6. WATER QUALITY AND SEWERAGE IMPACT ASSESSMENT

6.1. INTRODUCTION

6.1.1. This section presents an assessment of the potential water quality impacts associated with the construction and operation of the Project. Recommendations for mitigation measures have been provided, where necessary, to minimize the identified water quality impacts to an acceptable level. The water quality impact assessment was conducted in accordance with the requirements in Annexes 6 and 14 of the EIAO-TM and the requirements in *Section 3.4.6* and Appendix D of the EIA Study Brief (ESB-347/2021).

6.2. ENVIRONMENTAL LEGISLATION, STANDARDS AND GUIDELINES

General

6.2.1. The water quality impact assessment is carried out with reference to the following:

- Environmental Impact Assessment Ordinance (Cap. 499);
- Environmental Impact Assessment Ordinance Technical Memorandum (EIAO-TM), particularly Annex 6 and 14;
- Water Pollution Control Ordinance (Cap. 358); and
- Hong Kong Planning Standards and Guidelines.

6.2.2. Other relevant guidelines include:

- Water Supplies Department (WSD) Water Quality Criteria;
- Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS);
- Professional Persons Environmental Consultative Committee Practice Note 2/23 “Construction Site Drainage” (ProPECC PN2/23);
- Professional Persons Environmental Consultative Committee Practice Note 1/23 “Drainage Plans subject to Comment by the Environmental Protection Department” (ProPECC PN 1/23); and
- Sewerage Manual (SM) and the Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (GESF).
- Environmental, Transport and Works Bureau (ETWB) Technical Circular (Works) No. 5/2005 Protection of natural streams/rivers from adverse impacts arising from construction works
- Drainage Services Department (DSD) Technical Circular and Practice Notes

- EPD Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (version 1.0) (Report No. EPD/TP 1/05)

Water Pollution Control Ordinance (Cap. 358)

6.2.3. The *Water Pollution Control Ordinance (WPCO)* is the principal legislation to protect the water quality in Hong Kong. Under this Ordinance, Hong Kong's waters are classified into 10 Water Control Zones (WCZs) with specific Water Quality Objectives (WQOs) stipulated for each WCZ. The Project Area is adjacent to the Victoria Harbour (Phase Two) WCZ and the respective WQOs are summarised in ***Table 6.1***.

Table 6.1 Summary of WQO for Victoria Harbour (Phase Two) Water Control Zone

WQOs		**Part of Parts of Zone**
A. AESTHETIC APPEARANCE		
(a)	There should be 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)	The water should not contain substances which settle to form objectionable deposits.	Whole zone
B. BACTERIA		
	The level of Escherichia coli should not exceed 1 000 per 100 mL, calculated as the geometric mean of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days.	Inland waters
C. COLOUR		
	Human activity should not cause the colour of water to exceed 50 Hazen units.	Inland waters
D. DISSOLVED OXYGEN		
(a)	The level of dissolved oxygen should not fall below 4 mg per litre for 90% of the sampling occasions during the whole year; values should be calculated as the annual water column average (see Note). In addition, the concentration of dissolved oxygen should not be less than 2 mg per litre within 2 m of the seabed for 90% of the sampling occasions during the whole year.	Marine waters
(b)	The level of dissolved oxygen should not be less than 4 mg per litre.	Inland waters

WQOs		Part of Parts of Zone
E. pH		
(a)	The pH of the water should be within the range of 6.5–8.5 units. In addition, human activity should not cause the natural pH range to be extended by more than 0.2 unit.	Marine waters
(b)	Human activity should not cause the pH of the water to exceed the range of 6.0–9.0 units.	Inland waters
F. TEMPERATURE		
	Human activity should not cause the daily temperature range to change by more than 2.0ºC.	Whole zone
G. SALINITY		
	Human activity should not cause the salinity level to change by more than 10%.	Whole zone
H. SUSPENDED SOLIDS		
(a)	Human activity should neither cause the suspended solids concentration to be raised more than 30% nor give rise to accumulation of suspended solids which may adversely affect aquatic communities.	Marine waters
(b)	Human activity should not cause the annual median of suspended solids to exceed 25 mg per litre.	Inland waters
I. 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
J. NUTRIENTS		
(a)	Nutrients should not be present in quantities sufficient to cause excessive or nuisance growth of algae or other aquatic plants.	Marine waters
(b)	Without limiting the generality of objective (a) above, the level of inorganic nitrogen should not exceed 0.4 mg per litre, expressed as annual water column average (see Note).	Marine waters
K. 5-DAY BIOCHEMICAL OXYGEN DEMAND		
	The 5-day biochemical oxygen demand should not exceed 5 mg per litre.	Inland waters
L. CHEMICAL OXYGEN DEMAND		
	The chemical oxygen demand should not exceed 30 mg per litre.	Inland waters
M. TOXIC SUBSTANCES		
(a)	Toxic substances in the water should not attain such level 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 interactions of toxic substances with each other.	Whole zone
(b)	Human activity should not cause a risk to any beneficial use	Whole zone

