# 5 WATER QUALITY

## 5.1 INTRODUCTION

5.1.1 This Section presents an evaluation of the potential water quality impacts from the construction and operation of the Project, and the results were assessed with reference to the relevant environmental legislation, standards and criteria.

## 5.2 RELEVANT LEGISLATION AND GUIDELINES

5.2.1 Relevant legislations, standards and guidelines governing water quality in Hong Kong include the followings:

- *Water Pollution Control Ordinance (WPCO) (CAP.358)*;
- *Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters*;
- Annexes 6 and 14 of the *Technical Memorandum on the Environmental Impact Assessment Ordinance* (EIAO-TM);
- *Professional Persons Environmental Consultative Committee Practice Note for Professional Persons on Construction Site Drainage* (ProPECC PN 1/94);
- *Hong Kong Planning Standards and Guidelines* (HKPSG);
- *Professional Persons Environmental Consultative Committee Practice Note for Professional Persons on Drainage Plans subject to Comment by the Environmental Protection Department* (ProPECC PN 5/93); and
- *DSD Technical Circular No. 1/2017 Temporary Flow Diversions and Temporary Works Affecting Capacity in Stormwater Drainage Systems*.

**Water Pollution Control Ordinance**

5.2.2 The Water Pollution Control Ordinance (WPCO) provides the 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 each WCZ based on their beneficial uses. This Project is located in the Deep Bay WCZ. WQOs for the Deep Bay WCZ relevant to this assessment are listed in **Table 5.1**.

**Table 5.1 Summary of Water Quality Objectives for the Deep Bay WCZ**

| Parameters | Criteria | Sub-zone |
|---|---|---|
| Aesthetic Appearance | (a) Waste discharges shall cause no objectionable odours or discolouration of the water. | Whole zone |
| | (b) Tarry residues, floating wood, articles made of glass, plastic, rubber or of any other substances should be absent. | Whole zone |
| | (c) Mineral oil should not be visible on the surface. Surfactants should not give rise to a lasting foam. | Whole zone |

| Parameters | Criteria | Sub-zone |
|---|---|---|
| | (d) There should be no recognisable sewage derived debris. | Whole zone |
| | (e) 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. | Whole zone |
| | (f) Waste discharges shall not cause the water to contain substances which settle to form objectionable deposits. | Whole zone |
| Bacteria | (a) The level of Escherichia coli should not exceed 610 per 100 mL, calculated as the geometric mean of all samples collected in a calendar year. | Secondary Contact Recreation Subzone and Mariculture Subzone (L.N. 455 of 1991) |
| | (b) The level of Escherichia coli should be zero per 100 ml, calculated as the running median of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days. | Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones |
| | (c) The level of Escherichia coli should not exceed 1000 per 100 ml, calculated as the running median of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days. | Yuen Long & Kam Tin (Lower) Subzone and other inland waters |
| | (d) The level of Escherichia coli should not exceed 180 per 100 mL, calculated as the geometric mean of all samples collected from March to October inclusive in one calendar year. Samples should be taken at least 3 times in a calendar month at intervals of between 3 and 14 days. | Yung Long Bathing Beach Subzone (L.N. 455 of 1991) |
| Colour | (a) Waste discharges shall not cause the colour of water to exceed 30 Hazen units. | Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones |
| | (b) Waste discharges shall not cause the colour of water to exceed 50 Hazen units. | Yuen Long & Kam Tin (Lower) Subzone and other inland waters |
| Dissolved Oxygen | (a) Waste discharges shall not cause the level of dissolved oxygen to fall below 4 milligrams per litre for 90% of the sampling occasions during the year; values should be taken at 1 metre below surface. | Inner Marine Subzone excepting Mariculture Subzone |
| | (b) Waste discharges shall not cause the level of dissolved oxygen to fall below 4 milligrams per litre for 90% of the sampling occasions during the year; values should be calculated as water column average (arithmetic mean of at least 2 measurements at 1 metre below surface and 1 metre above seabed). In addition, the concentration of dissolved oxygen should not be less than 2 milligrams per litre within 2 metres of the seabed for 90% of the sampling occasions during the year. | Outer Marine Subzone excepting Mariculture Subzone |
| | (c) The dissolved oxygen level should not be less than 5 milligrams per litre for 90% of the sampling occasions during the year; values should be taken at 1 metre below surface. | Mariculture Subzone |
| | (d) Waste discharges shall not cause the level of dissolved oxygen to be less than 4 mg per litre. | Yuen Long & Kam Tin (Upper and Lower) Subzones, Beas Subzone, Indus Subzone, |

