Notes:
1. The flows presented in the table are the average daily flows for the Sha Tin and Tai Po STWs; and
2. There is no disinfection of the discharged effluent.

Table 4.12 Effluent Discharge Standards for the Upgraded Sha Tin and Tai Po STWs

Parameters	Sha Tin STW	Tai Po STW
Flow (m^3/d)	350,000	130,000
BOD (mg/L)	20 (95%ile), 40 (maximum)	20 (95%ile), 40 (maximum)
SS (mg/L)	30 (95%ile), 60 (maximum)	30 (95%ile), 60 (maximum)
E. coli (count/100mL)	1000 (monthly geometric mean), 15,000 (95%ile)	1000 (monthly geometric mean), 15,000 (95%ile)
NH_3-N (mg/L)	5 (annual average), 10 (maximum)	5 (annual average), 10 (maximum)
Total-N (mg/L)	20 (95%ile), 35 (maximum)	20 (95%ile), 35 (maximum)

Notes: The flows presented in the table are the designed flow rates for the upgraded Sha Tin and Tai Po STWs.

4.4 Identification, Prediction and Evaluation of Potential Impacts

4.4.1 The key issues pertinent to water pollution that would arise during the construction and operational phases of the proposed SEKD are listed as follows:

Construction Phase

- Changes in coastline configurations that affect the hydrodynamic and water quality conditions in the harbour and the water quality sensitive receivers;
- Nullah and box culvert diversion;
- Dredging and filling;
- Construction site runoff;
- Wastewater and sewage generated from construction activities;
- Ground Improvement; and
- Groundwater discharge during dewatering.

Operational Phase

- Sewage generated from the SEKD;
- Presence of the SEKD reclamation;
- Discharges from storm drains and sewage outfalls/nullahs;
- Water quality in the extended sections of diverted nullahs;
- Cooling water discharges; and
- Storm and Emergency Overflows.

4.4.2 *Construction Phase Water Quality Impacts*

Changes in Coastline Configurations

4.4.2.1 Reclamation will be carried out in KTAC, KTTS and Hoi Sham for the revised scheme of SEKD. The hydrodynamic condition in the vicinity of the proposed developments is likely to be affected by the new reclamation. Upon the completion of the whole SEKD reclamation, the current speeds within Victoria Harbour would be changed. The physical presence of the SEKD alters the flow patterns in the vicinity of the developments and would cause impacts on the discharges through the Victoria Harbour channel. The changes in hydrodynamic condition influence the water quality within the Assessment Area causing impacts to the nearby sensitive receivers.

2002 Base Year

4.4.2.2 The hydrodynamic condition in the Victoria Harbour, Western Buffer and Eastern Buffer WCZs for year 2002 was simulated to provide the baseline data for comparison with the future developments. **Drawing Nos. 22936/EN/152** and **153** show the flow patterns in Victoria Harbour for both the dry and wet seasons. The drawings illustrate the hydrodynamic condition in the harbour prior to the SEKD. The flow patterns showed higher current speeds in the central part of the Victoria Harbour channel. The flow condition near the development area was comparatively calm especially in the enclosed water body such as the KTAC, KTTS and TKWTS.

4.4.2.3 **Drawing No. 22936/EN/149** shows the locations of the indicator stations used for assessment of current speeds. The hydrodynamic computations for year 2002 showed that the average current speeds in Kwun Tong and Kowloon Bay for both the dry and wet seasons were relatively low with an order of 0.08 m/s. The maximum speeds in Kwun Tong and Kowloon Bay/Hoi Sham were 0.24 m/s and 0.28 m/s respectively. The current speeds in North Point and Central were of similar order of magnitude. The average current speeds in these two locations for the dry and wet seasons were 0.27 m/s and 0.34 m/s respectively. Maximum current speeds were 0.74 m/s for the dry season and 0.93 m/s for the wet season. The narrow cross-section in Lei Yue Mun induced higher current speeds. The average current speeds in Lei Yue Mun were 0.43 m/s for the dry season and 0.39 m/s for the wet season. The maximum current speeds were above 1 m/s (1.01 – 1.12m/s).

4.4.2.4 **Tables 4.13** and **4.14** present the predicted water quality results at the existing water quality sensitive receivers. These results provided the basis for comparisons with the modelling scenarios for other assessment years. To allow for direct comparison with the WQOs, which are on annual basis, the dry and wet season modelling results have been averaged to represent the annual average values. These results are summarised in **Table 4.15**. **Drawing Nos. 22936/EN/154** to **159**, **193** and **194** show the predicted mean depth-averaged water quality results for the dry and wet seasons. In general, the dissolved oxygen levels at most of the monitoring stations in the wet season were slightly lower than the dry season. The TIN and SS concentrations were comparatively higher in the wet season. This would be due to higher pollution loads entering the harbour in the wet season. The water quality at KTTS was the poorest amongst all the indicator points. The predicted annual depth-averaged and bottom DO (10%ile) levels exceeded the WQOs. The TIN and UIA results were much higher than the WQO requirements of 0.4 mg/l and 0.021 mg/l respectively. The predicted water quality results at the indicator points corresponding to the EPD's water monitoring stations EM1, WM2, VM1, VM2, VM4, VM5, VM6, VM7, VM13 and VM15 were consistent with the field data recorded in 1998.

Table 4.13 Predicted Water Quality for 2002 Dry Season

Indicator Point		Depth-averaged DO (mg/L)	Depth-averaged DO 10%ile (mg/L)	Bottom DO (mg/L)	Bottom DO 10%ile (mg/L)	Depth-averaged TIN (mg/L)	Depth-averaged UIA (mg/L)	Depth-averaged SS (mg/L)	Depth-averaged E. coli (count/ 100mL)
Tsuen Wan SI	A1	6.2	5.9	6.2	5.9	0.35	0.011	8.2	10740
Tsing Yi SI	A2	6.0	5.6	6.0	5.5	0.35	0.012	7.9	4220
Kennedy Town SI	A3	6.1	5.9	6.2	5.9	0.27	0.010	6.4	2063
Cheung Sha Wan SI	A4	4.1	3.6	3.9	3.3	0.67	0.030	7.9	21540
Yau Ma Tei SI	A5	5.2	4.9	5.1	4.8	0.40	0.017	6.5	3180
Central Water Front SI	A6	5.4	5.2	5.4	5.1	0.38	0.016	6.5	7269
Tsim Sha Tsui SI	A7	5.4	5.1	5.3	5.1	0.35	0.015	6.1	4957
Wan Chai SI	A8	5.5	5.3	5.4	5.2	0.34	0.015	6.0	6078
Tsim Sha Tsui East SI	A9	5.5	5.3	5.4	5.2	0.32	0.014	5.8	6395
Tai Wan SI	A10	5.7	5.5	5.7	5.4	0.27	0.012	5.3	1335
North Point SI	A11	5.6	5.4	5.6	5.4	0.30	0.013	5.7	5895
Quarry Bay SI	A12	5.8	6.5	5.8	6.5	0.25	0.011	5.2	4865
Sai Wan Ho SI	A13	5.9	5.7	5.9	5.7	0.22	0.010	5.0	1688
Cha Kwo Ling SI	A14	5.9	5.7	5.8	5.7	0.24	0.010	5.0	680
Yau Tong SI	A15	6.1	5.4	6.1	5.3	0.18	0.008	4.7	295
Chai Wan SI	A16	6.4	6.2	6.2	6.1	0.15	0.006	4.3	3218
Ap Lei Chau SI	A17	6.6	6.5	6.5	6.5	0.12	0.005	5.1	1519
Rambler Channel TS	B1	6.1	5.7	6.0	5.7	0.36	0.012	8.1	7035
Yau Ma Tei TS	B2	5.0	4.7	4.9	4.5	0.43	0.018	6.6	3078

Indicator Point		Depth-averaged DO (mg/L)	Depth-averaged DO 10%ile (mg/L)	Bottom DO (mg/L)	Bottom DO 10%ile (mg/L)	Depth-averaged TIN (mg/L)	Depth-averaged UIA (mg/L)	Depth-averaged SS (mg/L)	Depth-averaged E. coli (count/ 100mL)
Causeway Bay TS	B3	5.4	5.2	5.3	5.1	0.37	0.017	6.4	9592
To Kwa Wan TS	B4	5.5	5.4	5.3	5.0	0.31	0.013	5.4	452
Kwun Tong TS	B5	2.0	1.2	2.8	1.1	1.84	0.086	11.3	3349
Aldrich Bay TS	B6	5.9	5.7	5.8	5.7	0.23	0.010	5.0	2383
Sam Ka Tsuen TS	B7	5.9	5.8	5.7	5.6	0.23	0.010	4.9	753
Chai Wan TS	B8	6.5	6.4	6.3	6.0	0.19	0.008	4.6	10300
Aberdeen TS	B9	6.5	6.4	6.4	6.4	0.14	0.006	5.2	2778
Ma Wan MZ	C1	6.7	6.5	6.7	6.4	0.30	0.008	8.4	156
Tung Lung Chau MZ	C2	6.6	6.6	6.5	6.4	0.08	0.003	3.9	18
Tsing Yi Power Station SI	D1	6.1	5.9	6.1	5.9	0.32	0.012	7.1	3459
Tung Wan GB	E1	6.5	6.4	6.5	6.3	0.29	0.009	7.9	241
Ting Kau GB	E2	6.6	6.3	6.6	6.3	0.30	0.009	8.1	355
Ting Kau GB	E3	6.6	6.3	6.5	6.3	0.31	0.009	8.2	626
EPD Monitoring Station	EM1	6.2	5.9	6.2	5.9	0.16	0.007	4.5	286
EPD Monitoring Station	WM2	6.5	6.4	6.4	6.4	0.21	0.007	6.5	93
EPD Monitoring Station	VM1	5.9	5.5	5.9	5.5	0.22	0.010	5.0	1380
EPD Monitoring Station	VM2	5.8	5.5	5.8	5.4	0.25	0.011	5.2	1163
EPD Monitoring Station	VM4	5.7	5.3	5.6	5.3	0.30	0.013	5.7	9678
EPD Monitoring Station	VM5	5.5	5.2	5.4	5.2	0.34	0.015	6.1	6750
EPD Monitoring Station	VM6	5.4	5.2	5.4	5.2	0.37	0.016	6.3	8357
EPD Monitoring Station	VM7	5.4	5.2	5.4	5.1	0.40	0.017	6.7	15250
EPD Monitoring Station	VM13	6.0	5.6	6.0	5.5	0.35	0.012	7.9	2446
EPD Monitoring Station	VM15	5.3	5.1	5.2	5.0	0.40	0.017	6.7	5842

Notes: SI – Seawater Intake; TS – Typhoon Shelter; MZ – Mariculture Zone; and GB – Gazetted Beach.

Table 4.14 Predicted Water Quality for 2002 Wet Season

Indicator Point		Depth-averaged DO (mg/L)	Depth-averaged DO 10%ile (mg/L)	Bottom DO (mg/L)	Bottom DO 10%ile (mg/L)	Depth-averaged TIN (mg/L)	Depth-averaged UIA (mg/L)	Depth-averaged SS (mg/L)	Depth-averaged E. coli (count/ 100mL)
Tsuen Wan SI	A1	4.5	4.1	4.3	4.1	0.56	0.009	8.7	14010
Tsing Yi SI	A2	4.5	4.2	4.4	4.2	0.53	0.009	8.3	2683
Kennedy Town SI	A3	5.3	4.8	5.2	4.8	0.42	0.008	6.8	370
Cheung Sha Wan SI	A4	7.3	6.6	5.9	6.6	0.43	0.012	10.7	14880
Yau Ma Tei SI	A5	5.7	5.2	5.3	5.2	0.44	0.011	7.8	1893
Central Water Front SI	A6	5.3	4.9	5.1	4.9	0.45	0.013	7.6	4030
Tsim Sha Tsui SI	A7	5.6	5.2	5.4	5.2	0.43	0.012	7.6	5382
Wan Chai SI	A8	5.5	5.1	5.3	5.1	0.43	0.012	7.5	4375
Tsim Sha Tsui East SI	A9	5.6	5.2	5.4	5.2	0.42	0.012	7.5	7015
Tai Wan SI	A10	5.6	5.3	5.4	5.3	0.38	0.011	7.0	1520
North Point SI	A11	5.6	5.2	5.4	5.2	0.40	0.011	7.2	3719
Quarry Bay SI	A12	5.6	5.4	5.4	5.4	0.36	0.010	6.5	4392
Sai Wan Ho SI	A13	5.6	5.4	5.5	5.4	0.35	0.010	6.5	1495
Cha Kwo Ling SI	A14	5.8	5.5	5.6	5.5	0.39	0.011	7.0	715
Yau Tong SI	A15	5.6	5.2	5.5	5.2	0.28	0.008	5.5	187
Chai Wan SI	A16	5.6	5.5	5.4	5.5	0.28	0.008	5.5	2206
Ap Lei Chau SI	A17	5.8	5.4	5.6	5.4	0.35	0.007	5.6	599
Rambler Channel TS	B1	4.6	4.3	4.4	4.3	0.55	0.009	8.6	7608
Yau Ma Tei TS	B2	6.7	5.8	5.9	5.8	0.41	0.009	8.9	1424
Causeway Bay TS	B3	5.9	5.3	5.7	5.3	0.44	0.011	8.0	5404
To Kwa Wan TS	B4	5.6	5.2	5.2	5.2	0.42	0.012	7.5	1141

Indicator Point		Depth-averaged DO (mg/L)	Depth-averaged DO 10%ile (mg/L)	Bottom DO (mg/L)	Bottom DO 10%ile (mg/L)	Depth-averaged TIN (mg/L)	Depth-averaged UIA (mg/L)	Depth-averaged SS (mg/L)	Depth-averaged E. coli (count/ 100mL)
Kwun Tong TS	B5	3.0	2.5	2.4	2.5	1.75	0.108	15.5	2793
Aldrich Bay TS	B6	5.6	5.3	5.4	5.3	0.33	0.009	6.2	1679
Sam Ka Tsuen TS	B7	6.0	5.5	5.7	5.5	0.37	0.009	7.0	989
Chai Wan TS	B8	5.8	5.6	5.5	5.6	0.29	0.008	6.1	4129
Aberdeen TS	B9	5.9	5.4	5.7	5.4	0.37	0.007	6.1	1558
Ma Wan MZ	C1	4.3	3.9	4.2	3.9	0.53	0.006	8.1	92
Tung Lung Chau MZ	C2	5.9	5.8	5.5	5.8	0.20	0.005	4.4	17
Tsing Yi Power Station SI	D1	5.0	4.6	4.9	4.6	0.49	0.012	7.4	2171
Tung Wan GB	E1	4.4	3.9	4.4	3.9	0.51	0.006	7.9	101
Ting Kau GB	E2	4.6	4.1	4.5	4.1	0.51	0.007	7.8	141
Ting Kau GB	E3	4.5	4.1	4.3	4.1	0.53	0.006	8.0	153
EPD Monitoring Station	EM1	5.6	5.4	5.5	5.4	0.27	0.007	5.1	242
EPD Monitoring Station	WM2	5.3	4.6	5.3	4.6	0.41	0.007	6.8	71
EPD Monitoring Station	VM1	5.6	5.3	5.5	5.3	0.32	0.009	6.1	1244
EPD Monitoring Station	VM2	5.6	5.3	5.5	5.3	0.37	0.010	6.6	1278
EPD Monitoring Station	VM4	5.5	5.2	5.4	5.2	0.39	0.011	7.0	4551
EPD Monitoring Station	VM5	5.5	5.1	5.3	5.1	0.43	0.012	7.4	5113
EPD Monitoring Station	VM6	5.4	5.0	5.2	5.0	0.44	0.013	7.5	5248
EPD Monitoring Station	VM7	5.3	4.9	5.1	4.9	0.47	0.014	7.7	9809
EPD Monitoring Station	VM13	4.5	4.2	4.4	4.2	0.52	0.009	8.2	1306
EPD Monitoring Station	VM15	5.6	5.0	5.3	5.0	0.46	0.012	7.8	2699

Notes: SI – Seawater Intake; TS – Typhoon Shelter; MZ – Mariculture Zone; and GB – Gazetted Beach.

Table 4.15 Predicted Average Water Quality for 2002

Indicator Point		Depth-averaged DO (mg/L)	Depth-averaged DO 10%ile (mg/L)	Bottom DO (mg/L)	Bottom DO 10%ile (mg/L)	Depth-averaged TIN (mg/L)	Depth-averaged UIA (mg/L)	Depth-averaged SS (mg/L)	Depth-averaged E. coli (count/ 100mL)
Tsuen Wan SI	A1	5.3	5.0	5.3	4.9	0.45	0.010	8.5	12375
Tsing Yi SI	A2	5.3	4.9	5.2	4.8	0.44	0.010	8.1	3452
Kennedy Town SI	A3	5.7	5.3	5.7	5.4	0.34	0.009	6.6	1217
Cheung Sha Wan SI	A4	5.7	5.1	4.9	4.3	0.55	0.021	9.3	18210
Yau Ma Tei SI	A5	5.4	5.0	5.2	4.9	0.42	0.014	7.2	2537
Central Water Front SI	A6	5.4	5.0	5.2	5.0	0.42	0.015	7.0	5650
Tsim Sha Tsui SI	A7	5.5	5.1	5.4	5.1	0.39	0.013	6.8	5170
Wan Chai SI	A8	5.5	5.2	5.3	5.1	0.38	0.013	6.8	5227
Tsim Sha Tsui East SI	A9	5.6	5.2	5.4	5.1	0.37	0.013	6.6	6705
Tai Wan SI	A10	5.7	5.4	5.5	5.3	0.33	0.011	6.1	1428
North Point SI	A11	5.6	5.3	5.5	5.2	0.35	0.012	6.5	4807
Quarry Bay SI	A12	5.7	5.9	5.6	6.0	0.30	0.010	5.9	4629
Sai Wan Ho SI	A13	5.8	5.5	5.7	5.5	0.29	0.010	5.7	1592
Cha Kwo Ling SI	A14	5.9	5.6	5.7	5.5	0.31	0.011	6.0	698
Yau Tong SI	A15	5.9	5.3	5.8	5.2	0.23	0.008	5.1	241
Chai Wan SI	A16	6.0	5.8	5.8	5.7	0.21	0.007	4.9	2712
Ap Lei Chau SI	A17	6.2	5.9	6.1	6.0	0.24	0.006	5.3	1059
Rambler Channel TS	B1	5.3	5.0	5.2	4.9	0.46	0.010	8.4	7322
Yau Ma Tei TS	B2	5.9	5.3	5.4	4.8	0.42	0.014	7.8	2251
Causeway Bay TS	B3	5.6	5.3	5.5	5.1	0.40	0.014	7.2	7498
To Kwa Wan TS	B4	5.6	5.3	5.3	4.9	0.36	0.013	6.5	797
Kwun Tong TS	B5	2.5	1.9	2.6	1.2	1.79	0.097	13.4	3071
Aldrich Bay TS	B6	5.7	5.5	5.6	5.4	0.28	0.010	5.6	2031

Indicator Point		Depth-averaged DO (mg/L)	Depth-averaged DO 10%ile (mg/L)	Bottom DO (mg/L)	Bottom DO 10%ile (mg/L)	Depth-averaged TIN (mg/L)	Depth-averaged UIA (mg/L)	Depth-averaged SS (mg/L)	Depth-averaged E. coli (count/ 100mL)
Sam Ka Tsuen TS	B7	6.0	5.7	5.7	5.5	0.30	0.009	6.0	871
Chai Wan TS	B8	6.1	6.0	5.9	5.6	0.24	0.008	5.3	7215
Aberdeen TS	B9	6.2	5.9	6.1	5.9	0.25	0.006	5.6	2168
Ma Wan MZ	C1	5.5	5.2	5.5	5.0	0.41	0.007	8.3	124
Tung Lung Chau MZ	C2	6.3	6.2	6.0	5.9	0.14	0.004	4.2	17
Tsing Yi Power Station SI	D1	5.6	5.2	5.5	5.3	0.41	0.012	7.3	2815
Tung Wan GB	E1	5.5	5.1	5.5	5.1	0.40	0.007	7.9	171
Ting Kau GB	E2	5.6	5.2	5.5	5.2	0.41	0.008	7.9	248
Ting Kau GB	E3	5.5	5.2	5.4	5.1	0.42	0.007	8.1	389
EPD Monitoring Station	EM1	5.9	5.7	5.8	5.6	0.21	0.007	4.8	264
EPD Monitoring Station	WM2	5.9	5.5	5.9	5.6	0.31	0.007	6.6	82
EPD Monitoring Station	VM1	5.8	5.4	5.7	5.4	0.27	0.009	5.5	1312
EPD Monitoring Station	VM2	5.7	5.4	5.6	5.3	0.31	0.011	5.9	1221
EPD Monitoring Station	VM4	5.6	5.3	5.5	5.2	0.34	0.012	6.3	7115
EPD Monitoring Station	VM5	5.5	5.2	5.4	5.1	0.39	0.014	6.8	5932
EPD Monitoring Station	VM6	5.4	5.1	5.3	5.0	0.40	0.014	6.9	6803
EPD Monitoring Station	VM7	5.4	5.0	5.2	4.9	0.44	0.016	7.2	12530
EPD Monitoring Station	VM13	5.3	4.9	5.2	4.8	0.44	0.010	8.1	1876
EPD Monitoring Station	VM15	5.4	5.1	5.3	4.9	0.43	0.014	7.2	4271

Notes:
1. SI – Seawater Intake; TS – Typhoon Shelter; MZ – Mariculture Zone; and GB – Gazetted Beach.

Interim Reclamation Phase in 2003

4.4.2.5 The KTAC reclamation will commence in late 2002. Extensive filling at KTAC will be carried out in around 2003. The predicted flow patterns in Victoria Harbour are presented in **Drawing Nos. 22936/EN/160** and **161**. The hydrodynamic modelling results summarised in **Table 4.16** show a comparison of the current speeds for 2002 and 2003 during the dry and wet seasons. Although there were small differences in the average current speeds at Central and Lei Yue Mun, the current speeds for the two scenarios were in similar order of magnitude. The predicted average current speeds at Kwun Tong were almost the same (~0.08 m/s) between year 2002 and year 2003. The results indicated that the KTAC reclamation would not cause significant changes to the hydrodynamic condition in the harbour.

Table 4.16 Changes in Average Current Speeds in Victoria Harbour (2002 vs 2003)

Station	Dry Season		Wet Season	
	2002	2003	2002	2003
Central	0.34 (0.01-0.79)	0.33 (0.005-0.76)	0.27 (0.003-0.92)	0.33 (0.06-0.91)
Kowloon Bay	0.07 (0.0009-0.17)	0.07 (0.001-0.15)	0.08 (0.004-0.28)	0.08 (0.002-0.28)
North Point	0.33 (0.01-0.74)	0.33 (0.009-0.68)	0.29 (0.003-0.93)	0.32 (0.03-0.91)
Kwun Tong	0.08 (0.02-0.23)	0.08 (0.004-0.22)	0.08 (0.001-0.24)	0.07 (0.001-0.25)
Lei Yue Mun	0.43 (0.003-1.01)	0.41 (0.002-0.93)	0.39 (0.004-1.18)	0.44 (0.008-1.16)

4.4.2.6 The predicted water quality results for the dry and wet seasons in year 2003 are presented in **Tables 4.17** and **4.18**. The average results are showing in **Table 4.19** for direct comparison with WQOs. **Drawing Nos. 22936/EN/162** to **167**, **195** and **196** show graphically the predicted mean depth-averaged water quality results for the dry and wet seasons. There were no significant variations in water quality condition between 2002 and 2003 for both the dry and wet seasons at most of the monitoring stations. The predicted water quality results supported that the KTAC reclamation would not have significant impacts to the nearby sensitive receivers.

4.4.2.7 Comparing the water quality results between year 2002 and year 2003, the diversion of Kai Tak Nullah to the Kowloon Bay water would cause water quality changes in that area if this option were adopted. The predicted water quality in TKWTS would be slightly affected by the discharges from the diverted nullah. The concentrations of TIN, UIA, SS and *E. coli* increased in TKWTS after the Kai Tak Nullah diversion. The dissolved oxygen levels in the water decreased as a result of increasing pollution loads in the area.

