6 WATER QUALITY IMPACT

6.1 Introduction

6.1.1 This section presents an assessment of the potential water quality impacts associated with construction and operation of the Project. Recommendations for mitigation measures have been provided to minimize the identified water quality impacts.

6.2 Environmental Legislation, Plans, Standards and Guidelines

Environmental Impact Assessment Ordinance (EIAO)

6.2.1 The Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) was issued by Environmental Protection Department (EPD) under Section 16 of the EIAO. It specifies the assessment method and criteria that are to be followed in an EIA Study. Reference sections in the EIAO-TM provide the details of 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

Water Quality Objectives

6.2.2 The Water Pollution Control Ordinance (WPCO) provides major statutory framework for the protection and control of water quality in Hong Kong. According to the Ordinance and its subsidiary legislation, Hong Kong waters are divided into ten Water Control Zones (WCZs). Corresponding statements of Water Quality Objectives (WQOs) are stipulated for different water regimes (marine waters, inland waters, bathing beaches subzones, secondary contact recreation subzones and fish culture subzones) in the WCZs based on their beneficial uses. The study area for this water quality impact assessment covers the Victoria Harbour (Phase one) WCZ. The corresponding WQOs are listed in **Table 6.1**.

Table 6.1 Summary of Water Quality Objectives for Victoria Harbour 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 to exceed 1000 per 100 mL, calculated as the geometric mean of the most recent 5 consecutive samples taken at intervals between 7 and 21 days	Inland waters
Dissolved oxygen (DO) within 2 m of the seabed	Not less than 2.0 mg/L for 90% of samples	Marine waters
Depth-averaged DO	Not less than 4.0 mg/L for 90% of samples	Marine waters
DO	Not less than 4.0 mg/L	Inland waters
pH	To be in the range of 6.5 - 8.5, change due to human activity not to exceed 0.2	Marine waters
	Not to exceed the range of 6.0 - 9.0 due to human activity	Inland waters
Salinity	Change due to human activity not to exceed 10% of ambient	Whole zone
Temperature	Change due to human activity not to exceed $2^{o}C$	Whole zone
Suspended solids (SS)	Not to raise the ambient level by 30% caused by human activity	Marine waters
	Annual median not to exceed 25 mg/L due to human activity	Inland waters

Parameters	Objectives	Sub-Zone
Unionized ammonia (UIA)	Annual mean not to exceed 0.021 mg(N)/l as unionized form	Whole zone
Nutrients	Shall not cause excessive algal growth	Marine waters
Total inorganic nitrogen (TIN)	Annual mean depth-averaged inorganic nitrogen not to exceed 0.4 mg(N)/l	Marine waters
5-Day biochemical oxygen demand (BOD_5)	Not to exceed 5 mg/L	Inland waters
Chemical Oxygen Demand (COD)	Not to exceed 30 mg/L	Inland waters
Toxic substances	Should not attain such levels as to produce significant toxic, carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms.	Whole zone
	Human activity should not cause a risk to any beneficial use of the aquatic environment.	Whole zone

Source: Statement of Water Quality Objectives (Victoria Harbour (Phases One, Two and Three) Water Control Zone).

Technical Memorandum on Effluent Discharge Standard

6.2.3 Besides setting the WQOs, the WPCO controls effluent discharging into the WCZs through a licensing system. Guidance on the permissible effluent discharges based on the type of receiving waters (foul sewers, stormwater drains, inland and coastal waters) is provided in the Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS). The limits given in the TM-DSS cover the physical, chemical and microbial qualities of the effluents. Any effluent discharge during the construction and operational stages should comply with the relevant standards as stipulated in the TM-DSS.

Practice Notes

6.2.4 The Practice Note (PN) for Professional Persons on Construction Site Drainage (ProPECC PN 1/94) issued by EPD provides good practice guidelines for dealing with various types of discharge from a construction site. Practices outlined in the PN should be followed as far as possible during construction to minimize the water quality impact due to construction site drainage.