| Parameters | Criteria | Sub-zone |
|---|---|---|
| | | Ganges Subzone, Water Gathering Ground Subzones and other inland waters of the Zone |
| pH | (a) The pH of the water should be within the range of 6.5-8.5 units. In addition, waste discharges shall not cause the natural pH range to be extended by more than 0.2 unit. | Marine waters excepting Yung Long Bathing Beach Subzone |
| | (b) Waste discharges shall not cause the pH of the water to exceed the range of 6.5-8.5 units. | Yuen Long & Kam Tin (Upper and Lower) Subzones, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones |
| | (c) The pH of the water should be within the range of 6.0-9.0 units. | Other inland waters |
| | (d) The pH of the water should be within the range of 6.0-9.0 units for 95% of samples collected during the whole year. In addition, waste discharges shall not cause the natural pH range to be extended by more than 0.5 unit. | Yung Long Bathing Beach Subzone |
| 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 level to change by more than 10%. | Whole zone |
| Suspended Solids | (a) Waste discharges shall neither cause the natural ambient level to be raised by more than 30% nor give rise to accumulation of suspended solids which may adversely affect aquatic communities. | Marine waters |
| | (b) Waste discharges shall not cause the annual median of suspended solids to exceed 20 mg per litre. | Yuen Long & Kam Tin (Upper and Lower) Subzones, Beas Subzone, Ganges Subzone, Indus Subzone, Water Gathering Ground Subzones and other inland waters |
| Ammonia | The un-ionized ammoniacal nitrogen level should not be more than 0.021 mg per litre, calculated as the annual average (arithmetic mean). | Whole zone |
| Nutrients | (a) Nutrients shall not be present in quantities sufficient to cause excessive or nuisance growth of algae or other aquatic plants. | Inner and Outer Marine Subzones |
| | (b) Without limiting the generality of objective (a) above, the level of inorganic nitrogen should not exceed 0.7 mg per litre, expressed as annual mean. | Inner Marine Subzone |
| | (c) Without limiting the generality of objective (a) above, the level of inorganic nitrogen should not exceed 0.5 mg per litre, expressed as annual water column average (arithmetic mean of at least 2 measurements at 1m below surface and 1m above seabed). | Outer Marine Subzone |

| Parameters | Criteria | Sub-zone |
|---|---|---|
| 5-day Biochemical Oxygen Demand | (a) Waste discharges shall not cause the 5-day biochemical oxygen demand to exceed 3 mg per litre. | Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones |
| | (b) Waste discharges shall not cause the 5-day biochemical oxygen demand to exceed 5 mg per litre. | Yuen Long & Kam Tin (Lower) Subzone and other inland waters |
| Chemical Oxygen Demand | (a) Waste discharges shall not cause the chemical oxygen demand to exceed 15 mg per litre. | Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones |
| | (b) Waste discharges shall not cause the chemical oxygen demand to exceed 30 mg per litre. | Yuen Long & Kam Tin (Lower) Subzone and other inland waters |
| Toxins | (a) Waste discharges shall not cause the toxins in water to attain such levels as to produce significant toxic carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms, with due regard to biologically cumulative effects in food chains and to toxicant interactions with each other | Whole zone |
| | (b) Waste discharges shall not cause a risk to any beneficial uses of the aquatic environment | Whole zone |
| Phenol | Phenols shall not be present in such quantities as to produce a specific odour, or in concentration greater than 0.05 mg per litre as $C_6H_5OH$. | Yung Long Bathing Beach Subzone |
| Turbidity | Waste discharges shall not reduce light transmission substantially from the normal level. | Yung Long Bathing Beach Subzone |

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

5.2.3 All discharges from the construction and operation phases of the proposed Project are required to comply with the *Technical Memorandum Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS)* issued under Section 21 of the WPCO.