WQOs		Part of Parts of Zone
	of the aquatic environment.	

Note: Expressed normally as the arithmetic mean of at least 3 measurements at 1 m below surface, mid depth and 1 m above the seabed. However in water of a depth of 5 m or less the mean shall be that of 2 measurements (1 m below surface and 1 m above seabed), and in water of less than 3 m the 1 m below surface sample only shall apply.

WSD Water Quality Criteria

6.2.4. Besides the WQOs set under the *WPCO*, WSD has also specified a set of water quality standards for water quality at flushing water intakes as show in ***Table 6.2***.

Table 6.2 WSD Water Quality Standards at Flushing Water Intakes

Parameter (in mg/L unless otherwise stated)	Target Limit
Colour (Hazen Unit)	< 20
Turbidity (NTU)	< 10
Threshold Odour Number (odour unit)	< 100
Ammonia Nitrogen	< 1
Suspended Solids (SS)	< 10
Dissolved Oxygen (DO)	> 2
5-day Biochemical Oxygen Demand (BOD_5)	< 10
Synthetic Detergents	< 5
E. coli (no. per 100 mL)	< 20,000

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

6.2.5. Discharges of effluents into WCZs are controlled by the *WPCO* through a licensing system. The Technical Memorandum on Standards for Effluents Discharged into Drainage Sewerage Systems, Inland and Coastal Waters sets limits for effluent discharge, covering the physical, chemical, and microbial quality of effluents. Any effluent from the construction and operation of the Project must comply with relevant standards for effluents discharged into the foul sewers, inland/inshore/marine waters of the Victoria Harbour (Phase Two) WCZ.

Professional Persons Environmental Consultative Committee Practice Note 2/23 "Construction Site Drainage" (ProPECC PN2/23)

6.2.6. The EPD has issued the *Professional Persons Environmental Consultative Committee Practice Note 2/23 "Construction Site Drainage" (ProPECC PN2/23)* that controls site runoff and wastewater generated during construction phase of the Project. It provides guidelines for handling and disposal of construction discharges. Practices given in the *ProPECC PN2/23* shall be followed as far as possible during construction phase to minimise potential water quality impacts due to construction site drainage.

Professional Persons Environmental Consultative Committee Practice Note 1/23 "Drainage Plans subject to Comment by the Environmental Protection Department" (ProPECC PN 1/23)

6.2.7. The *ProPECC PN 1/23 "Drainage Plans subject to Comments by Environmental Protection Department"* provides guidelines and practices for handling, treatment and disposal of various effluent discharges to stormwater drains and foul sewers. The design of site drainage and disposal of various site effluents generated within the new development area should follow the relevant guidelines and practices as given in the *ProPECC PN 1/23*.

Sewerage Manual (SM) and the Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (GESF).

6.2.8. *GESF* published by EPD outline the methodology and provide guidance for estimating sewage flows in sewerage infrastructure planning. In conjunction with the *GESF*, the methodology and parameters for sewage flow estimation described in DSD's SM – Part I offer guidance on the planning, design, construction, operation and maintenance of public gravity sewerage systems in Hong Kong.

6.3. EXISTING ENVIRONMENT

6.3.1. A desktop study was conducted to collect and review background information on the water systems, the respective catchments and sensitive receivers that may be affected by the Project.

