Appendix 5.8

Non-point Source Surface Runoff

Pollution Loading due to Non-point Source Surface Runoff

Approach to Estimation of Daily Runoff Volume

It is assumed that only a daily rainfall of greater than 10 mm per day and a rainfall intensity greater than 2 mm/hour(hr) would give rise to runoff. The runoff percentage is calculated using the average rainfall data recorded at the Hong Kong Observatory (HKO) weather station in the period from 2019 to 2023. The rainfall data recorded at TKO weather station showed a lot of incomplete or missing data and are therefore not used. The daily runoff value and the runoff percentage are calculated as follows:

Daily runoff value (mm/day) = Average daily rainfall of the month (mm/day)
× Runoff percentage of the month

where

Runoff percentage of the month = (Sum of rainfall for days with total rainfall > 10 mm and with maximum rainfall intensity > 2 mm/hr) / Total rainfall of the month × 100%

The daily volume of runoff generated from the Project development is estimated as follows:

Daily volume of runoff (m^3/day) = Daily runoff value (mm/day) × Impermeable area (km^2) ×1000

The Project development area is expected to comprise both paved and landscaping areas. It is conservatively assumed that 100% of the Project development area would be paved or impermeable.

Pollution Flow and Load

The daily runoff volumes estimated for the Project development areas are summarized in **Table A5-8-1**. The average daily runoff value of the month is calculated for each year from 2019 to 2023. The runoff values estimated for different years are averaged and then multiplied by the Project development area to estimate the daily runoff volume in each month.

Table A5-8-1 Daily Flow of Surface Runoff

Month	Year	Runoff %	Average Daily Rainfall (mm/day)	Daily Runoff Value (mm/day)	5-year Average Daily Runoff Value (mm/day)	TKO 137 Development Area = 1,010,000 m^2 See Note (1)	TKO 132 Development Area = 250,000 m^2, See Note (2)
						Daily Runoff Volume (m^3/day)	Daily Runoff Volume (m^3/day)
January	2019	0.00%	0.255	0.000	0.080	81	20
	2020	71.14%	0.565	0.402			
	2021	0.00%	0.211	0.000			
	2022	0.00%	0.200	0.000			
	2023	0.00%	0.666	0.000			
February	2019	83.61%	2.659	2.223	2.481	2506	620
	2020	81.79%	2.840	2.322			
	2021	96.36%	2.255	2.173			
	2022	92.77%	6.129	5.686			
	2023	0.00%	0.182	0.000			
March	2019	74.53%	6.205	4.624	1.891	1910	473
	2020	23.59%	1.484	0.350			
	2021	0.00%	0.211	0.000			

Month	Year	Runoff %	Average Daily Rainfall (mm/day)	Daily Runoff Value (mm/day)	5-year Average Daily Runoff Value (mm/day)	TKO 137 Development Area = 1,010,000 m^2 See Note (1)	TKO 132 Development Area = 250,000 m^2, See Note (2)
						Daily Runoff Volume (m^3/day)	Daily Runoff Volume (m^3/day)
	2022	88.82%	3.102	2.755			
	2023	72.07%	2.397	1.727			
April	2019	72.37%	6.297	4.557	1.666	1683	417
	2020	83.82%	2.708	2.270			
	2021	0.00%	1.207	0.000			
	2022	0.00%	0.200	0.000			
	2023	54.96%	2.738	1.505			
May	2019	72.20%	7.769	5.610	7.279	7352	1820
	2020	96.24%	11.452	11.021			
	2021	42.35%	2.152	0.911			
	2022	95.66%	14.242	13.624			
	2023	87.67%	5.965	5.229			
June	2019	92.65%	14.415	13.355	14.239	14381	3560
	2020	93.48%	13.335	12.465			
	2021	91.41%	21.022	19.215			
	2022	94.63%	11.753	11.122			
	2023	91.37%	16.457	15.037			
July	2019	89.83%	10.735	9.644	6.592	6658	1648
	2020	62.71%	4.092	2.566			
	2021	91.70%	12.313	11.290			
	2022	93.01%	5.168	4.806			
	2023	81.50%	5.710	4.653			
August	2019	92.38%	19.324	17.852	12.787	12915	3197
	2020	94.35%	14.539	13.718			
	2021	91.85%	11.381	10.453			
	2022	92.86%	19.895	18.474			
	2023	75.04%	4.581	3.437			
September	2019	87.19%	6.690	5.833	14.239	14381	3560
	2020	95.39%	23.735	22.640			
	2021	79.29%	4.387	3.478			
	2022	79.32%	5.738	4.552			
	2023	97.34%	35.638	34.692			
October	2019	93.85%	4.850	4.552	9.455	9549	2364
	2020	91.89%	4.652	4.274			
	2021	98.02%	20.418	20.013			
	2022	83.40%	1.661	1.385			
	2023	96.36%	17.694	17.050			
November	2019	0.00%	0.007	0.000	0.548	554	137
	2020	0.00%	0.228	0.000			
	2021	0.00%	0.220	0.000			
	2022	61.24%	4.477	2.742			
	2023	0.00%	0.137	0.000			
December	2019	0.00%	0.506	0.000	0.000	0	0
	2020	0.00%	0.081	0.000			
	2021	0.00%	0.685	0.000			
	2022	0.00%	0.894	0.000			
	2023	0.00%	0.092	0.000			