5.2.4 The *TM-DSS* defines acceptable discharge limits to different types of receiving waters. Under the *TM-DSS*, effluents discharged into the drainage and sewerage systems, inshore and coastal waters of the WCZs are subject to pollutant concentration standards for specified discharge volumes. These are defined by the Environmental Protection Department (EPD) and are specified in licence conditions for any new discharge within a WCZ.

**Technical Memorandum of Environmental Impact Assessment Process (EIAO-TM)**

5.2.5 Annexes 6 and 14 of the *EIAO-TM* provide general guidelines and criteria to be used in assessing water quality impacts. Annex 6 of the *EIAO-TM* stipulates criteria for evaluating water pollution and Annex 14 specifies guidelines for assessment of water pollution.

**Practice Note for Professional Persons on Construction Site Drainage (ProPECC PN 1/94)**

5.2.6 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 PN 1/94)* provides good practice guidelines for dealing with various types of discharge from a construction site. Practices outlined in *ProPECC PN 1/94* should be followed as far as possible during construction to minimise the water quality impact due to construction site drainage.

**Hong Kong Planning Standards and Guidelines (HKPSG)**

5.2.7 Chapter 9 of the HKPSG provides environmental considerations for land use planning. Site selection for development, sensitive uses, provision of environmental facilities, and design, layout, phasing and operational controls to minimise adverse environmental impacts, etc., are covered in the chapter. Other factors affecting land use planning to be taken into account are listed and suitable buffer distances for land uses are recommended.

**Practice Note for Professional Persons, Drainage Plans subject to Comment by the Environmental Protection Department (ProPECC PN 5/93)**

5.2.8 This practical note provided guidelines and recommendations for handling, treatment and disposal of various effluent discharges to stormwater drains and foul sewers. Design considerations and disposal arrangements of various site effluents from project operation in *ProPECC PN 5/93* should be followed.

**DSD Technical Circular No. 1/2017 Temporary Flow Diversions and Temporary Works Affecting Capacity in Stormwater Drainage Systems**

5.2.9 This circular provides guidance on the basic principles to be applied when assessments are made on the adequacy of proposed temporary flow diversions and / or temporary works design applicable to various periods throughout the year. This circular suggests that for the purpose of works related to temporary flow diversion and other temporary works related to drainage, wet season should typically be from 1 April to 31 October, and dry season should be from 1 November to 31 March. With proper analysis of risk and justification, the designated period of wet and dry seasons can be adjusted to suit the need for a specific project. This circular also layout considerations and precautions to be taken for managing such works in view of the seasonality.

## 5.3 DESCRIPTION OF THE ENVIRONMENT

**Study Area**

5.3.1 According to Clause 3.4.6.2 of the EIA Study Brief, the Assessment Area shall include areas within 500m from the boundary of the Project and shall cover the Deep Bay Water Control Zone (DBWCZ) under the WPCO.

**River Water Quality**

5.3.2 The Project site is located at least 8 km from marine water in any direction. Notable body of water in the vicinity is a channelised tributary of River Indus at over 500m to the north, as well as the mid-stream of River Indus at about 900m northeast. Water at the mid-stream section of River Indus flows in the northwestern direction, merges with River Beas and then turns north. It then flows into the Shenzhen River and flows west into the Deep Bay. According to *River Water Quality in Hong Kong in 2021* (EPD, 2022), River Indus showed marked water quality improvement in the last three decades, with its WQO compliance rate rising significantly from 24% in 1991 to 84% in 2021 overall for the river. River water quality at River Indus was graded as “Good” to “Excellent” in 2021. The monitoring results from the nearest monitoring stations IN1 to IN3 are summarised in **Table 5.2**.

