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5 Water Quality Impact Assessment

5.1 Legislation, Standards, Guidelines and Criteria

5.1.1 General

5.1.1.1 The relevant legislation, standards, and guidelines applicable to the present Study for the assessment of water quality impacts include:

- Environmental Impact Assessment Ordinance (EIAO) (Cap.499)
- Water Pollution Control Ordinance (Cap. 358);
- Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (DSS-TM);
- ProPECC PN 1/94 "Construction Site Drainage"; and
- Water Supplies Department's (WSD) Water Quality Criteria for Sea Water Intakes.

5.1.2 Environmental Impact Assessment Ordinance (EIAO) (Cap. 499)

5.1.2.1 EIAO (Cap. 499) provides the major statutory framework for the environmental impact assessment in Hong Kong. Under Section 16 of the EIAO, Environmental Protection Department (EPD) issued the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) which specifies the assessment methods and criteria for the EIA. Annexes 6 and 14 of the EIAO-TM stipulate the "Criteria for Evaluating Water Pollution" and "Guidelines for Assessment of Water Pollution" respectively.

5.1.3 Water Pollution Control Ordinance (Cap. 358)

5.1.3.1 WPCO (Cap 358) provides the major statutory framework for the protection and control of water quality in Hong Kong. According to the Ordinance and its subsidiary legislation, the entire Hong Kong waters are divided into ten Water Control Zones (WCZs) and four supplementary WCZs. Each WCZ has a designated set of statutory Water Quality Objectives (WQOs). The WQOs set limits for different parameters that should be achieved in order to protect specific beneficial uses and conservation goals of each of the zones.

5.1.3.2 The assessment area is situated within the North Western WCZ and the water quality objectives for the North Western WCZ are summarized in **Table 5.1** below.

Table 5.1 WQOs of North Western WCZ

Water Quality Objectives	Part or Parts of Zone
Aesthetic Appearance	
• There should be no objectionable odours or discolouration of the water;	Whole Zone

Water Quality Objectives	Part or Parts of Zone
• Tarry residues, floating wood, articles made of glass, plastic, rubber or any other substances should be absent; • Mineral oil should not be visible on the surface. Surfactants should not give rise to a lasting foam; • There should be no recognisable sewage derived debris; • Floating, submerged and semi-submerged objects of a size likely to interfere with the free movement of vessels, or cause damage to vessels, should be absent; and • Waste discharges shall not cause the water to contain substances which settle to form objectionable deposits.	
Bacteria	
• The levels of *E coli* should not exceed 180 counts per 100ml at bathing beaches, calculated as the geometric mean of all samples collected from March to October inclusive. Samples have to be taken at least 3 times a month at intervals of between 3 and 14 days.	Bathing Beach Subzones
• The levels of *E coli* should not exceed 610 counts per 100ml at secondary contact recreation sub-zones, calculated as the geometric annual mean of all samples collected in a calendar year.	Secondary Contact Recreation Subzones
Dissolved Oxygen	
• The depth averaged concentration of dissolved oxygen should not fall below 4 mg/l for 90% of the sampling occasions during the whole year; and • The concentration of dissolved oxygen should not be less than 2 mg/l within 2m of the seabed for 90% of the sampling occasions during the whole year.	Marine waters
pH	
• The pH of the water should be within the range 6.5-8.5 units; and • Human activity should not cause the natural pH range to be extended by more than 0.2 units.	Marine waters excepting Bathing Beach Subzones
Temperature	
• Waste discharges shall not cause the natural daily temperature range to change by more than 2.0°C.	Whole Zone
Salinity	
• Waste Discharges shall not cause the natural ambient salinity to change by more than 10%.	Whole Zone
Suspended Solids	
• Human activity should neither cause the natural ambient level to be raised by more than	Marine waters

Water Quality Objectives	Part or Parts of Zone
30% nor give rise to accumulation of suspended solids which may adversely affect aquatic communities.	
Ammonia	
• The un-ionised ammoniacal nitrogen level should not be more than 0.021 mg/l calculated as the annual average (arithmetic mean).	Whole Zone
Nutrients	
• Nutrients should not be present in quantities sufficient to cause excessive or nuisance growth of algae or other aquatic plants.	Marine waters
• Without limiting the generality of the above point, the level of inorganic nitrogen should not exceed 0.3mg/l within Castle Peak sub-zone, expressed as the annual water column average.	Castle Peak Bay Subzone
• Without limiting the generality of the above point, the level of inorganic nitrogen should not exceed 0.5mg/l within Castle Peak sub-zone, expressed as the annual water column average.	Marine waters excepting Castle Peak Bay Subzone
Toxins	
• Waste discharges shall not cause the toxins in water to attain such a level as to produce significant toxic, carcinogenic, mutagenic or teratogenic effects in humans, fish or other aquatic organisms, with due regard to biologically cumulative effects in food chains and to interactions of toxic substances with each other; and • Waste discharges shall not cause a risk to any beneficial use of the aquatic environment.	Whole Zone

5.1.4 Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (DSS-TM)

5.1.4.1 Under Section 21 of the WPCO (Cap. 358), Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters was issued to control the physical, chemical and microbial quality of effluent discharges into foul sewers, stormwater drains, inland and coastal waters. Specific limits apply for different areas are different between surface waters and sewers. The limits vary with the rate of effluent flow. Standards for effluent discharged into the inshore waters and marine waters of North Western WCZ as well foul sewer leading into the Government's sewage treatments plants are summarized in **Table 5.2, Table 5.3** and **Table 5.4**.

Table 5.2 Standards for effluents discharged into the inshore waters of North Western WCZ

Flow rate (m^3/day)	**≤10**	**>10 and ≤200**	**>200 and ≤400**	**>400 and ≤600**	**>600 and ≤800**	**>800 and ≤1000**	**>1000 and ≤1500**	**>1500 and ≤2000**	**>2000 and ≤3000**	**>3000 and ≤4000**	**>4000 and ≤5000**	**>5000 and ≤6000**
pH (pH units)	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9
Temperature (°C)	40	40	40	40	40	40	40	40	40	40	40	40
Colour (lovibond units) (25mm cell length)	1	1	1	1	1	1	1	1	1	1	1	1
Suspended solids	50	30	30	30	30	30	30	30	30	30	30	30
BOD	50	20	20	20	20	20	20	20	20	20	20	20
COD	100	80	80	80	80	80	80	80	80	80	80	80
Oil & Grease	30	20	20	20	20	20	20	20	20	20	20	20
Iron	15	10	10	7	5	4	3	2	1	1	0.8	0.6
Boron	5	4	3	2	2	1.5	1.1	0.8	0.5	0.4	0.3	0.2
Barium	5	4	3	2	2	1.5	1.1	0.8	0.5	0.4	0.3	0.2
Mercury	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Other toxic metals individually	1	1	0.8	0.7	0.5	0.4	0.3	0.2	0.15	0.1	0.1	0.1
Total toxic metals	2	2	1.6	1.4	1	0.8	0.6	0.4	0.3	0.2	0.1	0.1
Cyanide	0.2	0.1	0.1	0.1	0.1	0.1	0.05	0.05	0.03	0.02	0.02	0.01
Phenols	0.5	0.5	0.5	0.3	0.25	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Sulphide	5	5	5	5	5	5	2.5	2.5	1.5	1	1	0.5
Total residual chlorine	1	1	1	1	1	1	1	1	1	1	1	1
Total nitrogen	100	100	80	80	80	80	50	50	50	50	50	50
Total phosphorus	10	10	8	8	8	8	5	5	5	5	5	5
Surfactants (total)	20	15	15	15	15	15	10	10	10	10	10	10
E. coli (count/100ml)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

Note:

All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated.

