5. Water Quality Impact Assessment

5.1 Introduction

This section presents an assessment of the potential water quality impacts associated with the carrying out of the Project. With reference to **Chapter 2**, there are three Reprovisioning Options, namely Option A, Option B, and Option C, that are being considered for the Project.

Regardless of the reprovisioning options, the Project involves mainly decontamination of contaminated soil, after which the decontaminated site will then be handed over to LandsD for redevelopment, any potential environmental impacts will only occur during the decontamination phase of the Decommissioning Project. The Project has no 'Operational Phase'.

The majority of the Project will be on the decontamination works, which will be further discussed in **Section 5.6**.

5.2 Environmental Legislation, Standards and Guidelines

5.2.1 Environmental Impact Assessment Ordinance

The *Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM) is issued by the EPD under Section 16 of the EIAO. It specifies the assessment method and criteria that needs to be followed in EIA studies. Reference sections in the EIAO-TM provide the details of the assessment criteria and guidelines that are relevant to the water quality impact assessment, including:

- Annex 6 Criteria for Evaluating Water Pollution
- Annex 14 Guidelines for Assessment of Water Pollution

5.2.2 Water Pollution Control Ordinance

The *Water Pollution Control Ordinance* (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 whole Hong Kong waters are divided into ten Water Control Zones (WCZs). Water Quality Objectives (WQOs) were established based on different water regimes (marine waters, inland waters, bathing beaches subzones, secondary contact recreation subzones and fish culture subzones) to protect the beneficial uses of water quality in WCZs. Specific WQOs are applied to each WCZ. The Project is located within the Victoria Harbour (Phase Three) WCZ and its corresponding WQOs are listed in **Table 5.1**.

Table 5.1 Water Quality Objective for the Victoria Harbour (Phase Three) WCZ

Parameters	Objectives	Sub-Zone
Offensive Odour, Tints	Not to be present	Whole zone
Visible foam, oil scum, litter	Not to be present	Whole zone
E. coli	Not exceed 1000 per 100 mL, calculated as the geometric mean of the most recent 5 consecutive	Inland waters

Parameters	Objectives	Sub-Zone
	samples taken at intervals of between 7 and 21 days.	
Colour	Change due to human activity not to exceed 50 Hazen Units	Inland waters
Depth-averaged DO	Not less than 4 mg L^{-1} for 90% of the sampling occasions during the whole year; values should be calculated as the annual water column average (expressed normally as the arithmetic mean of at least 3 measurements at 1m below surface, mid depth and 1m above the seabed. However in water of a depth of 5m of less the mean shall be that of 2 measurements – 1m below surface and 1m above seabed, and in water of less than 3m the 1m below surface sample only shall apply.)	Marine waters
	Not less than 4 mg L^{-1}	Inland waters
Dissolved Oxygen (DO) within 2 m of the seabed	Not be less than 2 mg L^{-1} within 2 m of the seabed for 90% of the sampling occasions during the whole year.	Marine waters
pH	To be in the range of 6.5 - 8.5, change due to human activity not to exceed 0.2	Marine waters
	To be within the range of 6.0 - 9.0	Inland waters
Salinity	Change due to human activity not to exceed 10% of ambient level	Whole zone
Temperature	Change due to human activity not to exceed 2 ^{o}C.	Whole zone
Suspended Solids (SS)	Not to be raised by more than 30% nor give rise to accumulation of suspended solids which may adversely affect aquatic communities.	Marine waters
	Annual median of suspended solids not to exceed 25 mg L^{-1} due to human activity	Inland waters
Unionised Ammonia (UIA)	Not to exceed 0.021 mg L^{-1}, calculated as the annual average (arithmetic mean).	Whole zone
Nutrients	Not present in quantities sufficient to cause excessive algal growth	Marine waters
	Annual mean depth-averaged inorganic nitrogen not to exceed 0.4 mg L^{-1}	Marine waters
5-day Biochemical Oxygen Demand (BOD)	Not to exceed 5 mg L^{-1}	Inland waters
Chemical Oxygen Demand (COD)	Not to exceed 30 mg L^{-1}	Inland waters
Toxic substances	Not to attain such levels as to produce significant toxic, carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms.	Whole zone

Source: Statement of Water Quality Objectives (Victoria Harbour (Phase Three) Water Control Zone).