**Table 5.2 Summary of EPD River Water Quality Monitoring Data from the River Indus in Year 2021**

| Parameters | Lower Reach IN1 | Mid-stream IN2 | Upper Reach IN3 |
|---|---|---|---|
| Dissolved Oxygen (mg/L) | 6.0 | 6.7 | 8.1 |
| | (4.3 - 7.6) | (3.1 - 9.3) | (6.9 - 9.3) |
| pH | 6.9 | 7.4 | 7.6 |
| | (6.7 - 7.2) | (6.9 - 7.9) | (7.1 - 7.8) |
| Suspended solids (mg/L) | 16.5 | 6.4 | 3.0 |
| | (5.2 - 65.0) | (2.8 - 15.0) | (1.4 - 13.0) |
| 5-Day Biochemical Oxygen Demand (mg/L) | 3.1 | 2.6 | 1.1 |
| | (1.1 - 12.0) | (0.7 - 7.3) | (0.5 - 5.1) |
| Chemical Oxygen Demand (mg/L) | 26 | 11 | 8 |
| | (15 - 36) | (7 - 21) | (5 - 13) |
| Oil and Grease (mg/L) | <0.5 | <0.5 | <0.5 |
| | (<0.5 - 0.5) | (<0.5 - <0.5) | (<0.5 - <0.5) |
| *E. coli* (counts/100mL) | 23,000 | 3,100 | 3 100 |
| | (3,700 – 520,000) | (430 – 15,000) | (270 – 29,000) |
| Faecal Coliforms (counts/100mL) | 82 000 | 18,000 | 9 900 |
| | (10 000 - 3 800 000) | (3,000 – 210,000) | (1,600 – 42,000) |
| Ammonia-Nitrogen (mg/L) | 0.880 | 0.810 | 0.092 |
| | (0.220 - 3.100) | (0.180 - 1.500) | (0.032 - 0.220) |
| Nitrate-Nitrogen (mg/L) | 2.650 | 0.980 | 0.670 |
| | (1.000 - 4.800) | (0.770 - 1.600) | (0.460 - 0.900) |
| Total Kjeldahl Nitrogen (mg/L) | 2.70 | 1.80 | 0.47 |
| | (2.00 - 5.80) | (1.50 - 2.40) | (0.35 - 0.84) |
| Orthophosphate Phosphorus (mg/L) | 0.290 | 0.079 | 0.094 |
| | (0.052 - 0.910) | (0.018 - 0.170) | (0.038 - 0.140) |
| Total Phosphorus (mg/L) | 0.48 | 0.16 | 0.13 |
| | (0.33 - 0.87) | (0.15 - 0.22) | (0.08 - 0.14) |
| 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 | <50 |
| | (<50 - <50) | (<50 - 57) | (<50 - 65) |
| 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 - 3) | (<1 - <1) | (<1 - <1) |
| Copper (µg/L) | 2 | 1 | <1 |
| | (1 - 3) | (1 - 3) | (<1 - 2) |
| Lead (µg/L) | <1 | <1 | <1 |
| | (<1 - <1) | (<1 - <1) | (<1 - <1) |
| Zinc (µg/L) | 14 | <10 | <10 |
| | (<10 - 20) | (<10 - 19) | (<10 - 15) |
| Flow ($m^3/s$) | 9.416 | NM | 0.046 |
| | (4.264 - 18.411) | | (0.021 - 0.364) |

**Notes:**
(a) Data presented are annual median except for faecal coliform and *E. coli*, which are geometric means.
(b) Figures in brackets are annual ranges.
(c) NM indicates no measurement taken.
(d) Values at or below laboratory reporting limits are presented as laboratory reporting limits.

| Parameters | Lower Reach IN1 | Mid-stream IN2 | Upper Reach IN3 |
|---|---|---|---|
| (e) Equal values for annual medians (or geometric means) and ranges indicate that all data are the same as or below laboratory reporting limits. | | | |

**Water Quality Sensitive Receivers**

5.3.3 There is no major body of water in the surrounding of the Project Site. The Project site is at least 8km away from any marine water and over 500m from any major river (nearest being River Indus). Within 500m from the Project Site, there are two surface drains that pass through the works area, both along the So Kwun Po Road (near North District Park), So Kwun Po Road (near SKH Wing Chun Primary School), Other nearby surface drainage include drainage system around So Kwun Po, and another nullah located in between Ching Ho Estate and Kai Leng flows northeasterly toward the Project site and turns into an underground drain / box culvert before passing underneath the Project Site. These are also considered water sensitive receivers. Note that within the 500m Assessment Area there are a few more surface drainage systems, which are also considered to be WSRs in nature, but are much further away and would less likely to be affected by this Project.