6.3 Water Sensitive Receivers

6.3.1 Any discharge from the Project works during the construction and operational phases would potentially affect the inland waters within the Victoria Harbour (Phase One) WCZ.

6.3.2 Major inland water bodies within 500m from the Project site boundaries were identified and their indicative locations are shown in **Figure 6.1**. These inland water bodies include Ma Yau Tong Streams (in the vicinity of the southern Project site) as well as the streams and channelized nullahs near Clear Water Bay Road in the north. Descriptions of these inland waters are provided in **Table 6.2**.

Table 6.2 Descriptions of Inland Waters

Inland Waters (refer to Figure 6.1)	Closest Distance from Project Site	Generalized Flow Direction	Height Relative to Project Site
Ma Yau Tong Streams near the southern Project site (Part natural streams / part channelized)	About 100 m	Water generally flows from the northeast or southeast towards the Project site in the west and discharges to the drainage network underneath the Project site and	Range from about ±200 mPD in the upstream to about ±80 mPD in the downstream as compared to the height of Project site at about ±80 mPD

Inland Waters (refer to Figure 6.1)	Closest Distance from Project Site	Generalized Flow Direction	Height Relative to Project Site
		eventually flows to the Victoria Harbour.	
Channelized nullahs near the northern Project site at Clear Water Bay Road	Immediate vicinity	Water generally flows from the north towards the south (some nullahs flow across the Project site via underground drainage) and eventually discharges to the Victoria Harbour.	Range from over 250 mPD in the upstream to about ±170 mPD in the downstream as compared to the height of Project site at about ±170 mPD

6.4 Description of the Environment

Ma Yau Tong Streams

6.4.1 Water quality monitoring data for Ma Yau Tong Streams (close to the southern Project site) are available from the approved Schedule 3 EIA Report for Development of Anderson Road Quarry (EIAO Register No. AEIAR-183/2014). Monitoring data at Ma Yau Tong Stream are available in terms of suspended solids (SS), dissolved oxygen (DO), temperature, pH, flow rate, nutrients (ammonia and unionized ammonia), biochemical oxygen demand (BOD) and chemical oxygen demand (COD), salinity and *E. coli*. These monitoring data were collected at 4 monitoring locations, namely A, B, C and D, as shown in **Figure 6.1**. The measurement was carried out three times a week within two consecutive weeks for both dry season (i.e. March 2013) and wet season (i.e. June 2013). The monitoring results as extracted from the Schedule 3 EIA Report are presented in **Table 6.3** and **Table 6.4**.

Table 6.3 Summary of Water Quality Monitoring Data for Ma Yau Tong Streams (Dry Season)

Parameter	Unit	Monitoring Data During Dry Season			
		Location A	Location B	Location C	Location D
Suspended Solids (SS)	mg/L	6.6 (1.2-11.0)	96.1 (0.7-358.5)	1.9 (0.6-3.8)	2.6 (0.8-6.3)
Ammonia as N	mg/L	0.02 (0.01-0.02)	0.73 (<0.01-1.67)	8.53 (5.95-10.45)	8.57 (5.45-13.35)
Unionized Ammonia (as N)	mg/L	<0.01 (<0.01-<0.01)	0.1 (<0.01-0.2)	0.3 (0.2-0.4)	0.2 (0.1-0.4)
Chemical Oxygen Demand (COD)	mg/L	6.5 (3.0-11.5)	24.4 (3.0-89.5)	15.8 (14.0-19.5)	16.6 (11.0-23.5)
Biochemical Oxygen Demand (BOD)	mg/L	1.5 (<1-1.5)	15.1 (<1-52.5)	5.7 (5.0-6.5)	5.4 (4.0-9.0)
pH Value	-	7.8 (7.2-8.3)	8.2 (7.4-8.7)	7.9 (7.8-8.0)	7.8 (7.7-8.0)
Temperature	°C	20.3 (19.3-21.8)	20.8 (19.2-23.6)	21.4 (19.4-23.5)	21.4 (19.1-23.8)
Salinity	g/L	0.1 (<0.1-0.1)	<0.1 (<0.1-0.2)	0.2 (0.1-0.2)	0.2 (<0.1-0.2)
Turbidity	NTU	9.3 (3.0-19.0)	220.3 (3.5-758.0)	4.4 (3.0-7.0)	4.4 (2.5-7.0)
Water Flow	L/s	3 (2-4)	<1 (<1-<1)	16 (12-25)	15 (12-20)