6.3.2. The Project Site is located within Victoria Harbour (Phase Two) Water Control Zone. The overall water quality in Victoria Harbour has been significantly improved since the implementation of the Harbour Area Treatment Scheme (HATS) Stage 1 in late 2001. Stonecutter Island Sewage Treatment Works (SCISTW) was commissioned under HATS to collect the sewage generated from Kowloon and Eastern Hong Kong Island in Stage 1; Northern and Southwestern Hong Kong Island for Stage 2A for chemically enhanced primary sewage treatment. Since its implementation, the pollution load (in terms of organic pollutants) into the harbour has reduced by 70%. The average DO level has been increased by 10%, and an overall decrease in some key pollutants (e.g., Unionized Ammonia (UIA), nutrients, Total Inorganic Nitrogen (TIN) and *E. coli*) have been observed. The overall WQO compliance rate of Victoria Harbour WCZ has increased sharply from around 50% in 2002 to 100% in 2021 according to the "Marine Water Quality in Hong Kong in 2021" published by EPD, with full compliance with the DO, UIA and TIN WQOs.

6.3.3. There are four representative EPD's marine water quality monitoring stations and two Typhoon Shelter monitoring stations within Victoria Harbour (Phase Two) WCZ that are in vicinity of the Project Site, namely VM4, VM5, VM6, VM7, VT10 (Yau Ma Tei) and VT11 (To Kwa Wan). The locations of the monitoring stations are shown in ***Figure 6.1***. Monitoring data of some key water quality parameters at these stations in 2021 are summarised in ***Table 6.3***. It is also noted that exceedance of the WQOs was recorded for TIN at VT10.

Table 6.3 Marine Water Quality for Victoria Harbour (Phase Two) WCZ in 2021

Parameters		EPD's Monitoring Stations					
		VM4	VM5	VM6	VM7	VT10	VT11
Temperature (°C)		23.7 (18.2-28.2)	23.8 (18.4-28.2)	24.4 (19.9-28.1)	24.5 (19.9-28.4)	26.0 (22.1-28.2)	25.3 (21.8-27.9)
Salinity (psu)		32.2 (29.6-33.6)	32.0 (29.2-33.4)	32.0 (29.4-33.4)	31.7 (28.6-33.4)	30.1 (26.4-32.7)	31.5 (28.5-33.0)
Dissolved Oxygen (mg/L)	Depth Average	4.9 (4.0-6.2)	4.8 (4.0-5.7)	4.8 (4.0-5.9)	4.6 (4.0-5.9)	4.2 (3.5-5.0)	4.5 (3.9-5.3)
	Bottom	4.8 (3.3-6.3)	4.8 (3.3-5.8)	4.6 (3.3-5.8)	4.4 (3.2-5.7)	3.3 (2.5-4.1)	3.9 (3.2-4.7)
Dissolved Oxygen (%saturation)	Depth Average	69 (57-84)	68 (57-79)	69 (57-83)	66 (58-80)	61 (51-71)	66 (56-76)
	Bottom	68 (48-85)	67 (49-81)	65 (50-81)	62 (48-81)	48 (38-57)	57 (46-67)
pH		7.5 (7.2-7.9)	7.5 (7.2-7.9)	7.5 (7.2-7.9)	7.5 (7.2-7.9)	7.4 (7.2-7.8)	7.5 (7.6-7.8)
Suspended Solids (mg/L)		3.8 (2.0-7.5)	3.8 (1.5-6.6)	4.1 (1.7-7.6)	3.8 (1.7-7.8)	5.0 (1.0-12.5)	6.3 (1.0-10.6)
5-day Biochemical Oxygen Demand (mg/L)		0.7 (<0.1-1.1)	0.7 (<0.1-1.1)	0.8 (0.1-1.9)	0.8 (0.2-1.8)	0.9 (0.6-1.1)	0.8 (0.6-1.2)
Ammonia Nitrogen (mg/L)		0.110 (0.035-0.237)	0.134 (0.069-0.203)	0.150 (0.071-0.223)	0.183 (0.064-0.347)	0.332 (0.270-0.395)	0.197 (0.153-0.297)
Unionised Ammonia (mg/L)		0.002 (<0.001-0.003)	0.002 (<0.001-0.003)	0.002 (<0.001-0.003)	0.002 (<0.001-0.004)	0.005 (0.002-0.013)	0.004 (0.002-0.011)
Nitrite Nitrogen (mg/L)		0.034 (0.006-0.117)	0.037 (0.006-0.120)	0.041 (0.007-0.120)	0.043 (0.005-0.127)	0.029 (0.011-0.038)	0.026 (0.009-0.034)
Nitrate Nitrogen (mg/L)		0.133 (0.036-0.330)	0.149 (0.039-0.343)	0.149 (0.056-0.367)	0.155 (0.068-0.373)	0.163 (0.072-0.285)	0.137 (0.070-0.207)
Total Inorganic Nitrogen (mg/L)		0.28 (0.13-0.52)	0.32 (0.16-0.57)	0.34 (0.22-0.62)	0.38 (0.26-0.63)	0.52 (0.46-0.62)	0.36 (0.26-0.52)
Total Kjeldahl Nitrogen (mg/L)		0.63 (0.35-0.90)	0.72 (0.37-1.04)	0.72 (0.53-1.01)	0.80 (0.52-1.07)	1.09 (0.88-1.30)	0.71 (0.61-0.80)
Total Nitrogen (mg/L)		0.74 (0.52-0.96)	0.83 (0.43-1.12)	0.82 (0.60-1.09)	0.90 (0.68-1.15)	1.19 (0.96-1.43)	0.81 (0.69-0.93)
Orthophosphate Phosphorus (mg/L)		0.017 (0.006-0.031)	0.019 (0.005-0.029)	0.020 (0.008-0.032)	0.021 (0.011-0.028)	0.031 (0.019-0.040)	0.023 (0.010-0.035)
Total Phosphorus (mg/L)		0.08 (0.03-0.18)	0.09 (0.05-0.21)	0.08 (0.04-0.18)	0.08 (0.04-0.14)	0.09 (0.07-0.12)	0.07 (0.05-0.08)
Chlorophy ll-a (μg/L)		2.7 (0.4-7.9)	2.6 (0.6-8.0)	2.5 (0.4-7.5)	2.4 (0.4-7.2)	2.8 (1.0-4.6)	2.8 (0.7-7.5)