5.2.3 Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters

Discharges of effluents are subject to control under the WPCO. The *Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters* (TM-DSS) sets limits for effluent discharges. Specific limits apply for different areas and are different between surface waters and sewers. The limits vary with the rate of effluent flow. Any sewage discharging into the

Victoria Harbour should comply with the standards for effluent discharged into inshore and marine waters, as shown in **Table 5.2** and **Table 5.3** of the TM-DSS.

Table 5.2: Standards for Effluents Discharged into the Inshore Waters of Victoria Harbour Water Control Zone

Flow rate (m3/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	2.7	2	1.3	1	8	0.6
Boron	5	4	3	2.7	2	1.6	1.1	0.8	0.5	0.4	0.3	0.2
Barium	5	4	3	2.7	2	1.6	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	0.25	0.2	0.15	0.1	0.1	0.1
Total toxic metals	2	2	1.6	1.4	1	0.8	0.5	0.4	0.3	0.2	0.14	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	0.13	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	100	100	100	100	80	80	50	50	50	50
Total phosphorus	10	10	10	10	10	10	8	8	5	5	5	5
Surfactants (total)	20	15	15	15	15	15	10	10	10	10	10	10
E. coli (count/100ml)	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000

Note: All units are 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 Victoria Harbour Water Control Zone

Flow rate (m3/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
Suspended solids	700	600	600	500	375	300	200	150	100	75	60	40
BOD	700	600	600	500	375	300	200	150	100	75	60	40
COD	1500	1200	1200	1000	700	600	400	300	200	100	100	85
Oil & Grease	50	50	50	30	25	20	20	20	20	20	20	20

Flow rate (m3/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
Iron	20	15	13	10	7.5	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	0.05	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.1	0.05	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	0.8	0.6	0.5	0.32	0.24	0.16	0.12	0.1	0.1
Total toxic metals	4	3	2	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	0.1	0.1	0.08	0.06	0.04
Phenols	0.5	0.5	0.5	0.3	0.3	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	100	100	100	100	100	100	100	100	100	50
Total phosphorus	10	10	10	10	10	10	10	10	10	10	10	5
Surfactants (total)	30	20	20	20	15	15	15	15	15	15	15	15
E. coli (count/100ml)	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000

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

5.2.4 Water Supplies Department (WSD) Water Quality Objective Target Values

For assessment of water quality impacts at seawater intakes for flushing water, the water quality objective target values as specified by WSD as shown in **Table 5.4** were adopted.

Table 5.4: WSD's Water Quality Objective Target Values for Flushing Water at Sea Water Intakes

Parameter (in mg/L unless otherwise stated)	Target Limit
Colour (HU)	< 20
Turbidity (NTU)	< 10
Threshold Odour Number (odour unit)	< 100
Ammonia Nitrogen (NH3-N)	< 1
Suspended Solids (SS)	< 10
Dissolved Oxygen (DO)	> 2
5-day Biochemical Oxygen Demand (BOD5)	< 10
Synthetic Detergents	< 5
E. coli (no. per 100 mL)	< 20,000

5.2.5 Practice Note for Professional Persons on Construction Site Drainage

A practice note for professional persons was issued by the EPD to provide guidelines for handling and disposal of construction site discharges. The *Practice Note for Professional Persons on Construction Site Drainage* (ProPECC Note PN 1/94) provides good practice guidelines for dealing with various types of

discharge from a construction site. Practices outlined in ProPECC Note PN 1/94 should be followed as far as possible during decommission to minimise the water quality impact due to site drainage from Project.

5.2.6 Criteria for Dissolved Metals

For assessment of water quality impacts at WSRs for dissolved metals (other than the ones specified in WQOs), the USEPA Criteria Maximum Concentration and UK Shellfish Waters Directive were adopted for those heavy metals not covered by HK TM-DSS. A summary of the assessment criteria is shown in **Table 5.5**.