Notes
(1) The latest update of the development area at TKO 137 from 101 ha to 103 ha (<2% increase) is considered minor. Using 101 ha in the calculation is considered acceptable in view that other conservative assumption has been adopted i.e. the effect of permeable areas in the new development (e.g. landscape areas) has been excluded in the calculation.
(2) The proposed development area at TKO 132 would be about 20 ha. Use of 25 ha. as the development area for calculation of runoff loading for model input is on the conservative side.

The daily runoff volume generated in each month as shown in **Table A5-8-1** is applied to the mean event concentrations for storm runoff in **Table A5-8-2** below to give the daily pollution loading as presented in **Table A5-8-3**.

Table A5-8-2 Event Mean Concentrations for Storm Runoff

5-day Biochemical Oxygen Demand (BOD_5) (g/m^3)	Suspended Solids (SS) (g/m^3)	Ammonia Nitrogen (NH_3-N) (g/m^3)	Total Kjeldahl Nitrogen (TKN) (g/m^3)	Total Phosphorus (TP) (g/m^3)	Orthophosphate Phosphorus (PO_4-P) (g/m^3)	Total Oxidized Nitrogen (TON) (g/m^3)	Copper (g/m^3)	Silicate (g/m^3)
22.48	43.25	0.20	1.40	0.20	0.04	0.40	0.01	3.28

Source: EPD Pilot Study of Storm Pollution

Table A5-8-3 Daily Pollution Load of Surface Runoff

Month	BOD_5 (g/day)	SS (g/day)	NH_3-N (g/day)	TKN (g/day)	TP (g/day)	PO_4-P (g/day)	TON (g/day)	Cu (g/day)	Si (g/day)
TKO 137 Development									
January	1824	3509	16	114	16	3	32	1	266
February	56329	108372	501	3508	501	100	1002	25	8219
March	42941	82616	382	2674	382	76	764	19	6265
April	37834	72790	337	2356	337	67	673	17	5520
May	165269	317966	1470	10293	1470	294	2941	74	24114
June	323286	621981	2876	20133	2876	575	5752	144	47170
July	149669	287952	1332	9321	1332	266	2663	67	21838
August	290321	558558	2583	18080	2583	517	5166	129	42360
September	323294	621995	2876	20134	2876	575	5753	144	47171
October	214670	413011	1910	13369	1910	382	3820	95	31322
November	12450	23953	111	775	111	22	222	6	1817
December	0	0	0	0	0	0	0	0	0
TKO 132 Development									
January	451	868	4	28	4	1	8	0	66
February	13943	26825	124	868	124	25	248	6	2034
March	10629	20450	95	662	95	19	189	5	1551
April	9365	18017	83	583	83	17	167	4	1366
May	40908	78705	364	2548	364	73	728	18	5969
June	80021	153956	712	4984	712	142	1424	36	11676
July	37047	71275	330	2307	330	66	659	16	5405
August	71862	138257	639	4475	639	128	1279	32	10485
September	80023	153959	712	4984	712	142	1424	36	11676
October	53136	102230	473	3309	473	95	945	24	7753
November	3082	5929	27	192	27	5	55	1	450
December	0	0	0	0	0	0	0	0	0

Pollution Loading for Model Input

Scenario B1 Baseline "Without Project" Condition

Storm pollution loading from TKO 137 is directly extracted from the original HK-DFM Model version 202210 and is evenly distributed amongst the four major existing storm outfalls (E1, E2, E3 and E4) as shown in **Figure A5-8-1** below. The baseline condition of the TKO 132 development area is a marine water and therefore no pollution loading is assumed at TKO 132 under Scenario B1.

