6 WATER QUALITY IMPACT

6.1 Legislation, Standards and Guidelines

6.1.1 General

6.1.1.1 The relevant legislations, standards and guidelines applicable to present study for the assessment of water quality impacts include:

- Water Pollution Control Ordinance (WPCO) (Cap. 358);
- Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems Inland and Coastal Waters (TM-DSS)
- Environmental Impact Assessment Ordinance (EIAO) (Cap. 499), Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO);
- Town Planning Board Guidelines for Application for Developments within Deep Bay Area, Under Section 16 of the Town Planning Ordinance, (TPB PG-NO. 12C), "No Net Increase in Pollution Loads Requirement in Deep Bay";
- Hong Kong Planning Standards and Guidelines (HKPSG); and
- ProPECC PN 1/94 "Construction Site Drainage"

6.1.2 Water Pollution Control Ordinance (Cap. 358)

6.1.2.1 The entire Hong Kong waters are divided into ten Water Control Zones (WCZs) and four supplementary WCZs under the WPCO. Each WCZ has a designated set of statutory Water Quality Objectives (WQOs) designed to protect the inland and/or marine environment and its users. The Project is located in the Deep Bay WCZ and the corresponding WQOs are summarised in **Table 6.1**.

Table 6.1 Water Quality Objectives for Deep Bay Water Control Zones

Parameters	Objectives	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
	(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 one calendar year.	Secondary Contact Recreation Subzone and Mariculture Subzone (L.N. 455 of 1991)
	(b) The level of *Escherichia coli* should be zero	Yuen Long & Kam Tin (Upper)

Parameters	Objectives	Sub-Zone
	per 100 ml, calculated as the running median of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days.	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 except 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 except 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 milligrams per litre.	Yuen Long & Kam Tin (Upper and Lower) Subzones, Beas Subzone, Indus Subzone, 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 units.	Marine waters except 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

Parameters	Objectives	Sub-Zone
	(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. In addition, waste discharges shall not cause the natural pH range to be extended by more than 0.5 units.	Yung Long Bathing Beach Subzone
Temperature	Waste discharges shall not cause the natural daily temperature range to change by more than 2.0 degrees Celsius.	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 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 milligrams 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 milligram 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 milligram 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 milligram per litre, expressed as annual water column average (arithmetic mean of at least 2 measurements at 1 metre below surface and 1 metre above seabed).	Outer Marine Subzone
5 day biochemical oxygen demand	(a) Waste discharges shall not cause the 5-day biochemical oxygen demand to exceed 3 milligrams 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 milligrams 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 milligrams 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 milligrams per litre.	Yuen Long & Kam Tin (Lower) Subzone and other inland waters

Parameters	Objectives	Sub-Zone
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 milligrams 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

6.1.3 Technical Memorandum for Effluents Discharge into Drainage and Sewerage Systems, Inland & Coastal Waters

6.1.3.1 Apart from the WQOs, Section 21 of the WPCO also specifies the limits to control the physical, chemical and microbial parameters for effluent discharges into drainage and sewage system at both inland and coastal waters under the TM-DSS. The discharge limits vary with the effluent flow rates and the sewage from the Project, treated after sewage treatment works, should comply with the standards for effluent discharged into inland waters, which would be used for either irrigation, pond fish culture or amenity subject to the exact locations. Group B (for irrigation), C (for pond fish culture) and D (for amenity) inland water standards in TM-DSS are therefore adopted and the effluent discharge standards are presented in **Table 6.2** to **Table 6.4**.

Table 6.2 Standards for effluents discharged into Group B Inland Waters

Parameter	Flowrate (m^3/day)							
	≤ 200	> 200 & ≤400	> 400 & ≤ 600	> 600 & ≤ 800	> 800 & ≤ 1000	> 1000 & ≤ 1500	> 1500 & ≤ 2000	> 2000 & ≤ 3000
pH (pH units)	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
Temperature (℃)	35	30	30	30	30	30	30	30
Colour (lovibond units) (25mm cell length)	1	1	1	1	1	1	1	1
Suspended solids	30	30	30	30	30	30	30	30
BOD	20	20	20	20	20	20	20	20
COD	80	80	80	80	80	80	80	80
Oil & Grease	10	10	10	10	10	10	10	10
Iron	10	8	7	5	4	3	2	1
Boron	5	4	3	2.5	2	1.5	1	0.5
Barium	5	4	3	2.5	2	1.5	1	0.5
Mercury	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

Parameter	Flowrate (m^3/day)							
	≤ 200	> 200 & ≤400	> 400 & ≤ 600	> 600 & ≤ 800	> 800 & ≤ 1000	> 1000 & ≤ 1500	> 1500 & ≤ 2000	> 2000 & ≤ 3000
Cadmium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Selenium	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
Other toxic metals individually	0.5	0.5	0.2	0.2	0.2	0.1	0.1	0.1
Total Toxic metals	2	1.5	1	0.5	0.5	0.2	0.2	0.2
Cyanide	0.1	0.1	0.1	0.08	0.08	0.05	0.05	0.03
Phenols	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Sulphide	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Fluoride	10	10	8	8	8	5	5	3
Sulphate	800	800	600	600	600	400	400	400
Chloride	1000	1000	800	800	800	600	600	400
Total phosphorus	10	10	10	8	8	8	5	5
Ammonia nitrogen	5	5	5	5	5	5	5	5
Nitrate + nitrite nitrogen	30	30	30	20	20	20	10	10
Surfactants (total)	5	5	5	5	5	5	5	5
E. coli (count/100ml)	100	100	100	100	100	100	100	100

Notes:
[1] All units in mg/L unless otherwise stated

Table 6.3 Standards for effluents discharged into Group C Inland Waters

Parameter	Flowrate (m^3/day)			
	≤ 100	> 100 & ≤500	> 500 & ≤ 1000	> 1000 & ≤ 2000
pH (pH units)	6-9	6-9	6-9	6-9
Temperature (℃)	30	30	30	30
Colour (lovibond units) (25mm cell length)	1	1	1	1
Suspended solids	20	10	10	5
BOD	20	15	10	5
COD	80	60	40	20
Oil & Grease	1	1	1	1
Boron	10	5	4	2
Barium	1	1	1	0.5
Iron	0.5	0.4	0.3	0.2
Mercury	0.001	0.001	0.001	0.001
Cadmium	0.001	0.001	0.001	0.001

Parameter	Flowrate (m^3/day)			
	≤ 100	> 100 & ≤500	> 500 & ≤ 1000	> 1000 & ≤ 2000
Silver	0.1	0.1	0.1	0.1
Copper	0.1	0.1	0.05	0.05
Selenium	0.1	0.1	0.05	0.05
Lead	0.2	0.2	0.2	0.1
Nickel	0.2	0.2	0.2	0.1
Other toxic metals individually	0.5	0.4	0.3	0.2
Total Toxic metals	0.5	0.4	0.3	0.2
Cyanide	0.05	0.05	0.05	0.01
Phenols	0.1	0.1	0.1	0.1
Sulphide	0.2	0.2	0.2	0.1
Fluoride	10	7	5	4
Sulphate	800	600	400	200
Chloride	1000	1000	1000	1000
Total phosphorus	10	10	8	8
Ammonia nitrogen	2	2	2	1
Nitrate + nitrite nitrogen	30	30	20	20
Surfactants (total)	2	2	2	1
E. coli (count/100ml)	1000	1000	1000	1000