Table 5.5: Overseas Water Quality Criteria for Dissolved Metals

Parameter (in µg/L unless otherwise stated)	Target Limit
Heavy Metals	
Cadmium (Cd)[#]	1
Chromium *	1,000
Copper (Cu)	4.8
Lead (Pb)	210
Nickel (Ni)	74
Zinc (Zn)	90
Mercury (Hg)[#]	1
Metalloid (Arsenic - As)	69

Source:
The USEPA Criteria Maximum Concentration (CMC),
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm#Z2, 16 June 2014
* UK Council Directive on the quality required of shellfish waters (Shellfish Waters Directive), http://evidence.environment-agency.gov.uk/ChemicalStandards/Driver.aspx?did=13, 16 June 2014
[#]HK TM-DSS

5.3 Assessment Area and Sensitive Receivers

According to Clause 3.4.5.2 of the EIA Study Brief, water quality impact assessment has been carried out in all areas within 500m from the Project site boundary and other areas such as water courses and the associated water systems in the vicinity that might be impacted by the Project.

The Project site is situated next to Victoria Road and Cadogan Street, Kennedy Town, adjacent to Victoria Harbour, (see **Figure 5.1**). There are no particular areas of conservation value, ecological importance or mariculture activities in the vicinity of the Project site.

No water courses, natural streams, ponds, change of water holding/flow regimes and change of catchment types or areas would be altered by the Project. There are no natural streams or rivers within or in close proximity to the proposed Project area. Existing small watercourses within 500m from the Project boundary comprise streams on the hillslopes of Mount Davis and Lung Fu Shan. These streams drain into stormwater drainage culverts on reaching the built-up urban areas. There are no open drainage culverts in close proximity to the proposed Project area.

A stormwater outfall is situated within the study area but is more than 100m away from the existing and planned sensitive receivers and no outfall or other water pollution source is planned in the Project.

Key WSR that may potentially be affected by the Decommissioning Project include WSD flushing water intake (existing and planned). The key WSR is listed in **Table 5.6** and the indicative locations of are shown in **Figure 5.2**.

Table 5.6: Water Sensitive Receiver

ID	Descriptions
WSD flushing water intakes	
WSD2	Kennedy Town Flushing Water Intake
P1	Planned Reprovision Kennedy Town Flushing Water Intake

5.4 Description of the Existing Environment/ Background Water Quality

5.4.1 Marine Water Quality

According to the *Marine Water Quality in Hong Kong in 2012*, which is the latest available information from EPD at the time of writing this report, the Victoria Harbour WCZ in 2012 attained an overall WQO compliance rate of 77%. The compliance rate of DO at all open water stations in the WCZ achieved 100% compliance rate; whereas the TIN objectives only achieved a 30% compliance rate, with high non-compliance at central and western stations. A summary of marine water quality monitoring data routinely collected by EPD in 2012 at relevant monitoring stations is presented in **Table 5.7**.

Table 5.7: Marine Water Quality in Victoria Harbour Water Control Zone at Selected Stations in 2012