Table 5.3 Standards for effluents discharged into the marine waters of North Western WCZ

Flow rate (m^3/day)	**≤10**	**>10 and ≤200**	**>200 and ≤400**	**>400 and ≤600**	**>600 and ≤800**	**>800 and ≤1000**	**>1000 and ≤1500**	**>1500 and ≤2000**	**>2000 and ≤3000**	**>3000 and ≤4000**	**>4000 and ≤5000**	**>5000 and ≤6000**
pH (pH units)	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10
Temperature (°C)	45	45	45	45	45	45	45	45	45	45	45	45
Colour (lovibond units) (25mm cell length)	4	1	1	1	1	1	1	1	1	1	1	1

Flow rate (m^3/day)	**≤10**	**>10 and ≤200**	**>200 and ≤400**	**>400 and ≤600**	**>600 and ≤800**	**>800 and ≤1000**	**>1000 and ≤1500**	**>1500 and ≤2000**	**>2000 and ≤3000**	**>3000 and ≤4000**	**>4000 and ≤5000**	**>5000 and ≤6000**
Suspended solids	500	500	500	300	200	200	100	100	50	50	40	30
BOD	500	500	500	300	200	200	100	100	50	50	40	30
COD	1000	1000	1000	700	500	400	300	200	150	100	80	80
Oil & Grease	50	50	50	30	25	20	20	20	20	20	20	20
Iron	20	15	13	10	7	6	4	3	2	1.5	1.2	1
Boron	6	5	4	3.5	2.5	2	1.5	1	0.7	0.5	0.4	0.3
Barium	6	5	4	3.5	2.5	2	1.5	1	0.7	0.5	0.4	0.3
Mercury	0.1	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Other toxic metals individually	2	1.5	1.2	0.8	0.6	0.5	0.32	0.24	0.16	0.12	0.1	0.1
Total toxic metals	4	3	2.4	1.6	1.2	1	0.64	0.48	0.32	0.24	0.2	0.14
Cyanide	1	0.5	0.5	0.5	0.4	0.3	0.2	0.15	0.1	0.08	0.06	0.04
Phenols	0.5	0.5	0.5	0.3	0.25	0.2	0.13	0.1	0.1	0.1	0.1	0.1
Sulphide	5	5	5	5	5	5	2.5	2.5	1.5	1	1	0.5
Total residual chlorine	1	1	1	1	1	1	1	1	1	1	1	1
Total nitrogen	100	100	80	80	80	80	50	50	50	50	50	50
Total phosphorus	10	10	8	8	8	8	5	5	5	5	5	5
Surfactants (total)	30	20	20	20	15	15	15	15	15	15	15	15
E. coli (count /100ml)	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000

Note:

All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated.

Table 5.4 Standards for effluents discharged into foul sewers leading into the Government's sewage treatments plants

Flow rate (m^3/day)	**≤10**	**>10 and ≤200**	**>200 and ≤400**	**>400 and ≤600**	**>600 and ≤800**	**>800 and ≤1000**	**>1000 and ≤1500**	**>1500 and ≤2000**	**>2000 and ≤3000**	**>3000 and ≤4000**	**>4000 and ≤5000**	**>5000 and ≤6000**
pH (pH units)	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10
Temperature (℃)	43	43	43	43	43	43	43	43	43	43	43	43
Suspended solids	1200	1000	900	800	800	800	800	800	800	800	800	800

Flow rate (m^3/day)	**≤10**	**>10 and ≤200**	**>200 and ≤400**	**>400 and ≤600**	**>600 and ≤800**	**>800 and ≤1000**	**>1000 and ≤1500**	**>1500 and ≤2000**	**>2000 and ≤3000**	**>3000 and ≤4000**	**>4000 and ≤5000**	**>5000 and ≤6000**
Settleable solids	100	100	100	100	100	100	100	100	100	100	100	100
BOD	1200	1000	900	800	800	800	800	800	800	800	800	800
COD	3000	2500	2200	2000	2000	2000	2000	2000	2000	2000	2000	2000
Oil & Grease	100	100	50	50	50	40	30	20	20	20	20	20
Iron	30	25	25	25	15	12.5	10	7.5	5	3.5	2.5	2
Boron	8	7	6	5	4	3	2.4	1.6	1.2	0.8	0.6	0.5
Barium	8	7	6	5	4	3	2.4	1.6	1.2	0.8	0.6	0.5
Mercury	0.2	0.15	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.2	0.15	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Copper	4	4	4	3	1.5	1.5	1	1	1	1	1	1
Nickel	4	3	3	2	1.5	1.5	1	0.8	0.7	0.7	0.6	0.6
Chromium	2	2	2	2	1	0.7	0.6	0.4	0.3	0.2	0.1	0.1
Zinc	5	5	4	3	1.5	1.5	1	0.8	0.7	0.7	0.6	0.6
Silver	4	3	3	2	1.5	1.5	1	0.8	0.7	0.7	0.6	0.6
Other toxic metals individually	2.5	2.2	2	1.5	1	0.7	0.6	0.4	0.3	0.2	0.15	0.12
Total toxic metals	10	10	8	7	3	2	2	1.6	1.4	1.2	1.2	1.2
Cyanide	2	2	2	1	0.7	0.5	0.4	0.27	0.2	0.13	0.1	0.08
Phenols	1	1	1	1	0.7	0.5	0.4	0.27	0.2	0.13	0.1	0.1
Sulphide	10	10	10	10	5	5	4	2	2	2	1	1
Sulphate	1000	1000	1000	1000	1000	1000	1000	900	800	600	600	600
Total nitrogen	200	200	200	200	200	200	200	100	100	100	100	100
Total phosphorus	50	50	50	50	50	50	50	25	25	25	25	25
Surfactants (total)	200	150	50	40	30	25	25	25	25	25	25	25

Note:
All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated.

5.1.5 ProPECC PN 1/94 "Construction Site Drainage"

5.1.5.1 Professional Persons Environmental Consultative Committee Practice Notes (ProPECC Note PN1/94) on Construction Site Drainage provides guidelines for the handling and disposal of construction discharges. This note is applicable for the

control of site runoff and wastewater generated during the construction phase of the Project.

5.1.5.2 The types of discharges from construction sites outlined in the ProPECC Note PN1/94 include:

- Surface run-off;
- Groundwater;
- Boring and drilling water;
- Wastewater from concrete batching and precast concrete casting;
- Wheel washing water;
- Bentonite slurry;
- Water for testing and sterilisation of water retaining structures and water pipes,
- Wastewater from building construction,
- Acid cleaning, etching, and pickling wastewater, and
- Wastewater from site facilities.

5.1.6 Water Supplies Department's (WSD) Water Quality Criteria for Sea Water Intakes

5.1.6.1 The criteria for assessing the water quality impact on the WSD's seawater intakes are based on the Water Quality Criteria for Sea Water Intakes (at intake point) issued by the WSD and are summarized in **Table 5.5**.