Parameter	Unit	Monitoring Data During Dry Season			
		Location A	Location B	Location C	Location D
Dissolved Oxygen	mg/L	7.6 (5.0-9.7)	8.3 (5.8-10.0)	7.7 (6.5-9.3)	7.6 (6.9-8.6)
Dissolved Oxygen - % Saturation	%	84.2 (54.9-106.0)	83.2 (68.1-95.4)	83.6 (73.5-92.9)	85.6 (79.5-96.4)
E. coli	cfu/ 100mL	450 (40-2,700)	1,200 (N.D.-20,000)	31,000 (11,000-110,000)	23,000 (6,000-72,000)

Note: N.D. indicates not detected.

Table 6.4 Summary of Water Quality Monitoring Data for Ma Yau Tong Stream (Wet Season)

Parameter	Unit	Monitoring Data During Wet Season			
		Location A	Location B	Location C	Location D
Suspended Solids (SS)	mg/L	15.5 (2.8-37.5)	227.7 (18.6-492.0)	39.6 (2.5-143.5)	104.4 (4.8-201.5)
Ammonia as N	mg/L	0.01 (<0.01-0.02)	0.03 (<0.01-0.07)	0.86 (0.01-2.18)	0.69 (0.03-1.26)
Unionized Ammonia (as N)	mg/L	<0.01 (<0.01-<0.01)	<0.01 (<0.01-<0.01)	0.03 (<0.01-0.1)	<0.01 (<0.01-0.1)
Chemical Oxygen Demand	mg/L	6.4 (<2-8.5)	8.0 (3.0-18.5)	7.9 (2.0-14.0)	10.1 (4.0-15.5)
Biochemical Oxygen Demand	mg/L	1.0 (<1-1.0)	1.5 (<1-2.0)	3.5 (<1-5.0)	2.2 (1.0-4.0)
pH Value	-	7.4 (6.7-7.8)	8.1 (8.0-8.6)	7.8 (7.7-7.9)	7.9 (7.8-8.0)
Temperature	°C	23.6 (23.1-24.4)	24.6 (24.0-26.0)	24.9 (23.5-27.3)	24.7 (23.5-27.0)
Salinity	g/L	<0.1 (<0.1-<0.1)	<0.1 (<0.1-<0.1)	<0.1 (<0.1-<0.1)	<0.1 (<0.1-<0.1)
Turbidity	NTU	20.9 (4.5-57.5)	308.6 (32.0-576.5)	48.1 (5.0-168.0)	129.4 (6.0-255.5)
Water Flow	L/s	88 (55-225)	15 (5-30)	38 (20-90)	102 (48-195)
Dissolved Oxygen	mg/L	8.3 (6.9-8.8)	8.1 (8.0-8.3)	7.9 (6.7-8.4)	8.0 (7.6-8.6)
Dissolved Oxygen - % Saturation	%	96.3 (81.5-101.0)	97.7 (94.5-99.0)	94.6 (84.0-99.0)	96.8 (93.0-101.5)
E. coli	cfu/ 100 mL	900 (60-22,000)	1,600 (30-24,000)	6,000 (600-33,000)	9,000 (1,000-39,000)

6.4.2 Monitoring data shown in above tables indicate that levels of nutrients at all monitoring locations are low. All monitoring locations have relatively high concentrations of DO. The comparatively higher concentrations of BOD and COD during dry season might be due to the low runoff volume and minor wastewater discharges from nearby villages. Generally, the water quality conditions at Ma Yau Tong Streams are satisfactory except relatively high levels of suspended solids (SS) at Location B and relatively high E. coli levels at Locations C and D.