4.4.2.8 After the KTAC reclamation, a new KTTS would be built with a portion of the typhoon shelter extended towards the tip of the disused airport runway. The average water quality results showed that the 10%ile depth-averaged and bottom DO levels in the new KTTS area would be in reasonable levels (4.9 mg/L and 4.5mg/L respectively at the inner part of KTTS). The pollutant levels would be much lower than the existing KTTS, which is currently influenced by the discharges from the Kai Tak Nullah and the nearby box culverts. The water quality condition in the Kwun Tong area is expected to be better after the permanent diversion of Kai Tak Nullah.

Table 4.17 Predicted Water Quality for 2003 Dry Season

Indicator Point		Depth-averaged DO (mg/L)	Depth-averaged DO 10%ile (mg/L)	Bottom DO (mg/L)	Bottom DO 10%ile (mg/L)	Depth-averaged TIN (mg/L)	Depth-averaged UIA (mg/L)	Depth-averaged SS (mg/L)	Depth-averaged E. coli (count/ 100mL)
Tsuen Wan SI	A1	6.3	6.0	6.2	5.9	0.33	0.011	8.1	8882
Tsing Yi SI	A2	6.1	5.7	6.0	5.6	0.34	0.011	7.8	2677
Kennedy Town SI	A3	6.0	5.8	6.1	5.8	0.28	0.012	6.3	2754
Cheung Sha Wan SI	A4	4.2	3.8	4.1	3.6	0.59	0.026	7.5	17860
Yau Ma Tei SI	A5	5.0	4.8	5.0	4.7	0.41	0.017	6.5	2345
Central Water Front SI	A6	5.3	5.0	5.3	4.9	0.39	0.017	6.5	7435
Tsim Sha Tsui SI	A7	5.2	4.9	5.2	4.9	0.37	0.016	6.2	5656
Wan Chai SI	A8	5.3	5.0	5.3	4.9	0.36	0.016	6.1	8928
Tsim Sha Tsui East SI	A9	5.3	5.0	5.3	5.0	0.35	0.015	5.9	4708
Tai Wan SI	A10	5.4	4.8	5.4	4.8	0.38	0.016	5.8	1417
North Point SI	A11	5.5	5.2	5.5	5.2	0.30	0.013	5.6	4887
Quarry Bay SI	A12	5.7	6.5	5.7	6.5	0.26	0.011	5.2	7903
Sai Wan Ho SI	A13	5.8	5.5	5.8	5.5	0.24	0.010	5.0	2590
Cha Kwo Ling SI	A14	5.9	5.7	5.8	5.6	0.21	0.009	4.9	556
Yau Tong SI	A15	6.1	5.9	6.0	5.9	0.17	0.007	4.5	273
Chai Wan SI	A16	6.4	6.2	6.3	6.1	0.15	0.006	4.2	6829
Ap Lei Chau SI	A17	6.6	6.5	6.6	6.5	0.10	0.004	4.9	485
Rambler Channel TS	B1	6.1	5.9	6.0	5.7	0.34	0.011	8.0	6113
Yau Ma Tei TS	B2	4.9	4.6	4.8	4.5	0.44	0.018	6.7	4684
Causeway Bay TS	B3	5.3	5.0	5.3	4.9	0.36	0.016	6.2	7484
To Kwa Wan TS	B4	5.0	4.6	5.0	4.4	0.50	0.021	6.5	2600
Aldrich Bay TS	B6	5.8	5.5	5.7	5.5	0.25	0.010	5.0	3271
Sam Ka Tsuen TS	B7	5.8	5.7	5.7	5.5	0.21	0.009	4.8	670
Chai Wan TS	B8	6.4	6.3	6.2	6.1	0.16	0.007	4.3	7123
Aberdeen TS	B9	6.5	6.5	6.5	0.2	0.13	0.006	4.9	5568
Ma Wan MZ	C1	6.7	6.4	6.7	6.4	0.30	0.008	8.3	172
Tung Lung Chau MZ	C2	6.6	6.5	6.4	6.3	0.09	0.004	3.9	9
Tsing Yi Power Station SI	D1	6.0	5.8	6.1	5.8	0.33	0.013	6.9	4482
Tung Wan GB	E1	6.5	6.3	6.4	6.2	0.28	0.009	7.9	185
Ting Kau GB	E2	6.6	6.3	6.5	6.3	0.29	0.009	8.0	376
Ting Kau GB	E3	6.6	6.3	6.5	6.3	0.30	0.009	8.1	529
Inner KTTS		5.0	4.7	5.0	4.6	0.40	0.018	8.4	7203
Outer KTTS		5.8	5.6	5.8	5.5	0.23	0.010	5.0	750
EPD Monitoring Station	EM1	6.2	5.8	6.1	5.9	0.16	0.007	4.4	297
EPD Monitoring Station	WM2	6.5	6.4	6.4	6.4	0.21	0.007	6.4	98
EPD Monitoring Station	VM1	5.9	5.4	5.8	5.4	0.22	0.009	5.0	1530
EPD Monitoring Station	VM2	5.8	5.4	5.8	5.4	0.24	0.010	5.1	1167
EPD Monitoring Station	VM4	5.6	5.1	5.6	5.1	0.29	0.012	5.5	5932
EPD Monitoring Station	VM5	5.4	5.0	5.3	5.0	0.36	0.015	6.2	11630
EPD Monitoring Station	VM6	5.3	5.0	5.3	5.0	0.38	0.016	6.3	9321
EPD Monitoring Station	VM7	5.3	5.0	5.3	5.0	0.44	0.019	7.0	38420
EPD Monitoring Station	VM13	6.1	5.7	6.0	5.6	0.34	0.011	7.8	2518
EPD Monitoring Station	VM15	5.2	4.9	5.2	4.8	0.40	0.017	6.7	4458

Notes:
1. SI – Seawater Intake; TS – Typhoon Shelter; MZ – Mariculture Zone; and GB – Gazetted Beach.

Table 4.18 Predicted Water Quality for 2003 Wet Season

Indicator Point		Depth-averaged DO (mg/L)	Depth-averaged DO 10%ile (mg/L)	Bottom DO (mg/L)	Bottom DO 10%ile (mg/L)	Depth-averaged TIN (mg/L)	Depth-averaged UIA (mg/L)	Depth-averaged SS (mg/L)	Depth-averaged E. coli (count/ 100mL)
Tsuen Wan SI	A1	4.3	4.1	4.2	4.0	0.57	0.008	8.6	9198
Tsing Yi SI	A2	4.3	4.2	4.2	4.1	0.54	0.008	8.3	1739
Kennedy Town SI	A3	5.1	4.7	5.0	4.6	0.44	0.008	7.0	322
Cheung Sha Wan SI	A4	7.0	5.9	5.5	4.5	0.49	0.015	11.3	19080
Yau Ma Tei SI	A5	5.4	4.9	5.0	4.6	0.48	0.011	7.9	1600
Central Water Front SI	A6	5.0	4.7	4.9	4.6	0.48	0.013	7.7	4028
Tsim Sha Tsui SI	A7	5.3	4.9	5.1	4.7	0.47	0.012	7.6	5456
Wan Chai SI	A8	5.3	4.9	5.2	4.8	0.48	0.013	7.7	8025
Tsim Sha Tsui East SI	A9	5.2	4.9	5.1	4.7	0.45	0.012	7.4	5155
Tai Wan SI	A10	5.2	4.9	5.1	4.7	0.44	0.013	7.1	1332
North Point SI	A11	5.2	4.9	5.1	4.8	0.43	0.011	7.2	3268
Quarry Bay SI	A12	5.3	5.4	5.2	5.5	0.40	0.011	6.7	6361
Sai Wan Ho SI	A13	5.3	5.0	5.2	4.9	0.38	0.010	6.4	1654
Cha Kwo Ling SI	A14	5.5	5.1	5.3	5.0	0.40	0.010	6.9	740
Yau Tong SI	A15	5.4	5.1	5.3	5.1	0.32	0.008	5.6	215
Chai Wan SI	A16	5.4	5.2	5.2	5.0	0.33	0.009	5.8	2828
Ap Lei Chau SI	A17	5.6	5.4	5.6	5.5	0.35	0.007	5.6	274
Rambler Channel TS	B1	4.4	4.2	4.2	4.0	0.55	0.007	8.6	3213
Yau Ma Tei TS	B2	6.4	5.6	5.6	4.8	0.45	0.009	9.1	3378
Causeway Bay TS	B3	5.3	4.9	5.1	4.7	0.47	0.012	7.9	3876
To Kwa Wan TS	B4	5.0	4.7	4.8	4.5	0.56	0.019	8.1	4480
Aldrich Bay TS	B6	5.2	4.9	5.1	4.8	0.38	0.010	6.4	1735
Sam Ka Tsuen TS	B7	5.6	5.2	5.3	5.0	0.38	0.009	6.7	1306
Chai Wan TS	B8	5.5	5.2	5.2	4.9	0.34	0.009	6.1	4114
Aberdeen TS	B9	5.8	5.4	5.6	0.2	0.38	0.007	6.2	3970
Ma Wan MZ	C1	4.2	3.9	4.1	3.6	0.54	0.005	8.2	119
Tung Lung Chau MZ	C2	5.6	5.4	5.3	5.1	0.24	0.006	4.6	22
Tsing Yi Power Station SI	D1	4.8	4.5	4.8	4.5	0.52	0.013	7.6	2965
Tung Wan GB	E1	4.6	4.4	4.4	4.2	0.49	0.006	7.8	92
Ting Kau GB	E2	4.4	4.1	4.4	4.0	0.53	0.006	8.0	153
Ting Kau GB	E3	4.4	4.2	4.3	4.0	0.54	0.006	8.1	179
Inner KTTS		5.5	5.0	4.9	4.5	0.42	0.011	8.9	2208
Outer KTTS		5.4	5.0	5.2	4.9	0.39	0.010	6.7	1046
EPD Monitoring Station	EM1	5.3	5.1	5.3	5.1	0.31	0.008	5.4	297
EPD Monitoring Station	WM2	5.1	4.5	5.1	4.8	0.44	0.006	7.1	70
EPD Monitoring Station	VM1	5.3	5.0	5.2	4.9	0.36	0.010	6.2	1348
EPD Monitoring Station	VM2	5.3	4.9	5.2	4.9	0.39	0.010	6.6	1354
EPD Monitoring Station	VM4	5.2	4.9	5.1	4.8	0.42	0.012	7.0	4818
EPD Monitoring Station	VM5	5.1	4.8	5.0	4.7	0.47	0.013	7.5	7435
EPD Monitoring Station	VM6	5.1	4.8	5.0	4.6	0.48	0.013	7.6	6035
EPD Monitoring Station	VM7	5.1	4.7	4.9	4.5	0.53	0.016	8.1	30830
EPD Monitoring Station	VM13	4.3	4.2	4.2	4.1	0.54	0.008	8.3	1227
EPD Monitoring Station	VM15	5.2	4.7	4.9	4.5	0.49	0.012	7.8	2677

Notes:
1. SI – Seawater Intake; TS – Typhoon Shelter; MZ – Mariculture Zone; and GB – Gazetted Beach.

Table 4.19 Predicted Average Water Quality for 2003

Indicator Point		Depth-averaged DO (mg/L)	Depth-averaged DO 10%ile (mg/L)	Bottom DO (mg/L)	Bottom DO 10%ile (mg/L)	Depth-averaged TIN (mg/L)	Depth-averaged UIA (mg/L)	Depth-averaged SS (mg/L)	Depth-averaged E. coli (count/ 100mL)
Tsuen Wan SI	A1	5.3	5.1	5.2	5.0	0.45	0.009	8.4	9040
Tsing Yi SI	A2	5.2	5.0	5.1	4.8	0.44	0.010	8.1	2208
Kennedy Town SI	A3	5.6	5.2	5.5	5.2	0.36	0.010	6.7	1538
Cheung Sha Wan SI	A4	5.6	4.8	4.8	4.1	0.54	0.020	9.4	18470
Yau Ma Tei SI	A5	5.2	4.8	5.0	4.7	0.44	0.014	7.2	1973
Central Water Front SI	A6	5.1	4.8	5.1	4.8	0.44	0.015	7.1	5732
Tsim Sha Tsui SI	A7	5.2	4.9	5.1	4.8	0.42	0.014	6.9	5556
Wan Chai SI	A8	5.3	4.9	5.2	4.9	0.42	0.014	6.9	8477
Tsim Sha Tsui East SI	A9	5.3	4.9	5.2	4.9	0.40	0.013	6.6	4932
Tai Wan SI	A10	5.3	4.8	5.2	4.8	0.41	0.014	6.4	1375
North Point SI	A11	5.4	5.0	5.3	5.0	0.36	0.012	6.4	4078
Quarry Bay SI	A12	5.5	6.0	5.4	6.0	0.33	0.011	6.0	7132
Sai Wan Ho SI	A13	5.6	5.2	5.5	5.2	0.31	0.010	5.7	2122
Cha Kwo Ling SI	A14	5.7	5.4	5.6	5.3	0.31	0.009	5.9	648
Yau Tong SI	A15	5.7	5.5	5.7	5.5	0.25	0.008	5.1	244
Chai Wan SI	A16	5.9	5.7	5.7	5.6	0.24	0.007	5.0	4829
Ap Lei Chau SI	A17	6.1	6.0	6.1	6.0	0.23	0.006	5.2	380
Rambler Channel TS	B1	5.2	5.0	5.1	4.9	0.45	0.009	8.3	4663
Yau Ma Tei TS	B2	5.6	5.1	5.2	4.7	0.45	0.014	7.9	4031
Causeway Bay TS	B3	5.3	4.9	5.2	4.8	0.41	0.014	7.0	5680
To Kwa Wan TS	B4	5.0	4.6	4.9	4.5	0.53	0.020	7.3	3540
Aldrich Bay TS	B6	5.5	5.2	5.4	5.1	0.31	0.010	5.7	2503
Sam Ka Tsuen TS	B7	5.7	5.4	5.5	5.2	0.29	0.009	5.7	988
Chai Wan TS	B8	5.9	5.7	5.7	5.5	0.25	0.008	5.2	5619
Aberdeen TS	B9	6.2	5.9	6.0	0.2	0.25	0.006	5.6	4769
Ma Wan MZ	C1	5.4	5.2	5.4	5.0	0.42	0.007	8.3	145
Tung Lung Chau MZ	C2	6.1	5.9	5.9	5.7	0.16	0.005	4.3	15
Tsing Yi Power Station SI	D1	5.4	5.1	5.4	5.2	0.42	0.013	7.3	3724
Tung Wan GB	E1	5.5	5.3	5.4	5.2	0.39	0.007	7.9	139
Ting Kau GB	E2	5.5	5.2	5.4	5.1	0.41	0.007	8.0	264
Ting Kau GB	E3	5.5	5.2	5.4	5.1	0.42	0.007	8.1	354
Inner KTTS		5.3	4.9	5.0	4.5	0.41	0.014	8.6	4706
Outer KTTS		5.6	5.3	5.5	5.2	0.31	0.010	5.9	898
EPD Monitoring Station	EM1	5.8	5.5	5.7	5.5	0.23	0.007	4.9	297
EPD Monitoring Station	WM2	5.8	5.4	5.8	5.6	0.32	0.007	6.7	84
EPD Monitoring Station	VM1	5.6	5.2	5.5	5.2	0.29	0.010	5.6	1439
EPD Monitoring Station	VM2	5.5	5.1	5.5	5.1	0.31	0.010	5.8	1261
EPD Monitoring Station	VM4	5.4	5.0	5.3	5.0	0.36	0.012	6.3	5375
EPD Monitoring Station	VM5	5.2	4.9	5.2	4.9	0.41	0.014	6.8	9533
EPD Monitoring Station	VM6	5.2	4.9	5.1	4.8	0.43	0.014	7.0	7678
EPD Monitoring Station	VM7	5.2	4.8	5.1	4.7	0.48	0.018	7.6	34625
EPD Monitoring Station	VM13	5.2	4.9	5.1	4.8	0.44	0.010	8.1	1873
EPD Monitoring Station	VM15	5.2	4.8	5.0	4.7	0.44	0.014	7.2	3568

Notes: SI – Seawater Intake; TS – Typhoon Shelter; MZ – Mariculture Zone; and GB – Gazetted Beach.

Nullah and Box Culvert Diversion

4.4.2.9 As an interim stage of the whole SEKD, diversion of Kai Tak Nullah and Jordan Valley box culvert would be carried out when the KTAC reclamation commences. Permanent extended sections will be ultimately constructed to discharge the flows into the open water in Kowloon Bay. It is planned to temporarily divert the nullah/box culvert along the disused airport runway. The flow is then temporarily discharged near the boundary between the KTAC and KTTS. This arrangement is not likely to have much difference from the original situation where the flows from the Kai Tak Nullah and the box culvert are first discharged into the KTAC and finally to the open water via KTTS. It is anticipated that the changes in water quality as a result of this arrangement would not deviate much from the original situation. As such, no attempt was made to assess the water quality impacts for this option.

4.4.2.10 An alternative option is to divert the flows from the Kai Tak Nullah and the box culvert to the Kowloon Bay waters. The most direct route to discharge the flows is to take the shortest distance by connecting the existing outlet of Kai Tak Nullah to Kowloon Bay across the disused airport runway. When taking the shortest route for nullah diversion, the flows would be discharged into TKWTS. The water quality in the typhoon shelter is likely to be affected. In order to include this arrangement as an alternative option, assessment of the potential water quality has been conducted. **Table 4.20** shows the predicted water quality condition in TKWTS.

4.4.2.11 The dissolved oxygen levels in the water at TKWTS were higher than the data recorded in 1998. There would be increases in BOD, TIN, UIA, SS and *E. coli* concentrations in the water at TKWTS. Higher concentrations of these parameters were predicted for the wet season condition. The increases in pollution levels reflected the impacts due to the nullah diversion. The background TIN concentration was high (0.46 mg/L) exceeding the WQO requirement (0.4 mg/L) in 1998. The TIN elevation contributed by the nullah diversion was about 20% for the wet season and 8% for the dry season. The average UIA concentrations would be increased to a level close to the WQO requirement of 0.02 mg/L. Although the percentages of increases in average BOD and SS concentrations were high, the resulting concentrations remained in acceptable levels.

4.4.2.12 The model predictions showed that the water quality in TKWTS would be affected by the nullah diversion, however, the changes in water quality condition are expected to be moderate. As the diversion of Kai Tak Nullah and box culverts is temporary, the final discharge point of the diverted channel will be located further away from the existing shoreline. The short-term influence to TKWTS is not likely to cause a significant deterioration of water quality at TKWTS.

4.4.2.13 Redistribution of the discharge from the KTAC and KTTS to Kowloon Bay would improve the water quality in the Kwun Tong area. Comparisons of the water quality condition in the existing KTTS and in the proposed new KTTS location are presented in **Table 4.21**. The DO levels in the water were significantly increased as a result of reduction in pollution loads in the water. In addition, the new KTTS would be located in area where tidal current is higher. The pollutants are more easily carried away by the tidal current and dispersed in the open water. This minimises the accumulation and settlement of pollutants in the area. The BOD, TIN, UIA and *E. coli* concentrations were predicted to be much lower than the 1998 condition. The predicted SS concentrations were comparatively higher but remained in acceptable levels.

4.4.2.14 The water quality in the nearby Tai Wan seawater intake would be potentially affected by the discharges from the diverted nullah. However, the modelling results showed that the SS concentrations (5.8 – 7.1 mg/L) at the intake point of the pumping station were below 10 mg/L. The concentrations of BOD (0.91 – 1.53mg/L), *E. coli* (1330 – 1420 count/100mL) and ammonical nitrogen (0.13 – 0.27mg/L) were also below the WSD's requirements for seawater intake indicating that the nullah diversion would not cause unacceptable impacts to the Tai Wan seawater intake.

Table 4.20 Water Quality Condition in To Kwa Wan Typhoon Shelter (2003) – Shortest Diversion Route

Parameter	Model Prediction		Annual Average Water Quality Condition in 1998 Note 1
	Dry Season	Wet Season	TKWTS
Depth-averaged 10%ile DO (mg/L)	4.6	4.7	3.9
Bottom 10%ile DO (mg/L)	4.4	4.5	3.7
Depth-averaged BOD (mg/L)	1.3	2.1	1.1
Depth-averaged TIN (mg/L)	0.50	0.56	0.46
Depth-averaged UIA (mg/L)	0.021	0.019	0.010
Depth-averaged SS (mg/L)	6.5	8.1	4.0
Depth-averaged E. coli (count/100mL)	2600	4480	3100

Notes:
1. EPD's routine water quality monitoring data (1998); and
2. All data are annual arithmetic means except for *E. coli* data which are geometric means.

Table 4.21 Water Quality Condition in the Existing and the New Kwun Tong Typhoon Shelter (2003 Scenario)

Parameter	Model Prediction New KTTS		Annual Average Water Quality Condition in 1998 Note 1
	Dry Season	Wet Season	Existing KTTS
Depth-averaged 10%ile DO (mg/L)	5.6	5.0	1.6
Bottom 10%ile DO (mg/L)	5.5	4.9	1.6
Depth-averaged BOD (mg/L)	0.4	1.4	2.2
Depth-averaged TIN (mg/L)	0.23	0.39	1.64
Depth-averaged UIA (mg/L)	0.010	0.010	0.037
Depth-averaged SS (mg/L)	5.0	6.7	3.3
Depth-averaged E. coli (count/100mL)	750	1046	100000

Notes:
1. EPD's routine water quality monitoring data (1998); and
2. All data are annual arithmetic means except for *E. coli* data which are geometric means.

4.4.2.15 A fall back option of discharging the diverted flows to the location away from TKWTS has been included. The primary objective of proposing the fall back option is that in case where the water quality in TKWTS is significantly deteriorated when adopting the shortest route of diversion, the fall back option would be an alternative for allocating the diverted flows to a more suitable discharge location. The water quality condition in TKWTS for the fall back option was predicted by taking the similar water quality modelling steps for the shortest diversion route option but the discharge point of the diverted channel was relocated to the location as shown in **Drawing No. 22936/EN/090**. The predicted water quality condition is shown in **Table 4.22**.

4.4.2.16 The predicted water quality condition for the fall back option was comparatively better than that for the shortest diversion route option. The dissolved oxygen levels were slightly higher whilst the concentrations of BOD, TIN, UIA, SS and *E. coli* were lower. Although the discharge location for the fall back option is at some distance away from TKWTS, the discharged pollutants may still be transported to TKWTS during flood tide affecting the water quality in TKWTS. Increases in pollutant levels in the water are expected. As the background TIN concentrations in the water are high, exceedances of WQO for TIN would likely to occur especially in the wet season.

4.4.2.17 There were no significant differences in water quality condition between the two options. Even the shortest diversion route option is adopted the water quality in TKWTS would not fall to unacceptable levels when comparing to the 1998 condition. Therefore, the shortest diversion route option would be an acceptable option for the nullah diversion.

4.4.2.18 Potential water quality impacts arising from the nullah diversion works would include release of construction wastes and pollutants into the water flowing in the nullah and box culvert.

Runoff from the construction site containing high concentrations of suspended solids is a potential source of pollution. Suitable control measures should be adopted to minimise the water quality impacts to the diverted nullah and box culvert.

Table 4.22 Water Quality Changes in To Kwa Wan Typhoon Shelter and Kowloon Bay (2003) - Fall Back Option

Parameter	Model Prediction		Annual Average Water Quality Condition in 1998 Note 1
	Dry Season	Wet Season	TKWTS
Depth-averaged 10%ile DO (mg/L)	5.0	4.8	3.9
Bottom 10%ile DO (mg/L)	4.8	4.6	3.7
Depth-averaged BOD (mg/L)	0.9	1.9	1.1
Depth-averaged TIN (mg/L)	0.39	0.50	0.46
Depth-averaged UIA (mg/L)	0.016	0.015	0.010
Depth-averaged SS (mg/L)	5.9	7.8	4.0
Depth-averaged E. coli (count/100mL)	1706	3277	3100

Note: All data are annual arithmetic means except for *E. coli* data which are geometric means.