Table 5.5 WSD's Water quality criteria for sea water intakes

Parameter	Concentration
Colour	< 20 H.U.
Turbidity	< 10 N.T.U.
Threshold Odour No.	< 100
Ammonia Nitrogen	< 1 mg/l
Suspended Solids	< 10 mg/l
Dissolved Oxygen	> 2 mg/l
Biochemical Oxygen Demand	< 10 mg/l
Synthetic Detergents	< 5 mg/l
E. coli.	< 20,000 cfu/100 ml

5.2 Baseline Conditions

5.2.1 Marine Water

5.2.1.1 The Project is located in the North Western WCZ, which is the mouth of the Pearl River Estuary and as such are heavily influenced by the massive freshwater flows from the Pearl River region.

5.2.1.2 The Pearl River carries very heavy loads of suspended sediment and nitrates and as a consequence, the concentrations of these parameters within North Western waters are variable but generally higher than in the more oceanic influenced waters to the south and east of Hong Kong.

EPD's Monitoring Data

5.2.1.3 The latest water quality monitoring data in 2020 indicated that the North Western WCZ attained an overall WQO compliance rate of 67%, a decline from the compliance rate of 89% in 2019, despite the DO and NH_3-N WQOs being met in 2020. The Total Inorganic Nitrogen (TIN) levels in 2020 could not meet the WQO, which was likely attributed to the higher background level of the Pearl River Estuary, and some local discharges and surface run-off from both the Northwest New Territories and North Lantau. The marine water quality monitoring data in 2020 is summarized in **Table 5.6** for the nearby monitoring stations: NM1, NM2, NM3, NM6, and NM8 as shown in **Figure 5.1**.

Table 5.6 Summary of EPD's routine marine water quality data for North Western WCZ in 2020

Parameters		North Western WCZ [1][2]				
		NM1	NM2	NM3	NM6	NM8
Temperature (°C)		25.4	25.9	24.8	26.2	25.9
		(20.5 - 29.3)	(20.5 - 29.4)	(18.9 – 29.4)	(20.7 – 29.4)	(20.5 – 29.4)
Salinity		28.9	26.6	27.3	24.0	26.5
		(25.6 – 32.2)	(19.8 – 31.6)	(20.2 – 31.9)	(14.8 – 30.5)	(14.3 – 31.0)
Dissolved Oxygen (mg/L)	Depth Average	5.4	5.8	5.7	5.9	6.0
		(4.4 – 6.4)	(4.7 – 7.2)	(4.3 – 6.7)	(4.7 – 7.2)	(4.7 – 7.0)
	Bottom	5.1	5.6	5.3	5.9	6.1
		(3.9 – 6.4)	(4.0 – 7.5)	(3.5 – 6.9)	(4.2 – 7.2)	(4.1 – 7.2)
Dissolved Oxygen (% Saturation)	Depth Average	77	82	81	83	85
		(64 – 89)	(68 – 104)	(64 – 89)	(68 – 102)	(67 – 98)
	Bottom	73	79	75	83	86
		(56 – 91)	(58 – 108)	(57 – 92)	(61 – 103)	(60 – 98)
pH		7.9	7.9	7.9	7.9	7.9
		(7.7 – 8.2)	(7.7 – 8.1)	(7.7 – 8.2)	(7.7 – 8.1)	(7.7 – 8.2)
Secchi Disc Depth (m)		2.0	2.1	2.1	1.9	1.9
		(1.7 – 2.3)	(1.7 – 2.6)	(1.7 – 2.7)	(1.6 – 2.5)	(1.5 – 2.8)
Turbidity (NTU)		5.5	4.3	5.6	6.7	10.3
		(2.9 – 10.9)	(1.9 – 7.8)	(3.4 – 8.9)	(4.2 – 11.0)	(5.0 – 23.3)
SS (mg/L)		9.0	7.1	8.4	9.1	13.0
		(2.3 – 15.0)	(2.4 – 12.7)	(3.6 – 15.3)	(4.5 – 16.7)	(2.2 – 29.3)
5-day Biochemical Oxygen Demand (mg/L)		0.6	0.6	0.5	0.8	0.6
		(<0.1 – 1.1)	(0.3 – 1.0)	(0.3 – 0.8)	(0.3 – 1.7)	(0.3 – 1.2)
Ammonia Nitrogen (mg/L)		0.086	0.076	0.096	0.064	0.036
		(0.039 – 0.180)	(0.031 – 0.177)	(0.023 – 0.167)	(0.016 – 0.157)	(0.016 – 0.089)
Unionised Ammonia (mg/L)		0.003	0.003	0.003	0.002	0.002
		(0.002 – 0.008)	(0.001 – 0.007)	(<0.001 – 0.007)	(<0.001 – 0.007)	(<0.001 – 0.004)

Parameters	North Western WCZ [1][2]				
	NM1	NM2	NM3	NM6	NM8
Nitrite Nitrogen (mg/L)	0.068	0.077	0.065	0.096	0.076
	(0.021 – 0.133)	(0.023 – 0.150)	(0.011 – 0.157)	(0.028 – 0.203)	(0.027 – 0.153)
Nitrate Nitrogen (mg/L)	0.350	0.469	0.436	0.591	0.472
	(0.140-0.640)	(0.157-0.757)	(0.160-0.850)	(0.263-0.913)	(0.167-0.967)
Total Inorganic Nitrogen (mg/L)	0.50	0.62	0.60	0.75	0.58
	(0.28 – 0.81)	(0.28 – 0.90)	(0.29 – 0.97)	(0.40 – 1.02)	(0.24 – 1.07)
Total Kjeldahl Nitrogen (mg/L)	0.35	0.32	0.40	0.28	0.29
	(0.10 – 0.60)	(0.07 – 0.62)	(0.08 – 0.93)	(0.05 – 0.54)	(0.08 – 0.45)
Total Nitrogen (mg/L)	0.76	0.87	0.90	0.96	0.83
	(0.45 – 0.97)	(0.57 – 1.08)	(0.49 – 1.15)	(0.57 – 1.24)	(0.52 – 1.48)
Orthophosphate Phosphorus (mg/L)	0.019	0.022	0.021	0.025	0.019
	(0.011-0.031)	(0.015-0.033)	(0.013-0.033)	(0.013-0.042)	(0.013-0.027)
Total Phosphorus (mg/L)	0.06	0.08	0.06	0.06	0.07
	(0.03 – 0.15)	(0.03 – 0.24)	(0.03 – 0.11)	(0.03 – 0.12)	(0.03 – 0.17)
Silica (as SiO_2) (mg/L)	2.11	2.59	2.38	3.18	2.75
	(0.44 – 3.83)	(0.54 – 4.27)	(0.56 – 4.67)	(0.91 – 4.90)	(1.13 – 5.40)
Chlorophyll-a (µg/L)	3.3	3.8	2.2	3.3	3.3
	(0.6 – 16.3)	(0.5 – 22.3)	(0.4 – 13.0)	(0.8 – 16.0)	(1.1 – 13.0)
E. coli (count/100mL)	88	36	66	32	3
	(17 – 600)	(13 – 140)	(16 – 470)	(6 – 600)	(<1 – 12)
Faecal Coliforms (count/100mL)	190	87	150	71	6
	(45 – 1500)	(24 - 590)	(30 – 1500)	(8 – 1000)	(1 – 25)

Notes:

[1] Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

[2] Data presented are annual arithmetic means of the depth-averaged results except for E. coli and faecal coliforms. which are annual geometric means

[3] Data in brackets indicate ranges.