The relatively high SS levels recorded at Location B was affected by the nearby construction works during the monitoring period. Such construction works are expected to be completed before the commencement of this Project. Locations C and D received water flows through the village houses at Ma Yau Tong. The relatively high E. coli levels recorded at these 2 locations could be caused by the possible sewage discharges from the nearby village houses.

Channelized Nullahs near Clear Water Bay Road

6.4.3 The catchments of these channelized nullahs mostly are undeveloped areas. In particular, the upstream sections of these nullahs are mainly collecting the runoff from the country park areas with no major pollution source. In dry season, most of these nullahs are expected to be dry, whereas in the wet seasons, the water flows in these nullahs mostly would be rainwater with low pollution levels. Site inspections and water sampling at these channelized nullahs were conducted in August 2015 representing the wet season. It was observed during the site inspections that most of these nullahs were dried out or had a very low flow (with water depth of less than 3 cm). Due to the low water flow, water sampling was only practical to be carried out at three stations (namely Stations E, F and G respectively) in the downstream sections of these channelized nullahs as shown in **Figure 6.1**. The associated sampling results are shown in **Table 6.5**.

Table 6.5 Water Quality Monitoring Data for Channelized Nullahs at Clear Water Bay Road

Parameter	Unit	Averaged Value of 2 Consecutive Measurements		
		Station E	Station F	Station G
pH Value	-	7.62	7.01	6.90
Temperature	°C	25.3	28.6	24.8
Salinity	ppt	0.0	0.4	0.1
Turbidity	NTU	7.82	16.9	0.01
Dissolved Oxygen	mg/L	7.06	6.31	5.94
Dissolved Oxygen - % Saturation	%	86.6	80.9	72.7

6.4.4 The pH and DO levels measured at all the three stations were good. The turbidity level measured at Station F was however relatively high, which could be due to the site constraint that the water depth at this station was extremely shallow, and the bottom silt was unavoidably disturbed during the sampling event.

6.5 Assessment Methodologies

6.5.1 The study area for the water quality impact assessment covers all areas within 500m from the Project boundary in Victoria Harbour (Phase One) Water Control Zone (WCZ) designated under the Water Pollution Control Ordinance (WPCO) and other areas that may have a bearing on the environmental acceptability of the Project.

6.5.2 The Water Sensitive Receivers (WSRs) that may be affected by the Project have been identified. Potential sources of water quality impact that may arise during the construction and operational stages of the Project were described. This task included identifying pollutants from point discharges and non-point sources that could affect the quality of surface water bodies. All the identified sources of potential water quality impact were then evaluated and their impact significance determined. The need for mitigation measures to reduce any identified adverse impacts on water quality to acceptable levels was determined.

6.6 Identification of Environmental Impacts

Construction Phase

6.6.1 The proposed construction works would not alter the streams and water courses identified in the study area. Potential sources of water quality impact associated with the land-based construction of the Project have been identified and include:

- General construction activities
- Construction site run-off;
- Accidental spillage;
- Sewage effluent from construction workforce; and
- Construction works in close proximity of inland water.

6.6.2 Based on the findings from the land contamination assessment provided in **Section 8**, no historical contaminative land uses were identified within the Project sites. Thus, generation of contaminated groundwater is not an issue of concern for this Project.

