosion	Area	2.70E-07	2.70E-07	833822	845104	7	87	0	43
NCR5	Wind Erosion	Area	2.70E-07	2.70E-07	833947	845099	131	16	0	16
NCR6	Wind Erosion	Area	2.70E-07	2.70E-07	833790	844917	21	150	0	21
NCR7	Wind Erosion	Area	2.70E-07	2.70E-07	833874	844771	42	183	0	40
NCR8	Wind Erosion	Area	2.70E-07	2.70E-07	834024	844609	29	255	0	48

Annex A2 (c)**Estimation of % active area for annual average TSP prediction**

Work Area	Length (approx.) (m)	Total Area (approx.) (m²)	Active Area at any one time (Approx.) (m²)
1	1,472	116,950	10,500
2	1,000	80,170	11,550
3	995	104,290	9,300
4	998	87,077	8,850
Total	388,487	388,487	40,200
No. of construction days in a year			25 days a month x 12 months a year = 300 days
% of active area in a year			$40,200 / 388,487 \times 100\% =$ 10.3% (say 10.5%)

Key

- Air Sensitive Receiver
- Proposed Regulation of Shenzhen River
- Shenzhen River Emission Sources
- BCP Emission Sources

Air Sensitive Receiver

A1	Muk Wu Chuen Yiu
A2	Ta Ku Ling Ling Ying Public School
A3	Chow Tin Tsuen
A4	Fung Wong Wu
A5	Ta Kwu Ling Village
A6	Ta Kwu Ling Police Station
A7	Ta Kwu Ling Fire Station
A8	ArchSD Property Services Branch
A9	Kan Tau Wai
A10	Kaw Liu Village
A11	Tsung Yuen Ha
A12	Chuk Yuen Tsuen Resite
A13	Proposed Future Recreation Use
A14	Kan Tau Wai Village House