Dredging and Filling

4.4.2.19 The sediments in the development area were heavily polluted and contained high concentrations of organic matter and heavy metals. When dredging and filling activities are carried out, uncontrolled release of sediments to the surrounding environment would cause adverse water quality impacts.

4.4.2.20 During dredging and filling, the sediments settled on the bottom of the reclamation sites would be disturbed. The quantities of fine sediment that would be generated are related to dredging/filling rates and methods. The SS levels in the water would increase as a result of generation of sediment plumes. Temporary deterioration of water quality in the vicinity of the dredging and filling areas is likely to occur. In the presence of tidal current, the sediment particles would be transported away from the dredging and filling areas causing water pollution in the nearby water body. Suitable mitigation measures should be undertaken to ensure that the dredging and filling activities would not cause significant water quality impacts to the surrounding environment.

4.4.2.21 The increases in SS levels at the sensitive receivers for the three scenarios were predicted using the detailed model. **Table 4.23** summarises the mean depth-averaged SS results over a complete spring neap cycle for Scenario 1. **Drawing No. 22936/EN/250** shows graphically the predicted SS contours. No mitigation measures such as application of silt curtains and filling behind sea wall for the dredging and filling activities were included in this prediction. High concentrations of SS levels in the KTAC were predicted as a result of extensive filling in the channel. Time series plots for SS for the dry and wet seasons at the nearby Tai Wan and Cha Kwo Ling seawater intakes, and Tung Lung Chau Mariculture Zone are shown in **Drawing Nos. 22936/EN/212** and **213**. In the first 8 days of simulation after the commencement of dredging and filling, the increases in SS at the two intakes were less significant especially during the dry season. This would be due to the confined condition in the channel. The sediment plumes mainly appeared in the channel section and the KTTS area. Under the no mitigation scenario, the continuous filling at KTAC would eventually cause the dispersion of sediment plumes to the open water. The fine particles carried by the tidal current caused the elevation of SS along the shoreline. The predicted SS levels at most of the indicator points exceeded the WQO for SS in both the dry and wet season simulations. The water quality at seawater intakes in the harbour would be affected and the SS levels at the intake points may exceed the WSD's criteria. The water quality at Tung Lung Chau would also be affected as a result of spreading of sediment plumes. Exceedance of WQO for SS at Tung Lung Chau Mariculture Zone was observed during the wet season. Increases in SS in the water near Kennedy Town seawater intake, which is located further away from the proposed reclamation areas, were however less significant (<6%). Marine ecology such as coral communities in Green Island would not be adversely affected even for the unmitigated scenario.

4.4.2.22 A mitigated scenario has been proposed to confine the sediment plumes generated from the filling activities inside the KTAC. This could be achieved by placing rock fill at the exit of the channel to form a barrier. A narrow opening at the exit would be provided to allow for entrance of barges. Silt curtains would be installed to control the release of fine particles through the opening. After implementing the mitigation measures, it is expected that the sediment plumes created during the filling activities in the channel could be effectively controlled and release of fine particles would be minimal.

4.4.2.23 **Table 4.24** shows the increases in SS at the sensitive receivers for the mitigated scenario. No sediment loss due to filling at KTAC was included in the mitigated scenario. Only the dredging activities at Hoi Sham Earth Bund and at the western arm of the new KTTS were considered in the sediment plume modelling. **Drawing No. 22936/EN/253** presents graphically the mean depth-averaged SS for Scenario 1 with inclusion of mitigation measures.

4.4.2.24 The predicted SS levels were distinctively different from the unmitigated scenario. Exceedances of the WQO for SS (< 30%) were only found at Tai Wan and Cha Kwo Ling seawater intakes, TKWTS and KTTS during the dry season. However, the SS levels at the two seawater intakes were below 10 mg/L and met the WSD's criteria. The causes of exceedances would be due to the close proximity between these sensitive receivers and the dredging points. The mean depth-averaged SS level for the wet season at Cheung Sha Wan seawater intake was slightly higher than 10 mg/L. This could be related to the confined location of this seawater intake. Based on the modelling results, there were no increases in SS at Kennedy Town seawater intake. The potential impacts to the marine ecology in Green Island would be minimal. With a suitable control of the filling activities at KTAC, it is likely that the water quality in the harbour would not be adversely affected and would remain in acceptable levels.

4.4.2.25 The time series plots for SS shown in **Drawing Nos. 22936/EN/212** and **213** showed that the SS levels measured at Tai Wan and Cha Kwo Ling seawater intakes and Tung Lung Chau Mariculture Zone for the mitigated scenario were consistent low. No increases in SS were detected. The mitigated scenario appeared to be an acceptable approach to minimise the potential water quality impacts arising from dredging and filling activities.

4.4.2.26 After enclosing the filling area with a temporary protective structure such as sea wall or rock-filled barrier, the movement of water inside the enclosed area would become very slow. Transport of sediment plumes inside the enclosed area is limited in the calm environment. The marine access at the sea wall is a narrow opening, which would be installed with silt curtains to minimise the release of sediment particles. A significant release of sediment through this opening is unlikely. The modelling results showed that the dredging impacts would be localised. When compared to the sediment loss due to dredging, release of sediment through the opening would be less significant. It is expected that release of a small amount of sediment at the opening is not likely to change the overall predictions to a larger extent. Therefore, no attempt was made to model the cases of sediment release from the opening for marine access.

4.4.2.27 For Scenario 2, both the unmitigated and mitigated scenarios were predicted. The increases in SS levels for these two cases are presented in **Tables 4.25** and **4.26**. **Drawing Nos. 22936/EN/251** and **254** present graphically the mean depth-averaged SS for Scenario 2 with and without mitigation measures. The extensive filling activities at the eastern arm of the new KTTS would cause significant increases in SS levels in the harbour. As the filling point is located at the open water, the tidal current could easily transport the fine particles away from the filling point and dispersed the fine particles in the harbour water. The sensitive receivers along the coastline of Kowloon Peninsula would be adversely affected for the case of no mitigation measures in place. **Drawing Nos. 22936/EN/214** and **215** show the time series plots for SS at Tai Wan and Cha Kwo Ling seawater intakes and Tung Lung Chau Mariculture Zone. The results showed that the highest SS levels recorded during the dry season at Cha Kwo Ling seawater intake and Tai Wan seawater intake were about 400 mg/L and 100 mg/L respectively. Lower peak values of 200 mg/L at Cha Kwo Ling seawater intake and 80 mg/L at Tai Wan seawater intake were recorded during the wet season. The impacts on Cha Kwo Ling seawater intake appeared to be more significant for the no mitigation scenario. The SS levels predicted at Tung Lung Chau Mariculture Zone increased from a relatively low level of about 4 mg/L to a level higher than 10 mg/L and above during the dry season. Increases in SS levels at this mariculture zone during the wet season were more significant. The highest SS level was above 20 mg/L.

4.4.2.28 To minimise the impacts due to filling and dredging, a mitigated scenario of using suction trailer to place sandfill through the suction arm to the bottom of the foundation of the breakwater (eastern arm of the new KTTS) was considered. The relatively low sediment loss rate of 2.1 kg/s for this approach would minimise the impacts. The numerical results and the plots showed that there would be some isolated patches with high concentrations of SS near the dredging and filling points. Exceedances of the WQO for SS were found during the dry season at the sensitive receivers nearest to the dredging and filling points. These included the seawater intakes at Tsim Sha Tsui East, Tai Wan and Cha Kwo Ling. The only exceedance of WQO during the wet season was recorded at TKWTS. **Drawing Nos. 22936/EN/214** and **215** also include the predicted SS levels at Tai Wan and Cha Kwo Ling seawater intakes and Tung Lung Chau Mariculture Zone for the mitigated scenario. Comparing the results for the unmitigated and mitigated scenarios showed that the mitigated scenario did not cause any obvious increases in SS at these indicator points. By adopting the recommended mitigation measures, the water quality in terms of SS at all the seawater intakes complied with the WSD's criteria.

4.4.2.29 **Tables 4.27** and **4.28** summarise the predicted SS levels for Scenario 3 with and without mitigation measures. The results are also shown graphically in **Drawing Nos. 22936/EN/252** and **255**. The unmitigated scenario included the filling activities at KTTS and Hoi Sham (Phase 1 Stage2), and dredging at Hoi Sham Phase 2. Based on the predicted results, it is likely that the SS levels in Victoria Harbour would be increased significantly. The water quality at all the sensitive receivers within the Victoria Harbour WCZ would exceed the WQO for SS and the water quality at most of the seawater intakes would also exceed the WSD's criteria. The increases in SS at the nearby seawater intakes at Cha Kwo Ling and Tai Wan, and Tung Lung Chau Mariculture Zone are shown in the time series plots in **Drawing Nos. 22936/EN/274** and **275.** It is obvious that the unmitigated scenario would not be acceptable.

4.4.2.30 It has been proposed that the filling activities would be carried out behind a temporary protective structure such as sea wall or rock-filled barrier. The barrier could be built using rock fill at the boundary of the reclamation zone. The physical presence of the barrier confines the spreading of sediment plumes generated during the filling activities. The proposed mitigation measure would be incorporated into the construction sequences to control the release of sediment particles during filling. The predicted results for the mitigated scenario with no inclusion of sediment loss due to filling showed that there would be only slight increases in SS at the seawater intakes at Yau Ma Tei, Tsim Sha Tsui, Tsim Sha Tsui East and Tai Wan during the dry season. The influence to the sensitive receivers during the wet season was insignificant when the filling activities are to be carried out within confined areas. Exceedance of WQO for SS at Cheung Shai Wan seawater intake during the wet season would not be directly related the dredging activities at Hoi Sham area. **Drawing Nos. 22936/EN/274** and **275** also include the predicted SS levels at Tai Wan and Cha Kwo Ling seawater intakes, and Tung Lung Chau Mariculture Zone for the mitigated scenario. There were no obvious increases in SS at these indicator points.

4.4.2.31 Filling behind seawall may not be feasible for filling to be carried out at Earth Bund, which is to facilitate the diversion of existing submarine gas main and for the construction of Culvert

P2. The possible mitigation measure is to use the sorted public fill with a smaller size or marine sand for filling at Earth Bund. The filling may be carried out through a pipeline to release the material into the seabed. This minimises the loss of fine material during the operation. The modelling results for similar approach undertaken at breakwater locations have shown to be acceptable and support the proposed mitigation measure.

4.4.2.32 To effectively control the release of fine particles, silt curtains should be installed surrounding the dredging areas and at the exits of the confined filling areas. With the mitigation measures in place, it is expected that the water quality at the nearby seawater intakes at Tai Wan and Cha Kwo Ling and the other sensitive receivers would not be adversely affected. Provision of silt curtains at these two intake points may not be required. However, it is recommended to include water quality monitoring in the EM&A programme to ensure that elevation of SS would be in acceptable levels during the reclamation period of the development.

4.4.2.33 With the mitigation measures in place, the daily production rates for sediment dredging (2500m^3/day) and filling (20000m^3/day) adopted for sediment, plume modelling would not cause adverse water quality impacts to the marine environment. It is recommended that these dredging and filling rates should be used as the maximum acceptable dredging and filling rates for the reclamation works.

4.4.2.34 The whole development of South East Kowloon would last more than 10 years commencing in 2002/2003. Other reclamation projects near the SEKD such as Central Reclamation Phase III, Wan Chai Development Phase II and Yau Tong Bay development would also be carried out during this period. The implementation of these projects may cause cumulative construction impacts. At the time of preparing this Final EIA, the reclamation programmes and dredging/filling details for these projects have yet to be finalised. Due to unavailability of reclamation information from these projects at this stage, it is not possible to include the cumulative impact assessment in the present study. The cumulative impacts from the other projects would be taken into account during the detailed study of the developments.

Table 4.23 Sediment Plume Modelling Results for Scenario 1 – No Mitigation

Indicator Point		Wet Season				Dry Season			
		Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)	Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)
Tsuen Wan SI	A1	8.6	-	Yes	Yes	8.0	-	Yes	Yes
Tsing Yi SI	A2	8.9	7	Yes	Yes	7.9	0	Yes	Yes
Kennedy Town SI	A3	7.2	6	Yes	Yes	6.5	1	Yes	Yes
Cheung Sha Wan SI	A4	13.0	22	Yes	No	10.0	27	Yes	Yes
Yau Ma Tei SI	A5	13.3	70	No	No	11.3	74	No	No
Central Water Front SI	A6	15.8	108	No	No	10.4	61	No	No
Tsim Sha Tsui SI	A7	18.5	145	No	No	13.8	126	No	No
Wan Chai SI	A8	17.0	126	No	No	11.0	82	No	No
Tsim Sha Tsui East SI	A9	21.2	185	No	No	15.3	164	No	No
Tai Wan SI	A10	31.8	357	No	No	17.0	222	No	No
North Point SI	A11	18.3	153	No	No	11.0	93	No	No
Quarry Bay SI	A12	18.4	182	No	No	10.2	95	No	No
Sai Wan Ho SI	A13	18.1	178	No	No	9.5	92	No	Yes
Cha Kwo Ling SI	A14	42.8	508	No	No	22.5	349	No	No
Yau Tong SI	A15	16.0	193	No	No	11.2	140	No	No
Chai Wan SI	A16	12.9	133	No	No	6.3	47	No	Yes
Ap Lei Chau SI	A17	5.2	-	Yes	Yes	4.7	-	Yes	Yes
Rambler Channel TS	B1	8.6	-	Yes	-	8.0	-	Yes	-
Yau Ma Tei TS	B2	11.3	27	Yes	-	10.3	55	No	-
Causeway Bay TS	B3	14.7	83	No	-	11.1	72	No	-

Indicator Point		Wet Season				Dry Season			
		Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)	Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)
To Kwa Wan TS	B4	38.0	404	No	-	19.0	251	No	-
Kwun Tong TS	B5	1084.0	6898	No	-	649.8	5676	No	-
Aldrich Bay TS	B6	16.4	163	No	-	9.2	83	No	-
Sam Ka Tsuen TS	B7	33.2	373	No	-	16.3	232	No	-
Chai Wan TS	B8	13.8	126	No	-	5.8	28	Yes	-
Aberdeen TS	B9	5.8	-	Yes	-	4.8	-	Yes	-
Ma Wan MZ	C1	7.9	-	Yes	-	8.0	-	Yes	-
Tung Lung Chau MZ	C2	8.1	83	No	-	4.0	2	Yes	-
Tsing Yi Power Station SI	D1	8.8	18	Yes	-	7.2	1	Yes	-
Tung Wan GB	E1	7.8	-	Yes	-	7.6	-	Yes	-
Ting Kau GB	E2	7.7	-	Yes	-	7.8	-	Yes	-
Ting Kau GB	E3	7.8	-	Yes	-	7.9	-	Yes	-
EPD Monitoring Station	EM1	12.1	137	No	-	7.9	74	No	-
EPD Monitoring Station	WM2	6.5	-	Yes	-	6.3	-	Yes	-
EPD Monitoring Station	VM1	16.7	176	No	-	10.1	100	No	-
EPD Monitoring Station	VM2	30.6	363	No	-	16.9	226	No	-
EPD Monitoring Station	VM4	20.8	199	No	-	12.1	114	No	-
EPD Monitoring Station	VM5	18.1	145	No	-	11.2	83	No	-
EPD Monitoring Station	VM6	17.4	131	No	-	11.4	80	No	-
EPD Monitoring Station	VM7	14.7	90	No	-	10.8	61	No	-
EPD Monitoring Station	VM13	8.9	9	Yes	-	7.9	-	Yes	-
EPD Monitoring Station	VM15	13.0	68	No	-	10.8	60	Yes	-

Table 4.24 Sediment Plume Modelling Results for Scenario 1 – With Mitigation

Indicator Point		Wet Season				Dry Season			
		Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)	Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)
Tsuen Wan SI	A1	8.2	-	Yes	Yes	7.8	-	Yes	Yes
Tsing Yi SI	A2	7.8	-	Yes	Yes	7.6	-	Yes	Yes
Kennedy Town SI	A3	6.3	-	Yes	Yes	6.1	-	Yes	Yes
Cheung Sha Wan SI	A4	10.4	-	Yes	No	8.1	4	Yes	Yes
Yau Ma Tei SI	A5	7.7	-	Yes	Yes	7.3	12	Yes	Yes
Central Water Front SI	A6	7.6	-	Yes	Yes	7.1	9	Yes	Yes
Tsim Sha Tsui SI	A7	7.8	-	Yes	Yes	7.4	21	Yes	Yes
Wan Chai SI	A8	7.6	1	Yes	Yes	6.8	13	Yes	Yes
Tsim Sha Tsui East SI	A9	7.9	6	Yes	Yes	7.4	27	Yes	Yes
Tai Wan SI	A10	8.5	22	Yes	Yes	7.6	45	No	Yes
North Point SI	A11	7.4	2	Yes	Yes	6.5	14	Yes	Yes
Quarry Bay SI	A12	6.7	3	Yes	Yes	5.9	13	Yes	Yes
Sai Wan Ho SI	A13	6.7	3	Yes	Yes	5.5	12	Yes	Yes
Cha Kwo Ling SI	A14	7.8	10	Yes	Yes	6.9	37	No	Yes
Yau Tong SI	A15	5.6	3	Yes	Yes	5.4	15	Yes	Yes
Chai Wan SI	A16	5.5	-	Yes	Yes	4.3	1	Yes	Yes
Ap Lei Chau SI	A17	5.1	-	Yes	Yes	4.7	-	Yes	Yes
Rambler Channel TS	B1	8.2	-	Yes	-	7.8	-	Yes	-
Yau Ma Tei TS	B2	8.6	-	Yes	-	7.2	9	Yes	-
Causeway Bay TS	B3	8.0	-	Yes	-	7.1	11	Yes	-
To Kwa Wan TS	B4	9.3	24	Yes	-	10.0	85	No	-
Kwun Tong TS	B5	11.7	-	Yes	-	26.4	134	No	-

Indicator Point		Wet Season				Dry Season			
		Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)	Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)
Aldrich Bay TS	B6	6.4	2	Yes	-	5.6	11	Yes	-
Sam Ka Tsuen TS	B7	7.7	10	Yes	-	6.3	29	Yes	-
Chai Wan TS	B8	6.1	-	Yes	-	4.5	-	Yes	-
Aberdeen TS	B9	5.6	-	Yes	-	4.7	-	Yes	-
Ma Wan MZ	C1	7.6	-	Yes	-	8.0	-	Yes	-
Tung Lung Chau MZ	C2	4.2	-	Yes	-	3.5	-	Yes	-
Tsing Yi Power Station SI	D1	7.1	-	Yes	-	6.8	-	Yes	-
Tung Wan GB	E1	7.5	-	Yes	-	7.5	-	Yes	-
Ting Kau GB	E2	7.3	-	Yes	-	7.7	-	Yes	-
Ting Kau GB	E3	7.5	-	Yes	-	7.8	-	Yes	-
EPD Monitoring Station	EM1	5.1	-	Yes	-	4.8	6	Yes	-
EPD Monitoring Station	WM2	6.3	-	Yes	-	6.2	-	Yes	-
EPD Monitoring Station	VM1	6.2	2	Yes	-	5.6	12	Yes	-
EPD Monitoring Station	VM2	7.2	10	Yes	-	6.5	27	Yes	-
EPD Monitoring Station	VM4	7.3	5	Yes	-	6.6	16	Yes	-
EPD Monitoring Station	VM5	7.5	2	Yes	-	6.9	13	Yes	-
EPD Monitoring Station	VM6	7.7	2	Yes	-	7.1	12	Yes	-
EPD Monitoring Station	VM7	7.7	-	Yes	-	7.3	9	Yes	-
EPD Monitoring Station	VM13	7.8	-	Yes	-	7.6	-	Yes	-
EPD Monitoring Station	VM15	7.6	-	Yes	-	7.3	9	Yes	-

Table 4.25 Sediment Plume Modelling Results for Scenario 2 – No Mitigation

Indicator Point		Wet Season				Dry Season			
		Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)	Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)
Tsuen Wan SI	A1	8.8	2	Yes	Yes	10.2	26	Yes	No
Tsing Yi SI	A2	9.5	15	Yes	Yes	12.3	58	No	No
Kennedy Town SI	A3	7.7	10	Yes	Yes	13.3	111	No	No
Cheung Sha Wan SI	A4	15.1	34	No	No	37.7	402	No	No
Yau Ma Tei SI	A5	14.9	88	No	No	45.1	598	No	No
Central Water Front SI	A6	19.0	148	No	No	40.4	520	No	No
Tsim Sha Tsui SI	A7	23.0	201	No	No	61.0	889	No	No
Wan Chai SI	A8	19.6	154	No	No	47.1	667	No	No
Tsim Sha Tsui East SI	A9	29.7	304	No	No	68.3	1066	No	No
Tai Wan SI	A10	43.7	516	No	No	78.6	1256	No	No
North Point SI	A11	25.5	253	No	No	48.3	763	No	No
Quarry Bay SI	A12	27.6	311	No	No	44.2	746	No	No
Sai Wan Ho SI	A13	27.0	323	No	No	42.1	738	No	No
Cha Kwo Ling SI	A14	82.5	1103	No	No	170.6	3407	No	No
Yau Tong SI	A15	32.2	471	No	No	51.4	1032	No	No
Chai Wan SI	A16	23.1	295	No	No	19.8	371	No	No
Ap Lei Chau SI	A17	5.3	-	Yes	Yes	5.3	8	Yes	Yes
Rambler Channel TS	B1	8.9	4	Yes	-	11.2	41	No	-
Yau Ma Tei TS	B2	12.8	41	No	-	40.8	508	No	-
Causeway Bay TS	B3	20.7	163	No	-	47.5	668	No	-
Aldrich Bay TS	B6	27.1	323	No	-	40.3	704	No	-
Sam Ka Tsuen TS	B7	53.0	690	No	-	84.9	1682	No	-
Chai Wan TS	B8	23.6	288	No	-	19.8	366	No	-
Aberdeen TS	B9	6.0	-	-	-	5.1	3	Yes	-

Indicator Point		Wet Season				Dry Season			
		Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)	Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)
Ma Wan MZ	C1	8.1	-	-	-	8.5	2	Yes	-
Tung Lung Chau MZ	C2	14.5	215	No	-	10.3	162	No	-
Tsing Yi Power Station SI	D1	10.1	32	No	-	12.7	82	No	-
Tung Wan GB	E1	8.0	2	Yes	-	8.7	11	Yes	-
Ting Kau GB	E2	8.0	1	Yes	-	8.8	10	Yes	-
Ting Kau GB	E3	8.1	0	-	-	8.7	8	Yes	-
EPD Monitoring Station	EM1	22.2	314	No	-	29.7	570	No	-
EPD Monitoring Station	WM2	7.0	-	-	-	7.6	18	Yes	-
EPD Monitoring Station	VM1	26.4	327	No	-	42.3	751	No	-
EPD Monitoring Station	VM2	41.6	533	No	-	65.1	1187	No	-
EPD Monitoring Station	VM4	29.8	327	No	-	53.7	871	No	-
EPD Monitoring Station	VM5	24.0	221	No	-	48.7	691	No	-
EPD Monitoring Station	VM6	21.7	185	No	-	49.1	678	No	-
EPD Monitoring Station	VM7	18.5	129	No	-	43.1	514	No	-
EPD Monitoring Station	VM13	9.7	16	Yes	-	12.3	57	No	-
EPD Monitoring Station	VM15	16.3	109	No	-	41.0	517	No	-