General Construction Activities

6.6.3 The land-based construction works could have the potential to cause water pollution. Various types of construction activities may generate wastewater. These include general cleaning and polishing, wheel washing, dust suppression and utility installation. These types of wastewater would contain high concentrations of suspended solids (SS). Various construction works may also generate debris and rubbish such as packaging, construction materials and refuse. Uncontrolled discharge of site effluents, rubbish and refuse generated from the construction works would lead to deterioration in water quality.

Construction Site Run-off

6.6.4 The total construction works area for all the RIW sites would be approximately 0.013 km^2. Assuming the works area is 100% active and a runoff coefficient of 1 (for conservative estimation), the total peak runoff generated from the construction site would be in the order of about 2,700 m^3 per hour under a 10-year-return-period rainstorm and design duration of 5 minutes according to the Stormwater Drainage Manual of the Drainage Services Department (DSD). Potential pollution sources of site run-off may include:

- Run-off and erosion of exposed bare soil and earth, drainage channel, earth working area and stockpiles;
- Release of any bentonite slurries, concrete washings and other grouting materials with construction run-off or storm water;
- Wash water from dust suppression sprays and wheel washing facilities; and
- Fuel, oil and lubricants from maintenance of construction vehicles and equipment.

6.6.5 During rainstorms, site run-off would wash away the soil particles on unpaved lands and areas with the topsoil exposed. The run-off is generally characterized by high concentrations of SS. Release of uncontrolled site run-off would increase the SS levels and turbidity in the nearby water environment. Site run-off may also wash away contaminated soil particles and therefore cause water pollution.

6.6.6 Wind blown dust would be generated from exposed soil surfaces in the works areas. It is possible that wind blown dust would fall directly onto the nearby water bodies when a strong wind occurs. Dispersion of dust within the works areas may increase the SS levels in surface run-off causing a potential impact to the nearby sensitive receivers.

Accidental Spillage

6.6.7 A large variety of chemicals may be used during construction activities. These chemicals may include petroleum products, surplus adhesives, spent lubrication oil, grease and mineral oil, spent acid and alkaline solutions/solvent and other chemicals. Accidental spillage of chemicals in the sites may contaminate the surface soils. The contaminated soil particles

may be washed away by construction site run-off or stormwater drainage which in turn causes water pollution.

Sewage Effluent from Construction Workforce

6.6.8 During the construction of the Project, the workforce on site will generate sewage effluents, which are characterized by high levels of BOD, ammonia and *E. coli* counts. Based on the DSD Sewerage Manual, the sewage production rate for construction workers is estimated at 0.35 m^3 per worker per day. For every 100 construction workers working simultaneously at the construction site, about 35 m^3 of sewage would be generated per day. Potential water quality impacts upon the local drainage and fresh water system may arise from these sewage effluents, if uncontrolled.

Construction Works in Close Proximity of Inland Water

6.6.9 Construction activities in close vicinity to the inland water courses may pollute the inland water bodies due to the potential release of construction wastes. Construction wastes are generally characterized by high concentration of SS and elevated pH. Mitigation measures should be implemented to control the release of construction waste and site effluent into the nearby inland water bodies.

Operational Phase

6.6.10 The identified potential sources of impact on water quality during the operational phase would be runoff from the road surfaces. Based on the paved area of the RIW sites of approximately 0.01 km^2 and a runoff coefficient of 1, the total peak runoff generated from the Project sites would be in the order of about 2,000 m^3 per hour under a 10-year-return-period rainstorm and design duration of 5 minutes according to the Stormwater Drainage Manual of the DSD. The road runoff may contain small amount of oil and grit leaked from passing vehicles. However, impacts upon water quality will be minimal provided that the road works are designed with adequate drainage systems and appropriate silt trap, as required.

6.7 Evaluation of Environmental Impacts

Construction Phase

General Construction Activities

6.7.1 Effluent discharged from temporary site facilities should be controlled to prevent direct discharge to the neighbouring inland waters and storm drains. Such effluent may include wastewater resulting from wheel washing of site vehicles at site entrances. Debris and rubbish such as packaging, construction materials and refuse generated from the construction activities should also be properly managed and controlled to avoid accidental release to the local storm system and inland waters. Adoption of the guidelines and good site practices for handling and disposal of construction discharges as specified in **Section 6.9** would minimize the potential impacts.