Parameters	EPD's Monitoring Stations					
	VM4	VM5	VM6	VM7	VT10	VT11
E.coli (count/100mL)	130 (24-410)	280 (78-900)	360 (29-1100)	480 (44-5200)	5300 (340-26000)	2400 (100-13000)
Faecal Coliforms (count/100mL)	300 (60-850)	590 (190-1500)	850 (56-2300)	1200 (120-9300)	12000 (1200-60000)	5500 (250-25000)

Notes:

[1] Data presented are depth averaged (except as specified) and are the annual arithmetic mean except for E. coli and faecal coliforms (geometric mean);

[2] Data in brackets indicate the ranges;

[3] Underlined indicates occurrence of non-compliance with that parameter of WQO.

Water Sensitive Receivers

6.3.4. The water quality impact assessment identified and analysed the existing and planned future activities, beneficial uses and WSRs within 500 m from the boundary of the Project Site and Victoria Harbour (Phase Two) WCZ in accordance with *Section 3.4.6.2* of the EIA Study Brief and evaluates the potential water quality impact from the Project. The review was made with reference to the latest best available information at the time of preparation of this study, which include those earmarked on the approved Tsim Sha Tsui OZP (No. S/K1/28), Development Permission Area Plans, Outline Development Plans and Layout Plans, and other relevant published land use plans, including plans and drawings published by Lands Department and any lands use and development applications approved by the Town Planning Board.

6.3.5. Due to the highly urbanised nature of the area, no natural streams or rivers are located within 500 m from the boundary of the Project Site. Also, there are no marine biological sensitive receivers, such as fish culture zone, shellfish culture grounds, marine park/reserves or commercial fishing rounds identified within the Victoria Harbour (Phase Two) WCZ. Other inland waters within 500 m from the site boundary including bird lake and lotus pond are identified in Kowloon Park at west of Project Site. 10 cooling water intakes identified near the boundary of the 500 m assessment area are tabulated in ***Table 6.4*** below and the locations are shown in ***Figure 6.1***. Given that the construction and operation activities will be land-based in nature, and the wastewater generated would be collected and discharged to public drainage and sewerage systems, it is not anticipated that the water pollutant would be carried into the distant watercourses. Thus, water quality impacts on the water sensitive receivers are not anticipated.