Table 4.26 Sediment Plume Modelling Results for Scenario 2 – With Mitigation

Indicator Point		Wet Season				Dry Season			
		Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)	Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)
Tsuen Wan SI	A1	8.2	-	Yes	Yes	7.7	-	Yes	Yes
Tsing Yi SI	A2	7.9	-	Yes	Yes	7.5	-	Yes	Yes
Kennedy Town SI	A3	6.6	-	Yes	Yes	6.1	-	Yes	Yes
Cheung Sha Wan SI	A4	11.0	-	Yes	No	8.3	10	Yes	Yes
Yau Ma Tei SI	A5	7.8	-	Yes	Yes	7.5	17	Yes	Yes
Central Water Front SI	A6	7.7	1	Yes	Yes	7.2	11	Yes	Yes
Tsim Sha Tsui SI	A7	7.9	4	Yes	Yes	7.9	28	Yes	Yes
Wan Chai SI	A8	7.8	1	Yes	Yes	7.0	14	Yes	Yes
Tsim Sha Tsui East SI	A9	7.9	8	Yes	Yes	7.9	34	No	Yes
Tai Wan SI	A10	8.8	24	Yes	Yes	9.7	68	No	Yes
North Point SI	A11	7.4	3	Yes	Yes	6.4	14	Yes	Yes
Quarry Bay SI	A12	7.0	4	Yes	Yes	5.8	11	Yes	Yes
Sai Wan Ho SI	A13	6.6	3	Yes	Yes	5.5	10	Yes	Yes
Cha Kwo Ling SI	A14	8.2	20	Yes	Yes	7.5	55	No	Yes
Yau Tong SI	A15	5.9	4	Yes	Yes	5.1	13	Yes	Yes
Chai Wan SI	A16	5.9	1	Yes	Yes	4.1	-	Yes	Yes
Ap Lei Chau SI	A17	5.1	-	Yes	Yes	4.4	-	Yes	Yes
Rambler Channel TS	B1	8.2	-	Yes	-	7.6	-	Yes	-
Yau Ma Tei TS	B2	8.8	-	Yes	-	7.6	14	Yes	-
Causeway Bay TS	B3	8.0	1	Yes	-	7.0	13	Yes	-
Aldrich Bay TS	B6	6.6	3	Yes	-	5.5	9	Yes	-
Sam Ka Tsuen TS	B7	7.4	11	Yes	-	6.0	26	Yes	-
Chai Wan TS	B8	6.1	1	Yes	-	4.1	-	Yes	-
Aberdeen TS	B9	5.7	-	Yes	-	4.4	-	Yes	-
Ma Wan MZ	C1	7.7	-	Yes	-	7.8	-	Yes	-
Tung Lung Chau MZ	C2	4.4	-	Yes	-	3.6	-	Yes	-
Tsing Yi Power Station SI	D1	7.3	-	Yes	-	6.7	-	Yes	-
Tung Wan GB	E1	7.4	-	Yes	-	7.4	-	Yes	-

Indicator Point		Wet Season				Dry Season			
		Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)	Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)
Ting Kau GB	E2	7.5	-	Yes	-	7.5	-	Yes	-
Ting Kau GB	E3	7.6	-	Yes	-	7.6	-	Yes	-
EPD Monitoring Station	EM1	5.4	-	Yes	-	4.6	3	Yes	-
EPD Monitoring Station	WM2	6.6	-	Yes	-	5.9	-	Yes	-
EPD Monitoring Station	VM1	6.4	3	Yes	-	5.4	10	Yes	-
EPD Monitoring Station	VM2	7.2	9	Yes	-	6.1	20	Yes	-
EPD Monitoring Station	VM4	7.5	7	Yes	-	6.5	18	Yes	-
EPD Monitoring Station	VM5	7.7	3	Yes	-	7.1	15	Yes	-
EPD Monitoring Station	VM6	7.8	3	Yes	-	7.4	17	Yes	-
EPD Monitoring Station	VM7	8.1	0	Yes	-	7.9	12	Yes	-
EPD Monitoring Station	VM13	7.9	-	Yes	-	7.5	-	Yes	-
EPD Monitoring Station	VM15	7.8	0	Yes	-	7.5	13	Yes	-

Table 4.27 Sediment Plume Modelling Results for Scenario 3 – No Mitigation

Indicator Point		Wet Season				Dry Season			
		Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)	Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)
Tsuen Wan SI	A1	10.4	21	Yes	No	13.3	64	No	No
Tsing Yi SI	A2	13.9	67	No	No	18.3	135	No	No
Kennedy Town SI	A3	10.7	52	No	No	22.1	249	No	No
Cheung Sha Wan SI	A4	26.4	134	No	No	78.8	949	No	No
Yau Ma Tei SI	A5	33.6	325	No	No	98.5	1425	No	No
Central Water Front SI	A6	45.3	491	No	No	76.6	1076	No	No
Tsim Sha Tsui SI	A7	62.0	712	No	No	139.5	2164	No	No
Wan Chai SI	A8	46.2	498	No	No	80.3	1210	No	No
Tsim Sha Tsui East SI	A9	79.9	986	No	No	155.6	2559	No	No
Tai Wan SI	A10	155.9	2097	No	No	259.4	4377	No	No
North Point SI	A11	56.6	684	No	No	73.9	1221	No	No
Quarry Bay SI	A12	56.7	745	No	No	61.6	1080	No	No
Sai Wan Ho SI	A13	54.1	747	No	No	56.9	1032	No	No
Cha Kwo Ling SI	A14	132.2	1827	No	No	110.9	2180	No	No
Yau Tong SI	A15	52.0	821	No	No	56.3	1140	No	No
Chai Wan SI	A16	41.8	614	No	No	22.6	436	No	No
Ap Lei Chau SI	A17	5.7	2	Yes	Yes	6.2	28	Yes	Yes
Rambler Channel TS	B1	11.1	29	Yes	-	15.7	97	No	-
Yau Ma Tei TS	B2	23.7	161	No	-	86.6	1191	No	-
Causeway Bay TS	B3	48.2	513	No	-	77.3	1151	No	-
Aldrich Bay TS	B6	53.3	732	No	-	54.1	980	No	-
Sam Ka Tsuen TS	B7	89.7	1239	No	-	75.9	1492	No	-
Chai Wan TS	B8	42.6	600	No	-	22.3	425	No	-
Aberdeen TS	B9	6.6	6	Yes	-	5.8	17	Yes	-
Ma Wan MZ	C1	9.0	9	Yes	-	9.4	12	Yes	-
Tung Lung Chau MZ	C2	23.6	412	No	-	10.1	155	No	-
Tsing Yi Power Station SI	D1	17.5	129	No	-	20.1	190	No	-
Tung Wan GB	E1	9.6	22	Yes	-	10.4	32	No	-
Ting Kau GB	E2	9.4	18	Yes	-	10.4	30	Yes	-
Ting Kau GB	E3	9.2	14	Yes	-	10.1	25	Yes	-
EPD Monitoring Station	EM1	39.0	629	No	-	34.7	682	No	-

Indicator Point		Wet Season				Dry Season			
		Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)	Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)
EPD Monitoring Station	WM2	8.1	15	Yes	-	9.6	49	No	-
EPD Monitoring Station	VM1	52.3	745	No	-	56.5	1039	No	-
EPD Monitoring Station	VM2	81.5	1139	No	-	92.8	1733	No	-
EPD Monitoring Station	VM4	74.0	960	No	-	88.6	1503	No	-
EPD Monitoring Station	VM5	58.6	683	No	-	87.5	1321	No	-
EPD Monitoring Station	VM6	54.8	620	No	-	96.8	1432	No	-
EPD Monitoring Station	VM7	44.2	446	No	-	85.9	1124	No	-
EPD Monitoring Station	VM13	14.4	73	No	-	18.3	133	No	-
EPD Monitoring Station	VM15	39.1	400	No	-	86.4	1199	No	-

Table 4.28 Sediment Plume Modelling Results for Scenario 3 – With Mitigation

Indicator Point		Wet Season				Dry Season			
		Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)	Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)
Tsuen Wan SI	A1	8.1	-	Yes	Yes	7.6	-	Yes	Yes
Tsing Yi SI	A2	7.9	-	Yes	Yes	7.3	-	Yes	Yes
Kennedy Town SI	A3	6.5	-	Yes	Yes	5.9	-	Yes	Yes
Cheung Sha Wan SI	A4	10.9	-	Yes	No	7.5	0	Yes	Yes
Yau Ma Tei SI	A5	7.6	-	Yes	Yes	6.5	1	Yes	Yes
Central Water Front SI	A6	7.4	-	Yes	Yes	6.4	-	Yes	Yes
Tsim Sha Tsui SI	A7	7.5	-	Yes	Yes	6.5	5	Yes	Yes
Wan Chai SI	A8	7.4	-	Yes	Yes	6.0	-	Yes	Yes
Tsim Sha Tsui East SI	A9	7.3	-	Yes	Yes	6.2	6	Yes	Yes
Tai Wan SI	A10	7.6	7	Yes	Yes	7.2	24	Yes	Yes
North Point SI	A11	7.0	-	Yes	Yes	5.4	-	Yes	Yes
Quarry Bay SI	A12	6.4	-	Yes	Yes	5.0	-	Yes	Yes
Sai Wan Ho SI	A13	6.1	-	Yes	Yes	4.7	-	Yes	Yes
Cha Kwo Ling SI	A14	6.6	-	Yes	Yes	4.6	-	Yes	Yes
Yau Tong SI	A15	5.3	-	Yes	Yes	4.2	-	Yes	Yes
Chai Wan SI	A16	5.5	-	Yes	Yes	3.8	-	Yes	Yes
Ap Lei Chau SI	A17	5.1	-	Yes	Yes	4.4	-	Yes	Yes
Rambler Channel TS	B1	8.1	-	Yes	-	7.5	-	Yes	-
Yau Ma Tei TS	B2	8.7	-	Yes	-	6.8	1	Yes	-
Causeway Bay TS	B3	7.6	-	Yes	-	6.1	-	Yes	-
Aldrich Bay TS	B6	6.1	-	Yes	-	4.7	-	Yes	-
Sam Ka Tsuen TS	B7	6.4	-	Yes	-	4.5	-	Yes	-
Chai Wan TS	B8	5.7	-	Yes	-	3.8	-	Yes	-
Aberdeen TS	B9	5.7	-	Yes	-	4.4	-	Yes	-
Ma Wan MZ	C1	7.7	-	Yes	-	7.8	-	Yes	-
Tung Lung Chau MZ	C2	4.2	-	Yes	-	3.4	-	Yes	-
Tsing Yi Power Station SI	D1	7.2	-	Yes	-	6.5	-	Yes	-
Tung Wan GB	E1	7.4	-	Yes	-	7.3	-	Yes	-
Ting Kau GB	E2	7.5	-	Yes	-	7.5	-	Yes	-
Ting Kau GB	E3	7.6	-	Yes	-	7.5	-	Yes	-
EPD Monitoring Station	EM1	5.0	-	Yes	-	4.0	-	Yes	-
EPD Monitoring Station	WM2	6.6	-	Yes	-	5.9	-	Yes	-
EPD Monitoring Station	VM1	5.9	-	Yes	-	4.7	-	Yes	-
EPD Monitoring Station	VM2	6.3	-	Yes	-	4.9	-	Yes	-
EPD Monitoring Station	VM4	6.8	-	Yes	-	5.4	-	Yes	-

Indicator Point		Wet Season				Dry Season			
		Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)	Predicted SS (mg/L)	Increase in SS (%)	Compliance with WQO (< 30% increase)	Compliance with WSD's Criteria (<10mg/L)
EPD Monitoring Station	VM5	7.3	-	Yes	-	6.1	-	Yes	-
EPD Monitoring Station	VM6	7.4	-	Yes	-	6.3	-	Yes	-
EPD Monitoring Station	VM7	7.8	-	Yes	-	7.0	-	Yes	-
EPD Monitoring Station	VM13	7.8	-	Yes	-	7.4	-	Yes	-
EPD Monitoring Station	VM15	7.5	-	Yes	-	6.6	-	Yes	-

4.4.2.35 Contaminants would be released from the sediment particles to the water column when the sediments are disturbed. In order to estimate the release of contaminants from the dredging/filling activities, elutriate tests were included in the Site Investigation (SI) for sediment chemical quality and biogas assessment. Grab samples of the upper sediment layer were collected at the sampling points in the KTAC (AC1, AC4 and AC7), KTTC (KT1, KT2 and KT4) and Hoi Sham/Kowloon Bay (KB1, KB5 and KB7). **Drawing No. 22936/EN/021** shows the locations of the sampling points. **Tables 4.29** and **4.30** summarises the elutriate test results of heavy metals, metalloid and organic micro-pollutants at these sampling points.

Table 4.29 Elutriate Test Results for Heavy Metals and Metalloid

Location	Elutriate test								
	Cd (μg/L)	Cr (μg/L)	Cu (μg/L)	Hg (μg/L)	Ni (μg/L)	Pb (μg/L)	Zn (μg/L)	Ag (μg/L)	As (μg/L)
AC1	<0.2	<10	<2	0.029	20	1	50	<1	8
AC4	<0.2	<10	<2	<0.001	5	<1	<10	<1	4
AC7	0.4	<10	<2	0.003	3	<1	<10	<1	6
KB1	<0.2	<10	<2	0.017	26	5	190	<1	12
KB5	<0.2	<10	<2	0.033	3	<1	<10	<1	8
KB7	<0.2	<10	<2	0.025	2	<1	<10	<1	10
KT1	0.2	<10	<2	0.052	3	<1	20	<1	6
KT2	<0.2	<10	<2	0.042	7	<1	<10	<1	6
KT4	<0.2	<10	<2	0.021	3	<1	<10	<1	8

Table 4.30 Elutriate Test Results for Organic Micro-pollutants and Other Parameters

Location	Elutriate test								
	Total TBT (μg TBT/L)	Total PCBs (μg/L)	Low molecular wt. PAHs (μg/L)	High molecular wt. PAHs (μg/L)	TKN (mg/L)	NO_3–N (mg/L)	NO_2–N (mg/L)	NH_3–N (mg/L)	Total P (mg/L)
AC1	0.015	<1	<<12	<<20	135	<0.01	0.01	143	6.8
AC4	0.41	<1	<<12	<<20	78.2	0.12	3.23	75.7	2.8
AC7	0.02	<1	<<12	<<20	15.6	<0.01	0.01	16.9	1.2
KB1	0.037	<1	<<12	<<20	26.3	0.03	<0.01	24.9	1.4
KB5	<0.015	<1	<<12	<<20	12.7	<0.01	0.02	13.1	1.7
KB7	<0.015	<1	<<12	<<20	6.9	0.23	<0.01	7.15	1.0
KT1	5.60	<1	<<12	<<20	12.5	<0.01	0.01	13.9	1.2
KT2	1.96	<1	<<12	<<20	15.9	<0.01	0.01	18.1	4.1
KT4	0.083	<1	<<12	<<20	4.1	<0.01	<0.01	4.25	0.8

Note: Each of the low and high molecular weight PAH components was below the detect limit (2 - 4 μg/L). The values of low and high molecular weight PAHs presented in the table are conservative estimates.

4.4.2.36 There are no existing legislative guidelines for release of contaminants in marine water. Relevant assessment criteria for defining allowable concentrations of heavy metals, metalloid and organic micro-pollutants in the receiving water are included in **Table 4.31**. Comparisons of the average contaminant concentrations with the assessment criteria are shown in **Table 4.32**. The average concentrations of copper, cadmium, chromium, lead, nickel, zinc, silver, mercury and arsenic that would be potentially released from the KTAC and KTTS sediments were below the assessment criteria. Similar results were observed for the samples collected from Hoi Sham but the average zinc concentration exceeded the assessment criteria. The exceedance was due to the elevated concentration of zinc recorded at KB1 (190 μg/L).

4.4.2.37 Except the elevated zinc concentration at KB1, the comparisons shown in **Table 4.32** showed that release of heavy metals and metalloid into the receiving water would be in relatively low concentrations.

Table 4.31 Relevant Assessment Criteria for Release of Contaminants

Relevant Standards	Parameters
UK Water Quality for Coastal Surface Water Note 1	Copper (5 μg/L), Cadmium (2.5 μg/L), Chromium (15 μg/L), Lead (25 μg/L), Nickel (30 μg/L), Zinc (40 μg/L), Mercury (0.3 μg/L)
The European Union Water Quality Standards Note 2	Arsenic (25 μg/L)
USEPA Standards Note 3	Silver (2.3 μg/L), PCBs (0.00017 μg/L)
The European Community Standards	TBT (0.002 μg/L), PAHs (0.2 μg/L)

Notes:
1. *The Environmental Quality Standards and Assessment Levels for Coastal Surface Water* (from HMIP (1994) Environmental Economic and BPEO Assessment Principals for Integrated Pollution Control);
2. *Environmental Economic and BPCO Assessment Principles for Integrated Pollution Control. Environmental Quality Standards and Assessment Levels for Surface Water* (*from Northshore Lantau Development Feasibility Study EIA* by Scott Wilson (HK) Ltd in association with ERM Hong Kong); and
3. Source is from *Northshore Lantau Development Feasibility Study EIA* by Scott Wilson (HK) Ltd in association with ERM Hong Kong.

Table 4.32 Comparisons of Elutriate Test Results with Assessment Criteria

Contaminant	KTAC (Average Concentrations)	KTTS (Average Concentrations)	Hoi Sham/Kowloon Bay (Average Concentrations)	Assessment Criteria
Copper (μg/L)	< 2	< 2	< 2	5
Cadmium (μg/L)	< 0.26	< 0.2	< 0.2	2.5
Chromium (μg/L)	< 10	< 10	< 10	15
Lead (μg/L)	< 1	< 1	< 2.3	25
Nickel (μg/L)	9.3	4.3	10.3	30
Zinc (μg/L)	< 23	< 13.3	< 70	40
Mercury (μg/L)	< 0.011	0.038	0.025	0.3
Silver (μg/L)	< 1	< 1	< 1	2.3
Arsenic (μg/L)	6	< 6.7	10	25
TBT (μg/L)	< 0.148	2.55	<0.022	0.002
PAHs ((μg/L)	Low molecular wt. << 12 High molecular wt. << 20	Low molecular wt. << 12 High molecular wt. << 20	Low molecular wt. << 12 High molecular wt. << 20	0.2
PCBs (μg/L)	< 1	<1	<1	0.00017

4.4.2.38 The contaminants in dissolved phase would last a short period as these contaminants would be rapidly adsorbed onto mineral and organic particles in the water column. The particles would then re-deposit on the sea bottom. Dispersion of these contaminants farther away from the working area would only occur when there is a significant movement of water in the working area. It is unlikely that the desorbed contaminants including heavy metals and metalloid would cause adverse impacts to the nearby water body.

4.4.2.39 A conservative tracer was added in the three scenarios for sediment plume modelling. The dilution rates around the dredging sites for these scenarios are presented in **Table 4.33**. In general, the modelling results showed lower dilution rates during the dry season. The lowest dilution when carrying out dredging at Hoi Sham D4 Tunnel was predicted to be 44 at a distance of about 100m around the dredging point. Applying this dilution to estimate the concentrations of heavy metals that may release from the sediments during dredging indicated that all the heavy metal concentrations would be well below the assessment criteria at about 100m away from the dredging point. The most concerned zinc concentration in the Hoi Sham sediments would be reduced to less than 1.6 μg/L (< 40 μg/L, UK Water Quality for Coastal Surface Water). The higher dilution rates predicted for the other scenarios as shown in the table would result in lower contaminant concentrations at the same distance. It is anticipated that the heavy metal concentrations would reach the background levels at a short distance from the dredging point.

Table 4.33 Dilution Around the Dredging Sites

Scenario	Location	Approximate Distance from the Dredging Point (m)	Dilution	
			Dry Season	Wet Season
1	Western Arm of the new KTTS	200	450	700
	Earth Bund at Hoi Sham	200	120	350
2	Hoi Sham (Phase 1 Stage 2)	100	90	300
	Hoi Sham – D4 Tunnel	100	44	150
3	Hoi Sham (Phase 2)	100	130	390

4.4.2.40 The analytical results of PAHs and PCBs were all below the detection limits. The high detection limits for the two parameters were due to the difficulty in analysing the samples, which contained a range of other contaminants. Use of these detection limits to represent the release of PAHs and PCBs from the KTAC, KTTS and Hoi Sham sediments would be a conservative approach. To consider the dilution of the organic micro-pollutants by the ambient water, a dilution of about 160 would reduce PAHs to a level below the assessment criteria. With reference to the data presented in **Table 4.33**, this dilution rate can be achieved within a short distance from the dredging site. Release of PAHs into the water column is not likely to be a major concern.

4.4.2.41 The average TBT concentrations from the elutratie tests for the sediments collected in the KTAC, KTTS and Hoi Sham were <0.148 μg/L, 2.55 μg/L and <0.022 μg/L respectively. The only concern is the high TBT in the KTTS area. A dilution of higher than 1200 would be required to meet the assessment criteria. In other areas including the KTAC, Hoi Sham and the breakwaters for the new KTTS, TBT would be diluted to an acceptable level fairly quickly.

4.4.2.42 The high detection limit introduced difficulty in determining the concentrations of PCB in the dredging sites. It is recommended that the detection limit for PCB should be comparable to the assessment criteria (0.00017 μg/L) during the laboratory analysis for the water quality monitoring exercise in order to make the comparison possible. It is, however, worth noting that the predicted dilution rates around the dredging sites at the breakwater locations of the new KTTS and Hoi Sham were reasonably high. It is expected that the tidal current would enhance the dilution of PCBs to a lower level within a certain distance from the dredging sites. The potential impacts to the water further away from the dredging sites would not be significant. To ensure that the water quality is within acceptable levels during dredging, monitoring of the increases in PCB, TBT and PAH levels in the water near the dredging sites should be included as part the EM&A programme.

4.4.2.43 The concentrations of total Kjeldahl nitrogen (TKN), nitrate nitrogen (NO_3-N), nitrite nitrogen (NO_2-N), ammonia nitrogen (NH_3-N) and total phosphorus (TP) at all the stations were high. The highest TKN level was found at AC1. The elutriate test results showed that the TKN and TP levels decreased along the downstream distance of the KTAC. Based on the elutriate test results, average TIN concentrations that may release from the KTAC, KTTS and Hoi Sham sediments have been calculated as 80, 15.1 and 12.1 mg/L respectively. The background level of TIN in area near the SEKD is about 0.38 mg/L (average TIN recorded at VM2) which is close to the WQO for TIN of 0.4mg/L. The required dilution rates to meet the WQO for TIN would be approximately 200, 38 and 30. It has been proposed not to carry out dredging at KTAC and filling would be conducted behind a barrier to limit the release of sediment particles. Increases in TIN levels during the filling activities would remain in the KTAC area only and would not affect the water body outside the channel. From the dilution rates presented in **Table 4.33**, it is anticipated that the concentrations of TIN would meet the WQO within a short distance (< 100m) from the dredging points in KTTS and Hoi Sham areas.

4.4.2.44 Dredging for sediment disposal would be avoided by adopting sediment remediation techniques to deal with the contaminated sediments at KTAC, KTTS and Hoi Sham. *In-situ* and *ex-situ* sediment treatment methods have been proposed in **Section 5**. The preferred approach for *in-situ* treatment is to first carry out the reclamation and then to apply the treatment from a land-based operation. By adopting this approach, it is expected that release of chemicals and/or end-products into the water bodies would be avoided. In addition, the remediation techniques of injecting oxidizing agents such as Fenton's Reagent and Oxygen Release Compound into the sediments would generate hydrated product, which is harmless. With regard to the *ex-situ* treatment, the main treatment processes would be carried out on land. The potential release of treatment chemicals into the nearby water bodies would not be a major concern. The residual impacts for the application of *in-situ* and *ex-situ* treatment methods would be investigated during the site trials. It is anticipated that the application of *in-situ* and *ex-situ* treatment methods would not cause adverse impacts to the environment.

Construction Site Runoff

4.4.2.45 Water quality impacts would arise during site formation. The carrying out of site formation would create exposed topsoil. When a rainstorm occurs, site runoff would be generated washing away the soil particles from the exposed topsoil. The runoff usually contains high concentration of suspended solids.

4.4.2.46 During the KTAC and KTTS reclamation, release of the runoff into KTTS would cause water pollution deteriorating the water quality in the typhoon shelter. The levels of suspended solids and turbidity in the water of KTTS would increase. Transport of the polluted water out of the typhoon shelter would cause water pollution in the Kwun Tong area. This also causes visual nuisance and hazards to the aquatic life.