Construction Site Run-off

6.7.2 Construction site run-off and drainage may impact local water quality. Increase in SS arising from the construction site could block the drainage channels. High concentrations of suspended degradable organic material in marine water could lead to reduction in DO levels in the water column.

6.7.3 It is important that proper site practice and good site management (as specified in the ProPECC PN 1/94 “Construction Site Drainage”) to be followed to prevent run-off with high level of SS from entering the surrounding waters. With the implementation of appropriate measures to control run-off and drainage from the construction site, disturbance of water bodies would be avoided and deterioration in water quality would be minimal. Thus, unacceptable impacts on the water quality are not expected, provided that the relevant mitigation measures as specified in the ProPECC PN 1/94 “Construction Site Drainage” are properly implemented.

Accidental Spillage

6.7.4 The use of 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 run-off into the nearby water environment, increasing hydrocarbon levels. The potential impacts could however be mitigated by practical mitigation measures and good site practices (as given in **Section 6.9**).

Sewage Effluent from Construction Workforce

6.7.5 Domestic sewage would be generated from the workforce during the construction phase. However, this temporary sewage can be adequately treated by interim sewage treatment facilities, such as portable chemical toilets. Provided that sewage is not discharged directly into storm drains or inland waters adjacent to the construction site, and temporary sanitary facilities are used and properly maintained, it is unlikely that sewage generated from the sites would have a significant water quality impact.

Construction Works in Close Proximity of Inland Water

6.7.6 Construction activities in close vicinity to the inland water courses may pollute the inland water bodies due to the potential release of construction wastes. Construction wastes are generally characterized by high concentration of SS and elevated pH. The implementation of measures to control runoff and drainage will be important for the construction works adjacent to the inland water in order to prevent runoff and drainage water with high levels of SS from entering the water environment. With the implementation of adequate construction site drainage as specified in the ProPECC PN 1/94 “Construction Site Drainage” and the provision of mitigation measures as described in the ETWB TC (Works) No. 5/2005 “Protection of natural streams/rivers from adverse impacts arising from construction works”, it is anticipated that unacceptable water quality impacts would not arise.

Operational Phase

6.7.7 The identified potential source of impact on water quality during the operational phase of the Project is runoff from the road surfaces. The road run-off may contain minimal amount of oil, grease and grit that may cause water quality impacts to the receiving waters in Victoria Harbour WCZ. To minimise the impacts from road run-off, a road drainage system will be properly planned to receive road run-off at the planning and design stages. With proper implementation of recommended mitigation measures and best management practices described in **Section 6.9**, adverse impact associated with the discharge of runoff is not anticipated.

6.8 Cumulative Impacts from Concurrent Project

6.8.1 The construction of the Project would tentatively commence in end 2016 for completion in 2022, which would potentially overlap with the construction period for site formation and infrastructural works at the Anderson Road Quarry site. No other major concurrent project related to water quality impact is identified within the study area.

6.8.2 As all the project works would be land-based and provided that proper mitigation measures will be implemented by the projects, the water quality impact generated from the projects would be localized and no adverse cumulative water quality impacts would be expected.

6.9 Mitigation of Adverse Environmental Impacts

Construction Phase

Control of Site Run-off of Different General Construction Activities as follows:

Boring and Drilling Water

6.9.1 Water used in ground boring and drilling for site investigation or rock / soil anchoring should as far as practicable be re-circulated after sedimentation. When there is a need for final disposal, the wastewater should be discharged into storm drains via silt removal facilities.