		Victoria Harbour (West)		Stonecutters Island	Rambler Channel	
Parameter		**VM7**	**VM8**	**VM15**	**VM12**	**VM14**
Temperature (°C)		23.2 (15.2 – 28.3)	23.2 (15.4 – 28.3)	23.7 (16.2 – 28.7)	23.3 (15.9 – 28.3)	23.5 (16.0 – 28.5)
Salinity		30.1 (24.9 – 32.7)	30.2 (24.6 – 32.9)	30.4 (27.4 – 32.6)	30.0 (26.0 – 32.6)	28.9 (21.2 – 32.5)
Dissolved Oxygen (DO) (mg/L)	Depth-averaged	6.1 (3.8 – 8.5)	6.6 (4.5 – 9.0)	5.7 (4.2 – 7.4)	6.0 (3.8 – 8.4)	6.2 (3.6 – 8.1)
	Bottom	5.9 (3.6 – 8.6)	6.3 (4.4 – 9.2)	5.5 (3.9 – 7.0)	6.0 (3.5 – 8.4)	6.2 (3.3 – 8.1)
Dissolved Oxygen (DO) (% Saturation)	Depth-averaged	84 (58 – 121)	90 (66 – 109)	80 (63 – 101)	83 (57 – 103)	85 (53 – 113)
	Bottom	82 (55 – 104)	87 (66 – 111)	76 (57 – 95)	82 (53 – 103)	85 (49 – 111)
pH		7.7 (7.4 – 7.9)	7.8 (7.5 – 7.9)	7.6 (7.4 – 7.9)	7.7 (7.4 – 7.9)	7.7 (7.4 – 7.9)
Secchi Disc Depth (m)		2.6 (2.0 – 4.0)	2.6 (2.0 – 3.0)	2.6 (2.0 – 4.0)	2.4 (1.8 – 3.5)	2.4 (2.0 – 3.5)
Turbidity (NTU)		12.8 (2.1 – 96.7)	11.4 (2.4 – 91.7)	4.8 (2.0 – 12.0)	14.6 (3.0 – 109.0)	13.1 (2.2 – 104.0)
Suspended Solids (SS) (mg/L)		4.0 (2.3 – 7.5)	6.3 (2.4 – 30.3)	6.8 (1.8 – 34.3)	8.3 (2.5 – 16.0)	5.8 (2.1 – 13.3)
5-day Biochemical Oxygen Demand (BOD_5) (mg/L)		0.6 (0.2 – 1.1)	0.6 (0.2 – 1.1)	0.5 (0.1 – 1.2)	0.4 (<0.1 – 1.0)	0.4 (<0.1 – 1.0)
Ammonia Nitrogen (mg/L)		0.206 (0.103 – 0.323)	0.159 (0.096 – 0.243)	0.212 (0.157 – 0.337)	0.190 (0.113 – 0.247)	0.159 (0.075 – 0.273)

	Victoria Harbour (West)		Stonecutters Island	Rambler Channel	
Parameter	**VM7**	**VM8**	**VM15**	**VM12**	**VM14**
Unionised Ammonia (UIA) (mg/L)	0.004 (0.002 – 0.010)	0.004 (0.002 – 0.006)	0.004 (0.001 – 0.008)	0.004 (0.002 – 0.007)	0.003 (0.001 – 0.006)
Nitrite Nitrogen (mg/L)	0.040 (0.014 – 0.067)	0.045 (0.012 – 0.090)	0.034 (0.018 – 0.057)	0.048 (0.015 – 0.087)	0.057 (0.016 – 0.110)
Nitrate Nitrogen (mg/L)	0.260 (0.100 – 0.690)	0.248 (0.079 – 0.627)	0.247 (0.107 – 0.580)	0.270 (0.097 – 0.620)	0.342 (0.123 – 0.840)
Total Inorganic Nitrogen (TIN) (mg/L)	0.51 (0.31 – 0.92)	0.45 (0.30 – 0.87)	0.49 (0.35 – 0.90)	0.51 (0.34 – 0.85)	0.56 (0.32 – 1.08)
Total Kjeldahl Nitrogen (mg/L)	0.41 (0.24 – 0.58)	0.33 (0.24 – 0.43)	0.40 (0.31 – 0.51)	0.36 (0.25 – 0.49)	0.33 (0.23 – 0.50)
Total Nitrogen (mg/L)	0.71 (0.45 – 1.15)	0.63 (0.40 – 1.08)	0.68 (0. 50 – 1.08)	0.68 (0.50 – 1.02)	0.73 (0.49 – 1.28)
Orthophosphate Phosphorus (mg/L)	0.034 (0.010 – 0.048)	0.027 (0.017 – 0.034)	0.035 (0.021 – 0.052)	0.032 (0.015 – 0.044)	0.030 (0.019 – 0.045)
Total Phosphorus (mg/L)	0.05 (0.04 – 0.07)	0.04 (0.03 – 0.06)	0.05 (0.04 – 0.07)	0.05 (0.04 – 0.07)	0.05 (0.03 – 0.06)
Silica (as SiO_2) (mg/L)	1.41 (0.67 – 2.70)	1.37 (0.60 – 2.60)	1.41 (0.92 – 2.20)	1.45 (0.90 – 2.47)	1.70 (0.83 – 4.10)
Chlorophyll-*a* (µg/L)	1.9 (0.3 – 9.3)	1.9 (0.4 – 7.1)	2.0 (0.4 – 9.8)	1.3 (0.4 – 3.5)	1.4 (0.4 – 4.2)
E. coli (count/100ml)	2000 (83 – 14000)	630 (67 –12000)	570 (89 – 2200)	410 (75 – 2100)	360 (51 – 5200)
Faecal Coliforms (count/100ml)	4400 (130 – 31000)	1300 (95 – 21000)	1300 (200 – 4900)	910 (110 – 5200)	780 (160 – 8900)