4.4.2.47 Release of the untreated runoff into storm drains, which discharge into Kowloon Bay, would pollute the water in the Kowloon Bay area. It is also possible that the runoff is released directly into Kowloon Bay from the construction site. Surface channels and settling facilities should be provided on site to control the release of site runoff.

4.4.2.48 The diverted KTN and Jordan Valley box culvert would be located in the close proximity to the KTAC. The water quality of these receivers would be significantly affected when receiving the runoff from the construction site. As the water carried by the nullah and box culvert would be discharged into Kowloon Bay, the water quality in Kowloon Bay and the nearby TKWTS would be inevitably affected. Implementation of mitigation measures to control site runoff would be required to minimise the potential water quality impacts.

4.4.2.49 Wind blown dust would be generated from exposed soil surfaces. Dispersion of dust would increase the levels of suspended solids in surface runoff and the dust would possibly fall directly onto the water surface of the nearby water bodies. The exposed soil surfaces should be properly protected to minimise dust emission.

Wastewater generated from Construction Activities

4.4.2.50 Wastewater would be generated from various types of construction activities. These include excavation and filling, foundation construction, building construction, construction of roads and associated facilities, and utility installation.

4.4.2.51 Excavation and filling activities generate stockpiles of excavated soils and filling materials. It is possible that site runoff would carry these materials to the diverted nullah and box culverts, KTTS and Kowloon Bay increasing the suspended solids and turbidity of these water bodies. Proper procedures should be implemented to handle and treat the excavated soils and fill materials on site.

4.4.2.52 Wastewater generated from foundation construction, which involves soil excavation and foundation cleaning, contains very high concentration of suspended solids. Collection and treatment facilities should be provided to properly deal with the wastewater.

4.4.2.53 Construction of buildings, access roads, and utility installation involves a large variety of activities. Water used for cleaning, polishing, wheel washing and dust suppression would contain high concentrations of suspended solids. Washing of concrete lorry on site generates wastewater with elevated pH values. Proper site arrangement and provision of wastewater collection and treatment facilities to minimise potential water pollution are required.

4.4.2.54 Accidental spillage of chemicals in the construction site is likely to cause soil contamination. This may also cause water pollution when the contaminants are washed away by the runoff and are discharged into KTTS and Kowloon Bay. Illegal disposal of chemicals into storm drains would result in serious damage to the aquatic environment. Good management practices should be implemented on site to control illegal disposal of chemicals.

4.4.2.55 Sewage would be generated due to the presence of workforce during the construction phase of the development. Discharges of sewage are subject to control and illegal discharge of untreated sewage would not be acceptable. Provision of temporary storage facilities or *in-situ* sewage treatment systems could prevent water pollution. Wastewater generated from kitchens, if any, should be collected and disposed of.

Ground Improvement

4.4.2.56 To minimise dredging in the development areas, it is likely that some areas would be undredged. The presence of soft sediments in the undredged areas may cause ground settlement. The ground condition should be improved in order to minimise the settlement in the reclaimed land and the potential damage to the building structures, tunnels, box culverts, breakwaters and sea walls. Ground improvement methods suitable for use in reclamation areas include:

- Pre-loading and installation of vertical drains;
- Soil Mixing;
- Vibroreplacement / vibrodisplacement; and
- Lime columns.

4.4.2.57 Use of vertical drains and surcharging has been recommended to consolidate the undredged areas. During primary consolidation of reclamation, dissipation of excess pore water pressure in the compressible soils would take place. Installation of vertical drains allows the vertical movement of pore water, which would be drained to the ground surface. The vertical drains could be sand drains or prefabricated vertical band drains. Use of surcharge accelerates the consolidation process.

4.4.2.58 In the event that the heavily polluted sediments in the proposed development areas are left in place, the fill material will cover the sediments. Contaminants in pore water would be released to the surface environment through the vertical drains. Release of contaminants into the nearby water body would cause water quality impacts.

4.4.2.59 Surface grab samples were collected at 9 sampling stations in the KTAC, KTTS and Hoi Sham to test for the contaminant levels of pore water. The laboratory results of pore water test are presented in **Tables 4.34** and **4.35**. The contamination in the sediment pore water was dominated by nickel, chromium, zinc and arsenic. Elevated chromium levels were detected at AC4 and KB7. The nickel concentration of 1110 μg/L (or 1.11 mg/L) at KB7 was found to be exceptionally high.

4.4.2.60 The nitrogen contents in the forms of total Kjeldahl nitrogen, nitrate, nitrite and ammonia were higher in the KTAC and Hoi Sham when compared to that in KTTS. The total phosphorus levels showed a similar pattern. Highest TKN and TP levels in pore water were found at AC1, AC4 and KB5. There were decreasing trends in TKN and TP levels along the downstream distance of the KTAC.

4.4.2.61 For the organic micro-pollutants, most of the PCB, PAH and TBT levels were found to be below the detection limits. In accordance with the specification in the TM, PCBs and PAHs are not allowed in effluents to be discharged into inland waters. Release of these organic micro-pollutants into the receiving water should be controlled.

4.4.2.62 The outlets of vertical drains should be installed above the surface of the reclaimed land and be higher than the seawater level. Pore water releasing from vertical drains would spread on the interim ground surface. There would be no direct discharge of pore water into the nearby water body. The fill material would absorb the contaminants. Based on the elutriate test results for organic micro-pollutants, the release of these contaminants from fill material is expected to be low. The continuous filling activities would cover the contaminants and avoid the spreading of these contaminants into the water body.

4.4.2.63 Release of pore water during the consolidation process should be controlled to minimise the potential impacts to the surrounding environment. It is expected that the releasing rate would be low and the consolidation process would take several months to a year. The released pore water may contain certain amount of contaminants and high concentrations of suspended solids. With suitable site arrangement and control facilities, the released pore water would retain within the reclaimed land. It is unlikely that release of excess pore water would cause significant water quality impacts.

4.4.2.64 In areas where dredging needs to be conducted, the contaminated sediments would be dredged away. The contaminant levels of the remaining soil would be low. Application of vertical drains to release pore water from the reclaimed land is not likely to cause significant environmental impacts. It is because the contaminant levels in pore water would be much lower.

4.4.2.65 Adoption of *in-situ/ex-situ* treatment may generate wastewater and sludge. Release of these by-products into the receiving water body would cause water pollution. The potential water quality impacts due to treatment of the contaminated sediments are dependent upon the types of treatment processes. The selection of environmentally acceptable treatment processes can minimise the potential water quality impacts. The treatment processes should be carried out with suitable process control. The final disposal of the by-products should be properly controlled to meet the required disposal criteria.

Table 4.34 Pore Water Test Results for Heavy Metals and Metalloid

Location	Pore Water Test Results								
	Cd (µg/L)	Cr (µg/L)	Cu (µg/L)	Hg (µg/L)	Ni (µg/L)	Pb (µg/L)	Zn (µg/L)	Ag (µg/L)	As (µg/L)
AC1	<0.2	3	5	0.160	16	<1	80	<1	50
AC4	<0.2	110	2	0.184	44	3	30	<1	20
AC7	<0.2	6	<1	0.123	28	<1	10	<1	10
KB1	<0.2	6	1	0.077	9	<1	10	<1	80
KB5	<0.2	6	<1	0.268	11	<1	<10	<1	40
KB7	<0.2	207	<1	0.113	1110	<1	60	<1	<10
KT1	0.4	22	<1	0.099	14	<1	30	<1	<10
KT2	<0.2	14	<1	0.058	36	<1	30	<1	<10
KT4	<0.2	2	<1	0.060	4	<1	10	<1	30

Table 4.35 Pore Water Test Results for Organic Micro-pollutants and Other Parameters

Location	Pore Water Test Results								
	Total TBT (ng TBT/L)	Total PCBs (µg/L)	Low molecular wt. PAHs (µg/L)	High molecular wt. PAHs (µg/L)	TKN (mg/L)	NO_3–N (mg/L)	NO_2–N (mg/L)	NH_3–N (mg/L)	Total P (mg/L)
AC1	<15	<1	<<12	<<20	570	33	0.06	586	29.8
AC4	<15	<1	<<12	<<20	310	0.1	<0.01	311	16
AC7	17	<1	<<12	<<20	55	0.24	<0.01	55	7.8
KB1	<15	<1	<<12	<<20	60	45	0.01	61	7.1

Location	Pore Water Test Results								
	Total TBT (ng TBT/L)	Total PCBs (mg/L)	Low molecular wt. PAHs (mg/L)	High molecular wt. PAHs (mg/L)	TKN (mg/L)	NO_3–N (mg/L)	NO_2–N (mg/L)	NH_3–N (mg/L)	Total P (mg/L)
KB5	<15	<1	<<12	<<20	202	0.77	0.02	198	16.7
KB7	<15	<1	<<12	<<20	14.1	128	<0.01	16.7	3
KT1	<15	<1	<<12	<<20	30.1	0.16	0.04	29.4	7.1
KT2	<15	<1	<<12	<<20	36.1	0.02	<0.01	37.6	6.6
KT4	<15	<1	<<12	<<20	16.1	2.86	<0.01	14.1	3.1

Note: Each of the low and high molecular weight PAH components was below the detection limit (2 - 4 µg/L). The values of low and high molecular weight PAHs presented in the table are conservative estimates.

4.4.2.66 Deep Cement Mixing (DCM) is an *in-situ* sea bottom soft ground improvement technology and is widely used in Japan. The application of this method could minimise the dredging volume of marine sediment. Use of DCM was proposed in the previous SEKD Study. As the applicability of DCM still needs to be proven in Hong Kong, site trials would be required in order to determine the appropriate acceptance criteria for using this method. After reviewing the site trial results, the areas for application of DCM could be evaluated. During the trials, monitoring could be carried out to assess the residual environmental impacts arising from the use of DCM.

Groundwater Discharge during Dewatering

4.4.2.67 The underground soils in the NAKTA area were contaminated due to leakage of the underground aviation fuel pipes. The previous EIA Study for Decontamination of NAKTA derived treatment target levels for groundwater to protect the human health. However, dewatering of the groundwater would be required during the excavation and construction of foundation and below ground structures. The groundwater may still contain relatively high levels of contaminants that may not be acceptable for direct discharge into the marine water in Victoria Harbour. To assess the contaminant levels of groundwater, relevant discharge standards have been used. The background levels of groundwater contaminants at the Kai Tak Airport North Apron and the corresponding guideline values adopted by the USEPA are summarised in **Table 4.36**.

Table 4.36 Groundwater Contaminants at the Kai Tak Apron and Standards used for Assessment

Standards	Benzene	Toluene	Tetrachloroethylene
Target Level (µg/L)[1]	17	25,000	110
Background level at the Kai Tak Apron (µg/L)	3.79-5.17	6.73	43
USEPA Guideline and Standard[2] –Subpart I (µg/L/d)	136	80	56
USEPA Guideline and Standard[2] –Subpart J (µg/L/d)	134	74	162
USEPA Guideline and Standard[2] – Subpart K (µg/L/d)	134	74	164
USEPA Water Quality Standards Regulation[3] (µg/L)	71	200,000	8.85

Notes:
1. The target levels were derived in the EIA Study for Decontamination of NAKTA based on an acceptable risk level of $1x10^6$ and an acceptable Hazard Quotient of 1.0;
2. The USEPA guidelines and standards are obtained from: USEPA Effluent Guidelines and Standards Part 414 (1995) Organic Chemicals, Plastics and Synthetic Fibres: Subpart I – Direct Discharge Point Source that uses End-of-Pipe Biological Treatment; Subpart J - Direct Discharge Point Source that do not use End-of-Pipe Biological Treatment; Subpart K – Indirect Discharge Point Sources;
3. No criteria for benzene, toluene and tetrachloroethylene in freshwater and saltwater are specified in the USEPA Water Quality Standards Regulation. The listed criteria are for human health (10^{-6} risk for carcinogens) for consumption of organisms.

4.4.2.68 The groundwater background levels of benzene, toluene and tetrachlororethylene found in the NAKTA area are well below the target levels derived for protection of human health. Comparing to the USEPA Effluent Guidelines and Standards for direct and indirect discharge point sources, the background levels of these contaminants are also many times lower than the standards indicating low contaminant levels of the groundwater.

4.4.2.69 There are no WQOs specific for benzene, toluene and tetrachloroethylene in Hong Kong. The USEPA Water Quality Standards Regulation for the three concerned contaminants has been included in the table for comparison. The regulation, however, has no criteria for these contaminants in freahwater and saltwater. The criteria for human health for consumption of organisms have been used. As can be seen in the table, the background concentrations of benzene and toluene are many times lower than the corresponding standards specified in the USEPA's regulation but the background concentration of tetrachloroethylene is about 5 times higher. A dilution of 5 times the initial discharge concentration could be easily achieved in the open water. This relatively low initial concentration of tetrachloroethylene is not expected to cause significant impacts to the receiving water body.

4.4.2.70 In the EIA Study for Decontamination of NAKTA, heavy metals including cadmium, chromium, copper, nickel, lead, zinc and mercury in groundwater were found to be present in 'A' level, which represents the normal background level adopted in the Dutch 'ABC' system. When compared to the relevant heavy metal concentrations specified in TM Standards for Effluents Discharged into the Inshore Waters of Victoria Harbour WCZ as shown in **Table 4.37**, the background concentrations of heavy metals in groundwater are much lower. In view of the low contaminant levels of groundwater, it is expected that groundwater discharge is not likely to cause adverse impacts to the Victoria Harbour water. Suitable settling facilities, i.e. sedimentation tanks, should however be provided to remove the SS in the extracted groundwater from the NAKTA.

Table 4.37 Heavy Metal Levels in Groundwater

Parameter	Dutch 'A' Level for Groundwater(mg/L)	TM Standards (Inshore Waters of Victoria Harbour WCZ), Flowrate <=10 m^3/day (mg/L)
Cadmium	0.001	0.1
Chromium	0.02	1
Copper	0.02	1
Nickel	0.02	1
Lead	0.02	1
Zinc	0.05	1
Mercury	0.0002	0.1

4.4.3 *Operational Phase Impact*

Sewage generated from the SEKD

4.4.3.1 A sewerage network will be built to collect the sewage generated from the SEKD. The collected sewage will be diverted to Kwun Tong Preliminary Treatment Works (KTPTW) and To Kwa Wan Preliminary Treatment Works (TKWPTW) for treatment. The impacts on the treatment capacity should be assessed during the sewerage design to ensure that KTPTW and TKWPTW have sufficient spare capacities to handle the sewage generated from the SEKD. The treatment facilities in these treatment plants would reduce the contaminant levels of the sewage to acceptable discharge standards. It is anticipated that the sewage generated from the SEKD would not cause adverse impacts to the environment.

Presence of the SEKD reclamation

4.4.3.2 The reclamation for the SEKD increases the total land area within Victoria Harbour. This may have influence on the flow condition in the harbour. The changes in flow condition due to the reclamation were assessed using the detailed model. Comparisons of the changes in hydrodynamic and water quality condition for different scenarios are presented as follows:

Scenario 1: Comparisons between 2016 with SEKD and 2002

4.4.3.3 The predicted flow patterns in Victoria Harbour for the dry and wet seasons in 2016 with SEKD are presented in **Drawing Nos. 22936/EN/168** and **169**. Comparing the flow patterns between year 2016 with SEKD and year 2002 in **Table 4.38**, there were no significant variations in current speeds at Central, Kowloon Bay, North Point and Lei Yue Mun for both the dry and wet seasons. The maximum speeds at Kowloon Bay near the SEKD were 0.18m/s for the dry season and 0.26m/s for the wet season.

4.4.3.4 The location of Kwun Tong station for year 2016 with SEKD is at the new KTTS. The enclosed water body at the new KTTS aims to provide a calm condition for sheltering vessels during typhoon season. The predicted average current speeds (0.02 – 0.04m/s) were much lower when compared to the 2002 scenario for both the dry and wet seasons (0.08m/s). The predicted hydrodynamic results for year 2016 with SEKD indicated that the presence of SEKD would not cause significant changes in tidal flow within the harbour.

Table 4.38 Changes in Average Current Speeds in Victoria Harbour (2002 vs 2016 with SEKD)

Station	Dry Season		Wet Season	
	2002	2016	2002	2016
Central	0.34 (0.01-0.79)	0.31 (0.009 – 0.68	0.27 (0.003-0.92)	0.33 (0.006-0.84)
Kowloon Bay	0.07 (0.001-0.17)	0.07 (0.006 – 0.18)	0.08 (0.004-0.28)	0.09 (0.0007-0.26)
North Point	0.33 (0.01-0.74)	0.30 (0.012 – 0.64)	0.29 (0.03-0.93)	0.32 (0.032-0.84)
Kwun Tong	0.08 (0.02-0.23)	0.020 (0.001 – 0.06)	0.08 (0.001-0.24)	0.04 (0.009-0.17)
Lei Yue Mun	0.43 (0.003-1.01)	0.38 (0.004 – 0.91)	0.39 (0.004-1.18)	0.43 (0.002-1.12)

Notes:
1. The station at Kwun Tong is at the new Kwun Tong Typhoon Shelter for year 2016 with SEKD; and
2. Values in bracket are the minimum and maximum levels.

4.4.3.5 The model predictions for the dry and wet season water quality for year 2016 with SEKD scenario are shown in **Tables 4.39** and **4.40** and the average results are summarised in **Table 4.41**. **Drawing Nos. 22936/EN/170** to **175, 197** and **198** present graphically the mean depth-averaged water quality results for the dry and wet seasons.

4.4.3.6 The TIN concentrations at all the indicator points were high with quite a number of the indicator points exceeded the WQO for TIN. The high TIN condition for the 2016 with SEKD scenario was similar to the condition for the base year in 2002. In general, the predicted results showed an increasing trend of TIN from the eastern waters to the western waters. Based on the model predictions, the overall water quality in Victoria Harbour for year 2016 was better than that for year 2002. It would be the results of flow and load reduction in the harbour for year 2016.

4.4.3.7 The flows of the diverted Kai Tak Nullah and box culverts will be ultimately discharged into the Kowloon Bay area. The water quality condition at Kowloon Bay (B4) would be affected by the diversion works. Increases in *E. coli* concentrations in the water were quite obvious. The enclosed water at the new marina also showed elevated *E. coli* concentrations.

4.4.3.8 The water quality in terms of SS concentrations at all the seawater intakes for year 2016 would be within WSD's requirement except for that at Cheung Sha Wan seawater intake for the wet season. The high SS concentrations at this intake would be related to the physical characteristics of the location and the outfall discharges in that area.

4.4.3.9 The annual average water quality results at the indicator points corresponding to EPD's monitoring stations were in compliance with WQOs.

Table 4.39 Predicted Water Quality for 2016 with SEKD Dry Season

Indicator Point		Depth-averaged DO (mg/L)	Depth-averaged DO 10%ile (mg/L)	Bottom DO (mg/L)	Bottom DO 10%ile (mg/L)	Depth-averaged TIN (mg/L)	Depth-averaged UIA (mg/L)	Depth-averaged SS (mg/L)	Depth-averaged E. coli (count/ 100mL)
Tsuen Wan SI	A1	6.5	6.3	6.4	6.3	0.28	0.009	7.6	6696
Tsing Yi SI	A2	6.4	6.2	6.3	6.2	0.26	0.008	7.2	1545
Kennedy Town SI	A3	6.4	6.3	6.4	6.3	0.19	0.007	5.6	289
Cheung Sha Wan SI	A4	5.4	5.1	5.3	4.8	0.39	0.016	6.5	15260
Yau Ma Tei SI	A5	6.1	6.1	6.1	6.0	0.23	0.008	5.3	869
Central Water Front SI	A6	6.2	6.1	6.2	6.1	0.22	0.008	5.3	1390
Tsim Sha Tsui SI	A7	6.2	6.1	6.1	6.1	0.22	0.008	5.1	2748
Wan Chai SI	A8	6.2	6.2	6.2	6.1	0.21	0.008	4.9	4130
Tsim Sha Tsui East SI	A9	6.2	6.1	6.1	6.1	0.22	0.008	4.9	2637
Tai Wan SI	A10	6.2	6.1	6.2	6.1	0.25	0.009	4.9	6206
North Point SI	A11	6.3	6.2	6.3	6.2	0.19	0.007	4.7	2188
Quarry Bay SI	A12	6.4	6.3	6.3	6.2	0.18	0.007	4.5	6082
Sai Wan Ho SI	A13	6.4	6.3	6.3	6.2	0.17	0.006	4.4	1533
Cha Kwo Ling SI	A14	6.3	6.3	6.3	6.2	0.16	0.006	4.4	378
Yau Tong SI	A15	6.4	6.3	6.4	6.3	0.14	0.005	4.2	265
Chai Wan SI	A16	6.6	6.5	6.5	6.4	0.13	0.005	4.0	7364
Ap Lei Chau SI	A17	6.5	6.5	6.5	6.5	0.12	0.005	4.7	27
Rambler Channel TS	B1	6.4	6.2	6.3	6.2	0.28	0.009	7.4	5081
Yau Ma Tei TS	B2	6.1	5.9	6.0	5.7	0.26	0.009	5.6	3673
Causeway Bay TS	B3	6.3	6.2	6.2	6.1	0.22	0.008	5.1	8790
To Kwa Wan TS	B4	6.1	6.0	6.1	6.0	0.28	0.011	5.1	6132
Aldrich Bay TS	B6	6.3	6.3	6.3	6.2	0.18	0.007	4.4	2540
Sam Ka Tsuen TS	B7	6.3	6.2	6.2	6.1	0.16	0.006	4.3	788
Chai Wan TS	B8	6.6	6.6	6.5	6.4	0.14	0.006	4.0	7986
Aberdeen TS	B9	6.5	6.5	6.5	6.4	0.14	0.006	4.7	2514
Ma Wan MZ	C1	6.8	6.6	6.7	6.5	0.28	0.008	8.2	53
Tung Lung Chau MZ	C2	6.6	6.5	6.4	6.3	0.08	0.003	3.8	7
Tsing Yi Power Station SI	D1	6.4	6.3	6.4	6.3	0.21	0.007	6.2	52
Tung Wan GB	E1	6.6	6.5	6.5	6.4	0.25	0.007	7.5	19
Ting Kau GB	E2	6.7	6.5	6.6	6.4	0.26	0.008	7.7	78
Ting Kau GB	E3	6.6	6.5	6.6	6.4	0.27	0.008	7.7	122
DCS intake		7.0	6.5	7.1	6.5	0.26	0.011	5.5	2001
Marina		6.1	5.9	6.1	5.9	0.30	0.012	5.2	13700
Inner KTTS		6.3	6.1	5.8	5.5	0.17	0.006	4.8	15
Outer KTTS		6.3	6.2	6.1	6.1	0.19	0.007	4.6	804
Inner RTS		6.2	6.1	5.9	5.8	0.19	0.007	4.7	509
Outer RTS		6.0	5.8	5.9	5.6	0.24	0.010	5.1	3385
EPD Monitoring Station	EM1	6.5	6.3	6.4	6.3	0.13	0.005	4.1	131
EPD Monitoring Station	WM2	6.5	6.5	6.5	6.4	0.18	0.006	6.0	7
EPD Monitoring Station	VM1	6.4	6.2	6.3	6.2	0.16	0.006	4.4	405
EPD Monitoring Station	VM2	6.3	6.2	6.3	6.2	0.17	0.006	4.5	732
EPD Monitoring Station	VM4	6.3	6.2	6.2	6.1	0.19	0.007	4.7	669
EPD Monitoring Station	VM5	6.2	6.2	6.2	6.1	0.21	0.007	5.0	764
EPD Monitoring Station	VM6	6.2	6.1	6.2	6.1	0.21	0.008	5.1	705
EPD Monitoring Station	VM7	6.2	6.1	6.2	6.1	0.22	0.008	5.3	563
EPD Monitoring Station	VM13	6.4	6.2	6.4	6.2	0.26	0.008	7.2	1648
EPD Monitoring Station	VM15	6.2	6.1	6.2	6.1	0.22	0.008	5.5	283

Notes:SI – Seawater Intake; TS – Typhoon Shelter; MZ – Mariculture Zone; and GB – Gazetted Beach.