5.3.4 There are also artificial ponds within the North District Park to the east of the Project, Tai Ping Estate to the west of the Project as well as Sheung Shui Garden to the north of the Project. They do not serve the beneficial uses listed as sensitive to water pollution under Section 3.1 of EIAO-TM Annex 14, therefore the pond is not considered to be a water sensitive receiver under this Study.

5.3.5 Identified representative WSRs within the 500m Assessment Area of the project are presented in **Figure 5.1** and listed in **Table 5.3**.

**Table 5.3 Identified Representative WSRs within 500m Assessment Area**

| ID | Description | Nature | Status | Geodesic Distance (m) |
|---|---|---|---|---|
| D1 | Surface drainage system along So Kwun Po Road (near North District Park) | Surface drain | These are actively managed surface drains. | Passes through Project footprint |
| D2 | Surface drainage system along So Kwun Po Road (near SKH Wing Chun Primary School) | Surface drain | | Passes through Project footprint |
| D3 | Surface drainage system around of So Kwun Po | Surface drain | | Less than 10 m |
| D4 | Surface drainage system (between Ching Ho Estate and Kai Leng) | Surface drain | | Around 36 m |
| D5 | Surface drainage system north to Po Wing Road Playground | Surface drain | | Passes through Project footprint |

## 5.4 APPROACH AND METHODOLOGY

5.4.1 According to Clause 3.4.6.2 of the EIA Study Brief, the Assessment Area shall include areas within 500m from the boundary of the Project and shall cover the DBWCZ under the WPCO. WSRs within the Assessment Area have been identified. Potential sources of water pollution were identified based on work nature and appropriate mitigation measures would be recommended accordingly to minimize the potential water quality impact. Residual impact would be evaluated. Environmental monitoring, if needed, would be recommended.

## 5.5 POTENTIAL SOURCES OF IMPACT

**Construction Phase**

5.5.1 Potential sources of water quality impact associated with construction activities for the Project include:

- Construction site runoff;
- General construction activities (including the effluents generated from dewatering associated with piling activities, grouting and concrete washing and those specified in the *ProPECC Practice Note 1/94*);
- Diversion / modification of box culvert;
- Accidental spillage; and
- Sewage effluent from the construction workforce.

**Operation Phase**

5.5.2 Potential sources of water quality impact associated with operation of the Project include road runoff containing oil/grease and suspended solids.

5.5.3 There will be no diversion of surface watercourses under this Project. Two sections of existing box culvert would be modified / realigned under this Project, but the modification will not significantly affect the surface characteristic as well as drainage capacity. Other than these two sections of affected box culverts, the proposed road works would only alter existing road surface, as well as certain road side vegetation for widening and realignment of road. No action related to notable change in hydrology of the area is identified.

## 5.6 IMPACT ASSESSMENT

**Construction Phase**

Construction Site Runoff

5.6.1 Road works involving clearance of existing structures would result in exposure surfaces, which are vulnerable towards erosion in rainstorm if unprotected. Other sources of pollution for construction site runoff may include:

- Erosion from stockpiles and earth working areas;
- Dust suppression sprays;
- Grout, bentonite slurries and concrete washings released; and
- Fuel, lubricants or other chemical for construction vehicles and equipment.

5.6.2 Such runoff, as well as stormwater during a rainstorm, could carry the above pollutants from work areas into the surrounding bodies of water, resulting in elevated levels of turbidity, suspended solids, other chemicals / pollutants as well as a reduction in dissolved oxygen levels. Debris washed into drainage system could also obstruct pipes and channels.