Source: Adopted from EPD Marine Water Quality in Hong Kong in 2012 (downloaded online)

Notes:

1. Except as specified, data presented are depth-averaged values calculated by taking the means of three depths: surface, mid-depth, bottom.
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 the ranges.

5.4.2 Ground Water Quality

Ground water sampling was conducted for the EIA Report for Demolition of Buildings and Structures in the Proposed Kennedy Town Comprehensive Development Area Site (AEIAR-058/2002), the locations of the sampling points can be referred to **Chapter 7** of this EIA report.

From the test results and onsite observations, extremely small amount of ground water and a very low recharge rate was observed. No exceedance was recorded when comparing the results with RBRG standards. Further discussions on the test methods can be found in **Chapter 7** of this EIA report.

5.5 Assessment Methodology

In accordance with Clause 3.4.5 and Appendix C of the EIA Study Brief, the assessment has been carried out in accordance with Annexes 6 and 14 of the EIAO-TM.

Potential pollutants from point discharges and non-point sources to surface water runoff, sewage or polluted discharge generated from the Project that may affect the quality of surface water runoff and nearby waters are considered. The potential water quality impacts and their impact significance were determined. Mitigation measures to reduce any identified adverse impacts on water quality to acceptable levels were also determined.

With reference to the previous EIA study performed on the Project site area (EIA ref. no.: EIA-064/2001), extremely low quantity of ground water was observed. As such, the probability of impact to ground water is extremely low and will not be considered in this assessment.

5.6 Identification, Prediction and Evaluation of Environmental Impact

5.6.1 Decontamination Phase

Potential sources of water quality impact associated with the construction and decontamination activities for the Project during Reprovisioning Option A include the following:

- Site runoff from Project;
- Sewage effluent from construction workforce;
- General site activities;
- Pipe piles;
- Excavation works; and
- Accidental chemical spillage.

5.6.1.1 Site Runoff from Project

Potential sources of pollution from site drainage include:

- Runoff and erosion from site surfaces, drainage channels, earth working areas and open stockpiles during rainfall events;
- Release of grouting materials with site runoff and storm water;
- Wash water from dust suppression sprays and wheel wash facilities; and
- Fuel, oil, solvents and lubricants from maintenance of site vehicles and mechanical equipment.

The surface runoff from Project works areas due to rainfall and other activities, and wastewater from wheel wash facilities will contain increased loads of suspended solids (SS) and contaminants such as heavy metals and hydrocarbons. It is anticipated that the concentration of contaminants in the contaminated runoff would be similar to the ground water test results shown in Appendix L of **Appendix 7.2** (CAR/RAP).

As mentioned in **Section 5.7.1.1**, the treated effluent has to fulfil the requirement set in the TM-DSS. As the closest WSR, WSD2, is approximately 10m away from the Project boundary and the fisheries activities in the vicinity are mainly offshore activities, unacceptable water quality impact to nearby WSRs is not anticipated. Nevertheless, to give an indication of the potential dispersion of contaminants that might be released from surface runoff, a theoretical calculation was conducted and is presented in **Appendix 5.2** to provide a reference to the potential mixing zone. The theoretical calculations suggest that without any treatment, the dissolved metal concentrations will still fully meet the relevant criteria within 5m of the discharge point. With treatment process that fulfils the TM-DSS requirements, the contaminants concentration would fully comply with the relevant criteria at the discharge point.