Notes:
[1] All units in mg/L unless otherwise stated

Table 6.4 Standards for effluents discharged into Group D Inland Waters

Parameter	Flowrate (m^3/day)							
	≦200	＞200 and ≦400	＞400 and ≦600	＞600 and ≦800	＞800 and ≦1000	＞ 1000 and ≦1500	＞ 1500 and ≦2000	＞ 2000 and ≦3000
pH (pH units)	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10
Temperature (℃)	30	30	30	30	30	30	30	30
Colour (lovibond units) (25mm cell length)	1	1	1	1	1	1	1	1
Suspended solids	30	30	30	30	30	30	30	30
BOD	20	20	20	20	20	20	20	20
COD	80	80	80	80	80	80	80	80
Oil & Grease	10	10	10	10	10	10	10	10
Iron	10	8	7	5	4	2.7	2	1.3
Boron	5	4	3.5	2.5	2	1.5	1	0.7
Barium	5	4	3.5	2.5	2	1.5	1	0.7
Mercury	0.1	0.05	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.05	0.001	0.001	0.001	0.001	0.001	0.001

Parameter	**Flowrate (m^3/day)**							
	≦200	**＞200 and ≦400**	**＞400 and ≦600**	**＞600 and ≦800**	**＞800 and ≦1000**	**＞ 1000 and ≦1500**	**＞ 1500 and ≦2000**	**＞ 2000 and ≦3000**
Other toxic metals individually	1	1	0.8	0.8	0.5	0.5	0.2	0.2
Total Toxic metals	2	2	1.6	1.6	1	1	0.5	0.4
Cyanide	0.4	0.4	0.3	0.3	0.2	0.1	0.1	0.05
Phenols	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1
Sulphide	1	1	1	1	1	1	1	1
Sulphate	800	600	600	600	600	400	400	400
Chloride	1000	800	800	800	600	600	400	400
Fluoride	10	8	8	8	5	5	3	3
Total phosphorus	10	10	10	8	8	8	5	5
Ammonia nitrogen	20	20	20	20	20	20	20	10
Nitrate + nitrite nitrogen	50	50	50	30	30	30	30	20
Surfactants (total)	15	15	15	15	15	15	15	15
E. coli (count/100ml)	1000	1000	1000	1000	1000	1000	1000	1000

Notes:
[1] All units in mg/L unless otherwise stated

6.1.3.2 The TM-DSS also specifies the discharge standards into foul sewers leading into Government sewage treatment plants as **Table 6.5** and **Table 6.6**. Subject to the flow rate of the effluents, corresponding standards for the effluent discharge into government foul sewers should be followed.

Table 6.5 Standards for effluents discharged into foul sewers leading into Government sewage treatments plants

Parameter	Flowrate (m^3/day)												
	≤ 10	**> 10 & ≤100**	**> 100 & ≤ 200**	**> 200 & ≤ 400**	**> 400 & ≤ 600**	**> 600 & ≤ 800**	**> 800 & ≤ 1000**	**> 1000 & ≤ 1500**	**> 1500 & ≤ 2000**	**> 2000 & ≤ 3000**	**> 3000 & ≤ 4000**	**> 4000 & ≤ 5000**	**> 5000 & ≤ 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	6-10
Temperature (℃)	43	43	43	43	43	43	43	43	43	43	43	43	43
Suspended solids	1200	1000	900	800	800	800	800	800	800	800	800	800	800
Settleable solids	100	100	100	100	100	100	100	100	100	100	100	100	100
BOD	1200	1000	900	800	800	800	800	800	800	800	800	800	800
COD	3000	2500	2200	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Oil & Grease	100	100	50	50	50	40	30	20	20	20	20	20	20
Iron	30	25	25	25	15	12.5	10	7.5	5	3.5	2.5	2	1.5
Boron	8	7	6	5	4	3	2.4	1.6	1.2	0.8	0.6	0.5	0.4
Barium	8	7	6	5	4	3	2.4	1.6	1.2	0.8	0.6	0.5	0.4
Mercury	0.2	0.15	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.2	0.15	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Copper	4	4	4	3	1.5	1.5	1	1	1	1	1	1	1
Nickel	4	3	3	2	1.5	1.5	1	0.8	0.7	0.7	0.6	0.6	0.6
Chromium	2	2	2	2	1	0.7	0.6	0.4	0.3	0.2	0.1	0.1	0.1
Zinc	5	5	4	3	1.5	1.5	1	0.8	0.7	0.7	0.6	0.6	0.6
Silver	4	3	3	2	1.5	1.5	1	0.8	0.7	0.7	0.6	0.6	0.6
Other toxic metals individually	2.5	2.2	2	1.5	1	0.7	0.6	0.4	0.3	0.2	0.15	0.12	0.1
Total toxic metals	10	10	8	7	3	2	2	1.6	1.4	1.2	1.2	1.2	1
Cyanide	2	2	2	1	0.7	0.5	0.4	0.27	0.2	0.13	0.1	0.08	0.06
Phenols	1	1	1	1	0.7	0.5	0.4	0.27	0.2	0.13	0.1	0.1	0.1

Parameter	Flowrate (m^3/day)												
	≤ 10	**> 10 & ≤100**	**> 100 & ≤ 200**	**> 200 & ≤ 400**	**> 400 & ≤ 600**	**> 600 & ≤ 800**	**> 800 & ≤ 1000**	**> 1000 & ≤ 1500**	**> 1500 & ≤ 2000**	**> 2000 & ≤ 3000**	**> 3000 & ≤ 4000**	**> 4000 & ≤ 5000**	**> 5000 & ≤ 6000**
Sulphide	10	10	10	10	5	5	4	2	2	2	1	1	1
Sulphate	1000	1000	1000	1000	1000	1000	1000	900	800	600	600	600	600
Total nitrogen	200	200	200	200	200	200	200	100	100	100	100	100	100
Total phosphorus	50	50	50	50	50	50	50	25	25	25	25	25	25
Surfactants (total)	200	150	50	40	30	25	25	25	25	25	25	25	25

Notes:
[1] All units in mg/L unless otherwise stated

Table 6.6 Standards for effluents discharged into foul sewers leading into Government sewage treatments plants with microbial treatment

Parameter	Flowrate (m^3/day)												
	≤ 10	**> 10 & ≤100**	**> 100 & ≤ 200**	**> 200 & ≤ 400**	**> 400 & ≤ 600**	**> 600 & ≤ 800**	**> 800 & ≤ 1000**	**> 1000 & ≤ 1500**	**> 1500 & ≤ 2000**	**> 2000 & ≤ 3000**	**> 3000 & ≤ 4000**	**> 4000 & ≤ 5000**	**> 5000 & ≤ 6000**
Copper	1.5	1	1	1	0.8	0.6	0.5	0.4	0.3	0.2	0.15	0.1	0.05

Notes:
[1] All units in mg/L unless otherwise stated

6.1.4 Environmental Impact Assessment Ordinance (Cap. 499), Technical Memorandum on Environmental Impact Assessment Process

6.1.4.1 Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO) specifies the assessment methods and criteria for impact assessment. This Study follows the TM-EIAO to assess the potential water quality impact that may arise during both the construction and operational phases of the Project. Sections in the TM-EIAO relevant to the water quality impact assessment are:

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

6.1.5 No Net Increase in Pollution Loads Requirement in Deep Bay

6.1.5.1 In addition to the provisions of the TM, the 'No Net Increase in Pollution Loads Requirement' aims to provide protection to the inland and marine water quality of the Deep Bay WCZ. According to EPD's "*Deep Bay Water Quality Regional Control Strategy Study*", the pollutions entering into Deep Bay have exceeded the assimilative capacity of the water body. Further increasing the pollution loads to the water body is therefore environmentally undesirable.