Table 4.40 Predicted Water Quality for 2016 with SEKD Wet Season

Indicator Point		Depth-averaged DO (mg/L)	Depth-averaged DO 10%ile (mg/L)	Bottom DO (mg/L)	Bottom DO 10%ile (mg/L)	Depth-averaged TIN (mg/L)	Depth-averaged UIA (mg/L)	Depth-averaged SS (mg/L)	Depth-averaged E. coli (count/ 100mL)
Tsuen Wan SI	A1	4.6	4.3	4.5	4.2	0.54	0.006	8.3	6373
Tsing Yi SI	A2	4.6	4.4	4.6	4.4	0.51	0.006	8.0	836
Kennedy Town SI	A3	5.4	4.9	5.3	4.9	0.42	0.006	6.6	62
Cheung Sha Wan SI	A4	7.4	6.3	5.9	5.1	0.46	0.014	11.2	18780
Yau Ma Tei SI	A5	5.8	5.2	5.5	5.0	0.42	0.006	7.3	286
Central Water Front SI	A6	5.4	5.0	5.2	4.9	0.43	0.007	7.1	577
Tsim Sha Tsui SI	A7	5.6	5.2	5.4	5.1	0.43	0.007	7.2	2070
Wan Chai SI	A8	5.6	5.2	5.5	5.1	0.43	0.007	7.2	3783
Tsim Sha Tsui East SI	A9	5.5	5.2	5.4	5.1	0.43	0.008	7.0	2191
Tai Wan SI	A10	5.5	5.2	5.4	5.1	0.47	0.012	7.0	6861
North Point SI	A11	5.5	5.2	5.4	5.1	0.42	0.008	6.9	1283
Quarry Bay SI	A12	5.5	5.2	5.4	5.1	0.42	0.008	6.7	5428
Sai Wan Ho SI	A13	5.5	5.2	5.4	5.1	0.40	0.008	6.4	1073
Cha Kwo Ling SI	A14	5.7	5.4	5.5	5.2	0.40	0.007	6.5	476
Yau Tong SI	A15	5.4	5.2	5.3	5.2	0.37	0.008	5.8	154
Chai Wan SI	A16	5.5	5.3	5.3	5.1	0.38	0.008	6.0	3084
Ap Lei Chau SI	A17	5.7	5.5	5.6	5.5	0.35	0.007	5.4	17
Rambler Channel TS	B1	4.6	4.3	4.5	4.2	0.53	0.006	8.3	2529
Yau Ma Tei TS	B2	6.8	5.9	6.1	5.3	0.40	0.007	8.5	2470
Causeway Bay TS	B3	5.7	5.3	5.5	5.1	0.43	0.007	7.4	4026
To Kwa Wan TS	B4	5.5	5.1	5.4	5.1	0.55	0.016	7.6	9553
Aldrich Bay TS	B6	5.4	5.2	5.3	5.1	0.40	0.008	6.4	1291
Sam Ka Tsuen TS	B7	5.7	5.4	5.5	5.2	0.40	0.007	6.4	1047
Chai Wan TS	B8	5.5	5.3	5.3	5.0	0.39	0.009	6.2	4390
Aberdeen TS	B9	6.0	5.6	5.8	5.5	0.36	0.007	5.8	1836
Ma Wan MZ	C1	4.5	4.1	4.5	3.9	0.53	0.005	8.1	52
Tung Lung Chau MZ	C2	5.5	5.4	5.2	5.1	0.31	0.007	4.9	12
Tsing Yi Power Station SI	D1	5.1	4.8	5.1	4.8	0.44	0.007	7.1	28
Tung Wan GB	E1	4.9	4.6	4.7	4.4	0.47	0.005	7.6	15
Ting Kau GB	E2	4.6	4.2	4.6	4.2	0.51	0.005	7.7	43
Ting Kau GB	E3	4.6	4.3	4.5	4.2	0.52	0.005	7.9	63
DCS Intake		5.8	5.4	5.7	5.3	0.52	0.014	7.8	4236
Marina		5.4	5.2	5.3	5.1	0.52	0.015	7.4	15160
Inner KTTS		6.6	6.1	5.7	5.2	0.37	0.007	7.4	120
Outer KTTS		5.6	5.3	5.4	5.1	0.42	0.008	6.9	706
Inner RTS		6.1	5.7	5.7	5.2	0.40	0.008	7.1	701
Outer RTS		5.8	5.4	5.5	5.1	0.42	0.009	7.0	1797
EPD Monitoring Station	EM1	5.3	5.2	5.2	5.1	0.37	0.008	5.5	132
EPD Monitoring Station	WM2	5.3	4.8	5.3	5.0	0.42	0.006	6.8	5
EPD Monitoring Station	VM1	5.4	5.2	5.3	5.1	0.39	0.008	6.2	306
EPD Monitoring Station	VM2	5.5	5.2	5.4	5.2	0.41	0.008	6.5	530
EPD Monitoring Station	VM4	5.5	5.2	5.4	5.1	0.42	0.008	6.8	634
EPD Monitoring Station	VM5	5.5	5.1	5.4	5.0	0.43	0.007	7.0	521
EPD Monitoring Station	VM6	5.5	5.1	5.3	5.0	0.43	0.007	7.1	437
EPD Monitoring Station	VM7	5.4	5.0	5.2	4.9	0.43	0.007	7.1	331
EPD Monitoring Station	VM13	4.6	4.3	4.6	4.3	0.51	0.006	8.0	788
EPD Monitoring Station	VM15	5.5	5.1	5.3	4.9	0.44	0.006	7.2	110

Notes: SI – Seawater Intake; TS – Typhoon Shelter; MZ – Mariculture Zone; and GB – Gazetted Beach.

Table 4.41 Predicted Average Water Quality for 2016 with SEKD

Indicator Point		Depth-averaged DO (mg/L)	Depth-averaged DO 10%ile (mg/L)	Bottom DO (mg/L)	Bottom DO 10%ile (mg/L)	Depth-averaged TIN (mg/L)	Depth-averaged UIA (mg/L)	Depth-averaged SS (mg/L)	Depth-averaged E. coli (count/ 100mL)
Tsuen Wan SI	A1	5.5	5.3	5.5	5.2	0.41	0.007	8.0	6535
Tsing Yi SI	A2	5.5	5.3	5.5	5.3	0.39	0.007	7.6	1190
Kennedy Town SI	A3	5.9	5.6	5.8	5.6	0.30	0.006	6.1	175
Cheung Sha Wan SI	A4	6.4	5.7	5.6	4.9	0.42	0.015	8.9	17020
Yau Ma Tei SI	A5	5.9	5.6	5.8	5.5	0.33	0.007	6.3	578
Central Water Front SI	A6	5.8	5.6	5.7	5.5	0.32	0.007	6.2	983
Tsim Sha Tsui SI	A7	5.9	5.6	5.8	5.6	0.33	0.008	6.1	2409
Wan Chai SI	A8	5.9	5.7	5.9	5.6	0.32	0.007	6.0	3957
Tsim Sha Tsui East SI	A9	5.9	5.6	5.8	5.6	0.32	0.008	6.0	2414
Tai Wan SI	A10	5.8	5.6	5.8	5.6	0.36	0.011	5.9	6534
North Point SI	A11	5.9	5.7	5.8	5.6	0.31	0.007	5.8	1736
Quarry Bay SI	A12	5.9	5.7	5.8	5.7	0.30	0.008	5.6	5755
Sai Wan Ho SI	A13	5.9	5.7	5.8	5.7	0.29	0.007	5.4	1303
Cha Kwo Ling SI	A14	6.0	5.8	5.9	5.7	0.28	0.007	5.4	427
Yau Tong SI	A15	5.9	5.8	5.8	5.7	0.26	0.006	5.0	210
Chai Wan SI	A16	6.0	5.9	5.9	5.8	0.26	0.007	5.0	5224
Ap Lei Chau SI	A17	6.1	6.0	6.0	6.0	0.24	0.006	5.0	22
Rambler Channel TS	B1	5.5	5.3	5.4	5.2	0.40	0.007	7.9	3805
Yau Ma Tei TS	B2	6.4	5.9	6.0	5.5	0.33	0.008	7.1	3072
Causeway Bay TS	B3	6.0	5.8	5.9	5.6	0.33	0.008	6.2	6408
To Kwa Wan TS	B4	5.8	5.6	5.7	5.5	0.42	0.013	6.3	7843
Kwun Tong TS	B5								
Aldrich Bay TS	B6	5.9	5.7	5.8	5.6	0.29	0.007	5.4	1916
Sam Ka Tsuen TS	B7	6.0	5.8	5.8	5.6	0.28	0.007	5.4	917
Chai Wan TS	B8	6.1	5.9	5.9	5.7	0.27	0.007	5.1	6188
Aberdeen TS	B9	6.2	6.0	6.1	6.0	0.25	0.006	5.3	2175
Ma Wan MZ	C1	5.6	5.3	5.6	5.2	0.41	0.006	8.1	52
Tung Lung Chau MZ	C2	6.1	6.0	5.8	5.7	0.20	0.005	4.3	10
Tsing Yi Power Station SI	D1	5.8	5.6	5.8	5.6	0.33	0.007	6.6	40
Tung Wan GB	E1	5.7	5.5	5.6	5.4	0.36	0.006	7.5	17
Ting Kau GB	E2	5.6	5.4	5.6	5.3	0.39	0.006	7.7	61
Ting Kau GB	E3	5.6	5.4	5.6	5.3	0.40	0.006	7.8	92
DCS intake		6.4	5.9	6.4	5.9	0.39	0.013	6.6	3119
Marina		5.8	5.5	5.7	5.5	0.41	0.013	6.3	14430
Inner KTTS		6.5	6.1	5.8	5.3	0.27	0.006	6.1	67
Outer KTTS		6.0	5.8	5.8	5.6	0.31	0.008	5.8	755
Inner RTS		6.1	5.9	5.8	5.5	0.30	0.008	5.9	605
Outer RTS		5.9	5.6	5.7	5.4	0.33	0.010	6.1	2591
EPD Monitoring Station	EM1	5.9	5.8	5.8	5.7	0.25	0.006	4.8	131
EPD Monitoring Station	WM2	5.9	5.6	5.9	5.7	0.30	0.006	6.4	6
EPD Monitoring Station	VM1	5.9	5.7	5.8	5.7	0.28	0.007	5.3	355
EPD Monitoring Station	VM2	5.9	5.7	5.8	5.7	0.29	0.007	5.5	631
EPD Monitoring Station	VM4	5.9	5.7	5.8	5.6	0.31	0.008	5.7	651
EPD Monitoring Station	VM5	5.8	5.6	5.8	5.6	0.32	0.007	6.0	643
EPD Monitoring Station	VM6	5.8	5.6	5.8	5.5	0.32	0.007	6.1	571
EPD Monitoring Station	VM7	5.8	5.6	5.7	5.5	0.33	0.007	6.2	447
EPD Monitoring Station	VM13	5.5	5.3	5.5	5.3	0.39	0.007	7.6	1218
EPD Monitoring Station	VM15	5.8	5.6	5.7	5.5	0.33	0.007	6.3	196

Notes: SI – Seawater Intake; TS – Typhoon Shelter; MZ – Mariculture Zone; and GB – Gazetted Beach.

Scenario 2: Comparisons between 2016 without SEKD and 2002

4.4.3.10 **Table 4.42** shows the predicted average current speeds in Victoria Harbour for year 2016 without SEKD and year 2002. The predicted flow patterns for the no SEKD scenario are presented in **Drawing Nos. 22936/EN/176** and **177**. In general, there would be no significant variations in current speeds at the monitoring points between the two scenarios. The average current speeds at Kowloon Bay and Kwun Tong were rather consistent for both the dry and wet seasons with the order of approximately 0.08 m/s.

Table 4.42 Comparisons of Average Current Speeds in Victoria Harbour (2002 vs 2016 without SEKD)

Station	Dry Season		Wet Season	
	2002	2016	2002	2016
Central	0.34 (0.01-0.79)	0.31 (0.01-0.69)	0.27 (0.003-0.92)	0.34 (0.01-0.87)
Kowloon Bay	0.07 (0.001-0.17)	0.07 (0.004-0.15)	0.08 (0.004-0.28)	0.09 (0.005-0.26)
North Point	0.33 (0.01-0.74)	0.3 (0.01-0.65)	0.29 (0.03-0.93)	0.33 (0.03-0.86)
Kwun Tong	0.08 (0.002-0.23)	0.07 (0.001-0.21)	0.08 (0.001-0.24)	0.08 (0.001-0.27)
Lei Yue Mun	0.43 (0.003-1.01)	0.39 (0.003-0.91)	0.39 (0.004-1.18)	0.45 (0.002-1.16)

4.4.3.11 The predicted water quality results for the dry and wet seasons for 2016 without SEKD are presented in **Tables 4.43** and **4.44**. The annual average results are presented in **Table 4.45**. **Drawing Nos. 2293/EN/178** to **183**, **199** and **200** present graphically the predicted water quality results. Similar to the case for 2016 with SEKD, the overall water quality condition in the harbour would be improved as a result of reduction in flows and loads entering the harbour. There would be decreases in *E. coli* concentrations and increases in dissolved oxygen concentrations in the harbour.

Table 4.43 Predicted Water Quality for 2016 without SEKD Dry Season

Indicator Point		Depth-averaged DO (mg/L)	Depth-averaged DO 10%ile (mg/L)	Bottom DO (mg/L)	Bottom DO 10%ile (mg/L)	Depth-averaged TIN (mg/L)	Depth-averaged UIA (mg/L)	Depth-averaged SS (mg/L)	Depth-averaged E. coli (count/ 100mL)
Tsuen Wan SI	A1	6.5	6.3	6.4	6.3	0.27	0.008	7.5	4857
Tsing Yi SI	A2	6.4	6.2	6.4	6.2	0.26	0.008	7.2	2084
Kennedy Town SI	A3	6.4	6.4	6.4	6.3	0.18	0.006	5.6	245
Cheung Sha Wan SI	A4	4.8	4.3	4.8	4.2	0.52	0.022	7.3	23820
Yau Ma Tei SI	A5	6.2	6.1	6.1	6.0	0.20	0.007	5.2	1018
Central Water Front SI	A6	6.3	6.2	6.3	6.2	0.19	0.007	5.2	1894
Tsim Sha Tsui SI	A7	6.2	6.2	6.2	6.1	0.19	0.007	4.9	1910
Wan Chai SI	A8	6.3	6.3	6.3	6.2	0.19	0.007	4.8	6273
Tsim Sha Tsui East SI	A9	6.3	6.2	6.2	6.2	0.19	0.007	4.6	1552
Tai Wan SI	A10	6.3	6.2	6.3	6.2	0.18	0.007	4.4	579
North Point SI	A11	6.3	6.3	6.3	6.2	0.16	0.006	4.5	1911
Quarry Bay SI	A12	6.4	6.3	6.3	6.3	0.15	0.006	4.4	6638
Sai Wan Ho SI	A13	6.4	6.4	6.4	6.4	0.14	0.006	4.3	1467
Cha Kwo Ling SI	A14	6.3	6.3	6.3	6.2	0.16	0.007	4.3	570
Yau Tong SI	A15	6.4	6.9	6.4	6.8	0.12	0.005	4.1	186
Chai Wan SI	A16	6.7	6.6	6.6	6.5	0.11	0.004	3.8	5297
Ap Lei Chau SI	A17	6.5	6.5	6.5	6.4	0.12	0.005	4.8	27
Rambler Channel TS	B1	6.4	6.2	6.3	6.2	0.27	0.008	7.4	4510
Yau Ma Tei TS	B2	6.1	6.0	6.0	5.8	0.23	0.008	5.4	3380
Causeway Bay TS	B3	6.3	6.3	6.2	6.2	0.19	0.007	4.9	5987
To Kwa Wan TS	B4	6.2	6.1	6.1	5.9	0.19	0.007	4.5	356
Kwun Tong TS	B5	3.0	1.7	3.9	3.2	2.15	0.101	11.2	6077
Aldrich Bay TS	B6	6.4	6.4	6.3	6.3	0.15	0.006	4.2	2583
Sam Ka Tsuen TS	B7	6.3	6.3	6.2	6.1	0.14	0.006	4.2	460
Chai Wan TS	B8	6.5	6.4	5.9	5.8	0.16	0.007	4.6	6912
Aberdeen TS	B9	6.5	6.6	6.4	6.6	0.13	0.006	4.7	2271
Ma Wan MZ	C1	6.8	6.6	6.8	6.4	0.28	0.008	8.2	51
Tung Lung Chau MZ	C2	6.6	6.4	6.5	6.3	0.08	0.003	3.7	8
Tsing Yi Power Station SI	D1	6.4	6.5	6.4	6.4	0.20	0.007	6.2	51
Tung Wan GB	E1	6.6	6.5	6.5	6.4	0.25	0.007	7.5	22
Ting Kau GB	E2	6.7	6.5	6.6	6.4	0.26	0.008	7.7	73
Ting Kau GB	E3	6.6	6.5	6.6	6.4	0.26	0.008	7.7	110
EPD Monitoring Station	EM1	6.5	6.6	6.4	6.6	0.11	0.004	4.0	78
EPD Monitoring Station	WM2	6.5	6.5	6.5	6.4	0.18	0.006	6.1	7
EPD Monitoring Station	VM1	6.4	6.3	6.4	6.3	0.13	0.005	4.2	293
EPD Monitoring Station	VM2	6.4	6.2	6.3	6.2	0.16	0.006	4.3	226
EPD Monitoring Station	VM4	6.3	6.2	6.3	6.2	0.16	0.006	4.5	330
EPD Monitoring Station	VM5	6.3	6.2	6.3	6.2	0.18	0.007	4.8	599
EPD Monitoring Station	VM6	6.3	6.2	6.3	6.2	0.19	0.007	5.0	534
EPD Monitoring Station	VM7	6.3	6.2	6.2	6.2	0.19	0.007	5.2	391
EPD Monitoring Station	VM13	6.4	6.2	6.3	6.2	0.26	0.008	7.2	1797
EPD Monitoring Station	VM15	6.2	6.2	6.2	6.2	0.20	0.007	5.3	221

Notes: SI – Seawater Intake; TS – Typhoon Shelter; MZ – Mariculture Zone; and GB – Gazetted Beach.

Table 4.44 Predicted Water Quality for 2016 without SEKD Wet Season

Indicator Point		Depth-averaged DO (mg/L)	Depth-averaged DO 10%ile (mg/L)	Bottom DO (mg/L)	Bottom DO 10%ile (mg/L)	Depth-averaged TIN (mg/L)	Depth-averaged UIA (mg/L)	Depth-averaged SS (mg/L)	Depth-averaged E. coli (count/ 100mL)
Tsuen Wan SI	A1	4.6	4.3	4.5	4.2	0.54	0.006	8.2	4197
Tsing Yi SI	A2	4.6	4.3	4.6	4.3	0.51	0.006	8.0	1013
Kennedy Town SI	A3	5.4	4.9	5.3	4.9	0.42	0.006	6.6	48
Cheung Sha Wan SI	A4	7.3	6.3	5.7	4.9	0.50	0.019	12.4	41120
Yau Ma Tei SI	A5	5.7	5.2	5.4	5.0	0.42	0.006	7.3	300
Central Water Front SI	A6	5.4	5.0	5.3	4.9	0.42	0.007	7.1	695
Tsim Sha Tsui SI	A7	5.6	5.2	5.5	5.1	0.42	0.007	7.1	1133
Wan Chai SI	A8	5.6	5.2	5.5	5.1	0.42	0.007	7.2	4139
Tsim Sha Tsui East SI	A9	5.5	5.2	5.4	5.0	0.41	0.007	6.9	1213
Tai Wan SI	A10	5.5	5.2	5.4	5.1	0.41	0.008	6.8	597
North Point SI	A11	5.6	5.2	5.4	5.1	0.41	0.007	6.9	1131
Quarry Bay SI	A12	5.5	5.2	5.4	5.1	0.40	0.008	6.6	5015
Sai Wan Ho SI	A13	5.5	5.2	5.4	5.1	0.39	0.007	6.4	655
Cha Kwo Ling SI	A14	5.7	5.3	5.5	5.1	0.44	0.010	6.8	315
Yau Tong SI	A15	5.4	6.0	5.3	5.6	0.38	0.008	5.9	153
Chai Wan SI	A16	5.5	5.2	5.3	5.1	0.37	0.008	5.9	2063
Ap Lei Chau SI	A17	5.7	5.5	5.6	5.5	0.35	0.007	5.4	17
Rambler Channel TS	B1	4.6	4.3	4.4	4.2	0.53	0.006	8.3	2022
Yau Ma Tei TS	B2	6.8	5.9	6.0	5.3	0.39	0.007	8.5	2191
Causeway Bay TS	B3	5.8	5.3	5.6	5.1	0.42	0.006	7.4	3608
To Kwa Wan TS	B4	5.6	5.2	5.3	4.9	0.43	0.008	7.1	430
Kwun Tong TS	B5	2.8	2.4	2.4	1.4	2.42	0.162	16.4	2610
Aldrich Bay TS	B6	5.4	5.2	5.3	5.0	0.39	0.008	6.4	1116
Sam Ka Tsuen TS	B7	5.8	5.4	5.5	5.2	0.41	0.008	6.6	614
Chai Wan TS	B8	5.4	5.1	5.0	4.7	0.39	0.009	6.3	3851
Aberdeen TS	B9	6.0	4.2	5.8	4.0	0.36	0.007	5.8	1660
Ma Wan MZ	C1	4.5	5.4	4.4	5.2	0.55	0.004	8.2	46
Tung Lung Chau MZ	C2	5.5	4.8	5.3	4.8	0.32	0.007	5.2	18
Tsing Yi Power Station SI	D1	5.1	4.4	5.1	4.4	0.44	0.006	7.1	30
Tung Wan GB	E1	4.8	4.2	4.7	4.1	0.48	0.005	7.8	25
Ting Kau GB	E2	4.6	4.2	4.6	4.2	0.51	0.005	7.7	38
Ting Kau GB	E3	4.6	5.6	4.5	5.5	0.52	0.005	7.9	43
EPD Monitoring Station	EM1	5.4	4.7	5.2	4.7	0.36	0.008	5.5	104
EPD Monitoring Station	WM2	5.3	5.2	5.3	5.1	0.43	0.006	6.8	5
EPD Monitoring Station	VM1	5.4	5.2	5.3	5.1	0.39	0.007	6.2	268
EPD Monitoring Station	VM2	5.5	5.2	5.4	5.1	0.41	0.008	6.5	206
EPD Monitoring Station	VM4	5.5	5.2	5.4	5.1	0.41	0.007	6.7	307
EPD Monitoring Station	VM5	5.5	5.1	5.4	5.0	0.42	0.007	7.0	456
EPD Monitoring Station	VM6	5.5	5.1	5.3	5.0	0.42	0.007	7.1	365
EPD Monitoring Station	VM7	5.4	5.0	5.3	4.9	0.43	0.006	7.1	171
EPD Monitoring Station	VM13	4.6	4.3	4.6	4.4	0.51	0.006	8.0	884
EPD Monitoring Station	VM15	5.6	5.1	5.4	4.9	0.42	0.006	7.3	90

Notes: SI – Seawater Intake; TS – Typhoon Shelter; MZ – Mariculture Zone; and GB – Gazetted Beach.