Wheel Washing Water

6.9.2 All vehicles and plant should be cleaned before they leave a construction site to minimize the deposition of earth, mud, debris on roads. A wheel washing bay should be provided at every site exit if practicable and wash-water should have sand and silt settled out or removed before discharging into storm drains. The section of construction road between the wheel washing bay and the public road should be paved with backfall to reduce vehicle tracking of soil and to prevent site run-off from entering public road drains.

Rubbish and Litter

6.9.3 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.

Construction Site Run-off

6.9.4 The site practices outlined in ProPECC PN 1/94 “Construction Site Drainage” should be followed as far as practicable to minimise surface run-off and the chance of erosion. The following measures are recommended to protect water quality and sensitive uses of the coastal area, and when properly implemented should be sufficient to adequately control site discharges so as to avoid water quality impact:

6.9.5 Surface run-off from construction sites should be discharged into storm drains via adequately designed sand/silt removal facilities such as sand traps, silt traps and sedimentation basins. Channels or earth bunds or sand bag barriers should be provided on site to properly direct stormwater to such silt removal facilities. Perimeter channels at site boundaries should be provided on site boundaries where necessary to intercept storm run-off from outside the site so that it will not wash across the site. Catchpits and perimeter channels should be constructed in advance of site formation works and earthworks.

6.9.6 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. Any practical options for the diversion and re-alignment of drainage should comply with both engineering and environmental requirements in order to provide adequate hydraulic capacity of all drains. Minimum distance of 100m should be maintained between the discharge points of construction site run-off and the existing saltwater intakes. No effluent will be discharged into typhoon shelter.

6.9.7 Construction works should be programmed to minimize soil excavation works in rainy seasons (April to September). If excavation in soil cannot be avoided in these months or at any time of year when rainstorms are likely, for the purpose of preventing soil erosion, temporary exposed slope surfaces should be covered e.g. by tarpaulin, and temporary access roads should be protected by crushed stone or gravel, as excavation proceeds. 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.

6.9.8 Earthworks final surfaces should be well compacted 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.

6.9.9 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.

Rainwater pumped out from trenches or foundation excavations should be discharged into storm drains via silt removal facilities.

6.9.10 Construction materials (e.g. aggregates, sand and fill material) on sites should be covered with tarpaulin or similar fabric during rainstorms.

6.9.11 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 run-off from getting into foul sewers. Discharge of surface run-off into foul sewers must always be prevented in order not to unduly overload the foul sewerage system.

6.9.12 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.

Site Effluent

6.9.13 There is a need to apply to EPD for a discharge licence for discharge of effluent from the construction site under the WPCO. The discharge quality must meet the requirements specified in the discharge licence. All the runoff and wastewater generated from the works areas should be treated so that it satisfies all the standards listed in the TM-DSS. The beneficial uses of the treated effluent for other on-site activities such as dust suppression, wheel washing and general cleaning etc., can minimise water consumption and reduce the effluent discharge volume. If monitoring of the treated effluent quality from the sites is required during the construction phase of the Project, the monitoring should be carried out in accordance with the relevant WPCO licence which is under the ambit of regional office (RO) of EPD.

Accidental Spillage

6.9.14 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.

6.9.15 Any service shop 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 potential for leakage and spillage should only be undertaken within the areas appropriately equipped to control these discharges.

6.9.16 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; and
- Storage area should be selected at a safe location on site and adequate space should be allocated to the storage area.

Sewage Effluent from Construction Workforce

6.9.17 The construction workforce on site will generate sewage. It is recommended to provide sufficient chemical toilets in the works areas. A licensed waste collector should be deployed to clean the chemical toilets on a regular basis.

6.9.18 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 will provide an effective control of any malpractices and can encourage

continual improvement of environmental performance on site. It is anticipated that sewage generation during the construction phase of the project would not cause water pollution problem after undertaking all required measures.