Table 6.4 Summary of Representative Water Sensitive Receivers

WSR ID	Description	Closest Distance between WSRs and Site Boundary (m)
WSR01	West Kowloon Terminus (MTRC) Cooling Water Intake	860

WSR02	China H. K. City Cooling Water Intake	922
WSR03	Harbour City Cooling Water Intake	776
WSR04	Ocean Centre Cooling Water Intake	761
WSR05	Ocean Terminal Cooling Water Intake	1034
WSR06	Government Premises Cooling Water Intake	935
WSR07	New World Centre Cooling Water Intake	869
WSR08	East Rail Extension Cooling Water Intake	713
WSR09	Metropolis Cooling Water Intake	836
WSR10	Hong Kong Coliseum Cooling Water Intake	909

6.4. ASSESSMENT METHODOLOGY

6.4.1. The water quality impact assessment follows the criteria and guidelines as stated in Annexes 6 and 14 of the EIAO-TM. The assessment area includes areas within 500 m from the boundary of the Project Site and Victoria Harbour (Phase Two) WCZ.

6.4.2. Potential sources of water quality impact that may arise during the construction and operation stages of the Project were described, including point discharges and non-point sources to surface water run-off, sewage from workforce and polluted discharge generated from the Project. All the identified sources of potential water quality impact have been evaluated and their impact significance determined. Practical water pollution control measures have been recommended to mitigate identified water quality impacts.

6.4.3. The potential cumulative impacts due to other related concurrent and planned projects or pollution sources within assessment area have been assessed with mitigation measures where necessary to ensure that any water quality impacts would be controlled to acceptable levels.

6.5. CONSTRUCTION PHASE IMPACT ASSESSMENT

Identification of Pollution Sources

6.5.1. As described in *Section 3* of this EIA Report, the Project comprises mainly the construction of land-based structures with foundation piling. Upon site clearance, site formation will be carried out in limited scale as the Site is relatively flat, followed by construction of foundation work by piling. As marine construction works are not required, potential water pollution sources during construction phase would originate from the land-based works activities including excavation works, piling, footing, concrete slab, utilities work, etc.

6.5.2. Major potential sources of water quality impacts during construction phase of the Project are identified, which include:

- Construction site run-off;
- Accidental spillage of chemicals;

- Sewage generated from on-site construction workers; and
- General construction activities.

Construction Site Run-off

6.5.3. Construction site run-off may increase the loads of sediment and other contaminants. The discharge of uncontrolled site run-off may cause potential blockage of drainage channel and increase of SS level and turbidity in the nearby water bodies. The pH of the water system may be altered from the release of contaminants and result in toxic effects to the water biota.

6.5.4. Major construction site run-off comprises:

- Contaminated surface run-off and erosion from site surfaces, exposed bare soil and earth, drainage channels, earth working areas and stockpiles;
- Effluents from dewatering associated with piling, grouting and cement washing;
- Wastewater from dust suppression sprays and vehicle wheel washing; and
- Contaminated surface run-off by fuel, oil, solvents and lubricants from maintenance area for construction equipment and vehicle.

6.5.5. The potential release of pollutants into the stormwater drainage system and coastal marine water can be minimised by the adoption of good site practices and relevant guidelines for construction run-off. Adequate site drainage with sedimentation tank and perimeter drain along site boundary will be provided on-site. With the implementation of mitigation measures and good site practices outlined in *Section 6.8*, the effluent discharge quality will meet the requirements specified on the discharge licence issued under the *WPCO* and the TM-DSS. Therefore, unacceptable water quality impacts on the nearby water environment are not anticipated.

Accidental Spillage of Chemicals

6.5.6. Surface soils may be contaminated by the accidental spillage of chemicals used in general construction works, e.g. lubricant oil, paints, diesel and solvents, etc. The contaminated soil may be washed away by construction site run-off and enter nearby stormwater drainage channels, thus resulting in adverse water quality impacts.

6.5.7. Implementation of good construction and site management practices, such as perimeter drain along site boundary and sediment trap, will ensure the generation of accidental chemical spillage is minimised. As such, spillage of chemicals shall not enter nearby stormwater drains and adverse water quality impacts on the water system including nearby WSRs will be avoided.