Monitoring data under the TCNTE EIA Study

5.2.1.4 In addition, one of the water quality monitoring stations (i.e. TCE-WQM1) under the EM&A Manual of the construction and operation of Tung Chung East (TCE) of Tung Chung New Town Extension (TCNTE) is close to the assessment area of the Project in Tung Chung West so it is also representative of the Project. The latest water quality monitoring data in 2020 is summarized in **Table 5.7** for TCE-WQM1 as shown in **Figure 5.1**.

Table 5.7 Summary of EM&A routine marine water quality data under EIA for TCNTE in 2020

Parameters	TCE-WQM1	
	Mid-Ebb	Mid-Flood
Temperature (°C)	24.3	24.3
	(17.4 - 29.5)	(17.4 - 29.5)
Salinity	27.3	27.3

Parameters		TCE-WQM1	
		Mid-Ebb	Mid-Flood
		(16.1 - 34.1)	(16.1 - 34.1)
Dissolved Oxygen (mg/L)	Depth Average	6.7	6.8
		(4.2 - 9.6)	(4.5 - 9.8)
	Bottom	6.5	6.6
		(3.1 - 9.2)	(3.2 - 9.1)
Dissolved Oxygen (% Saturation)	Depth Average	92.8	95.1
		(58.4 - 134)	(64.2 - 142.2)
	Bottom	89.6	91.4
		(43.7 - 127.7)	(45 - 130.9)
pH		8.0	8.0
		(4.5 - 8.4)	(4.1 - 8.5)
Turbidity (NTU)		7.1	7.5
		(1.6 - 15.4)	(1.8 - 16.9)
SS (mg/L)		8.2	8.2
		(3.2 - 33.1)	(2.3 - 21.4)

5.2.2 Inland River

5.2.2.1

Tung Chung River is the major river closest to the assessment area. There are three EPD monitoring stations (TC1, TC2, and TC3) recording the water quality conditions of the Tung Chung River as shown in **Figure 5.1**. According to the River Water Quality in Hong Kong 2020, the compliance with the WQO for Tung Chung River was 93%, declining from 97% in 2019. Details of Tung Chung River water quality monitoring data is presented in **Table 5.8**.

Table 5.8 Summary of EPD's routine river water quality data for North Tung Chung River in 2020

Parameter [3]	Tung Chung River [1][2][4]		
	TC1	TC2	TC3
Dissolved oxygen (mg/L)	7.2 (6.9 – 8.4)	8.5 (7.7 – 10.0)	7.9 (7.6 – 8.3)
pH	7.4 (6.7 – 8.0)	8.9 (7.7 – 9.3)	8.2 (8.1 – 8.8)
SS (mg/L)	1.0 (0.8 – 7.0)	2.1 (0.7 – 8.6)	2.5 (0.9 – 6.0)
5-day Biochemical Oxygen Demand (mg/L)	0.3 (<0.1 – 3.4)	0.8 (0.6 – 1.8)	5.7 (1.9 – 15.0)
Chemical Oxygen Demand (mg/L)	4 (<2 - 6)	6 (3 - 12)	9 (4 – 16)
Oil & grease (mg/L)	<0.5 (<0.5 - <0.5)	<0.5 (<0.5 - <0.5)	<0.5 (<0.5 - <0.5)
Faecal coliforms (cfu/100mL)	680 (110 – 3 900)	5 500 (1 200 – 34 000)	69 000 (13 000 – 230 000)
E. coli (cfu/100mL)	66 (18 – 210)	970 (440 – 2 800)	27 000 (3 000 – 140 000)
Ammonia-nitrogen (mg/L)	0.018 (0.013 – 0.084)	0.055 (0.023 – 0.120)	2.150 (0.600 – 4.300)

Parameter [3]	Tung Chung River [1][2][4]		
	TC1	TC2	TC3
Nitrate-nitrogen (mg/L)	0.045 (0.015 – 0.200)	0.081 (0.055 – 0.140)	0.170 (0.060 – 0.500)
Total Kjeldahl nitrogen (mg/L)	0.11 (<0.05 – 0.34)	0.32 (0.10 – 0.64)	2.55 (0.77 – 5.00)
Orthophosphate phosphorous (mg/L)	0.005 (0.002 – 0.012)	0.016 (0.006 – 0.025)	0.075 (0.008 – 0.230)
Total phosphorus (mg/L)	0.02 (<0.02 – 0.04)	0.04 (<0.02 – 0.07)	0.22 (0.02 – 0.33)
Sulphide (mg/L)	<0.02 (<0.02 - <0.02)	<0.02 (<0.02 - <0.02)	<0.02 (<0.02 - <0.02)
Aluminium (µg/L)	<50 (<50 - 150)	<50 (<50 - <50)	<50 (<50 - 230)
Cadmium (µg/L)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - <0.1)
Chromium (µg/L)	<1 (<1 - <1)	<1 (<1 - <1)	<1 (<1 - <1)
Copper (µg/L)	<1 (<1 - <1)	<1 (<1 - <1)	1 (<1 - 2)
Lead (µg/L)	<1 (<1 - <1)	<1 (<1 - <1)	<1 (<1 - <1)
Zinc (µg/L)	<10 (<10 - 13)	<10 (<10 - <10)	<10 (<10 - 18)
Flow (L/s)	0.138 (0.053 – 0.211)	0.263 (0.077 – 0.422)	0.043 (0.019 – 0.155)

Notes:

[1] Data presented are in annual medians of monthly samples; except those for faecal coliforms and *E. coli* which are in annual geometric means.
[2] Figures in brackets are annual ranges.
[3] cfu - colony forming unit.
[4] Equal values for annual medians (or geometric means) and ranges indicate that all data are the same as or below laboratory reporting limits.

5.3 Representative Water Sensitive Receivers

5.3.1.1 According to Section 3.4.6.2 of EIA SB, the assessment area for the water quality impact assessment shall include areas within 500 m from the boundary of the Project and shall cover the North Western Water Control Zone as designated under the Water Pollution Control Ordinance (Cap. 358). The assessment area was further extended to cover other areas such as stream courses and water intake in the vicinity, which may be affected by the Project and have a bearing on the environmental acceptability of the Project.

5.3.1.2 The Water Sensitive Receiver (WSRs) in the vicinity including areas of ecological sensitivity and conservation importance, commercial fishing resources, and various points where seawater is abstracted for domestic, commercial, or industrial purposes are shown in **Table 5.9** below and marked in **Figure 5.1**.

Table 5.9 Summary of the representative WSRs

ID	Description
WSR 01	Ma Wan Chung Bay
WSR 02	Yat Tung West Channel
WSR 03	Estuary of Tung Chung River
WSR 04	San Tau Beach Sites of Special Scientific Interest (SSSI)
WSR 05	Tai Ho Wan Inlet (inside)
WSR 06	Tai Ho Bay (inner), Near Tai Ho Stream SSSI
WSR 07	Tai Ho Wan Inlet (outside)
WSR 08	Proposed Seawater intake for Tung Chung East (Flushing)
WSR 09	Proposed Marina at Tung Chung East Reclamation
WSR 10	The Brothers Marine Park
WSR 11	Wong Lung Hang Stream
WSR 12	Tung Chung River
WSR 13	Tung Chung Bay
WSR 14	Proposed Seawater Intake for Tung Chung District Cooling System
WSR 15	Spawning Grounds of Commercial Fisheries Resources in Northeast Lantau
WSR 16	Watercourse near Ma Wan Chung

Notes:

[1] The identified WSRs have considered the relevant plans, including Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans and Layout Plans, and any other relevant published land use plans, including plans and drawings published by Lands Department and any land use and development applications approved by the Town Planning Board.