5.6.3 However, it is anticipated that no adverse water quality impacts would arise if proper mitigation measures, described in **Section 5.7.2**, are in place to control site runoff.

General Construction Activities

5.6.4 Discharges from the site during land-based construction may contain suspended solids which could be a source of water pollution. Other construction works, such as concreting, dewatering for piling, grouting, general dust suppression, cleaning, polishing, etc. could generate wastewater, which may contain high level of suspended solids, as well as other contaminants

within site boundary. With the implementation of good site practices described in **Section 5.7.2**, no unacceptable adverse water quality impacts would be anticipated.

Diversion / Modification of Box Culvert

5.6.5 Based on the latest available information, a section of box culvert near the North District Park requires modification under this Project, while another section of box culvert near Kai Leng Roundabout will be realigned. The related construction works involve construction within existing box culvert. Typically, these kinds of works would be arranged during the dry season to ensure drainage flow be manageable and to allow diversion. Before the commencement of construction works within box culverts, diversion of channel flow (using sandbag barrier and/or other means of temporary flow diversion) would first be conducted to ensure works can be conducted in dry area. This avoids drainage water from encroaching in the work area (for safety and for environmental protection) and control site runoff and wastewater from entering the drainage flow. Excavation works for the Project should be undertaken in a confined and dry condition to minimise the adverse impact on water quality. All wastewater generated from the construction works should be collected and properly stored for disposal by licensed contractor. With the implementation of the above mitigation measures, no unacceptable water quality impact from construction works for the diversion and modification of box culverts would be expected.

Accidental Spillage

5.6.6 Various chemicals would be used for the proposed road works and accordingly different chemical waste would be generated. These chemicals and corresponding chemical wastes include:

- Fuel;
- (Spent) lubricants;
- (Spent) grout;
- (Spent) paint and adhesive;
- (Spent) solvent; and
- (Spent) acid and alkaline

5.6.7 Accidental spillage of these chemicals or chemical wastes would contaminate surface or (for exposed surface) soil. The contaminated surface and soil could be swept up by runoff / stormwater and result in elevated level of pollutants in the receiving waters. Proper clean up kits should be available onsite for the corresponding types of chemicals used for various construction works. Clean up waste should be stored in marked container as chemical wastes for proper disposal.

5.6.8 Proper control and storage of these chemicals as well as the associated wastes should be implemented according to *Waste Disposal Ordinance* (Cap 354) as well as the associated regulations including the *Waste Disposal (Chemical Waste) (General) Regulation* to minimize the risk of spillage and contamination. All chemical wastes should be stored in secured and sheltered area(s) for collection and disposal by licensed contractor.

Sewage Effluent from the Construction Workforce

5.6.9 Construction workforce onsite will generate sewage effluent. Sufficient number of chemical toilets, properly served, cleaned and emptied regularly by licensed contractor, would be required for each work areas to ensure hygiene and avoid nuisance.

**Operation Phase**

5.6.10 Operation of the proposed road improvement works would result in slight increase to road runoff of similar nature to existing condition. According to the separate *Drainage Impact Assessment*

*Report*, the estimated increase in runoff (based on 1 in 50 years rainstorm) would be only 0.18 $m^3/s$ and is considered to be negligible for the catchment. Such runoff typically contains elevated levels of suspended solids, grits as well as trace amount of oil and grease from vehicles, which could affect the water quality of the receiving waters. Proper road drainage system fitted with appropriate pollutant removal devices (such as grit traps) will be required to ensure pollutants from road runoff be removed before entering receiving bodies of water. Given the negligible change in terms of the nature and amount of runoff, as well as the implementation of proposed mitigation measures and management practices (**Section 5.7.6**), no significant change to pollution loading related to road runoff would be expected. No unacceptable water quality impact associated with road runoff is expected.

5.6.11 The modification and realignment of box culvert sections under this Project is not expected to adversely affect the hydraulic capacity of the drainage system, or any surface water features. No unacceptable impact on hydrology of the area is expected.