Sewage Generated from On-Site Workforce and Staff

6.5.8. There will be sewage generation from eating areas, temporary sanitary facilities and waste disposal area for on-site construction workforce and staff. The characteristics of the sewage may include high levels of BOD_5, ammonia and *E. coli*. However, adverse water quality impacts on the water system including nearby WSRs are not anticipated by adequate control

of construction phase sewage through provision of temporary sanitary facilities, such as on-site chemical toilets.

General Construction Activities

6.5.9. The land-based construction works could have the potential to cause water pollution. Nevertheless, it is considered that the impact of these activities to nearby water bodies will be minimal provided that the site boundaries are well maintained. Good construction and site management practices, such as site drainage and waste disposal, will also limit the sediment and pollutants to acceptable levels.

6.6. OPERATION PHASE IMPACT ASSESSMENT

Identification of Pollution Sources

6.6.1. The Project mainly involves construction of a new Annex Block, refurbishment of the Red House and road widening works for vehicular access. With reference to the operational activities as described in *Section 3*, major potential sources of water quality impacts during operation phase of the Project are identified, which include:

- Sewage generated from staff and visitors at office; and
- Additional surface runoff as a result of increased paved area.

Existing, Committed and Planned Sewerage Facilities

6.6.2. The Project consists of a new Annex Block comprising various functional areas for weather monitoring, calibration laboratory, studio as well as offices. The existing Red House will be converted into a History Room to display history of HKO.

6.6.3. A desktop study was carried out to identify the existing sewerage networks, sewage treatment and disposal facilities and the characteristics of the concerned sewerage catchments within and in the vicinity of the Project Site.

6.6.4. An assessment of the drainage information obtained from the GeoInfo Map services of the Lands Department has concluded that there are existing sewerage networks in the vicinity of the Project Site for serving the concerned sewerage catchments. The existing gravity sewers with pipe diameters ranging from 150mm to 225mm running along the western entrance of HKO Headquarters to Nathan Road are identified. The sewage is then discharged into a series of sewers along Nathan Road then diverted northeast into the DSD Hung Hom Bay Pumping Station, and eventually conveyed to the DSD To Kwa Wan Preliminary Treatment Works located approximately 2km to the northeast of the Project.

6.6.5. Apart from the above existing sewers, there is an upgrading work for Central and East Kowloon Sewerage (Contract No. DC/2018/11) identified in the vicinity of the Project. The works include upgrading of 8 km of gravity sewers and rehabilitation of about 315 m of existing sewers in East Kowloon, To Kwa Wan, Hung Hom and Tsim Sha Tsui areas. Its expected completion year will be early 2024.

Sewage generated from Staff and Visitors at Office

6.6.6. Sewage from the operation of the Project would be generated mainly from toilets in the Annex Block, including sanitary wastewater within the Project Site. Proper draining system would be provided for the collection and discharge into the existing public sewerage system. As confirmed by HKO, the laboratory provided in the Annex Block is for calibration of electronic meteorological equipment. No generation of sewerage discharge from laboratory to public sewer is expected.

6.6.7. According to the *GESF*, the average dry weather flows (ADWF) from the existing buildings within the boundary of HKO Headquarters (i.e. 1883 Building, Annex Building of 1883 Building, Centenary Building, Red House, White House and three Staff Quarters) is estimated to be 70.15 m^3/day based on the estimated sewage generation in ***Appendix 6.1***. A peaking factor of 8 and a catchment inflow factor of 1.0 have then been applied to the ADWF to establish the peak wet weather flow (PWWF) of 0.0065 m^3/s, which includes the stormwater allowances in accordance with the *GESF*, in order to provide a conservative basis for the performance assessment of the sewerage facilities.

6.6.8. The total amount of sewerage discharged into the terminal manhole and the public manhole FMH4099623 will take into account the generation from the existing buildings within HKO Headquarters as well as the discharge from the new Annex Block. Sewerage generated from the operation of new Annex Block will lead to an increment of 40.32 m^3/day ADWF and 0.0037 m^3/s PWWF to the existing generation. Total of 110.47 m^3/day ADWF and 0.0102 m^3/s PWWF will be discharged into the terminal manhole after the commission of the new Annex Block.