6.1.5.2 In accordance with Town Planning Board Guideline No.12C, the pollution loads of concern should be offset by equivalent reduction of current loads for new discharge into Deep Bay. The policy ensures that developments within the Deep Bay catchment areas do not result in an increase in pollution loads to both the inland and marine waters.

6.1.6 Hong Kong Planning Standards and Guidelines

6.1.6.1 Chapter 9 of the Hong Kong Planning Standards and Guidelines (HKPSG) outlines environmental requirements that need to be considered in land use planning. The recommended guidelines, standards and guidance cover the selection of suitable locations for the developments and sensitive uses, provision of environmental facilities, and design, layout, phasing and operational controls to minimise adverse environmental impacts. It also lists out environmental factors that influence land use planning and recommends buffer distances for land uses.

6.1.7 ProPECC PN 1/94 "Construction Site Drainage"

6.1.7.1 Professional Persons Environmental Consultative Committee Practice Notes (ProPECC Note PN1/94) on Construction Site Drainage provides guidelines for the handling and disposal of construction discharges. It is applicable to this study for the control of site runoff and wastewater generated during the construction phase. The types of discharges from construction sites outlined in the ProPECC Note PN1/94 include:

- Surface runoff;
- Groundwater;
- Boring and drilling water;
- Wastewater from concrete batching plant;
- Wheel washing water;

- Bentonite slurries;
- Water for testing and sterilization of water retaining structures and water pipes;
- Wastewater from building construction and site facilities; and
- Acid cleaning, etching and pickling wastewater.

6.2 Baseline Conditions

6.2.1 Existing Hydrology

6.2.1.1 The Project Site falls within the Deep Bay WCZ according to the WPCO. It is located at Yuen Long Town Nullah between West Rail Long Ping Station and south of Kau Yuk Road. Downstream of the project is a drainage channel along the edge of Tai Tseng Wai and the ultimate discharge of this drainage channel is downstream of Shan Pui River and Inner Deep Bay. Apart from Yuen Long Creek, the inner Deep Bay was most affected by the discharges from Shenzhen River as well as Kam Tin River and Tin Shui Wai Nullah. The WQO compliance rate of the Deep Bay WCZ in 2014 was 40%, same as from 2008 to 2013 except in 2012 (53%).

6.2.2 Baseline Water Quality Conditions

6.2.2.1 The closest water quality monitoring stations are Yuen Long Creek (YL1 – YL4) and **Table 6.7** summarises the water quality monitoring data for YL1 – YL4. The locations of water quality monitoring stations are shown in **Figure 6.1**.

Table 6.7 Water Quality at Yuen Long Creek (YL1 – YL4) for Year 2014

Parameter	YL1	YL2	YL3	YL4
Dissolved oxygen (mg/L)	5.2 (3.3 - 8.0)	6.5 (3.3 - 9.7)	3.6 (1.8 - 7.4)	3.8 (1.3 - 5.6)
pH	7.3 (7.1 - 7.5)	7.4 (7.2 - 7.5)	7.3 (7.1 - 7.8)	7.2 (6.9 - 8.0)
SS (mg/L)	16 (5 - 450)	5 (2 - 9)	17 (3 - 47)	34 (5 - 73)
5-day Biochemical Oxygen Demand (mg/L)	19 (4 - 90)	8 (2 - 13)	29 (5 - 140)	86 (6 - 280)
Chemical Oxygen Demand (mg/L)	23 (8 - 120)	26 (17 - 37)	35 (12 - 140)	70 (23 - 200)
Oil & grease (mg/L)	<0.5 (<0.5 - 0.9)	0.6 (<0.5 - 1.0)	0.6 (<0.5 – 2.2)	0.9 (<0.5 – 8.2)
Faecal coliforms (cfu/100mL)	460,000 (86,000 - 2,300,000)	150,000 (35,000 - 1,200,000)	1,500,000 (240,000 - 6,600,000)	3,000,000 (150,000 - 12,000,000)
E. coli(cfu/100mL)[4]	160,000 (49,000 - 870,000)	78,000 (4,300 - 930,000)	490,000 (80,000 - 2,000,000)	1,200,000 (48,000 - 5,700,000)
Ammonia-nitrogen (mg/L)	6.95 (0.98 - 15.00)	14.50 (6.90 - 26.00)	5.50 (1.20 - 16.00)	7.40 (3.70 - 14.00)
Nitrate-nitrogen (mg/L)	0.58 (<0.01 - 1.20)	2.00 (0.17 - 5.90)	<0.01 (<0.01 - 1.40)	<0.01 (<0.01 - 0.76)

Parameter	YL1	YL2	YL3	YL4
Total Kjeldahl nitrogen (mg/L)	9.10 (1.50 - 26.00)	17.50 (7.30 - 31.00)	7.65 (2.10 - 23.00)	11.00 (4.80 - 22.00)
Ortho-phosphate (mg/L)	0.90 (0.17 - 3.40)	2.40 (1.40 - 3.20)	0.54 (0.10 - 1.70)	0.48 (0.25 - 0.86)
Total phosphorus (mg/L)	1.25 (0.28 - 4.40)	2.75 (1.60 - 3.60)	0.92 (0.26 - 2.70)	1.10 (0.39 - 2.00)
Total sulphide (mg/L)	0.03 (<0.02 - 0.09)	<0.02 (<0.02 - 0.09)	<0.02 (<0.02 - 0.33)	0.08 (<0.02 - 0.25)
Aluminium (µg/L)	216 (140 - 1,438)	55 (<50 - 98)	172 (72 - 332)	205 (101 - 848)
Cadmium (µg/L)	<0.1 (<0.1 - 0.4)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.3)
Chromium (µg/L)	<1 (<1 - 2)	<1 (<1 - <1)	<1 (<1 - 3)	<1 (<1 - 4)
Copper (µg/L)	6 (3 - 23)	3 (2 - 6)	5 (2 - 14)	5 (2 - 8)
Lead (µg/L)	4 (2 - 44)	<1 (<1 - 2)	3 (<1 - 10)	2 (<1 - 5)
Zinc (µg/L)	48 (22 - 206)	30 (15 - 82)	42 (26 - 92)	47 (24 - 88)
Flow (L/s)	202 (10 - 303)	40 (11 - 83)	490 (160 - 1,538)	125 (81 - 205)