Table 4.45 Predicted Average Water Quality for 2016 without SEKD

Indicator Point		Depth-averaged DO (mg/L)	Depth-averaged DO 10%ile (mg/L)	Bottom DO (mg/L)	Bottom DO 10%ile (mg/L)	Depth-averaged TIN (mg/L)	Depth-averaged UIA (mg/L)	Depth-averaged SS (mg/L)	Depth-averaged E. coli (count/ 100mL)
Tsuen Wan SI	A1	5.5	5.3	5.5	5.2	0.40	0.007	7.9	4527
Tsing Yi SI	A2	5.5	5.3	5.5	5.3	0.38	0.007	7.6	1549
Kennedy Town SI	A3	5.9	5.6	5.8	5.6	0.30	0.006	6.1	147
Cheung Sha Wan SI	A4	6.1	5.3	5.3	4.5	0.51	0.021	9.8	32470
Yau Ma Tei SI	A5	6.0	5.7	5.8	5.5	0.31	0.007	6.2	659
Central Water Front SI	A6	5.8	5.6	5.8	5.6	0.31	0.007	6.1	1295
Tsim Sha Tsui SI	A7	5.9	5.7	5.8	5.6	0.31	0.007	6.0	1522
Wan Chai SI	A8	5.9	5.7	5.9	5.6	0.31	0.007	6.0	5206
Tsim Sha Tsui East SI	A9	5.9	5.7	5.8	5.6	0.30	0.007	5.8	1383
Tai Wan SI	A10	5.9	5.7	5.8	5.6	0.30	0.008	5.6	588
North Point SI	A11	5.9	5.7	5.9	5.7	0.29	0.007	5.7	1521
Quarry Bay SI	A12	5.9	5.8	5.9	5.7	0.28	0.007	5.5	5827
Sai Wan Ho SI	A13	6.0	5.8	5.9	5.7	0.27	0.006	5.3	1061
Cha Kwo Ling SI	A14	6.0	5.8	5.9	5.7	0.30	0.008	5.6	443
Yau Tong SI	A15	5.9	6.4	5.9	6.2	0.25	0.006	5.0	170
Chai Wan SI	A16	6.1	5.9	5.9	5.8	0.24	0.006	4.8	3680
Ap Lei Chau SI	A17	6.1	6.0	6.0	6.0	0.24	0.006	5.1	22
Rambler Channel TS	B1	5.5	5.3	5.4	5.2	0.40	0.007	7.8	3266
Yau Ma Tei TS	B2	6.4	5.9	6.0	5.5	0.31	0.008	7.0	2786
Causeway Bay TS	B3	6.0	5.8	5.9	5.6	0.30	0.007	6.2	4798
To Kwa Wan TS	B4	5.9	5.7	5.7	5.4	0.31	0.008	5.8	393
Kwun Tong TS	B5	2.9	2.1	3.2	2.3	2.29	0.131	13.8	4344
Aldrich Bay TS	B6	5.9	4.4	5.8	3.8	0.27	0.007	5.3	1850
Sam Ka Tsuen TS	B7	6.1	5.7	5.9	5.6	0.27	0.007	5.4	537
Chai Wan TS	B8	6.0	5.9	5.5	5.5	0.27	0.008	5.5	5382
Aberdeen TS	B9	6.2	5.9	6.1	5.6	0.25	0.006	5.3	1966
Ma Wan MZ	C1	5.6	5.4	5.6	5.2	0.42	0.006	8.2	49
Tung Lung Chau MZ	C2	6.1	5.9	5.9	5.8	0.20	0.005	4.5	13
Tsing Yi Power Station SI	D1	5.8	5.7	5.7	5.6	0.32	0.007	6.6	40
Tung Wan GB	E1	5.7	5.4	5.6	5.4	0.37	0.006	7.7	23
Ting Kau GB	E2	5.6	5.3	5.6	5.3	0.39	0.006	7.7	55
Ting Kau GB	E3	5.6	5.3	5.6	5.3	0.39	0.006	7.8	76
EPD Monitoring Station	EM1	5.9	6.1	5.8	6.1	0.23	0.006	4.7	91
EPD Monitoring Station	WM2	5.9	5.6	5.9	5.6	0.30	0.006	6.5	6
EPD Monitoring Station	VM1	5.9	5.8	5.8	5.7	0.26	0.006	5.2	281
EPD Monitoring Station	VM2	5.9	5.7	5.8	5.7	0.28	0.007	5.4	216
EPD Monitoring Station	VM4	5.9	5.7	5.8	5.7	0.28	0.007	5.6	319
EPD Monitoring Station	VM5	5.9	5.7	5.8	5.7	0.30	0.007	5.9	528
EPD Monitoring Station	VM6	5.9	5.7	5.8	5.6	0.30	0.007	6.0	449
EPD Monitoring Station	VM7	5.8	5.7	5.8	5.6	0.31	0.007	6.1	281
EPD Monitoring Station	VM13	5.5	5.7	5.5	5.5	0.38	0.007	7.6	1340
EPD Monitoring Station	VM15	5.9	5.6	5.8	5.5	0.31	0.007	6.3	155

Notes: SI – Seawater Intake; TS – Typhoon Shelter; MZ – Mariculture Zone; and GB – Gazetted Beach.

Scenario 3: Comparisons between 2016 with SEKD and 2016 without SEKD

4.4.3.12 Comparisons of the momentary flows and accumulated flows through the Victoria Harbour channel for the dry and wet seasons are presented in **Drawing Nos. 22936/EN/184** and **185**. The differences in current speeds between 2016 with SEKD and 2016 without SEKD presented in **Table 4.46** were small except for the Kwun Tong station. The physical presence of the SEKD would cause changes in tidal flow in the vicinity of the development area. The tidal flow passing through the harbour would also be influenced by the reclamation.

4.4.3.13 As shown in the table, the predicted current speeds at Central, Kowloon Bay, North Point and Lei Yue Mun for the two scenarios were very much the same. The predicted current speeds for the wet season were comparatively higher than the results for the dry season. The differences in average current speeds were below 5%. The differences in current speeds for the two scenarios revealed that the SEKD would not have any adverse impacts to the tidal flow condition in the vicinity of the development as well as the tidal flow condition in the harbour. The slight increases in current speeds would be the result of reduction in cross-sectional area of the harbour.

4.4.3.14 The Kwun Tong station for 2016 with SEKD is located in the enclosed water at the new KTTS. The predicted current speeds were low (0.02 – 0.04m/s for the dry and wet seasons). The large differences in current speeds at this station represent the condition of the presence of breakwaters, which protect the inner part of the typhoon shelter. A reduction in current speeds would be up to 250%.

4.4.3.15 Comparisons of the discharges through the Victoria Harbour channel are presented in **Table 4.47**. The sections selected for calculating discharges are shown in **Drawing No. 22936/EN/299**. Average discharge through the channel would be reduced by about 0.4-1% for the dry season and about 2.4-2.6% for the wet season when the SEKD is in place. The reduction in discharge through the Victoria Harbour channel would be the result of the increase in flow resistance due to the presence of SEKD. However, these small differences in the discharge would not restrict the flow from entering the harbour. When compared to the previous scheme of the SEKD, the average reduction in discharge at Victoria Harbour East (Lei Yue Mun) is about 3 times smaller. The reduced reclamation area for the present scheme is more acceptable and is not likely to cause a significant reduction in flushing capacity in the harbour.

Table 4.46 Changes in Average Current Speed in Victoria Harbour (2016 with SEKD vs 2016 without SEKD)

Station	Dry Season			Wet Season		
	2016 with SEKD	2016 without SEKD	Differences (%)	2016 with SEKD	2016 without SEKD	Differences (%)
Central	0.31 (0.009 – 0.68	0.31 (0.01-0.69)	0.0%	0.33 (0.006-0.84)	0.34 (0.01-0.87)	3.0%
Kowloon Bay	0.07 (0.006 – 0.18)	0.07 (0.004-0.15)	0.0%	0.09 (0.0007-0.26)	0.09 (0.005-0.26)	0.0%
North Point	0.30 (0.012 – 0.64)	0.30 (0.01-0.65)	0.0%	0.32 (0.032-0.84)	0.33 (0.03-0.86)	3.1%
Kwun Tong	0.020 (0.001 – 0.06)	0.07 (0.001-0.21)	250%	0.04 (0.009-0.17)	0.08 (0.001-0.27)	100%
Lei Yue Mun	0.38 (0.004 – 0.91)	0.39 (0.003-0.91)	2.6%	0.43 (0.002-1.12)	0.45 (0.002-1.16)	4.7%

Note: The location of Kwun Tong station for 2016 with SEKD scenario is at the new KTTS.

Table 4.47 Residual Flows Through Victoria Harbour (2016 with SEKD vs 2016 without SEKD)

Season	Channel	Discharge (m^3/s) Year 2016 with SEKD	Discharge (m^3/s) Year 2016 without SEKD	Differences[Note 1] (%)
Dry	Victoria Harbour East	431.8	433.6	-0.4
	Victoria Harbour Central	427.6	431.8	-1.0
Wet	Victoria Harbour East	-951.1	-974.4	-2.4
	Victoria Harbour Central	-950.8	-976.5	-2.6

Note: "-" sign represents a decrease in discharge through the channel.

4.4.3.16 The predicted water quality results for the scenarios with and without SEKD are presented in **Tables 4.39** to **4.41** and **4.43** to **4.45**. The major differences in the two scenarios would be the degree of influence to the water quality sensitive receivers located near the proposed development area.

4.4.3.17 The nullah diversion works redistribute the pollutants from the Kwun Tong area to Kowloon Bay. At present, some of the pollutants would be settled in the KTAC and KTTS before the flow enters the harbour causing contamination in the KTAC and KTTS. Upon completion of the SEKD, the pollutant concentrations in the Kowloon Bay water would be increased affecting the water quality in this area. The predicted water quality results showed that the contaminant concentrations at indicator point B4 (Kowloon Bay) were relatively high. The TIN concentrations exceeded the WQO requirement for the wet season. The water in this area would contain relatively high concentrations of *E. coli*. The discharges from the diverted nullah and box culverts contribute to the changes in water quality in this area. Although the TIN concentrations for the wet season at indicator point B4 was found to exceed the WQO for the no SEKD scenario, all contaminant concentrations were comparatively lower than those for the 2016 with SEKD scenario. The *E. coli* concentrations in Kowloon Bay area were orders of magnitude lower when there is no nullah and box culvert diversion.

4.4.3.18 The new marina is located in Kowloon Bay and the predicted water quality in the new marina showed even higher *E. coli* concentrations and exceedances of the WQO for TIN for both the dry and wet seasons. As the new marina is located in the close proximity to a number of storm drain discharges, the water quality condition is expected to be relatively poor.

4.4.3.19 Exceedances of WSD’s requirements for seawater intake in terms of *E. coli* were predicted at Cheung Sha Wan seawater intake for the no SEKD scenario only. Except for the exceedance of SS level at this pumping station for the wet season, the water quality at all the seawater intakes would meet the WSD’s requirements for the 2016 with SEKD scenario.

4.4.3.20 There would be full compliance of WQO for UIA (< 0.021mg/L) for the 2016 with SEKD scenario. The UIA concentrations at the existing KTTS and Cheung Sha Wan seawater intake exceeded the WQO requirement for the no SEKD scenario.

4.4.3.21 With the SEKD in place, the predicted parameters at EPD’s marine water sampling stations were within the WQO requirements except for the TIN results. This would be related to the high background TIN levels in the Hong Kong waters. There were no significant differences in water quality condition between 2016 with SEKD and 2016 without SEKD at EPD’s marine water sampling stations.

Discharges from Storm Drains and Sewage Outfalls/Nullahs

4.4.3.22 Upon commencement of the KTAC reclamation, the discharge point of Kai Tak Nullah would be relocated to the northern part of the disused runway. There would be no discharge from Kai Tak Nullah into the KTAC. Effluent from the nullah would be diverted to Kowloon Bay. The water quality model prediction has indicated that the water quality in the new KTTS would be in acceptable conditions.

4.4.3.23 Discharge of effluent from the storm outfalls including the diverted Kai Tak Nullah into Kowloon Bay would cause localised deterioration in water quality near the outlets of the outfalls. The relatively fast moving tidal current in Kowloon Bay would be able to disperse the pollutants away from the outfall outlets.

Water Quality in the Extended Sections of Diverted Nullahs

4.4.3.24 The SEKD would have a direct impact on the Kai Tak Nullah and Tsui Ping Nullah. It is planned to relocate the existing outlet point of Kai Tak Nullah from the KTAC to Kowloon Bay. An extended section of the nullah would be constructed as a box culvert, which would be extended to the southern part of the old Kai Tak Airport. The water quality in the extended section is likely to be influenced by the tidal water. During flood tides, seawater intrusion would occur and may affect the water quality inside the extended section of the nullah.

4.4.3.25 To assess the dissolved oxygen content in the nullahs, a level, which can provide adequate dissolved oxygen to prevent the anaerobic condition and hypoxia to occur, has been selected. A reasonably high DO level minimises the generation of hydrogen sulphide gas under anaerobic condition and influence to the living organisms in the nullahs. A DO concentration of 1 to 2 mg/L is in general maintained to ensure aerobic condition in aerobic wastewater treatment systems. The value of 2 mg/L was adopted in the previous SEKD Study to assess the water quality condition in the Kai Tak and Tsui Pang nullahs. In considering the ecological effects, Harper et al. (1991)[10] reported that the critical oxygen concentration causing mass mortality of benthic systems was about 2mg/L. The dissolved oxygen level of 2 mg/L has been adopted to set as the standard for assessing the dissolved oxygen concentration in the nullahs. The value of 2 mg/L is considered as the absolute minimum and is not on a percentile basis.

4.4.3.26 Water quality condition in the extended sections of the two nullahs has been predicted using the water quality model. A large portion of flow in Kai Tak Nullah would be from the THEES. The flows and loads from the THEES directly affect the water quality in Kai Tak Nullah. In order to assess the changes in water quality condition in the nullah, the following three scenarios have been considered:

Scenario 1 : 95%ile THEES loading throughout the simulation period

Scenario 2 : 95%ile THEES loading for the first day, maximum THEES loading for the following two days and 95%ile THEES loading for the rest of the simulation period

Scenario 3 : No THEES flow and load.

4.4.3.27 **Tables 4.48** and **4.49** summarise the predicted water quality results in the extended sections of Kai Tak Nullah for the three scenarios.

4.4.3.28 For Scenario 1, the depth-averaged dissolved oxygen levels in the extended section of Kai Tak Nullah at SEKD were 4.3 mg/L and 3.6mg/L respectively for the dry and wet seasons. In the section near EPD's monitoring station KN1, the dissolved oxygen levels were 4.0 mg/L for the dry season and 3.1 mg/L for the wet season. These results were well above the assessment standard of 2 mg/L. The dissolved oxygen concentrations in the extended section of Kai Tak Nullah would be in reasonable levels. It is unlikely that anaerobic condition would occur leading to deterioration of water quality in the channel section.

4.4.3.29 The predicted BOD concentrations ranged from 7.1 mg/L to 10.0 mg/L. With reference to the TM standard for BOD as shown in **Table 4.2**, the BOD concentrations were below the limit of 20 mg/L. The SS concentrations (13.8 – 17.9 mg/L) were also below the reference limit of 30 mg/L. Ammoina nitrogen concentrations (>1.3 mg/L) and *E. coli* concentrations (>140,000 count/100mL) would be high in the water. The time series plots of these parameters for Scenario 1 are presented in **Drawing Nos. 22936/EN/305** to **309**. The predicted water quality condition in the extended section of Kai Tak Nullah was comparable to the condition in 1998. It is anticipated that there would be no deterioration of water quality in the channel section.

4.4.3.30 **Drawing Nos. 22936/EN/207** to **211** show the time series plots of these parameters for Scenario 2. It is clearly shown in the drawings that a slight decrease in dissolved oxygen levels appeared in days 2 and 3 when maximum THEES loading was imposed. The levels of suspended solids, ammonia nitrogen, *E. coli* and BOD increased in these two days and dropped to lower levels in the remaining simulation period. The predicted water quality results for Scenario 2 did not show significant differences when compared to the results for Scenario 1 although maximum THEES loading was used in the simulation for two days. There

[10] Harper, D. E., McKinney, L. D., Nance, J. M. and Salzer, R. B. (1991). Recovery responses of two benthic assemblages following and acute hyopxic event on the Texas continental shelf, northwestern Gulf of Mexico. In modern and ancient continental shelf anoxia,. R. V. Tyson & T. H. Pearson (eds.), 49-64. London: Geological Society [Special Publication 58].

was almost no effect on dissolved oxygen over a simulation period of 15 days. Slight increases in BOD, suspended solids, ammonia nitrogen and *E. coli* were found.

4.4.3.31 Scenario 3 represents the situation where maintenance work of the export tunnel is being carried out. No flow from the two sewage treatment works is exported to Kai Tak Nullah. The remaining loading to the Kai Tak Nullah is the dry weather flow. Time series plots of these parameters for Scenario 3 are presented in **Drawing Nos. 22936/EN/300** to **304**. The water in the nullah would experience slight increases in dissolved oxygen and decreases in suspended solids, ammonia nitrogen, *E. coli* and BOD. The predicted results indicated that the reduction in pollution loads would improve the water quality condition in the nullah.

4.4.3.32 The extended section of Kai Tak Nullah would be constructed as a large box culvert. Decking of the box culvert may limit the ingress of fresh air into the inner section of the culvert. The invert level of the box culvert outlet is –1.5mPD and the highest point is 2.9mPD. Comparing to the predicted tidal ranges at Quarry Bay tidal station for year 2001, which is located nearest to the SEKD, the predicted heights of high tides are all below the level of 2.9mPD. In addition, the 1 in 1 year tide (2.5mPD) is below the ceiling level of 2.9mPD at the box culvert outlet. This indicates that the proposed box culvert would not be fully submerged by the seawater in most of the times. There would be a free surface above the flows inside the box culvert. Ingress of air would be through the openings of the box culvert. It is unlikely that decking of the box culvert in this case would restrict the supply of fresh air and cause a significant reduction in air exchange between the flow and the atmosphere in the box culvert.

4.4.3.33 In order to examine the water quality in terms of dissolved oxygen in the box culvert, additional model runs for the Kai Tak Nullah were conducted to simulate the conditions of decking the box culvert. Three different re-aeration rates were included to cover the normal re-aeration situation, the situation with half of the exchange rate, and the situation with no exchange inside the box culvert. **Drawing No. 22936/EN/289** shows the depth-averaged DO levels for the three cases. In general, the DO for each case was quite stable throughout the modelling period. Lower DO levels were observed for the cases with half of the exchange rate and no exchange between the flowing water and the atmosphere. The lowest DO (3.25 mg/L) recorded for the no air exchange situation was well above 2 mg/L. The tidal flow with a higher DO content would enter the box culvert during the flood tide. Therefore, a reasonable DO level could be maintained in the water of the box culvert. The results showed that decking of the box culvert would not cause a significant decrease in DO in the flowing water and would not generate unacceptable conditions in the box culvert.

4.4.3.34 Exchange of flows inside the box culvert will occur during the flood and ebb tides. The seawater with less pollutants and higher dissolved oxygen contents move inside the box culvert during the flood tides. After mixing with the flows from the Kai Tak Nullah, the pollutants in the flows inside the box culvert would be diluted. The tidal effects enhance flushing of the discharge flows from the box culvert into the open water during the ebb tides. The presence of seawater in the lower reach of the extended section of the Kai Tak Nullah would limit the growth of biofilm on the submerged surface of the culvert. This minimises the potential odour problem that may be generated due to decay of organic substances adhered on the biofilm.

4.4.3.35 The decked section of the box culvert prevents the sunlight from penetrating into the inner part of the box culvert. This in turn limits the possibility of algal growth inside the box culvert. Deterioration of water quality as a result of algal growth is unlikely. However, the decay rate of *E. coli* is dependent on sunlight intensity. Lack of sunlight inside the box culvert would not contribute to a reduction in *E. coli* levels.

4.4.3.36 Deposition of debris and silt would reduce the flow velocity in the culvert resulting in accumulation of deposits. Hydrogen sulphide would be generated from the deposits of debris and silt. Hydrogen sulphide is toxic and will pose a risk to human. Accumulation of hydrogen sulphide would also cause corrosion of concrete and steelwork. Regular cleaning and desilting of the culvert should be undertaken to maintain the hydraulic capacity in the culvert. This in turn minimises the potential hazard of hydrogen sulphide emission.

4.4.3.37 As part of the development programme, a breakwater will be constructed in front of the outlet of Tsui Ping Nullah. Discharges from the nullah will be guided by the breakwater and run parallel to the shoreline in a short section before reaching the open water. The flushing rate in the restricted waterway, which is bounded by the breakwater and the shoreline, is expected to be low. However, the SEKD project would not cause any physical change in the existing nullah and no expansion of the nullah section would be required. The newly built breakwater will guide the discharges from the nullah to the open water. The key concern is the water quality in the restricted waterway between the breakwater and the shoreline.

4.4.3.38 The discharges from the Tsui Ping Nullah would mix with the ambient seawater in the extended section. Dilution of pollutants would lead to a better water quality condition in the channel section. As presented in **Table 4.50**, the water quality condition in the extended section of Tsui Ping Nullah would be acceptable. The dissolved oxygen levels were reasonably high and the concentrations of other contaminants (BOD, SS, ammonia nitrogen and *E. coli*) were in relatively low levels. **Drawing Nos. 22936/EN/310** to **313** presents time series plots for DO, NH_4, *E. coli*, SS and BOD in the extended section of Tsui Ping Nullah during the dry and wet seasons. Time series plots for the new KTTS, which is semi-enclosed by the breakwaters, are also shown in the same drawings. The predicted depth-averaged DO inside the new KTTS was in a reasonable range and the pollutant levels in terms of NH_4, SS, *E. coli* and BOD were relatively low. The extension of Tsui Ping Nullah is not likely to cause unacceptable water quality impacts to the nullah and the nearby water body.

4.4.3.39 In the event that the water quality in Tsui Ping Nullah is affected by the presence of breakwater causing serious sediment deposition and water quality deterioration in the nullah section, a control mechanism may be required to prevent the tidal flow from entering the nullah during the flood tides.

Table 4.48 Water Quality in the Extended Section of Kai Tak Nullah (2016 with SEKD) – Dry Season

Parameter	Dry Season					
	Section at SEKD			Section near KN1		
	95%ile THEES[1]	Max + 95%ile THESS[2]	No THEES[3]	95%ile THEES	Max + 90%ile THESS	No THEES
Dissolved Oxygen (mg/L)	4.3	4.3	4.8	4.0	4.0	4.6
Suspended Solids (mg/L)	13.8	14.8	7.5	15.0	16.1	8.0
Biochemical Oxygen Demand (mg/L)	7.1	7.6	3.3	7.7	8.4	3.6
Ammonia Nitrogen (mg/L)	1.38	1.53	0.37	1.47	1.63	0.39
E. coli (count/100mL)	171300	172800	15070	186700	188100	16330

Notes:
1. 95%ile THEES loading throughout the simulation period;
2. 95%ile THEES loading for the first day, maximum THEES loading for the following two days and 95%ile THEES loading for the rest of the simulation period; and
3. No THEES flow and load.

Table 4.49 Water Quality in the Extended Section of Kai Tak Nullah (2016 with SEKD) – Wet Season

Parameter	Wet Season					
	Section at SEKD			Section near KN1		
	95%ile THEES[1]	Max + 95%ile THESS[2]	No THEES[3]	95%ile THEES	Max + 95%ile THESS	No THEES
Dissolved Oxygen (mg/L)	3.6	3.6	4.0	3.1	3.0	3.6
Suspended Solids (mg/L)	15.8	16.5	9.0	17.9	18.8	9.5
Biochemical Oxygen Demand (mg/L)	8.2	8.6	3.92	10.0	10.5	4.63
Ammonia Nitrogen (mg/L)	1.39	1.50	0.32	1.74	1.87	0.39
E. coli (count/100mL)	146700	149100	11690	207000	210100	16420

Notes:
4. 95%ile THEES loading throughout the simulation period;

5. 95%ile THEES loading for the first day, maximum THEES loading for the following two days and 95%ile THEES loading for the rest of the simulation period; and
6. No THEES flow and load.