Potential Sewerage Impact on Public Sewers and Sewerage Facilities

6.6.9. The proposed sewerage layout plans for the Project for connection into the public sewerage system are shown in ***Figure 6.2***. With the provision of the stormwater drainage system for serving the uncovered areas of the Project, no surface run-off due to rainfall would enter public sewerage system during operation phase in accordance with *ProPECC PN 1/23*.

6.6.10. The collected sewage flows from the Project Site will be connected and discharged into the existing 150 mm diameter gravity sewer along the western entrance of HKO Headquarters under existing condition. According to DSD's SM clause 5.1.1, the minimum size for public sewers should be 200 mm diameter. Sewers with diameter 150 mm may need to be upgraded (subject to further studies) and handed over to DSD for future maintenance. As invert levels of 5 existing manholes (namely FMH4099626, FMH4099625, FMH4099622, FMH4099623 and FMH4099624) are not available at this moment, survey will be conducted to verify the missing information for the assessment at a later stage. As a conservative approach, the current hydraulic calculation will adopt 150mm diameter for existing and future conditions, and invert levels are derived from the existing gradient information available, which is subject to survey result. The PWWF to be discharged into the existing sewer is estimated to be 0.0102 m^3/s (included peaking factor of 8).

6.6.11. A hydraulic assessment, which has taken into account of the sewage discharge from the surrounding catchment areas as well as the Project Site, is conducted for the public sewerage system as shown in ***Appendix 6.1***. Comparing the PWWF of 0.0102 m^3/s from the Project

with the capacities of the 150 mm diameter gravity sewer and the further downstream 225mm to 300mm diameter gravity sewers, no significant impact to the receiving sewerage networks and the associated sewage treatment and disposal facilities arising from the Project is anticipated. It is demonstrated in ***Appendix 6.1*** that the used capacity for the existing downstream sewers ranged from 10.1% to 72.5% for S1 to S9 under existing condition (i.e., only the generation from existing HKO Headquarters buildings) and ranged from 15.9% to 74.3% after the construction of the new Annex Block. Contribution due to the new Annex Block is insignificant. Moreover, no sewer with insufficient capacity is observed with respect to the sewage generated from the Project Site under both conditions. Further mitigation works for the sewerage networks, sewage treatment and disposal facilities are not required.

6.6.12. In addition, the downstream DSD Hung Hom Pumping Station receives sewage flows from the South Kowloon and Hung Hom Bay areas with a design capacity of 103,680 m^3/day. Comparing the estimated PWWF from the Project with the said design capacity of receiving pumping station, sewage generation from the Project Site will take up 0.85% of the total design capacity of the pumping station. The capacity of the pumping station is adequate to cater for the additional flow from the operation, thus significant impact to the downstream sewerage facilities is not anticipated.

Agreement with Government Authorities for Proposed Sewerage Discharge

6.6.13. The proposed sewerage layout plans for the Project for connection into the public sewerage system as shown in ***Figure 6.2*** shall be submitted to the Government authorities (including DSD and EPD) for approval in the detailed design stage of the Project. Agreement from the authorities should be sought prior to the commencement of the proposed sewerage connection work.

6.6.14. As there would be discharge of treated effluent from the Project, application for a discharge licence pursuant to the *WPCO* should be submitted to EPD for approval.

Additional Surface Runoff as a Result of Increased Paved Area

6.6.15. It is expected that there will be more total paved area (increased from 975 m^2 to 2,400 m^2 including permeable paver) after the construction of New Annex Block, which brings about an increase of surface runoff. Under existing condition, 0.122 m^3/s of runoff is expected from Project Site. Due to the change in surface type, the 1 in 50 years runoff from Project Site is expected to increase to 0.175 m^3/s compared to existing scenario. Surface runoff within the Project Site will be discharged to terminal stormwater manhole at the western entrance of the HKO Headquarters and conveyed to public drains along Nathan Road. Detailed calculation of peak flow from the Project Site under existing and proposed scenario is presented in ***Appendix 6.2***.

6.6.16. Despite surface runoff will be increased, impact upon water quality would be minimal given that proper drainage system would be incorporated to receive the surface runoff. It is anticipated that with proper implementation of mitigation measures as recommended in *Section 6.7*, no adverse water quality impact from additional surface runoff is expected during operation of the Project.