5.4 Assessment Methodology

5.4.1.1 The assessment approach was based on the requirements as specified in the EIA Study Brief (ESB-329/2020). The criteria and guidelines for assessing water quality impacts as stated in Annexes 6 and 14 of the EIAO-TM were followed.

5.4.1.2 The assessment area covers the area within 500 m from the Project boundary, and further extended to cover other areas such as stream courses and water intake in the vicinity, which may be affected by the Project and have a bearing on the environmental acceptability of the Project. The assessment area falls into North Western WCZ.

5.4.1.3 As discussed in **Section 2**, no dredging works is proposed for the barging point and there would not be any marine works for the Project. The potential pollution sources caused by the operation of barging point and the land-based works during the construction phase as well as the operation of the train with the railway alignment and the two new stations have been identified and the associated potential water quality impacts have been assessed as below.

5.5 Identification and Evaluation of Environmental Impacts

Construction Phase

5.5.1 General

5.5.1.1 According to the latest design, flat top barges would be deployed to form 2 temporary unloading points to allow lorries/dump trucks to drive on and reach the spoil carriers berthing at the end of the barges, and no dredging works is required for the Project including the barging point. Hence, the potential water pollution sources are mainly induced from the operation of barging point and land-based activities for construction of Tung Chung Line (TCL) realignment, TCE Station, Tung Chung West (TCW) Station, and Emergency Access Point (EAP)/ Emergency Egress Point (EEP) at an artificial slope to the west of Shun Tung Road as follows:

- Construction runoff;
- Sewage due to workforce;
- Effluent discharge from tunnelling and open cut excavation;
- Alteration of Groundwater level; and
- Accidental spillage.

5.5.2 Construction Runoff

5.5.2.1 Construction site runoff would come from all works sites. The surface runoff might be polluted by the following potential sources. The construction works in TCW requires more attention to minimise any untreated surface runoff into the Tung Chung River estuary and the Wong Lung Hang estuary. **Section 5.7** discusses the mitigation measures that are applicable to all works sites, and those that are specific to TCW, barging point, tunnelling, open cut excavation, etc.

- Runoff and erosion from site surfaces, earth working areas and stockpiles;
- Accidental release of any bentonite slurries, concrete washing and other grouting materials with construction run-off, stormwater or groundwater dewatering process;
- splashing of material into the surrounding water due to transportation of spoil using the barging point;
- Wash water from concrete washing, dust suppression sprays and wheel washing facilities; and
- Chemicals spillage such as fuel, oil, solvents and lubricants from the maintenance of construction machinery and equipment.

5.5.3 Sewage due to Workforce

5.5.3.1 Sewage will arise from the sanitary facilities provided for the on-site construction workforce. Sewage is characterized by high levels of BOD_5, Ammonia and *E. coli* counts. According to Table T-2 of Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning, the unit flow is 0.23 m^3/day/employee (0.08 m^3/day/employee for commercial employee and 0.15 m^3/day/employee for employees of construction activities). There will be a workforce of around 800 people hence total sewage of 184 m^3/day will be generated per day. Adequate portable chemical toilets will be provided to avoid direct discharge into any nearby watercourse or public drain.

5.5.4 Effluent Discharge from Tunnelling and Open Cut Excavation

5.5.4.1 Tunnelling wastewater from groundwater inflows, drilling and wash-down may be generated from tunnel sections. Effluent would also arise from groundwater pumping inside the open cut excavation.

5.5.4.2 According to the land contamination review, no land contamination is found within the Project (see **Section 7**). However, the groundwater pumped out from the tunnel and open cut excavation would have a high content of suspended solids and on-site treatment would be required prior to off-site discharge. The water pumped out from the tunnel may contain bentonite and grouting materials that would be required for the construction of the bored tunnels (for tunnel boring and groundwater treatment) and diaphragm walls for the cut-and-cover station box at TCW as well as the excavation works for EAP/EEP. The quantity of wastewater produced would depend on the volume and type of excavation carried out. The estimated maximum rate of wastewater to be discharged from tunnelling works and excavation during construction for treatment, that is, chemically enhanced sedimentation, before discharge into the stormwater drains have been estimated and are shown in **Table 5.10** below for the various works sites.

Table 5.10 Wastewater discharge from tunnelling and excavation during construction phase

Works Location	Maximum Rate of Wastewater Discharge (m^3/hr)
TCE Station	80
TCW Station	80
EAP/EEP	80
TCW Extension Alignment	80

Notes:

[1] The maximum rate of discharge values presented in the table is the best estimated value for excavation and tunnelling works based on drainage consideration and reference to other similar projects. The estimated values are agreed with engineer.

5.5.5 Alteration of Groundwater Level

5.5.5.1 The activities of TBM and other potential underground works may influence the groundwater levels. However, as the works area is close to the estuary area, the groundwater level would be quickly balanced by the surrounding marine environments and watercourses. Also, the TBM excavation works would take place at the rock layer (10 – 20 m below sea level) underneath a thick alluvium layer, the disturbance to the sediment of Ma Wan Chung mudflat should be minor. Therefore, any change of groundwater level caused by the project would be insignificant and hence significant change in underground hydrology, flow regime, sediment erosion, and deposition patterns are not anticipated.

5.5.6 Accidental Spillage

5.5.6.1 The use of chemicals such as engine oil and lubricants, and their storage as waste materials has the potential to create impacts on the water quality if spillage occurs and enters adjacent water environment. Waste oil may infiltrate into the surface soil layer, or runoff into the nearby water environment, increasing hydrocarbon levels. The potential impacts could however be mitigated by practical mitigation measures and good site practices.

5.5.6.2 For the operation of TBM near water sensitive area in Tung Chung Bay and Ma Wan Chung Bay, reservation of adequate soil cover and/or sealing up of charted boreholes would be provided to prevent potential accidental seepage or discharge due to excessive pressure of TBM. It may cause accidental blowout during annulus grouting around the completed segment rings at the back of the TBM. The grouting may penetrate through the voids of the soil above the TBM and reach the seabed and leak into the sea. However, provided that there is adequate soil cover, it will prevent the potential of the blowout from happening.

Operational Phase

5.5.7 General

5.5.7.1 During the operational phase, the potential sources of water quality impact associated with the operation of the Project include:

- Stormwater runoff from realigned open tracks section at TCE station;
- Stormwater runoff from paved or developed areas within the Project;
- Discharge from cooling systems; and
- Sewage from sanitary fitment and other wastewater from facility washing and track runoff from tunnel sections.

5.5.8 Stormwater Runoff

5.5.8.1 Surface runoff would be generated from realigned open tracks and other paved or developed areas within the Project, including TCE Station, entrances and vent shaft

structures of TCW Station, EAP/EEP to the west of Shun Tung Road. It may also contain debris, refuse, and dust from the roof of buildings, which require good practices and management to achieve the required water quality.