Table 4.50 Water Quality in the Extended Section of Tsui Ping Nullah (2016 with SEKD)

Parameter	Dry Season		Wet Season	
	Near RTS Berthing Area	Near Outlet	Near RTS Berthing Area	Near Outlet
Dissolved Oxygen (mg/L)	6.2	6.0	6.1	5.8
Suspended Solids (mg/L)	4.7	5.1	7.1	7.0
Biochemical Oxygen Demand (mg/L)	0.52	1.0	1.41	1.46
Ammonia Nitrogen(mg/l)	0.12	0.17	0.081	0.09
E. coli (count/100mL)	509	3385	701	1797

Cooling Water Discharges

4.4.3.40 Discharges from the district cooling water systems are characterised by elevated water temperature. The biocide and chlorine concentrations are also of concern. A high concentration of biocide and chlorine in the discharges would reduce the dissolved oxygen level and endanger the aquatic life in the vicinity of the discharge points. The dispersion of thermal plume and the regions that would be affected by the discharges were assessed using the water quality model. As the cooling water discharge point was submerged at a level near the water surface, the discharges were therefore allocated at the surface layer in the model.

4.4.3.41 **Tables 4.51** and **4.52** show variations in temperatures at selected indicator points for both the dry and wet seasons. The predicted time-averaged temperature results at surface and bottom layers for the dry and wet seasons are shown in **Drawing Nos. 22936/EN/201, 204, 217** and **220**. Time series plots for temperature at Tai Wan and Cha Kwo Ling seawater intakes, and two EPD's water sampling stations (VM2 and VM4) during the dry and wet seasons are presented in **Drawing Nos. 22936/EN/314** and **315**.

4.4.3.42 The seawater intake point of the preferred scheme of DCS would locate approximately 300m away from the discharge point. The temperature increases at the intake point were predicted to be 2.9 ^{o}C for the dry season and 3.1 ^{o}C for the wet season. The results indicated that the water temperatures in the close vicinity of the discharge point would be elevated to levels exceeding the WQO (increase in temperature should be less than 2 ^{o}C above the ambient water temperature). To minimise the short-circuiting of the discharged cooling water, a longer distance between the seawater intake point and the cooling water discharge point needs to be considered. However, it is worth noting that the smallest model grid size of approximately 75m in the SEKD area is not able to provide the details of the flow dynamics in the near-field. The flow property in a grid cell is an average quantity over the area represented by that grid cell. In other words, the detailed model could not indicate the exact flow path of the thermal plume, hence the detailed information on flow attachment to the shoreline and thickness of thermal plume in the water column. It is therefore recommended that a near-field model such as CORMIX (USEPA model) or JETLAG (by Lee and Cheung, 1990) should be used to provide details of the flow dynamics of the thermal plume at the detailed design stage of the development. The near-field model results can be used to determine:

The size of the mixing zone;

The high velocity region that may cause impact to ship navigation and cause local scouring; and

The most suitable distance to separate the cooling water intake point and discharge point.

4.4.3.43 Except for the WQO exceedance at the seawater intake point, the increases in temperature at the selected indicator points were well below 2 ^{o}C. The water temperatures at the nearest sensitive receivers including the new marina, Tai Wan and Cha Kwo Ling seawater intakes and the new KTTS were slightly increased but the increases were less than 1 ^{o}C. Due to the close proximity of EPD's water sampling station VM2, there were some fluctuations of temperature at this indicator point. However, the fluctuations were in general lower than 0.6^{o}C for both the dry and wet seasons. The patterns of thermal plumes showed that elevations in water temperatures would be localised and mainly occurred in the region near the cooling water discharge point. It is expected that the dispersion of thermal plume would not cause adverse impact to the nearby sensitive receivers.

4.4.3.44 **Tables 4.53** and **4.54** summarise the predicted residual chlorine and biocide concentrations at the selected indicator points. The predicted chlorine and biocide concentrations at the surface and bottom layers for the dry and wet seasons are shown in **Drawing Nos. 22936/EN/202, 203, 205, 206, 218, 219, 221** and **222**. Time series plots for residual chlorine and biocide at Tai Wan and Cho Kwo Ling seawater intakes and the two EPD's water sampling points (VM2 and VM4) during the dry and wet seasons are presented in **Drawing Nos. 22936/EN/314** and **315**.

4.4.3.45 All the predicted results were below the corresponding assessment criteria except the high residual chlorine level (0.031 mg/L) at the seawater intake for the district cooling system. The indicator points located near the cooling discharge point would have higher residual chlorine concentrations. These include the locations at Tai Wan, North Point, Cha Kwo Ling seawater intakes, the new KTTS and marina. Periodic high peaks of residual chlorine (>0.01mg/L) were recorded at VM2 during the dry season. The time-averaged residual chlorine results at VM2 were 0.0056 mg/L for the dry seasons and 0.0017 mg/L for the wet season. These results were below the limiting concentration of 0.01 mg/L. Fluctuations of residual chlorine at this water sampling point were less significant during the wet season.

4.4.3.46 Low biocide concentrations were predicted at all the indicator points. The results would be related to the intermittent discharge condition of biocide (1 hour every week). There were isolated peaks of biocide in the time series plots. The peaks occurred during the release of biocide. The highest peak recorded at VM2 was about 0.01 mg/L, which is much lower than the limiting concentration of 0.1 mg/L. No consistent high levels of biocide were observed at the nearest indicator points throughout the simulation period. All the predicted results were well below the assessment standard (< 0.1mg/L). The predicted results showed that the proposed biocide concentration and frequency of application would not cause significant impacts to the aquatic life.

Table 4.51 Changes in Temperatures due to Cooling Water Discharges – Dry Season (2016)

Indicator point	Temperature (^{o}C)			
	Background	With Cooling Water Discharge	*Differences*	Compliance with WQO (< 2 ^{o}C)
Central Water Front SI (A6)	20.3	20.5	0.2	Yes
Tai Wan SI (A10)	20.3	21.0	0.7	Yes
North Point SI (A11)	20.6	20.8	0.2	Yes
Quarry Bay SI (A12)	20.7	20.9	0.2	Yes
Sai Wan Ho SI (A13)	20.8	21.0	0.2	Yes
Cha Kwo Ling SI (A14)	20.9	21.1	0.2	Yes
Tsing Yi Power Station SI (D1)	19.9	19.9	0	Yes
Tung Lung Chau MZ (C2)	21.4	21.4	0	Yes
Tung Wan GB (E1)	19.0	19.0	0	Yes
New KTTS	20.3	21.0	0.7	Yes
Marina	20.1	20.9	0.8	Yes
Seawater Intake Point of DCS	21.7	24.6	2.9	**No**

Notes: SI – Seawater Intake; GB – Gazetted Beach; and MZ – Mariculture Zone.

Table 4.52 Changes in Temperatures due to Cooling Water Discharges – Wet Season (2016)

Indicator point	Temperature(°C)			
	Background	With Cooling Water Discharge	*Differences*	Compliance with WQO (< 2 °C)
Central Water Front SI (A6)	26.8	26.8	0	Yes
Tai Wan SI (A10)	26.6	26.8	0.2	Yes
North Point SI (A11)	26.8	26.9	0.1	Yes
Quarry Bay SI (A12)	26.8	26.9	0.1	Yes
Sai Wan Ho SI (A13)	26.8	26.8	0	Yes
Cha Kwo Ling SI (A14)	26.8	26.9	0.1	Yes
Tsing Yi Power Station SI (D1)	26.7	26.8	0.1	Yes
Tung Lung Chau MZ (C2)	26.7	26.8	0.1	Yes
Tung Wan GB (E1)	26.8	26.8	0	Yes
New KTTS	26.9	27.0	0.1	Yes
Marina	26.3	26.7	0.4	Yes
Seawater Intake Point of DCS	26.5	29.6	3.1	**No**

Notes: SI – Seawater Intake; GB – Gazetted Beach; and MZ – Mariculture Zone.

Table 4.53 Predicted Residual Chlorine and Biocide Concentrations – Dry Season (2016)

Indicator point	Residual Chlorine (mg/L)		Biocide(mg/L)	
	Predicted Concentration	Below Criteria (< 0.01 mg/L)	Predicted Concentration	Below Criteria (< 0.1 mg/L)
Central Water Front SI (A6)	0.003	Yes	0.0001	Yes
Tai Wan SI (A10)	0.005	Yes	0.0001	Yes
North Point SI (A11)	0.004	Yes	0.0001	Yes
Quarry Bay SI (A12)	0.003	Yes	0.0001	Yes
Sai Wan Ho SI (A13)	0.003	Yes	0.0001	Yes
Cha Kwo Ling SI (A14)	0.004	Yes	0.0001	Yes
Tsing Yi Power Station SI (D1)	0.001	Yes	< 0.0001	Yes
Tung Lung Chau MZ (C2)	0.001	Yes	< 0.0001	Yes
Tung Wan GB (E1)	< 0.001	Yes	< 0.0001	Yes
New KTTS	0.006	Yes	0.0002	Yes
Marina	0.006	Yes	0.0001	Yes
Seawater Intake Point of DCS	0.008	Yes	0.0002	Yes

Notes: SI – Seawater Intake; GB – Gazetted Beach; and MZ – Mariculture Zone.

Table 4.54 Predicted Residual Chlorine and Biocide Concentrations – Wet Season (2016)

Indicator point	Residual Chlorine (mg/L)		Biocide(mg/L)	
	Predicted Concentration	Below Criteria (< 0.01 mg/L)	Predicted Concentration	Below Criteria (< 0.1 mg/L)
Central Water Front SI (A6)	< 0.001	Yes	< 0.0001	Yes
Tai Wan SI (A10)	0.004	Yes	0.0003	Yes
North Point SI (A11)	0.001	Yes	0.0001	Yes
Quarry Bay SI (A12)	0.001	Yes	0.0001	Yes
Sai Wan Ho SI (A13)	0.001	Yes	0.0001	Yes
Cha Kwo Ling SI (A14)	0.002	Yes	0.0001	Yes
Tsing Yi Power Station SI (D1)	< 0.001	Yes	< 0.0001	Yes
Tung Lung Chau MZ (C2)	0.001	Yes	< 0.0001	Yes
Tung Wan GB (E1)	< 0.001	Yes	< 0.0001	Yes
New KTTS	0.004	Yes	0.0001	Yes
Marina	0.006	Yes	0.0004	Yes
Seawater Intake Point of DCS	0.031	**No**	0.0016	Yes

Notes: 1. SI – Seawater Intake; GB – Gazetted Beach; and MZ – Mariculture Zone.

Storm and Emergency Overflows

4.4.3.47 Under the revised scheme of SEKD, it is proposed to reclaim a strip of land approximately 80 meters wide along the existing seafront at KTTS. This will require extension of the existing stormwater culverts to the new seafront. The existing box culverts would be combined and extended to the new culvert (Outfall T) for discharging into Victoria Harbour. Diversion of storm drains outside KTTS would minimise the direct impacts to this enclosed water body.

4.4.3.48 For the new development, it is required that there be no increase in risk to flooding in the hinterland associated with the drainage extension. To achieve this with the increased length of culvert, the size of the culverts has to be much larger than the existing ones. However, it is difficult to meet the requirements of the extreme design cases of 1 in 200 years storm and 10 years tide event, and 1 in 10 year storm with 1 in 200 years tide event. The following options have been considered for resolving the issue:

Option 1 – Increase Size of Proposed Culvert

4.4.3.49 This option consists of increasing the number of culvert cells to eliminate the headloss thus preventing any upstream increases in water level. This option would require that the number of cells has to be more than doubled. This in turn would require additional reclamation in the first instance and a doubling of the maintenance effort in this area. For these reasons, this option has not been pursued further.

Option 2 – Divert Flows to Southeast outside the new KTTS

4.4.3.50 The resulting culvert for diverting storm flow to the southeast outside the typhoon shelter would pass under the proposed barging point and discharge all flow into the relatively restricted waterway. This option would cause a landuse conflict, which requires additional reclamation for a relocated barging point. In addition, there would be a potential water quality issue associated with dry weather flow being discharged at this point. This option has therefore been rejected.

Option 3 – Allowing Part of the Storm Flow to Discharge into the new KTTS

4.4.3.51 This option is to allow part of the storm flow to discharge into the typhoon shelter. Overflow weirs would be set at 2.5mPD on culverts A, B and T (1 in 1 year tide guideline level from Stormwater Drainage Manual). In peak wet weather events a proportion of the peak flow would discharge into the typhoon shelter. This option is considered as a practical solution.

4.4.3.52 Assessment of the potential water quality impacts to the new KTTS as a result of storm overflow has been conducted based on Option 3. It is proposed to install overflow weirs on Culverts A, B and T to discharge partial flow of peak storm events into the new KTTS. The water quality in the typhoon shelter would then be assessed using the detailed model based on the estimated overflow frequency and pollution loads to determine whether the proposed option is acceptable in terms of water quality condition.

4.4.3.53 The proposed weirs are set at 2.5mPD (1 in 1 year tide guideline level from Stormwater Drainage Manual). For this case all the dry weather flow would discharge to Victoria Harbour through culvert T with the exception of several hours once per year when the tide overtops the weir. The occurrence of overflow will also depend on rainfall events. In peak wet weather events a proportion of the peak flow would discharge into KTTS.

4.4.3.54 By examining the distribution of maximum rainfall intensity using the rainfall data between 1989 to 1999, there were on average about 5 storm events with maximum rainfall intensity > 90mm/hr each year. It is considered that such significant storm events would not occur within a few days in a year. To make a conservative assumption, input to the water quality model was made on the basis of 3 overflow events occurring on 3 consecutive days within a modelling period of 15 days during the wet season. Stormwater overflow was assumed to occur during neap tide. The overflow volume for the weirs at culverts A, B and T was determined from the Hydroworks model for 1 in 1 year storm and 1 in 1 year tide (2.5mPD). The overflow rate was approximately 25,000 m^3/d. The estimated pollution loads that would be released into KTTS are summarised in **Table 4.55**.

Table 4.55 Estimated Flow and Load Discharging into KTTS

Flow (m^3/d)	BOD (g/d)	SS (g/d)	Org-N (g/d)	NH3N (g/d)	E. coli (no/d)	Cu (g/d)	TP (g/d)	Ortho-P (g/d)	Si (g/d)	TON (g/d)
25,000	833,932	2,195,000	74,918	44,778	6.66E+14	279	24,819	13,861	71,826	4,737

4.4.3.55 **Drawing Nos. 22936/EN/22936/346** to **350** are the time series plots for depth-averaged DO (10%ile), bottom DO (10%ile), TIN, *E. coli* and BOD at the inner and outer parts of KTTS. The modelling results without storm overflow were shown on the same plots for comparison. In general, the DO levels in the new KTTS were not affected by the storm overflow and maintained in an acceptable level. There were no significant increases in *E. coli* and BOD when the storm overflow occurred. Exceedances of the WQO for TIN (0.4mg/L) were however observed. These might be related to the high background level of TIN. Comparing the results between the inner KTTS and the outer KTTS, the water quality condition appeared to be slightly better at the outer part of KTTS.

4.4.3.56 The other possible overflows that may occur are the emergency overflows from KTPTW and TKWPTW. The frequency of the emergency case is expected to be low and the duration of overflow would be short. Discharge of the emergency overflow in the restricted waterway could not achieve a rapid dilution of the discharged effluent. Diversion of the emergency overflows outside KTTS and marina would be required to minimise the potential water quality impacts to these sensitive receivers.

4.4.3.57 For the emergency overflow from KTPTW, it is proposed to use a bypass pipe to convey the emergency overflow along the new breakwater (eastern arm of KTTS) and to discharge near the end of the breakwater. The level of discharge would be near the water surface. **Drawing No. 22936/DR/060** shows the proposed alignment of the emergency overflow bypass pipe. The relatively fast moving water at the proposed discharge point can quickly disperse the pollutants minimising the potential water quality impacts. An alternative routing of the bypass pipe is to run along the northern boundary of RTS and along the whole length of the new breakwater to discharge the overflow near the end of the breakwater. This avoids the use of inverted siphon.

4.4.3.58 For the emergency overflow from TKWPTW, an emergency bypass would be provided to divert the flow along the proposed box culvert (Outfall P1) and to discharge to the open water. **Drawing No. 22936/DR/055** shows the proposed alignment of the emergency overflow bypass from TKWPTW. In order to prevent the discharged effluent from entering the new marina, it is proposed to extend the emergency bypass approximately 150m from the shoreline. A short section of submerged outfall would be required to discharge the effluent at seabed level. Details of the operational issues of the submarine outfall would be dealt with during the detailed design stage. The proposed discharge locations of the KTPTW and TKPTW emergency discharges are located more than 500 from the nearest WSD’s seawater intakes, i.e. Cha Kwo Ling and Tai Wan.

4.4.3.59 The pollution loads to TKWPTW and KTPTW for year 2016 have been calculated based on the estimated flows and loads for the SSDS catchments presented in the Pollution Loading Inventory Report of the Cumulative Impact Study. **Table 4.56** presents the relevant data.

Table 4.56 Flow and Load for the SSDS Catchments

Design Year	Flow (ML/d)	SS (t/d)	BOD (t/d)	TKN (t/d)	NH_3-N (t/d)	E. coli (E+17 no./d)
2012	2403	437	537	76	42	3.70

Notes:
1. The data were extracted from Table 2.18 Estimated Pollution Flows and Loads for Year 2012 in the Pollution Loading Inventory Report (Final) under the Update on Cumulative Water Quality and Hydrological Effect of Coastal Development and Upgrading of Assessment Tool; and
2. The data represented the scenario for a total population of 9 million by year 2016.

4.4.3.60 For the present SEKD study, the projected average dry weather flows to TKWPTW and KTPTW for year 2016 are 3.99 and 5.24 m^3/s respectively. The pollution loads to these two preliminary treatment works have been estimated by flow proportion using the data presented in **Table 4.56**. **Table 4.57** summarizes the estimated pollution loads.

Table 4.57 Estimated Pollution Loads to TKWPTW and KTPTW for Year 2016

Location	Flow (m^3/d)	SS (kg/d)	BOD (kg/d)	TKN (kg/d)	NH_3-N (kg/d)	E. coli (no./d)
TKWPTW	344,736	62,692	77,038	10,903	6,025	5.31E+16
KTPTW	452,736	82,333	101,173	14,319	7,913	6.97E+16

4.4.3.61 To assess the water quality impacts due to emergency overflows from TKWPTW and KTPTW, it was assumed that all flows and loads would enter the emergency overflow bypass pipes and discharged at the locations shown in **Drawing Nos. 22936/DR/055** and **060**. This assumption represents a worst case condition. To avoid water pollution during emergency overflow conditions, the overflow discharge locations for all proposed pumping stations should be kept away from the areas of: 1) the KTTS; 2) marina; 3) the embayment created at the mouth of Tsui Ping Nullah by the eastern breakwater of the KTTS; and 4) the existing and proposed seawater intakes. It is anticipated that the frequency of occurrence for the emergency case would be low and the duration of overflow would be short. A single discharge event with the duration of 24 hours in the wet season was used to assess the water quality changes in the vicinity of the discharge locations. The emergency overflows from TKWPTW and KTPTW were considered separately during the modelling.

4.4.3.62 The predicted water quality results of depth-averaged DO, SS, *E. coli* and TIN are shown in **Drawing Nos. 22936/EN290** to **293**. Over a spring-neap cycle of 15 days, emergency overflows from TKWPTW and KTPTW appeared to have no obvious impacts to the receiving water body in terms of the DO and SS levels. Elevated TIN levels were observed in the immediate discharge locations of the emergency overflows for both cases. The area of influence was approximately 100 to 150m in diameter. Similarly, the *E. coli* levels around the discharge locations of the emergency overflows from KTPTW and TKWPTW were higher than the surrounding ambient water. However, the area of influence was relatively small and the pollution was localised.

4.4.3.63 Time series plots for DO, TIN, SS and *E. coli* at Cha Kwo Ling and Tai Wan seawater intakes are presented in **Drawing Nos. 22936/EN/294** and **295** to show the potential impacts to the nearest sensitive receivers. Due to the close proximity of the two sensitive receivers, there were sudden increases in pollutant concentrations and decreases in DO shortly after the release of the emergency overflows. The influence of the emergency overflow from KTPTW to the seawater intake at Cha Kwo Ling increased for the first 7 days and then seceded on the following days. No exceedance of the WSD's WQO for SS (< 10 mg/L) at this seawater intake was predicted. However, there would be some exceedances of the WSD's WQO for *E. coli* (< 20,000 count/100mL). The emergency overflow from TKWPTW would have a direct impact to the seawater intake at Tai Wan due to the close proximity to the discharge location and the duration of influence would last a longer period. Periodic exceedances of the WSD's WQOs for SS and *E. coli* at Tai Wan Seawater Intake were predicted. High peaks of TIN levels would also appear after the occurrence of emergency overflow from TKWPTW. **Drawing Nos. 22936/EN/379** to **384** show the water quality conditions at the marina, the new Kwun Tong Typhoon Shelter and embayment at the mouth of the Tsing Ping Nullah. The predicted results showed that the overflow from KTPTW would not cause significant impacts to the marina. There were slight increases in TIN, SS and *E. coli* levels and decreases in DO at the new KTTS and embayment at the mouth of the Tsing Ping Nullah. The water quality conditions were in general within acceptable levels. The overflow from TKWPTW would not have direct impacts to the new KTTS and the embayment at the mouth of the Tsing Ping Nullah. However, the new marina would be affected by the overflow discharged from TKWPTW. The predicted results showed periodic high TIN, SS and *E. coli* levels at the new marina and the DO levels were in acceptable ranges.

4.4.3.64 As the assessment of the water quality impacts using an overflow period of 24 hours is a conservative assumption, it is expected that the potential impacts to the nearby sensitive receivers would be lower for a shorter period of emergency overflow. Provision of mitigation measures would protect the seawater intakes.

4.5 Mitigation of Adverse Impacts

4.5.1 *Construction Phase*

Changes in Coastline Configurations

4.5.1.1 The changes in coastline configurations as a result of the SEKD reclamation would potentially affect the hydrodynamic and water quality conditions in the harbour and the seawater intakes for flushing and cooling purposes. Reduction in the cross-sectional area in the harbour would increase the flow velocity enhancing water flushing and dispersion of pollutants.

4.5.1.2 The present scheme of SEKD involves the reclamation in the KTAC, KTTS and Hoi Sham. As the KTAC and KTTS are bounded by the disused Kai Tak Airport runway and the existing land boundary, the reclamation in these two areas would not cause a major change in coastline configurations.

4.5.1.3 The proposed reclamation area in Hoi Sham is located between the disused Kai Tak Airport runway and Hung Hom. The existing coastline in this region is quite irregular forming a partially enclosed area in between these two locations. This partially enclosed area would be reclaimed after the implementation of the Hoi Sham reclamation. The smoothness of the future coastline in this region would be improved causing less restriction to the flow movement in Kowloon Bay. With a smaller reclamation area for the present development scheme, the influence on hydrodynamic and water quality conditions is likely to be less when compared to the cases in the previous scheme of SEKD.

Nullah and Box Culvert Diversion

4.5.1.4 The option of discharging the KTN flow near the boundary between the KTAC and KTTS would not make much difference from the original discharge situation where the KTN flow is first discharged into the KTAC then to the open water via KTTS. The potential water quality impacts to the harbour would be similar to the original discharge situation.

4.5.1.5 The option for temporary diversion of the KTN and box culverts to the Kowloon Bay water may affect the water quality in TKWTS. The modelling results showed that the option of adopting the shortest diversion route would not cause a significant deterioration of the water quality in the typhoon shelter. The fall back option of diverting the flow away from the typhoon shelter provides an alternative for allocating the discharges. The modelling results for this fall back option also indicated no unacceptable water quality impacts to the nearby sensitive receivers.

4.5.1.6 During the implementation of nullah/box culvert diversion works, potential impacts would arise from the construction activities close to the nullahs and box culverts. Release of construction wastes into the diverted section of the nullah and box culverts would pollute the water quality of these receivers. These wastes are generally characterised by high concentrations of suspended solids and elevated pH values. Adoption of good housekeeping would reduce generation of construction wastes and the potential water pollution.

4.5.1.7 Stockpiles of construction and dusty materials should not be placed near the nullahs/box culverts during the carrying out of diversion works. This avoids the release of dusty materials into the water of the nullahs/box culverts. Construction activities, which generate a large amount of wastewater, should be carried out in a distance away from the diverted section, wherever practicable.