Notes:
[1] Data presented are in annual medians of monthly samples; except those for faecal coliforms and *E. coli* which are in annual geometric means.
[2] Figures in brackets are annual ranges.
[3] NM indicates no measurement taken.
[4] cfu - colony forming unit.
[5] Equal values for annual medians (or geometric means) and ranges indicate that all data are the same as or below laboratory reporting limits.
[6] Extracted from EPD River Water Quality in Hong Kong 2014

6.2.2.2 According to EPD's River Monitoring Report, Yuen Long Creek's overall compliance rate was 52% in 2014, higher than 51% in 2013. The compliance rates for upstream stations YL1 and YL2 were 58% and 60% respectively in 2014 as compared with 72% and 60% respectively in 2013. The rates for the stations in the middle of Yuen Long township (YL3 and YL4) were 57% and 33% in 2014 as compared with 42% and 30% in 2013 respectively. The river was still subject to discharges from remaining livestock farms, unsewered village house establishments and other specific uses (Storage and Workshop, and Open Storage).

6.2.2.3 The Deep Bay is located at downstream of the Yuen Long Town Nullah. As the water quality impacts on the downstream water systems depend on the scale and nature of the discharge of upstream area, the Inner Deep Bay is considered as a WSR of the Project. The closest marine water quality monitoring stations to the estuary of the downstream water system of Yuen Long Town Nullah is located at the Inner Deep Bay (i.e. DM1, DM2 and DM3). **Table 6.8** summarises the water

quality monitoring data for DM1 – DM3. The locations of water quality monitoring stations are shown in **Figure 6.1**.

Table 6.8 Water Quality at Inner Deep Bay (DM1 – DM3) for Year 2014

Parameter	DM1	DM2	DM3
Temperature (^oC)	24.2 (14.3 -32.1)	24.4 (14.5 – 31.9)	24.4 (15.1 – 32.0)
Salinity	15.5 (3.5 – 24.4)	17.5 (5.6 – 25.8)	21.2 (10.7 – 29.4)
Dissolved oxygen (mg/L)	3.7 (1.3 – 6.1)	4.6 (2.6 – 6.8)	5.5 (4.1 – 7.3)
Dissolved oxygen (mg/L) (Bottom)	N.M	N.M	N.M
Dissolved oxygen (% Saturation)	48 (18 – 73)	60 (36 – 81)	73 (60 – 88)
Dissolved oxygen (% Saturation) (Bottom)	N.M	N.M	N.M
pH	7.4 (7.1 – 7.7)	7.5 (7.3 – 7.9)	7.7 (7.5 – 7.9)
Secchi Disc Depth (m)	1.3 (0.7 – 1.7)	1.2 (0.7 – 2.0)	1.3 (0.4 – 2.0)
Turbidity (NTU)	29.5 (12.6 – 48.2)	20.5 (10.3 – 40.2)	10.2 (5.4 – 15.1)
SS (mg/L)	46.2 (15.0 – 95.0)	23.0 (13.0 – 41.0)	15.5 (4.9 – 53.0)
5-day Biochemical Oxygen Demand (mg/L)	3.1 (1.6 – 6.7)	2.4 (0.8 – 6.7)	1.0 (0.4 – 2.7)
Ammonia-nitrogen (mg/L)	2.080 (0.930 – 4.500)	1.410 (0.330 – 2.800)	0.536 (0.069 – 1.700)
Unionised Ammonia (mg/L)	0.026 (0.006 – 0.077)	0.025 (0.005 – 0.076)	0.014 (0.001 – 0.045)
Nitrite-nitrogen (mg/L)	0.367 (0.170 – 0.560)	0.291 (0.100 – 0.570)	0.184 (0.055 – 0.350)
Nitrate-nitrogen (mg/L)	1.030 (0.380 – 2.500)	0.918 (0.460 – 1.800)	0.759 (0.410 – 1.100)
Total inorganic nitrogen (mg/L)	3.48 (2.36 – 5.74)	2.61 (1.56 – 3.75)	1.48 (0.84 – 3.07)
Total Kjeldahl nitrogen (mg/L)	2.78 (1.00 – 6.00)	1.94 (0.79 – 3.90)	0.85 (0.24 – 2.40)
Total nitrogen (mg/L)	4.17 (2.43 – 6.80)	3.15 (2.02 – 4.85)	1.79 (1.12 – 3.77)
Orthophosphate Phosphorus (mg/L)	0.213 (0.110 – 0.320)	0.183 (0.110 – 0.260)	0.093 (0.045 – 0.180)
Total Phosphorus (mg/L)	0.31 (0.18 – 0.50)	0.27 (0.17 – 0.41)	0.13 (0.08 – 0.24)
Silica (as SiO_2) (mg/L)	7.53	6.46	4.31

Parameter	DM1	DM2	DM3
	(4.70 – 12.00)	(2.90 – 11.00)	(1.40 – 8.50)
Chlorophyll-*a* (µg/L)	6.4 (1.7 – 17.0)	7.6 (1.8 – 31.0)	4.7 (0.4 – 18.0)
E. coli (count/100mL)	1300 (72 – 140000)	380 (36 – 7800)	37 (<1 – 840)
Faecal coliforms (count/100mL)	3600 (150 – 250000)	1000 (81 – 14000)	110 (5 – 2700)

Notes:
[1] Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).
[2] Data presented are annual arithmetic means of the depth-averaged results except for *E.coli* and faecal coliforms which are annual geometric means.
[3] Data in brackets indicate the ranges.
[4] N.M. – not measured.

6.2.2.4 According to EPD's "*Marine Water Quality Monitoring in Hong Kong in 2014*", the WQO compliance rate of the Deep Bay WCZ in 2014 was 40%, same as from 2008 to 2013 except in 2012 (53%).

6.2.2.5 Similar to the previous years, the Deep Bay WCZ had relatively high nutrient levels in 2014. The total inorganic nitrogen (TIN) level in the Deep Bay Inner Subzone (i.e. 1.5 – 3.5 mg/L) was higher than the respective TIN objective of 0.7 mg/L. Non-compliance with the ammonia-nitrogen and dissolved oxygen objective was also observed at two of the three stations in the Deep Bay Inner Subzone.

6.2.3 Water Sensitive Receivers

6.2.3.1 In order to identify the water quality sensitive receivers (WSRs) in the vicinity, a desktop study has been conducted. The study has reviewed the Yuen Long OZP (S/YL/22) has been conducted together with site visits. The identified WSR is presented in **Table 6.9** and shown in **Figure 6.1**.

Table 6.9 Water quality sensitive receivers

ID	WSRs	Status
WSR1	Yuen Long Creek	• Drainage nullah within Yuen Long Town Centre • Discharge into Deep Bay
WSR2	Shan Pui River	• Downstrem of the Yuen Long Town Nullah • Discharge into Deep Bay
WSR3	Inner Deep Bay	• The inner Deep Bay was most affected by the discharges from Shenzhen River as well as unsewered villages, Kam Tin River, Yuen Long Creek and Tin Shui Wai Nullah.