5.5.8.2 The detailed design of the drainage system of the Project shall ensure that the drainage system would be properly connected to the public drainage system for Tung Chung area, which has taken into account of all the existing and planned development under Tung Chung New Town Extension.

5.5.9 Discharge from Cooling System

5.5.9.1 For TCE station, making use of the District Cooling System (DCS) proposed and constructed by CEDD has been considered in current design. However, no additional bleed off water would be generated from the DCS as the DCS capacity has already included the potential demand from the Project.

5.5.9.2 For TCW Station, either a freshwater cooling system or an air cooling system would be adopted. The bleed off water from the freshwater cooling chiller would be recycled for flushing use as far as practical, with any excess bleed off be discharged into the sewerage system. The water quality of bleed off water discharge into the sewerage system should comply the "Standards for effluents discharged into foul sewers leading into Government sewage plants" of the EPD Technical Memorandum as listed in **Table 5.4**. There would be no discharge from the cooling system to the nearby watercourses.

5.5.10 Sewage and Other Wastewater

5.5.10.1 Sewage from sanitary fitments and other wastewater generated from passengers, staff, the Food & Beverage (F&B) outlets, and indoor facility washing at the two stations, which may contain an insignificant amount of oil/grease and grits, will be connected to the public sewer. Track runoff from tunnel sections including wastewater flows at the EAP/EEP will be pumped to ground level to an oil interceptor prior to discharge to public sewer.

5.5.10.2 A separate Sewage Impact Assessment (SIA) has been conducted for the Project. There would be a sewerage system with sufficient capacity in the vicinity to cater to the discharge sewerage and wastewater from the Project. According to the latest SIA, suitable local connections will be implemented to connect to public sewer. The preliminary sewage discharge from both TCE and TCW stations and the EAP/EEP listed in **Table 5.11**.

Table 5.11 Average daily discharges to sewerage system

ID	**Average Daily Discharges to Sewerage System** [1] **(m^3/day)**
TCE Station	25
TCW Station [2]	147
EAP/EEP	2
Total	174

Notes:

[1] The average daily discharge to sewerage system from the Project will be reviewed in the detailed designed stage.

[2] As a conservative estimation for the magnitude of discharge from TCW to the sewerage system, 5m³/s of bleed off flows from cooling system has been included, which will be reviewed and considered to be reused at TCW Station for toilet flushing purposes as far as possible.

5.6 Cumulative Impacts from Concurrent Project

5.6.1.1

The construction of the Project potentially overlaps with the construction period of other nearby concurrent projects as identified in **Table 5.12** below. However, since marine works is not required for the current Project, the cumulative direct marine-base water quality impact contributed by the current Project is not anticipated. Moreover, with the incorporation of the recommended mitigation measures during the construction and operational phases of the Project, the water quality impact generated from the Project would be localized and no adverse cumulative water quality impacts would be expected.

Table 5.12 Cumulative impacts from concurrent projects

Proposed development/ on-going projects	Nature of the projects	Major potential water quality impacts	Significant Cumulative Impact	
			Construction phase	Operational phase
Reprovisioning, Remedial and Improvement Work (RRIW)	Demolition and reprovision of the footbridge along Yu Tung Road	Minor land-based work only is anticipated, and no significant water impact is anticipated.	No	No
Tung Chung New Town Extension and its Associated Infrastructures (TCNTE)	New town development extension at both TCE and TCW for accommodating about 220,000 population to meet housing and other development needs.	According to the latest construction works schedule of TCNTE, the reclamation works of TCNTE will be completed (planned in 2022) before the construction of the Project (i.e. Year 2023). According to the EIA for TCNTE, potential water quality impact from TCNTE during the construction phase, including the surface runoff or other wastewater from site formation works/ infrastructural works are anticipated, but cumulative water quality impact would be minor with proper mitigation measure. For the operational phase, the sewerage discharge from TCNTE will be collected and pumped to SHWSTW via new pumping stations. With the provision of stormwater attenuation and treatment ponds, the surface runoff would be minimised. Therefore, no adverse cumulative water quality impact is anticipated during the operational phase.	No	No
Siu Ho Wan Station and Siu Ho Wan Depot Replanning Works	Siu Ho Wan Depot (SHD) replanning works comprises 4 major phases; podium deck and property enabling works for supporting the SHD Topside Development; and a new	Only land-based works is anticipated, and the site is located more than 1km from the current Project, no adverse cumulative water quality impact is anticipated during construction phase. Proper sewage collection and connection to public sewer during operational phase will be designed, no	No	No

Proposed development/ on-going projects	Nature of the projects	Major potential water quality impacts	Significant Cumulative Impact	
			Construction phase	Operational phase
	station and the associated trackwork, as well as local access roads and EVA.	cumulative water quality impact is anticipated for operational phases.		
Proposed Comprehensive Residential and Commercial Development atop Siu Ho Wan Depot	Residential development	Only land-based works is anticipated, and the site is located more than 1km from the current Project, no adverse cumulative water quality impact is anticipated during construction phase. Proper sewage collection and connection to public sewer during operational phase will be designed, no cumulative water quality impact is anticipated for operational phases.	No	No
Additional Sewage Rising Main and Rehabilitation Of The Existing Sewage Rising Main Between Tung Chung And Siu Ho Wan	Construction of additional sewage rising main from Tung Chung sewage pumping station to Siu Ho Wan sewage treatment works and rehabilitation of the existing sewage rising main.	Small scale of land-based construction works, and only small pipe sections are closed to the current Project, adverse cumulative water quality impact should be minor.	No	No
Expansion of Hong Kong International Airport into a Three-Runway System (3RS)	The new land formation immediately north of HKIA comprising associated taxiways, aprons, new passenger concourse buildings, and expansion of the existing Terminal 2 building	Since marine works is not required for the current Project, and this concurrent project is more than 3.5 km from the current Project, adverse cumulative water quality impact is not anticipated during construction phase. Proper sewage collection and connection to public sewer during operational phase will be designed, no cumulative water quality impact is anticipated for operational phases.	No	No
Topside Development at HKBCF Island of the HZMB	The construction programme is yet to be confirmed.	Only land-based works is anticipated, and the site is located more than 1.5km from the current Project, no cumulative water quality impact is anticipated	No	No

Proposed development/ on-going projects	Nature of the projects	Major potential water quality impacts	Significant Cumulative Impact	
			Construction phase	Operational phase
		during construction phase. Proper sewage collection and connection during operational phase will be designed, no cumulative water quality impact is anticipated for operational phases.		
SkyCity Development	Development of a commercial complex adjacent to HKIA	Only land-based works is anticipated, and the site is located more than 1.5km from the current Project, no adverse cumulative water quality impact is anticipated during construction phase. Proper sewage collection and connection to public sewer during operational phase will be designed, no cumulative water quality impact is anticipated for operational phases.	No	No
Intermodal Transfer Terminal (ITT) - Bonded Vehicular Bridge and Associated Roads	Development of a new building which serves intermodal transfer of passengers to and from HZMB	The site is located more than 2km from the current Project. No open sea dredging works are proposed during construction phase and proper sewage collection and connection to public sewer during operational phase will be designed, hence no cumulative water quality impact is anticipated both construction and operational phases.	No	No
Road P1	Road work of about 12 km long in total to the east of TCE Station connecting the HKIA with Sunny Bay (about 2.5 km of Tung Chung to Tai Ho Section and 9.5 km of Tai Ho to Sunny Bay Section).	The reclamation works for Road P1 are more than 1 km away from the Project and there is no marine works under the Project, no adverse cumulative water quality impact is anticipated. For the land-based works of the site, which is located more than 500m from the current Project, no adverse cumulative water quality impact is anticipated as well with proper mitigation measures. Any potential cumulative impact would be addressed in the EIA study for Road P1.	No	No