Sediment laden runoff particularly from works areas subjected to excavation or earth works, if uncontrolled, may carry SS into nearby storm water drains. This may physically affect the drainage system (via blockages) as well as create adverse water quality impacts at the storm water outfall (such as high turbidity, discolouration, and release of contaminants into the surrounding marine environment).

As a good site practice, mitigation measures should be implemented to control site runoff from Project and drainage from the works areas, and to prevent runoff and drainage water with high levels of SS from entering nearby storm water drains. With the implementation of adequate site drainage from Project and provision of sediment removal facilities such as silt traps and oil interceptors, unacceptable water quality impacts due to site runoff from Project is not anticipated.

5.6.1.2 Sewage Effluent from Construction Workforce

Sewage would be generated from the workforce on-site during the decontamination works. However, portable chemical toilets and adequate sanitary facilities will be provided within the Project site. The Contractor would have the responsibility to ensure that chemical toilets and sanitary facilities are used and properly maintained, and that licensed Contractors are employed to collect and dispose of the waste off-site at approved locations. Therefore no sewage will be released into the surrounding environment and no water quality impacts are anticipated.

5.6.1.3 General Site Activities

On-site activities from construction and decontamination works may result in water pollution from the following:

- Uncontrolled discharge of debris and rubbish such as packaging, construction materials and refuse
- Spillages of liquids stored on-site, such as oil, diesel and solvents etc.

Uncontrolled discharge of debris and rubbish, and spillages of liquids on site could result in litter, fuels and solvents entering the public drainage system and the marine environment, which may cause physical blockage of the drainage system as well as potential adverse water quality impact from increased SS levels, nutrients, heavy metals, hydrocarbons and oxygen demand in the marine environment. However, these impacts are likely to be minimal provided that good site practices and proper site management is observed. It is anticipated that water quality impacts caused by general activities from construction and decontamination works would be insignificant with proper implementation of recommended mitigation measures.

5.6.1.4 Pipe Piles

The Project involves pipe piling activities along the seawall to avoid any seawater ingress to the site. The selected pipe piling method for the Project will include cement silica grout around the piles. This method will ensure that no gaps are formed between piles, which can minimise any seawater ingress. Details of the method can be referred to **Appendix 5.1**. Water generated during the installation of the pipe piles will be air lifted to sedimentation tanks for treatment before discharge as shown in **Appendix 5.3**. The treatment mentioned in **Section 5.7.1.4** would be used to ensure the effluent quality before discharge.

Water might be discharged during the installation of pipe pile installation, potentially releasing contaminants in the process. As mentioned in **Section 5.6.1.1**, unacceptable water quality impact to nearby WSRs is not anticipated, and the amount of water discharged is anticipated to be of a minute amount when compared with the daily runoff volume adopted for theoretical calculations in **Appendix 5.2**. In this respect, unacceptable water quality impact due to the potential contaminant release from pipe pile installation is not anticipated.

With the implementation of good site practices and mitigation measures, in combination with the above arrangements and designs, no adverse water quality impact is anticipated.

5.6.1.5 Excavation Works

The Project involves excavation for treatment of the contaminated soil. Excavated material will be treated on-site for de-contamination and backfilled on-site. Temporary storage might be required before treatment. Stockpiles of loose soil may generate site runoff during rainfall if the stockpile is not covered properly. Runoff from stockpiles of contaminated materials will contain high levels of suspended solids which may lead to adverse impacts on the marine environment if discharged into the nearby storm drains. Runoff might also contain low concentration of pollutants, similar to the groundwater.

As discussed in **Section 5.6.1.1**, due to the anticipated low concentration of pollutants, water quality impact due to pollutant release is considered relatively low.

By adopting good site practices and appropriate mitigation measures, site runoff and seawater seepage from Project can be controlled, and the potential water quality impact would be minimised. An EM&A programme is recommended to manage and control the potential impact and to ensure the implication of recommended mitigation measures.

5.6.1.6 Accidental Chemical Spillage

A variety of chemicals would be stored and generated on-site during the carrying out of the Project. These chemicals may include petroleum products, spent lubricants, oil and grease, mineral oil, solvent and other chemicals. Accidental spillages of these chemicals in construction workshops may contaminate the treated top soil at the Project site, and site runoff from Project may release contaminated soil and/or water into the surrounding environment.