## 5.7 MITIGATION MEASURES

**Construction Phase**

5.7.1 A WPCO discharge license should be applied for the disposal of effluent from the construction site. All standards, criteria and requirements stipulated in the relevant license apply.

5.7.2 Suitable control measures stipulated in *ProPECC PN 1/94* should be implemented, namely:

- 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 sediment 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 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.
- 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 ensure that these facilities are functioning properly at all times
- Construction works should be programmed to minimize soil excavation works in rainy seasons (April to September). If excavation in soil could not be avoided in these months or at any time of year when rainstorms are likely, for the purpose of preventing soil erosion, temporarily exposed slope surfaces should be covered e.g. by tarpaulin. 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 to ensure that adequate surface protection measures can be safely carried out well before the arrival of a rainstorm.
- 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
- 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.
- Open stockpiles of construction materials (e.g. aggregates, sand and fill material) on sites should be covered with tarpaulin or similar fabric during rainstorms. Measures should be taken to prevent the washing away of construction materials, soil, silt or debris into any drainage system.

- 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.
- Water used in ground boring and drilling for site investigation or rock/soil anchoring should as far as practicable be recirculated after sedimentation. When there is a need for final disposal, the wastewater should be discharged into storm drains via silt removal facilities.
- All vehicles and plant should be cleaned before they leave a construction site to ensure no earth, mud, debris and the like is deposited by them 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.
- Wastewater generated from building construction activities including concreting, cleaning of works and similar activities should not be discharged into the stormwater drainage system. If the wastewater is to be discharged into foul sewers, it should undergo the removal of settleable solids in a silt removal facility, and pH adjustment as necessary.
- Acidic wastewater generated from acid cleaning, etching, pickling and similar activities should be neutralized to within the pH range of 6 to 10 before discharging into foul sewers. If there is no public foul sewer in the vicinity, the neutralized wastewater should be tankered off site for disposal into foul sewers or treated to a standard acceptable to storm drains and the receiving waters.

5.7.3 Sufficient number of chemical toilets should be required for each works area. These toilets should be regularly cleaned, maintained and emptied by licensed contractor.

5.7.4 For construction works within box culverts, construction works should preferably be arranged in dry season. Before the commencement of construction works within box culverts, diversion of channel flow (using sandbag barrier and/or other means of temporary flow diversion) would first be conducted to ensure works can be conducted in dry area. Excavation works for the Project should be undertaken in a confined and dry condition to minimise the adverse impact on water quality. All wastewater generated from the construction works should be collected and properly stored for disposal by licensed contractor.

5.7.5 Under the *Waste Disposal Ordinance* (Cap 354), the contractor must register as a chemical waste producer if chemical wastes would be produced from the construction activities. The *Waste Disposal Ordinance* and its associated regulations including the *Waste Disposal (Chemical Waste) (General) Regulation*, should be observed for handling, storage and disposal of chemical wastes. Detailed requirements for the handling, storage and disposal of chemical wastes are provided in the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes* published under the *Waste Disposal Ordinance*, including the followings:

- 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.

**Operation Phase**

5.7.6 The design of the drainage system shall follow the relevant guidelines and practices as given in the *ProPECC PN 5/93* and be fitted with appropriate design measures to control pollution of drainage water, namely,

- Standard screening designs such as gully grating should be provided to stop large objects from entering;
- Where appropriate, silt traps and oil interceptors should be provided to remove pollutants from runoff / stormwater.

5.7.7 These facilities should also be cleaned, maintained and inspected regularly and particularly before and after a rainstorm.

## 5.8 CUMULATIVE IMPACT

5.8.1 Known concurrent projects in the vicinity are listed in **Table 2.5**. The potential cumulative water quality impact from the construction and operation of these concurrent projects is discussed below.

**Construction Phase**

Housing Development in Ching Hiu Road

5.8.2 Based on the latest available information, this housing development project, located at 217m southwest to the Project site, is expected to be under construction from 2022 to 2030. The construction of the housing development at Ching Hiu Road is considered relatively small scale according to its site area. The site is currently flat land and the construction is expected to mainly involve piling and superstructure works. Any potential water quality impact from this housing development project is expected to be limited and localised. No unacceptable cumulative water quality impact is anticipated.