Proposed development/ on-going projects	Nature of the projects	Major potential water quality impacts	Significant Cumulative Impact	
			Construction phase	Operational phase
Improvement Works for Ma Wan Chung Pier	Redevelopment of a pier	The improvement works would commence in 2022, and overlap with the Project. Given the small-scale project, and pre-fabrication construction plus off-site element breaking and treatment would be adopted, cumulative water quality impact during the construction phase would be minor with proper mitigation measures.	No	No
Tuen Mun – Chek Lap Kok Link (TMCLKL)	Dual-2 lane carriageway between northwest New Territories and HKBCF	The construction of this concurrent project has been completed and no cumulative water quality impact is anticipated.	No	No
Airport City Link	Development of a new bridge	The site is located more than 2km from the current Project, no open sea dredging would be adopted as practicable, no cumulative water quality impact is anticipated with appropriated mitigation measures.	No	No
Airport Tung Chung Link	Development of a new bridge	Any potential cumulative impact would be addressed in the EIA study for Airport Tung Chung Link	No	No
Commercial Development-cum-Public Market in Tung Chung Area 6	Commercial development	The scale of the project is relatively small and proper sewage collection and handling facilities will be designed as part of the commercial development project and sewerage will be discharge to public sewerage. Hence, no cumulative impact is anticipated with appropriate mitigation measures.	No	No

5.7 Mitigation Measures Recommendations

Construction Phase

5.7.1 General Construction Activities

5.7.1.1 Best Management Practices (BMPs) of mitigation measures in controlling water pollution and good site management, as specified in The Professional Persons Environmental Consultative Committee (ProPECC) Practice Note (PN) 1/94 "Construction Site Drainage" should be followed as applicable to prevent runoff with a high level of suspended solids (SS) from entering the surrounding waters.

5.7.1.2 All effluent discharged from the construction site should comply with the standards stipulated in the DSS-TM. The following measures are recommended to protect the water quality of the nearby water, and when properly implemented should be sufficient to adequately control site discharges so as to avoid water quality impacts.

5.7.1.3 Surface runoff from construction sites including barging point should be discharged into storm drains via adequately designed sand/silt removal facilities such as sand traps, silt traps, and sedimentation tanks with sufficient retention time. Channels or earth bunds or sandbag barriers should be provided on-site during construction works to properly direct stormwater to such silt removal facilities. Perimeter channels should be provided on-site boundaries where necessary to intercept storm runoff from outside the site so that it will not wash across the site. Catch pits and perimeter channels should be constructed in advance of site formation works and earthworks.

5.7.1.4 To prevent soil erosion in case of inevitable excavation during rainstorms, temporarily exposed slope surfaces should be covered e.g. by a tarpaulin, and temporary access roads should be protected by crushed stone or gravel, as excavation proceeds as far as practicable. Intercepting channels should be provided (e.g. along the crest/edge of excavation) to prevent storm runoff from washing across exposed soil surfaces. Arrangements should always be in place in such a way that adequate surface protection measures can be safely carried out well before the arrival of a rainstorm.

5.7.1.5 The final surfaces of earthworks should be well compact and the subsequent permanent work or surface protection should be carried out immediately after the final surfaces are formed to prevent erosion caused by rainstorms. Appropriate drainage like intercepting channels should be provided where necessary.

5.7.1.6 Measures should be taken to minimize the ingress of rainwater into trenches. If excavation of trenches in wet seasons is necessary, they should be dug and backfilled in short sections as far as practicable. Rainwater pumped out from trenches or foundation excavations should be discharged into storm drains via silt removal facilities.

5.7.1.7 According to the latest design, bentonite slurries are required during tunnel boring. The bentonite should be reconditioned and reused wherever practicable to minimise the disposal volume of used bentonite slurries. Temporary enclosed storage locations should be provided on-site for any unused bentonite that needs to be transported away after the related construction activities are completed. Requirements as stipulated in ProPECC PN 1/94 should be closely followed when handling and disposing of bentonite slurries.

5.7.1.8 Open stockpiles of construction materials (e.g. aggregates, sand and fill material) on sites should be covered with tarpaulin or similar fabric during rainstorms.

5.7.1.9 Manholes (including newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials, or debris from getting into the drainage system, and to prevent storm runoff from getting into foul sewers. Discharge of surface runoff into foul sewers must always be prevented in order not to unduly overload the foul sewerage system.

5.7.1.10 The temporary drainage system during the construction phase could cope with a design return period of 1 in 10 years rainfall as recommended in DSD Technical Circular No. 1/2017 "Temporary Flow Diversions and Temporary Works Affecting Capacity in Stormwater Drainage System" and DSD's practical Notes No. 1/2017 "Design rainfall and profile for temporary works within the Dry Season".

5.7.1.11 Good site practices should be adopted to remove rubbish and litter from construction sites so as to prevent the rubbish and litter from spreading from the site area. It is recommended to clean the construction sites on a regular basis.

5.7.1.12 Requirements to be incorporated in the Project contract document should be established based on the water quality mitigation measures as mentioned above.

5.7.2 Specific to TCW Area

5.7.2.1 The open-cut works sites of TCW Stations are relatively close to the Yat Tung West Channel, Ma Wan Chung Bay, Wong Lung Hang channel section, and Tung Chung Estuary. According to the latest ecological survey findings, Ma Wan Chung Bay, part of Yat Tung West Channel and Tung Chung Estuary accommodate rich ecological resources including mudflats, mangroves, etc. Hence, it is important to implement precautionary measures to minimise the opportunities of having untreated surface run-off being accidentally discharged into the adjoining water bodies.

5.7.2.2 While the BMP as stipulated in ProPECC PN 1/94 has recommended a comprehensive set of measures that could be implemented on-site, it is recommended that additional precautionary measures are implemented to address the unique circumstances with Tung Chung Estuary in such close proximity.

5.7.2.3 Subject to actual site circumstances and subsequent detailed design, a barrier such as sheet pile/hoarding with concrete footing could be installed along the western boundary of the construction site/works areas for TCW Station as shown in **Figure**

5.2. This barrier shall be designed to contain the surface run-off from releasing to the estuary in an uncontrolled manner during heavy rainfall. Moreover, it has been reviewed and confirmed that the enhancement measures are feasible taking into account the estimates on the runoff during heavy rainfall events and space required for the desilting facilities. The capacity of the sedimentation tanks and perimeter drains shall be reviewed during the detailed design stage to cater for adverse weather conditions. Prior to the commencement of the construction works, the Contractor shall also apply for a discharge licence under the WPCO and shall conduct necessary water quality measurements at the discharge location(s) to demonstrate compliance with the licence conditions.

5.7.2.4 Regardless of the above additional precautionary measures, silt removal facilities, channels, and manholes should be maintained and the deposited silt and grit should be removed regularly, at the onset of and after each rainstorm to prevent local flooding if necessary.