As part of good site practice, chemicals should be managed, stored and handled properly, preventing the contamination of top soil and water pollution due to site runoff from Project. With the implementation of good site practices and mitigation measures, no adverse water quality impact is anticipated.

5.7 Mitigation of Adverse Environmental Impact

5.7.1 Decontamination Phase

5.7.1.1 Site Runoff and Other Discharge Instances from the Project

The site practices outlined in ProPECC Note PN 1/94 should be observed to control surface runoff and the chance of erosion. To prevent overflow of contaminants from the site, a detailed **Construction Site**

Drainage Management Plan (the Plan) with detailed design of the site drainage system, which should be certified by a qualified civil engineer of the Engineer's Representative's team who has suitable drainage system design experience prior to submission to EPD, before commencement of the construction works of the Project. In general, **the Plan** shall incorporate the requirements shown in bullet points below**:**

- A detailed construction site drainage proposal with justifications for design rain storm frequency (e.g. 1 in 50 year rainstorm), taking into consideration relevant factors such as the downstream public storm drain capacity available, practicability of providing on-site storm water storage tank; etc.
- Perimeter cut-off drains to prevent inadvertent discharge should be constructed. In addition, cut-off channels, earth bunds or similar impervious water barriers should be provided on site to direct site runoff to silt removal facilities and other treatment as necessary if contaminants or contaminated water are encountered (schematic diagram at **Appendix 5.4** also refers);
- The site area should be made impervious (e.g. concrete top) except for the active excavation area. A daily inspection checklist of the impervious layers for confirming no leaks and cracks and other defects and attach to the site drainage audit checklist should also be submitted to the ER and deposit a copy with EPD;
- The active excavation areas should be cut-off from the remaining site by impervious bunds;
- The collected storm water from cut-off drains should be treated to meet the requirements of the TM standards under the WPCO or the WPCO licence requirement, whichever is more stringent, before discharge off site;
- Runoff should be treated with wastewater treatment facilities and ensure that the requirements of the TM standards under the WPCO or the WPCO licence requirement, whichever is more stringent are met before discharge;
- Sand/silt removal facilities such as sand/silt traps and sediment basins should be provided to remove sand/silt particles from runoff to meet the requirements of the TM standards under the WPCO. The design of silt removal facilities should be based on the guidelines in Appendix A1 of ProPECC Note PN 1/94;
- All drainage facilities and erosion and sediment control structures should be regularly inspected and maintained to ensure proper and efficient operation at all times and particularly before and during rainstorms. Deposited silt and grit should be regularly removed at the onset of, and after each rainstorm event to ensure that these facilities are functioning properly at all times;
- Measures should be taken to minimise the ingress of site drainage into excavations. If excavation of trenches in wet periods is necessary, they should be dug and backfilled in short sections wherever practicable. Water pumped out from excavations should be treated through silt removal facilities before reused on site or treated in the cement solidification process;
- Water used in ground boring and drilling for site investigation or rock/soil anchoring should as far as practicable be recirculated after sedimentation. Excess wastewater should go through silt removal facilities and used in the cement solidification process or disposed of as chemical waste;
- All vehicles and plants should be cleaned before leaving a Project site to ensure no earth, mud, debris and the like is deposited by them on roads. An adequately designed and sited wheel washing facility should be provided at Project site exits where practicable. Wash-water should have sand and silt settled out and removed regularly to ensure the continued efficiency of the process. The section of access road leading to, and exiting from, the wheel-wash bay to the public road should be paved with sufficient backfall toward the wheel-wash bay to prevent vehicle tracking of soil and silty water to public roads and drains;

- Open stockpiles of construction materials or construction wastes on-site should be covered with tarpaulin or similar impervious material during rainstorms. Measures should be taken to prevent construction materials, soil, silt or debris runoff into any drainage system;
- Manholes (including newly constructed ones) should be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris being washed into the drainage system and to avoid storm water runoff being directed into foul sewers;
- Precautions should be taken at any time of the year when rainstorms are likely. Actions should be taken when a rainstorm is imminent or forecasted and actions to be taken during or after rainstorms are summarised in Appendix A2 of ProPECC Note PN 1/94. Particular attention should be paid to the control of silty surface runoff during storm events, especially for areas located near steep slopes;
- A site drainage audit checklist should also be designed by the ER to ensure the drainage design is properly constructed executed and maintained. The Contractor should submit the duly completed checklist to the ER daily for certification and the ER should deposit a certified copy with EPD; and
- The Contractor shall obtain a valid license from EPD under the WPCO before the commencement of construction works.