Housing Development in Fanling Area 17

5.8.3 Based on the latest available information, this housing development project, located at 274m east to the Project site, is expected to be under construction from 2023 to 2031. The housing development project is expected to involve localised construction works and minor modifications works at the surrounding. Nevertheless, given the large separation distance from the Project site, construction of the housing development at Fanling Area 17 is not expected to cause unacceptable cumulative water quality impact.

Expansion of North District Hospital

5.8.4 Based on the latest available information, this expansion project, located at 272m west to the Project site, is expected to be construction from 2021 to 2028. The site for North District Hospital Expansion has been formed and the upcoming construction is expected to mainly involve piling and superstructure works. Any potential water quality impact from this housing development project is expected to be limited and localised. No unacceptable cumulative water quality impact is anticipated.

Utilities Works and Junction Improvement Works for Partial Development of Fanling Golf Course Site

5.8.5 Based on the latest available information, this utilities and junction improvement project, located at 195m west to the Project site, is expected to be under construction from 2024 to 2029. Utilities Works and Junction Improvement Works for Partial Development of Fanling Golf Course Site are considered as minor works. The associated water quality impact is expected to be limited with the implementation of appropriate mitigation measures. No unacceptable cumulative water quality impact is anticipated.

Reclaimed Water Supply to Sheung Shui and Fanling

5.8.6 Based on the latest available information, this reclaimed water supply project, located at north and east to the Project site (nearest section at 18m from Project site), is expected to be under construction from 2021 to 2026. The works of the Reclaimed Water Supply to Sheung Shui and Fanling are divided into different segments. Based on the construction programme

attached in the latest available monthly EM&A report of the Reclaimed Water Supply to Sheung Shui and Fanling (3/WSD/20) (i.e. Report No.21 - Aug 2023) during the preparation of this EIA Report, the works which encroach into the 500m Assessment Area will be completed by end of August 2025, whereas the construction works of the proposed Project commences in August 2025. Hence, the overlapping of the two projects only lasts for less than a month. In addition, the project is considered as minor work and the associated water quality impact is expected to be limited with the implementation of appropriate mitigation measures. No unacceptable cumulative water quality impact is anticipated.

**Operation Phase**

5.8.7 Potential water quality impact from operation of the Project is expected to be minimal. No unacceptable cumulative water quality impact for operation phase is expected.

## 5.9 RESIDUAL IMPACT

5.9.1 With the implementation of the recommended mitigation measures, no unacceptable water quality impact associated with the construction and operation of the proposed road improvement works would be expected.

## 5.10 ENVIRONMENTAL MONITORING AND AUDIT

**Construction Phase**

5.10.1 With the implementation of the recommended mitigation measures, no unacceptable water quality impact is expected during Project construction. Environmental monitoring is not considered necessary for water quality. Regular site inspections should be conducted during construction to ensure the proper implementation of the recommended mitigation measures.

**Operation Phase**

5.10.2 As there is no unacceptable water quality impact expected during the operation of the Project, water quality monitoring for operation phase is not considered necessary.

## 5.11 CONCLUSION

5.11.1 The environment and baseline condition at and around the Project Site has been reviewed based on historic record of water quality data from nearby EPD river water quality monitoring stations. Applicable environmental legislations and guidelines related to construction and operation phase water quality impacts were identified. Potential sources of water quality impact from construction and operation phases of the proposed road improvement works have been identified and evaluated. These sources of impacts include, construction site runoff; general construction activities, diversion/modification of box culvert, accidental spillage and sewage effluent from the construction workforce for construction phase, as well as increase road runoff for operation phase. Suitable mitigation / control measures were recommended based on standard guidelines including *ProPECC PN 1/94*, and *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes*. No unacceptable residual water quality impact is expected from the construction and operation of the Project with the implementation of proposed mitigation measures.