5.7.3 Specific to Barging Point

5.7.3.1 To minimize the potential water quality impact due to transportation of spoil using the barging point, the following good site practices should be strictly followed:

- All vessels should be sized so that adequate clearance is maintained between vessels and the seabed in all tide conditions, to minimise that undue turbidity is not generated by turbulence from vessel movement or propeller wash;
- Loading of barges and hoppers should be controlled to prevent the splashing of material into the surrounding water. Barges or hoppers should not be filled to a level that will cause the overflow of materials or polluted water during loading or transportation; and

5.7.4 Wastewater Discharge from Tunnelling and Open Cut Excavation

5.7.4.1 Wastewater with a high level of suspended solids should be treated before discharge by settlement in tanks with sufficient retention time. Oil interceptors would be required to remove the oil, lubricants, and grease from wastewater. A discharge licence under the Water Pollution Control Ordinance (WPCO) would be required for discharge to the stormwater drain. The Contractor might be stipulated under the discharge license to monitor the quantity and quality of discharge to ensure compliance with the conditions of the discharge license.

5.7.5 Alteration of Groundwater Level

5.7.5.1 Even it is unlikely to change the groundwater level due to the Project works, groundwater monitoring wells would be installed as a precautionary measure in the area closed to TBM and other potential underground works. The precise locations of the monitoring wells will be determined during the detailed design stage. An

action plan is recommended to guide the work arrangement in case of appearing change of groundwater level.

5.7.6 Sewage from Construction Workforce

5.7.6.1 No discharge of sewage to the stormwater system and marine water will be allowed. Adequate and sufficient portable chemical toilets should be provided in the works areas to handle sewage from the construction workforce. A registered collector should be employed to clean and maintain the chemical toilets on a regular basis.

5.7.6.2 Notices should be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the surrounding environment. Regular environmental audit of the construction site should be conducted to provide an effective control of any malpractices and achieve continual improvement of environmental performance on site.

5.7.7 Accidental Spillage

5.7.7.1 Contractor must register as a chemical waste producer if chemical wastes would be produced from the construction activities. The Waste Disposal Ordinance (Cap 354) and its subsidiary regulations in particular the Waste Disposal (Chemical Waste) (General) Regulation, should be observed and complied with for control of chemical wastes. The Contractor is also recommended to develop management procedures for chemicals used and prepare an emergency spillage handling procedure to deal with chemical spillage in case of an accident occurs.

5.7.7.2 Any services and maintenance facilities should be located on hard standings within a bunded area, and sumps and oil interceptors should be provided. Maintenance of vehicles and equipment involving activities with the potential for leakage and spillage should only be undertaken within the areas appropriately equipped to control these discharges. The service and maintenance as well as any chemical storage area would be avoided to position near the watercourse as a safeguard.

5.7.7.3 Disposal of chemical wastes should be carried out in compliance with the Waste Disposal Ordinance. The Code of Practice on the Packaging, Labelling, and Storage of Chemical Wastes published under the Waste Disposal Ordinance details the requirements to deal with chemical wastes. General requirements are given as follows:

- Suitable containers should be used to hold the chemical wastes to avoid leakage or spillage during storage, handling, and transport.
- Chemical waste containers should be suitably labelled, to notify and warn the personnel who are handling the wastes, to avoid accidents.
- Storage area should be selected at a safe location on-site and adequate space should be allocated to the storage area.

5.7.7.4 For the accidental seepage or discharge from TBM works, sufficient ground investigation and soil testing should be carried out for ascertaining that adequate soil cover is achieved. Also, all charted drill holes should be checked by engineer to ensure proper seal up prior to the TBM passing.

5.7.7.5 The Contractor should devise a contingency plan for any accidental spillage and heavy rainfall event.

Operational Phase

5.7.8 Stormwater Surface Runoff

5.7.8.1 Stormwater surface runoff from the realigned open tracks in TCE area would be connected to the nearby existing track side drainage system. The drainage system for other sources of the surface runoff from the Project including TCE Station, entrances and vent shaft structures of TCW Station, EAP/EEP to the west of Shun Tung Road would be provided with silt trap to remove debris and refuse where appropriate. The relevant maintenance staff would also conduct necessary inspection and maintenance to maintain the conditions of silt trap. Stormwater surface runoff generated should be discharged to the nearby public drainage system.

5.7.9 Sewage and Other Wastewater

5.7.9.1 Sewage and other wastewater including the sewage from the sanitary fitments, other wastewater from F&B outlets and indoor facility washing from the two proposed stations, track runoff from tunnel sections, and wastewater flows at the EAP/EEP should be conveyed to the public sewers.

5.7.9.2 Standard oil interceptors should be provided where necessary to remove the oil, lubricants, grease, silt, and grit from wastewater generated from facility washing before discharge to public sewers. A discharge licence for the discharge of commercial and industrial effluent is needed and the discharge quality must satisfy all the standards listed in the DSS-TM and meet the requirements specified in the discharge licence.

5.7.9.3 The bleed off water from the freshwater cooling chiller should be recycled for flushing use as far as practical, with any excess bleed off be discharged into the sewerage system.

5.7.9.4 The practices outlined in ProPECC PN 5/93 for handling, treatment, and disposal of operational stage effluent should also be adopted where applicable.

5.8 Residual Impacts

5.8.1.1 With the implementation of appropriate and possible mitigation measures such as the provision of a barrier such as sheet piles or hoarding with concrete footing along

the western boundary of the construction site/works areas for TCW Station, adverse residual impact is not anticipated during the construction phase.

5.8.1.2 With the proper connection to the public drainage and sewage systems no residual impact is anticipated during the operational phase of the Project.

5.9 Environmental Monitoring and Audit (EM&A)

5.9.1.1 It is recommended that regular site inspections during the construction phase should be undertaken to inspect the construction activities and works areas to ensure the recommended mitigation measures are properly implemented. Details of the audit requirements are provided in the stand-alone EM&A Manual for the Project.

5.9.1.2 As no adverse water quality impact is anticipated, no EM&A activities is required during operational phase.

5.10 Conclusion

5.10.1.1 This section assesses the potential water quality impacts arising from the construction and operation of the Project.

5.10.1.2 The relevant legislation, standards, guidelines, and criteria have been examined. Representative discrete WSRs that are potentially affected by the construction and operation of the Project have been identified.

5.10.1.3 As no dredging works for the barging point is proposed under the latest construction method, the potential sources of water quality impact during the construction phase are mainly from operation of barging point and land-based construction activities including construction runoff, sewage from the workforce, and accidental spillage. Appropriate and possible mitigation measures such as providing perimeter drains, on-site treatment of tunnelling wastewater prior to discharge are recommended. Moreover, a barrier such as sheet piles or hoarding with concrete footing along the western boundary of the construction site/works areas for TCW Station are provided to further minimise the water quality impact. With the implementation of the recommended measures, adverse water quality impact is not anticipated during the construction phase.

5.10.1.4 For the operation phase, the potential water quality impacts mainly from the stormwater runoff, wastewater from facility washing, sewage from the sanitary fitment of station operation, track runoff from tunnel sections and discharge from cooling systems. Stormwater runoff from station structures generated from the Project would be discharged to the public storm drain while sewage with wastewater as well as runoff from underground station and tunnel rail tracks section generated from the Project would be conveyed to public sewer. Hence, it would not cause adverse water quality impact during the operational phase.