5.7.1.2 Sewage Effluent from Construction Workforce

Temporary sanitary facilities, such as portable chemical toilets, should be provided on-site to handle sewage from the workforce. A licensed contractor should be employed to provide appropriate and adequate portable toilets and be responsible for appropriate disposal and maintenance.

5.7.1.3 General Site Activities from the Project

Construction solid waste, debris and refuse generated on-site should be collected, handled and disposed of properly by a licensed contractor to avoid entering any nearby storm water drains. Stockpiles of cement and other construction materials should be kept covered when not being used.

5.7.1.4 Pipe Piles

Water generated from the pipe piling activities should be treated and reused on site. Any excess wastewater shall be treated to ensure that the requirements of the TM standards under the WPCO are met before discharge. The silt removed in the process will be reused on site in the cement solidification process.

5.7.1.5 Excavation Works

During wet season (April to September), temporarily exposed slope/soil surfaces should be covered by tarpaulin or similar means, as far as practicable. Interception channels should be provided (e.g. along the crest/edge of the excavation) to prevent storm runoff from washing across exposed soil surfaces. Arrangements should always be in place to ensure that adequate surface protection measures can be safely carried out well before the arrival of a rainstorm. Other measures that need to be implemented before, during and after rainstorms are summarised in ProPECC PN 1/94.

5.7.1.6 Accidental Chemical Spillage

The Contractor should register as a chemical waste producer if chemical wastes would be produced from decommissioning/reprovisioning or other 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.

Maintenance of vehicles and equipment involving activities with potential for leakage and spillage should only be undertaken within designated areas which are appropriately equipped to control discharges.

Oils and fuels should only be stored in designated areas which have pollution prevention facilities. To prevent spillage of fuels and solvents to any nearby storm water drain, all fuel tanks and storage areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. The bund should be drained of rainwater after a rainfall event.

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.

5.8 Cumulative Impact

As mentioned in **Chapter 2**, the following projects have been identified as possible concurrent projects.

- Residential Development at the Ka Wai Man Road and Ex-Mount Davis Cottage Area
- Reprovisioning of Kennedy Town Saltwater Pumping Station
- Development within the Kennedy Town CDA site (for Reprovisioning Option A only)

Detailed construction methods and construction programmes for the Reprovisioning of Kennedy Town Saltwater Pumping Station and seawater intake are not available during the assessment. It was not possible to assess the cumulative water quality impact with the concerned project.

As for the two potential development projects, the anticipated water quality impact would be sediment laden runoff, but with implementation of the good site practices as stated in ProPECC Note PN 1/94, no residual adverse water quality impact is expected. As such, no cumulative impact is anticipated from the projects.

5.9 Evaluation of Residual Impact

With the implementation of the recommended mitigation measures for the decontamination phase, no residual water quality impact is anticipated.

5.10 Environmental Monitoring and Audit

Adverse water quality impact was not predicted during the carrying out of the Project. Nevertheless, appropriate mitigation measures are recommended to minimise potential water quality impacts. It is recommended that regular audit of the implementation of the recommended mitigation measures during carrying out of the Project at the work areas should be undertaken to ensure the recommended mitigation measures are properly implemented.

A water quality monitoring programme is also recommended to be implemented, as part of the management and control programme defined in the action plan of the EM&A Manual. Details of the water quality monitoring programme are specified in the EM&A Manual.

5.11 Conclusion

During the carrying out of the Project, potential water quality impact would be generated from site run-off, sewage from workforce, and generation of wastewater from various Project activities. With the implementation of the recommended mitigation measures, no adverse water quality impact from the Project works is anticipated.