6.3 Identification of Pollution Sources

6.3.1 Construction Phase

6.3.1.1 The main water pollution sources of the Project during construction phase includes:

- Construction activities within Yuen Long Town Nullah (e.g. excavation, piling, construction of pile cap, etc);
- Construction surface runoff (including accidental chemicals spillage); and
- Sewage from site workforce.

6.3.1.2 According to the latest design, there is a total of 5 columns and 6 box culverts supporting the entire elevated pedestrian corridor. As mentioned in **Section 3.5.1.3** and **Figure 3.2**, out of these supporting structures, only 2 columns and 6 box culverts will be located inside the Yuen Long Town Nullah and they would approximately occupy 720 m^3 of Yuen Long Nullah which is about 1.3% of the volume of Yuen Long Nullah for the section along the elevated pedestrian corridor. For the construction activities within the nullah, temporary working platform and cofferdams with water tight feature will be constructed to isolate the working area from the flow of the nullah. Any pollutants generated from the above sources may entering into the WSRs and pose potential water quality impact.

6.3.1.3 The presence of the temporary working platform and cofferdams within the nullah may also pose potential impact on the drainage characteristics, such as capacity, flow characteristics, etc., of the nullah. Sufficient flow area will be maintained to provide passage of a storm event in accordance with DSD Technical Circular No. 14/2000 “Temporary Flow Diversions and Temporary Works Affecting Capacity in Stormwater Drainage System” and DSD Practice Note No. 1/2004 “Design Rainfall Depth for Temporary Works within the Dry Season”.

6.3.2 Operational Phase

6.3.2.1 The potential water pollution source during the operational phase would be surface runoff from the elevated pedestrian corridor. The surface runoff may contain grit, oil and debris from the pedestrians and cause potential water quality impact to the WSRs.

6.3.2.2 Similar to construction phase, the presence of columns of the proposed elevated pedestrian corridor and box culverts may also pose potential impact on the drainage characteristics of the nullah.

6.4 Prediction and Evaluation of Impacts During Construction Phase

6.4.1 Construction activities within Yuen Long Town Nullah

6.4.1.1 The Project will be constructed along the Yuen Long Town Nullah, which is a channelized river with a dry weather flow (DWF) channel. In dry seasons, the majority of the base flow from the catchment would utilize the DWF channel and most of the area in nullah would remain dry, except during occasional heavy rainfall. The construction works within the nullah, such as excavation and modification of the existing nullah, will be undertaken during dry seasons. Nevertheless, watertight cofferdams will be constructed to isolate the working area from the flow of nullah. Hence, these temporary cofferdams would provide sufficient measures even during heavy rainfall. Sufficient flow area, will be retained to provide passage of storm events in accordance with DSD Technical Circular No. 14/2000 “Temporary Flow Diversions and Temporary Works Affecting Capacity in Stormwater Drainage System” and DSD Practice Note No. 1/2004 “Design Rainfall Depth for Temporary Works within the Dry Season”. Water pumps would be used to collect any construction site surface runoff and ingress / seepage water within the cofferdam. The collected construction site surface runoff and ingress / seepage water would be diverted to the on-site wastewater treatment facilities for treatment to satisfactory levels before discharge. Together with the temporary platforms to be constructed, all these would constrain any SS released to the river waters during construction activities. Prior to the completion of the temporary platform, any temporary

stockpile should be stored outside the nullah and at location away from the air sensitive receivers. Bunds will be installed around the stockpile area and stock material will be covered with tarpaulin to minimize leakage as practicable as possible. If storage within nullah is unavoidable, stockpile should be located within the cofferdam which will be designed to be water tight and be covered with tarpaulin. Once the temporary platform is completed, any stockpile should be stored on the temporary platforms which should be designed to be water tight to prevent leakage. The stockpile should be also removed from the site as soon as possible and overnight storage should be avoided. Therefore, adverse water quality impact is not anticipated with the implementation of the mitigation measures recommended in **Section 6.6**.

6.4.1.2 Box culverts at the pedestrian interchanges will be constructed within the nullah. According to the latest design, box culverts will be constructed at pedestrian interchanges at Yuen Long On Ning Road, Castle Peak Road – Yuen Long Section and Kau Yuk Road. For each pedestrian interchange, box culverts will be constructed cell by cell so that the construction activities will not be conducted concurrently. Similar to the construction of columns within the nullah, temporary cofferdams with water tight features will be used to isolate the construction site from the nullah water. Hence, release of SS into the nullah is also considered unlikely with provision of temporary watertight cofferdams during construction works. Therefore, adverse water quality impact is not anticipated with the implementation of the mitigation measures recommended in **Section 6.6**.

6.4.1.3 As mentioned in **Section 6.4.1.1** to **Section 6.4.1.2**, cofferdams and temporary platform will be constructed during construction of columns and box culverts to prevent release of the SS and other pollutants into the nullah water. These cofferdams may pose potential impacts on the drainage characteristic of the nullah.

6.4.1.4 As mentioned in **Section 3.6.1.1**, , the construction activities at the eastern side, central part and western side of the nullah would be conducted separately to minimize the potential hydraulic impact in order to maintain sufficient capacity for the passage of flow over the entire nullah during construction phase. Since the construction works and use of cofferdams will be implemented in phases and hence not all the cofferdams would be in place concurrently. Together with the fact that the construction works within the nullah would be conducted during the dry seasons. This arrangement will ensure that the impacts on the hydrology and water quality of the nullah would be minimized.

6.4.1.5 The Contractor would be requested to carry out detail design of the cofferdams in accordance with the DSD Technical Circular No. 14/2000 “Temporary Flow Diversions and Temporary Works Affecting Capacity in Stormwater Drainage System” and DSD Practice Note No. 1/2004 “Design Rainfall Depth for Temporary Works within the Dry Season” for DSD approval in order to finalize options of these temporary structure to avoid adverse impact to the drainage characteristics of the nullah.

6.4.2 Construction Site Runoff

6.4.2.1 During rainstorm events, construction site runoff would come from all over the works site. The surface runoff might be polluted by:

- Runoff and erosion from site surfaces, earth working areas and stockpiles;
- Wash water from dust suppression sprays and wheel washing facilities; and

- Accidental chemicals spillage such as fuel, oil, solvents and lubricants from maintenance of construction machinery and equipment.

6.4.2.2 Construction runoff may cause physical, biological and chemical effects. The physical effects include potential blockage of drainage channels and increase of suspended solid levels in the Deep Bay WCZ. Runoff containing significant amounts of concrete and cement-derived material may cause primary chemical effects such as increasing turbidity and discoloration, elevation in pH, and accretion of solids. A number of secondary effects may also result in toxic effects to water biota due to elevated pH values, and reduced decay rates of faecal micro-organisms and photosynthetic rate due to the decreased light penetration. Therefore, good site practices and mitigation measures would be required to minimize any potential impact to nearby water sensitive receivers. With the implementation of mitigation measures recommended in **Section 6.6**, adverse water quality impact is not anticipated.