Construction Works in Close Proximity of Inland Waters

6.9.19 The practices outlined in ETWB TC (Works) No. 5/2005 "Protection of natural streams/rivers from adverse impacts arising from construction works" should also be adopted where applicable to minimize the water quality impacts upon any natural streams or surface water systems. Relevant mitigation measures from the ETWB TC (Works) No. 5/2005 are listed below:

- Construction works close to the inland waters should be carried out in dry season as far as practicable where the flow in the surface channel or stream is low.
- The use of less or smaller construction plants may be specified in areas close to the water courses to reduce the disturbance to the surface water.
- Temporary storage of materials (e.g. equipment, chemicals and fuel) and temporary stockpile of construction materials should be located well away from any water courses during carrying out of the construction works.
- Stockpiling of construction materials and dusty materials should be covered and located away from any water courses.
- Construction debris and spoil should be covered up and/or disposed of as soon as possible to avoid being washed into the nearby water receivers.
- Proper shoring may need to be erected in order to prevent soil or mud from slipping into the watercourses.

Operational Phase

6.9.20 Best Management Practices (BMPs) to reduce storm water and non-point source pollution have been proposed for the RIW as follows:

Design Measures

- Exposed surface shall be avoided within the RIW sites to minimize soil erosion. The development site shall be either hard paved or covered by landscaping area where appropriate.
- The streams and channelized nullahs near the RIW sites will be retained to maintain the original flow path. The drainage system will be designed to avoid flooding.
- Green areas / tree / shrub planting etc. will be introduced along roadside amenity strips and central dividers as far as possible, which can help to reduce soil erosion.
- Evergreen trees species, which in general generate relatively smaller amount of fallen leaves, should be selected where possible.

Devices/ Facilities to Control Pollution

6.9.21 In addition to the above, the following devices/ facilities will be incorporated into the design:

- Screening facilities such as standard gully grating and trash grille, with spacing which is capable of screening off large substances such as fallen leaves and rubbish should be provided at the inlet of drainage system.
- Road gullies with standard design and silt traps and oil interceptors should be incorporated during the detailed design to remove particles present in stormwater runoff, where appropriate.

Administrative Measures

6.9.22 Good management measures such as regular cleaning and sweeping of road surface/ open areas are suggested. The road surface/ open area cleaning should also be carried out prior to occurrence rainstorm.

6.9.23 Manholes, as well as stormwater gullies, ditches provided at the Project sites should be regularly inspected and cleaned (e.g. monthly). Additional inspection and cleansing should be carried out before forecast heavy rainfall.

6.10 Evaluation of Residual Environmental Impacts

6.10.1 With the full implementation of the recommended mitigation measures for the construction and operational phases of the proposed Project, no residual impacts on water quality are anticipated.

6.11 EM&A Requirements

6.11.1 Water quality monitoring is recommended for Ma Yau Tong Stream and the channelized nullahs at Clear Water Bay Road during the site formation works. Details of the recommended water quality monitoring requirements are provided in the stand-alone EM&A Manual for the Project. It is recommended that regular site inspections during the construction phase should be undertaken to inspect the construction activities and works areas in order to ensure the recommended mitigation measures are properly implemented.

6.12 Conclusions

Construction Phase

6.12.1 Water Sensitive Receivers (WSRs) are identified for the water quality impact assessment. The key issue from the land-based road improvement works construction activities would be the potential for release of wastewater from surface works areas and open cut excavation. Minimization of water quality deterioration could be achieved through implementing adequate mitigation measures, such as control of site run-off of different general construction activities. Regular site inspections should be undertaken routinely to inspect the construction activities and works areas in order to ensure the recommended mitigation measures are properly implemented.

Operational Phase

6.12.2 The only source of potential impact on water quality during the operational phase will be runoff from the road surfaces. It is anticipated that the water quality impact associated with the operational phase would be minimal and acceptable, provided that the recommended mitigation measures (such as design measures to be incorporated and devices/facilities to control pollution) and best management practices are properly implemented.