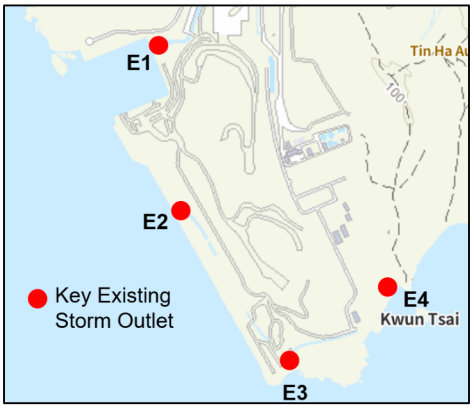

Figure A5-8-1 Key Existing Storm Outlets at TKO 137 (Scenario B1)

Scenarios B2 and B3 Impact Scenarios with the Project

The drainage plan for the Project is subject to detailed design. The tentative locations of the storm outfalls at the Project development areas are shown in **Figure A5-8-2** and **Figure A5-8-3** below for modelling purpose. The monthly pollution flow and loading generated from the TKO 137 development given in **Table A5-8-1** and **Table A5-8-3** are assumed to be evenly distributed amongst the storm outfalls (O1, O2, O3, O4 and O5) as shown in **Figure A5-8-2** below. The monthly pollution flow and loading generated from the TKO 132 development are assumed to be discharged via a storm outfall (O6) located at the southern boundary of the development area as shown in **Figure A5-8-3**.

The tentative location of the storm outfall O5 adopted in the modelling is located at a distance of about 600 m away from the seawater intake of the TKO desalination plant. To minimize the potential water quality impact upon the seawater intake, it is recommended to relocate the storm outfall (O5) away from the seawater intake as far as practicable as indicated in **Figure 5-8-2** below. The final storm outfall locations are subject to detailed design. The storm outfall O5 adopted in the modelling is nearer to the seawater intake of TKO desalination plant and therefore would provide worst case assessment for the seawater intake.

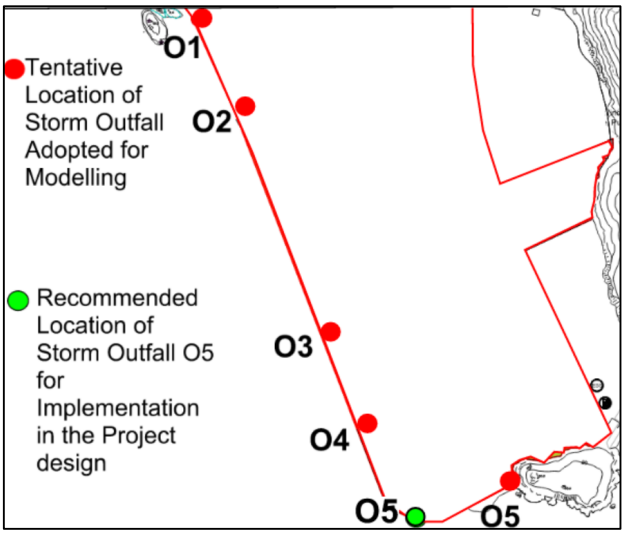

Figure A5-8-2 Tentative Locations of Storm Outfalls at TKO 137 (Scenarios B2 & B3)

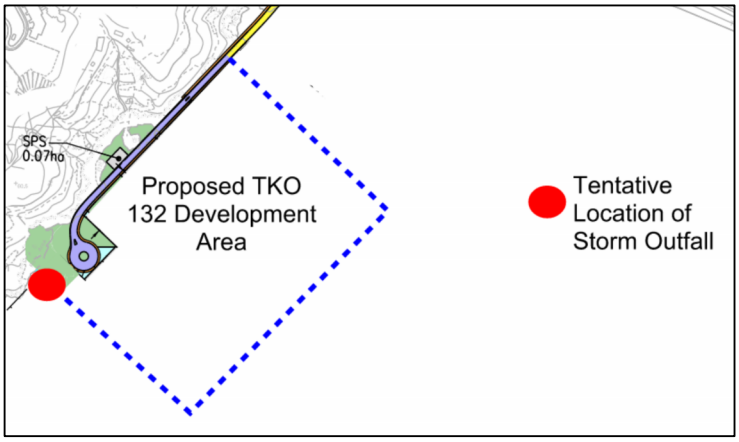

Figure A5-8-3 Tentative Location of Storm Outfall at TKO 132 (Scenarios B2 & B3)