6.4.3 Sewage from Workforce

6.4.3.1 Sewage effluents will arise from the sanitary facilities provided for the on-site construction workforce. According to Table T-2 of *Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning*, the unit flow is 0.23 m^3/day/employed population. The characteristics of sewage would include high levels of BOD_5, Ammonia and *E. coli* counts. Since portable chemical toilets and sewage holding tank will be provided, no adverse water quality impact is anticipated.

6.4.4 Cumulative Water Quality Impact during Construction Phase

Concurrent Projects

6.4.4.1 As discussed in **Chapter 3**, the tentative commencement year for the construction of the Project is Year 2018 with target full completion in Year 2022. Concurrent projects in the vicinity of the Project, which may have cumulative environmental impacts, have been discussed in **Section 3.7** and shown in **Figure 3.1**. Key concurrent projects of water quality concern during the construction phase of the Project have been identified and are summarised in the **Table 6.10**. The implementation programme of these concurrent projects are provided by the respective project proponents. Where information is not available, references have been made to the best available information such as EIA reports and respective project proponents' websites.

Table 6.10 Key concurrent projects for water quality impact assessment during construction phase

Key Concurrent Projects	Tentative Programme		Potential Cumulative Impact
	Start	Complete	
West Rail Long Ping Station (North) Property Development	2013	2018	Water quality
West Rail Long Ping Station (South) Property Development	2014	2019	Water quality
Housing Sites in Yuen Long South[1]	-	-	Water quality
Drainage Improvement Works Near Four Village in Yuen Long – Sung Shan	2017	2022	Water quality

Key Concurrent Projects	Tentative Programme		Potential Cumulative Impact
	Start	Complete	
New Village, Tai Wo, Lin Fa Tei and Ha Che			

Notes:

[1] No construction programme is available at the time preparing this report. Considering the first population intake year would be Year 2026, the cumulative water quality impact during construction phase would be also considered in this EIA study as a conservative approach.

West Rail Long Ping Station (North) Property Development

6.4.4.2 For the West Rail Long Ping Station (North) Property Development, the construction period will overlap with the Project in Year 2018.

6.4.4.3 The property development is a land-based project. The major sources of the water quality impact are the construction site surface runoff, accidental spillage of chemicals and sewage from the work force. As the wastewater from the construction site and sewage from the work force will be collected and treated to statutory limits before discharging to the public drainage system, which is connected to the Yuen Long Town Nullah, and sewage will be proper handled. Hence, potential water quality impact from the project is not anticipated since the property development are also required to comply with the relevant environmental legislations for wastewater discharge and handling of sewage.

West Rail Long Ping Station (South) Property Development

6.4.4.4 For the West Rail Long Ping Station (South) Property Development, the construction period will overlap with the Project in Year 2018 and Year 2019.

6.4.4.5 The property development is a land-based project. The major sources of the water quality impact are the construction site surface runoff, accidental spillage of chemicals and sewage from the work force. As the wastewater from the construction site and sewage from the work force will be collected and treated to statutory limits before discharging to the public drainage system, which is connected to the Yuen Long Town Nullah, and sewage will be proper handled. Hence, potential water quality impact from the project is not anticipated since the property development are also required to comply with the relevant environmental legislations for wastewater discharge and handling of sewage.

Housing Sites in Yuen Long South

6.4.4.6 For the Housing Sites in Yuen Long South, there is no construction programme available at the time preparing this report. As the first population year is Year 2026 and the project will be developed in stages, cumulative water quality impact from the housing developments project is also considered for conservative assessment.

6.4.4.7 According to the project profile of the housing development project (ESB-279/2014), potential water quality impact would be arise from various construction activities, including site formation, sediment removal, re-alignment of stream and rivers, concrete washings, bore piling, construction of bridges / underpasses / buildings, construction and upgrading of road networks, site workshop or depot and sewage effluent from the workforce. As the wastewater from the construction site and sewage from the work force will be collected and treated to statutory limits before discharging to the public drainage system and sewage will be proper handled, potential water quality impact from the project is not anticipated since EIA study

will be conducted to assess the potential water quality impact, including the potential hydraulic impact. Mitigation measures would be recommended in the EIA study for the water quality impact to comply with the relevant environmental legislations for wastewater discharge and handling of sewage.

Drainage Improvement Works Near Four Village in Yuen Long – Sung Shan New Village, Tai Wo, Lin Fa Tei and Ha Che

6.4.4.8 For the Drainage Improvement Works near Four Village in Yuen Long – Sung Shan New Village, Tai Wo, Lin Fa Tei and Ha Che, the construction period will overlap with the Project from Year 2018 to Year 2022.

6.4.4.9 According to the project profile of the drainage improvement works (ESB-279/2014), the major sources of the water quality impact are the construction site surface runoff, other potential release to the aquatic environment and effluent from the construction workforce. As the wastewater from the construction site and sewage from the work force will be collected and treated to statutory limits before discharging to the public drainage system and sewage will be proper handled, potential water quality impact from the project is not anticipated since EIA study will be conducted to assess the potential water quality impact, including the potential hydraulic impact. Mitigation measures would be recommended in the EIA study for the water quality impact to comply with the relevant environmental legislations for wastewater discharge and handling of sewage.

Cumulative Impact during the Construction Phase

6.4.4.10 As mentioned in **Section 6.4.1** to **Section 6.4.3**, the Project will not generate significant water quality impact during the construction phase with the implementation of the recommended mitigation measures, such as site management, use of temporary cofferdams, use of portable chemical toilets, etc.

6.4.4.11 In consideration of both the Project and concurrent projects (as mentioned in **Section 6.4.4.2** to **Section 6.4.4.9**) will not generate significant water quality impact. Adverse cumulative water quality impact is not anticipated.

6.5 Prediction and Evaluation of Impacts During Operational Phase

6.5.1 Surface Runoff from the Elevated Pedestrian Corridor

6.5.1.1 Surface runoff from the elevated pedestrian corridor is the only source of the water pollution from the Project during operational phase. The runoff may contain grit, oil and debris from the pedestrians.

6.5.1.2 Proper drainage system including gratings at the gully inlets will be provided to remove grit and debris before the runoff discharge to the public storm water drainage system or the Yuen Long Town Nullah. As the nature of surface runoff is similar to the existing condition and hence no adverse water quality impact is anticipated with the provision of the drainage system.

6.5.2 Permanent Structure of the Elevated Pedestrian Corridor

6.5.2.1 According to the latest design, the existing areas to be occupied by the proposed elevated pedestrian corridor are already paved. Hence, the Project will not increase the surface runoff. In addition, the catchment area of the Project is very small in comparing with the overall Yuen Long drainage basin which has a basin area of 93

km^2. Hence, the Project will not have any significant impact on the existing surface runoff hydrographs. Furthermore, the Project will not transverse any existing flood storage area. Therefore, there will be no loss in flood storage arising from the Project.

6.5.2.2 While the Project will not increase the amount of surface runoff and velocity, there are 2 footbridge columns located within the nullah. In addition, a total of 6 box culverts will be constructed at the pedestrian interchanges which will reduce the volume of the nullah by about 720 m^3 (i.e. 1.3%) for the section under the elevated pedestrian corridor. As these permanent structures will decrease the cross-section area of the nullah, the water level of the nullah will be increased, especially during high flow conditions.

6.5.2.3 According to the latest design, the maximum increase in water levels under a 1 in 50 year peak flow event and under a 1 in 200 year peak flow event would be over 0.5m and would not meet DSD requirements and thus may increase flood risk. Therefore, mitigation measures, such as construction of parapet wall, use of lens-shaped footbridge column to reduce head loss, etc., will be required to mitigate the flood risk generated by the Project. With the recommended mitigation measure in **Section 6.7**, the flood risk can be mitigated to acceptable level and adverse water quality impact is therefore not anticipated.

6.5.3 Cumulative Water Quality Impact during Operational Phase

Concurrent Projects

6.5.3.1 The tentative commencement year for the construction of the Project is Year 2018 with target full completion in Year 2022. Concurrent projects in the vicinity of the Project, which may have cumulative environmental impacts, have been discussed in **Section 3.7**. Key concurrent projects of water quality concern during the operation phase of the Project have been identified and are summarised in the **Table 6.11**. In consideration that the sewage generated from the occupiers of the two property development projects during operational phase will be collected by the sewage system and treated by sewage treatment works before discharge and the surface runoff has no difference in the nature comparing with the existing conditions. Hence, no potential water pollution source is identified for the property development projects during the operational phase and no cumulative impact from these two property development projects is therefore anticipated. The implementation programme of these concurrent projects are provided by the respective project proponents. Where information is not available, references have been made to the best available information such as EIA reports and respective project proponents' websites.

Table 6.11 Key concurrent projects for water quality impact assessment during operation phase

Key Concurrent Projects	Tentative Programme		Potential Cumulative Impact
	Start	Complete	
Improvement of Yuen Long Town Nullah (Town Centre Section) – Stage 1 Improvement Works	3rd quarter of 2022	2026	Water quality and drainage characteristics
Improvement of Yuen Long Town Nullah (Town Centre Section) – Stage 2 Beautification Works	2027	2029	Water quality and drainage characteristics

Key Concurrent Projects	Tentative Programme		Potential Cumulative Impact
	Start	Complete	
Housing Sites in Yuen Long South	-	-	Water quality and drainage characteristics
Drainage Improvement Works Near Four Village in Yuen Long – Sung Shan New Village, Tai Wo, Lin Fa Tei and Ha Che	2017	2022	Water quality and drainage characteristics

Improvement of Yuen Long Town Nullah (Town Centre Section) – Stage 1 Improvement Works and Stage 2 Beautification Works

6.5.3.2 According to the drainage impact assessment of the Nullah Improvement Works, which has been approved by DSD, the hydraulic impact of the Nullah Improvement Works would be minimal. Further assessment on the hydraulic impact of the Nullah Improvement Works will be conducted during the EIA study of the Nullah Improvement Works. Suitable mitigation measures would be recommended to reduce the hydraulic impact to acceptable level.

6.5.3.3 As mentioned in **Section 3.7.2**, a dry weather flow interception system will be constructed to intercept the polluted dry weather flow being discharged to the Yuen Long Town Nullah from the town centre section and upstream main nullah. Refer to Section 4.4 of the project profile of the Nullah Improvement Works (DIR-227/2013), water quality and odour issue in the Town Centre Section of the nullah will be alleviated once the improvement works completed. Hence, the nullah improvement works would benefit the water quality of the nullah during operational phase and adverse cumulative water quality impact is therefore not anticipated.

Housing Sites in Yuen Long South

6.5.3.4 According to the project profile of the housing development project (ESB-246/2012), the operation of the development will result in increases of sewage and surface runoff and changes to the hydrological regime of the drainage basins. In addition, nullah revitalizing works and creation of new watercourse, flood retention facilities and reedbed are also proposed in the Stage 3 Community Engagement Digest. The proposed works would also cause potential impact to the hydrological regime in the vicinity.

6.5.3.5 For the hydraulic impact, further assessment will be conducted during the EIA study of the housing development project. Suitable mitigation measures would be recommended to reduce the hydraulic impact to acceptable level.

6.5.3.6 For the water quality impact, proper drainage and sewerage works, and silt and oil traps are recommended in the project profile to serve the housing development and to prevent ingress of pollutants to the storm water system respectively. In addition, a sewage treatment works of tertiary treatment level is proposed in the Stage 3 Community Engagement Digest. With the implementation of these mitigation

measures, no adverse water quality impact is anticipated during the operational phase.

Drainage Improvement Works Near Four Village in Yuen Long – Sung Shan New Village, Tai Wo, Lin Fa Tei and Ha Che

6.5.3.7 According to the Section 3.2 of the project profile of the drainage improvement works (ESB-279/2014), the project only involves widening of existing streams and channels and the construction of pipelines. The upgraded channels and the pipes will be for stormwater only. Therefore, no adverse water quality impact is anticipated during operational phase. Further assessment on the hydraulic impact, if necessary, will be conducted during the EIA study of the drainage improvement works. Suitable mitigation measures would be recommended to reduce the hydraulic impact to acceptable level.

Cumulative Impact during the Operational Phase

6.5.3.8 As mentioned in **Section 6.5.1** and **Section 6.5.2**, the Project will not generate significant water quality impact during the operation phase with the implementation of the recommended mitigation measures, such as construction of parapet wall, use of lens-shaped footbridge column to reduce head loss, etc..

6.5.3.9 In consideration of both the Project and concurrent projects (as mentioned in **Section 6.5.3.2** to **Section 6.5.3.7**) will not generate significant water quality impact. Adverse cumulative water quality impact is not anticipated.

6.6 Mitigation Measures during Construction Phase

6.6.1 General Site Operation

6.6.1.1 In accordance with the *Practice Note for Professional Persons on Construction Site Drainage, Environmental Protection Department, 1994* (ProPECC PN 1/94), best management practices should be implemented as far as practicable as below:

- At the start of site establishment, perimeter cut-off drains to direct off-site water around the site should be constructed with internal drainage works. Channels (both temporary and permanent drainage pipes and culverts), earth bunds or sand bag barriers should be provided on site to direct stormwater to silt removal facilities.
- Diversion of natural stormwater should be provided as far as possible. The design of temporary on-site drainage should prevent runoff going through site surface, construction machinery and equipment in order to avoid or minimize polluted runoff. Sedimentation tanks with sufficient capacity, constructed from pre-formed individual cells of approximately 6 to 8 m^3 capacities, are recommended as a general mitigation measure which can be used for settling surface runoff prior to disposal. The system capacity shall be flexible and able to handle multiple inputs from a variety of sources and suited to applications where the influent is pumped.
- The dikes or embankments for flood protection should be implemented around the boundaries of earthwork areas. Temporary ditches should be provided to facilitate the runoff discharge into an appropriate watercourse, through a silt/sediment trap. The silt/sediment traps should be incorporated in the permanent drainage channels to enhance deposition rates.

- The design of efficient silt removal facilities should be based on the guidelines in Appendix A1 of ProPECC PN 1/94. The detailed design of the sand/silt traps should be undertaken by the contractor prior to the commencement of construction.
- All exposed earth areas should be completed and vegetated as soon as possible after earthworks have been completed. If excavation of soil cannot be avoided during the rainy season, or at any time of year when rainstorms are likely, exposed slope surfaces should be covered by tarpaulin or other means.
- 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 following rainstorms. Deposited silt and grit should be removed regularly and disposed of by spreading evenly over stable, vegetated areas.
- If the excavation of trenches in wet periods is necessary, it should be dug and backfilled in short sections wherever practicable. Water pumped out from trenches or foundation excavations should be discharged into storm drains via silt removal facilities.
- All open stockpiles of construction materials (for example, aggregates, sand and fill material) 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 should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris being washed into the drainage system and storm runoff being directed into foul sewers.
- Precautions to be taken at any time of year when rainstorms are likely, actions to be taken when a rainstorm is imminent or forecasted, and actions to be taken during or after rainstorms are summarized in Appendix A2 of ProPECC PN 1/94. Particular attention should be paid to the control of silty surface runoff during storm events.
- All vehicles and plant should be cleaned before leaving a construction site to ensure no earth, mud, debris and the like is deposited by them on roads. An adequately designed and sited wheel washing facilities should be provided at every construction site exit where practicable. Wash-water should have sand and silt settled out and removed at least on a weekly basis 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.
- Oil interceptors should be provided in the drainage system downstream of any oil/fuel pollution sources. The oil interceptors should be emptied and cleaned regularly to prevent the release of oil and grease into the storm water drainage system after accidental spillage. A bypass should be provided for the oil interceptors to prevent flushing during heavy rain.
- Construction solid waste, debris and rubbish on site should be collected, handled and disposed of properly to avoid water quality impacts.
- All fuel tanks and storage areas should be provided with locks and sited on

sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank to prevent spilled fuel oils from reaching water sensitive receivers nearby.

- Regular environmental audit on the construction site should be carried out in order to prevent any malpractices. Notices should be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the water bodies, marsh and ponds.

6.6.1.2 By adopting the best management practices, it is anticipated that the impacts of general site operation will be reduced to satisfactory levels before discharges. The details of best management practices will be highly dependent to actual site condition and Contractor shall apply for a discharge license under WPCO.

6.6.2 Implementation of Temporary Cofferdams during Construction Phase

6.6.2.1 Cofferdam should be constructed to isolate the construction activities from the nullah water. The detail design of the cofferdams will be conducted by the Contractor during the construction phase to fulfil the requirements in DSD Technical Circular No. 14/200 "Temporary Flow Diversions and Temporary Works Affecting Capacity in Stormwater Drainage System for DSD approval in order to formulate feasible options of these temporary structure.

6.6.3 Mitigation Measure for Construction Activities / Sites in close proximity to the Dry Weather Flow Channel

6.6.3.1 In addition to **Section 6.6.1** and **Section 6.6.2**, following mitigation measures are also recommended for the construction activities / sites in close proximity to the dry weather flow channel:

- Water pumps should be used to collect any construction site surface runoff and ingress / seepage water within the cofferdam. The collected construction site surface runoff and ingress / seepage water should be diverted to the on-site wastewater treatment facilities for treatment to satisfactory levels before discharge;
- Prior to the completion of the temporary platform, any temporary stockpile should be stored outside the nullah and at location away from the air sensitive receivers. Bunds should be installed around the stockpile area and stock material should be covered with tarpaulin to minimize leakage as practicable as possible;
- Stockpile should be located within the cofferdam which will be designed to be water tight and be covered with tarpaulin if storage within nullah is unavoidable,
- Once the temporary platform is completed, any stockpile should be stored on the temporary platforms which should be designed to be water tight to prevent leakage;
- Removal of stockpile from the site as soon as possible and overnight storage should be avoided;
- Avoidance of stockpiling materials near the dry weather flow channel; and
- Avoidance of major excavation during high stream flow.

6.6.4 Emergency Contingency Plan

6.6.4.1 Given the construction activities will be conducted inside or above the nullah, the nullah would be potentially affected during construction phase when there is accidental spillage of chemicals or leakage of polluting water into the nullah. Therefore, an emergency contingency plan should be prepared by the Contractor to state the details of action in such an event. The Contractor should prepare the contingency plan prior to the commencement of construction works and for submission to IEC, Engineer and EPD for approval.

6.6.5 Sewage from Workforce

6.6.5.1 Portable chemical toilets and sewage holding tanks should be provided for handling the construction sewage generated by the workforce. A licensed contractor should be employed to provide appropriate and adequate portable toilets to cater 0.23 m^3/day/employed population and be responsible for appropriate disposal and maintenance.

6.6.5.2 Notices should be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the nearby environment during the construction phase of the Project. Regular environmental audit on the construction site should be conducted in order to provide an effective control of any malpractices and achieve continual improvement of environmental performance on site. It is anticipated that sewage generation during the construction phase of the Project would not cause water quality impact after undertaking all required measures.

6.7 Mitigation Measures during Operational Phase

6.7.1 Surface Runoff from Elevated Pedestrian Corridor

6.7.1.1 As discussed in **Section 6.5**, adverse water quality impact is not anticipated with the proper installation of drainage system. Hence, no specific mitigation measures would be required during the operational phase.

6.7.2 Permanent Structure of the Elevated Pedestrian Corridor

6.7.2.1 As discussed in **Section 6.5**, the Project would provide mitigation measures to mitigate the flood risk of the Yuen Long Town Nullah. According to the latest design, the following mitigation measures are recommended to mitigate the impact to acceptable level:

- construction of parapet wall, that the height is subject to further drainage impact assessment, which is capable to containing passage of 50 year design events with 500mm freeboard and passage of 200 year design event;
- adopting of lens-shaped footbridge column to reduce head loss; and
- connecting individual rows of supporting column at the three existing road bridges to reduce head loss.

6.7.2.2 As mentioned in **Section 3.4.3.2**, the size of permanent structure inside the nullah would be also minimized. Width of columns and walls within nullah will not exceed 1m in width and will be orientated in line with the nullah flow. Drainage impact assessment would be conducted to mitigate the potential flood risk and hydraulic impact to acceptable level.

6.8 Residual Impacts

6.8.1.1 With implementation of the recommended mitigation measures, the Project would not generate unacceptable residual water quality impacts.

6.9 Conclusion

6.9.1.1 During construction phase, potential water pollution and impact sources have been identified as construction of elevated pedestrian corridor within Yuen Long Town Nullah, construction site surface runoff, sewage from site workforce and temporary structure within the nullah. With the full implementation of the recommended mitigation measures, such as covering excavated materials and providing sedimentation tanks on-site etc., no adverse water quality impact is anticipated.

6.9.1.2 During the operational phase, the potential water quality impact is mainly surface runoff from the elevated pedestrian corridor and permanent structure of the proposed elevated pedestrian corridor within the nullah. With the proper installation of drainage system and recommended mitigation measures, no adverse water quality impact is anticipated.