6.7. MITIGATION MEASURES

Construction Site Run-off and General Construction Activities

6.7.1. In accordance with *ProPECC PN2/23*, potential water quality impact shall be minimised by the implementation of construction phase mitigation measures and general good practices including but not limited to the following:

- At the establishment of works site, perimeter cut-off drains to direct off-site water around the Site should be constructed with internal drainage works and erosion and sedimentation control facilities implemented. Channels (both temporary and permanent drainage pipes and culverts), earth bunds or sand bag barriers should be provided to divert the stormwater to silt removal facilities. The design of the temporary on-site drainage system will be undertaken by the Contractor prior to the commencement of construction, followed by proper maintenance and management practices throughout the construction phase;

- Dikes or embankments for flood protection should be implemented around the boundaries of earthwork areas. Temporary ditches should be provided to facilitate the run-off discharge into an appropriate watercourse, through a silt/sediment trap. Silt/sediment traps should also 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 PN2/23*, which states that the retention time for silt/sand traps should be less than 5 minutes under maximum flow conditions. The sizes may vary depending upon the flow rate, but for a flow rate of 0.1 m^3/s, a sedimentation basin of 30 m^3 would be required and for a flow rate of 0.5 m^3/s the basin would be 150 m^3. The detailed design of the sand/silt raps should be undertaken by the Contractor prior to the commencement of construction;

- The construction works should be programmed to minimise surface excavation works during rainy seasons (April to September), as possible. All exposed earth areas should be completed and vegetated as soon as possible after completion of the earthwork, or alternatively, within 14 days of the cessation of earthworks where practicable. 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 and temporary access roads should be protected by crushed stone or gravel, as excavation proceeds. Intercepting channels should be provided (e.g. along the crest/edge of excavation) to prevent storm runoff from washing across exposed soil surfaces. Arrangements should always be in place to ensure that adequate surface protection measures can be safely carried out well before the arrival of a rainstorm;

- The overall slope of works sites should be kept to a minimum to reduce the erosive potential of surface water flows, and all trafficked areas and access roads should be protected by coarse stone ballast. An additional advantage accruing from the use of crushed stone is the positive traction gained during the prolonged periods of inclement weather and the reduction of surface sheet flows;

- All drainage facilities and erosion and sediment control structures should be regularly inspected and maintained to ensure their proper and efficient operation at all times particularly following rainstorms. Deposited silts and grits should be removed regularly and disposed of by spreading evenly over stable, vegetated areas;

- Measures should be taken to minimise the ingress of site drainage into excavations. If the excavation of trenches in wet season is inevitable, they should be dug and backfilled in short sections wherever practicable. The 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 materials) 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 being washed into the drainage system and storm run-off being directed into foul sewers;

- Precautions to be taken at any time of the year when rainstorms are likely, actions to be taken when a rainstorm is imminent or forecasted and during or after rainstorms, are summarised in *Appendix A2* of *ProPECC PN2/23*. Particular attention should be paid to the control of silty surface run-off during storm events;

- All vehicles and plants should be cleaned before leaving the Project Site to ensure no earth, mud, debris and the like is deposited by them on roads. An adequately designed and sited wheel washing bay should be provided at the exit of Project Site 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-washing bay to public roads should be paved with sufficient backfall toward the wheel-washing 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. 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 oil interceptors to prevent flushing during heavy rain. Any drainage channels connecting storm drains via designed sand/silt removal facilities should be disconnected/removed after completion of construction stage to prevent any direct discharge to the stormwater system;

- The construction solid waste, debris and rubbish on-site should be collected, handled and disposed of properly to avoid causing any water quality impacts. The requirements for solid waste management are detailed in *Section 8* of this EIA Report;

- 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 the nearby WSRs;

- Groundwater pumped out of wells, etc. for the lowering of ground water level in basement or foundation construction, and groundwater seepage pumped out of tunnels or caverns under construction should be discharged into storm drains after the removal of silt in silt removal facilities;
- 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;
- Bentonite slurries used in diaphragm wall and bore-pile construction should be reconditioned and reused wherever practicable. If the disposal of a certain residual quantity cannot be avoided, the used slurry may be disposed of at the marine spoil grounds subject to obtaining a marine dumping licence from EPD on a case-by-case basis;
- If the used bentonite slurry is intended to be disposed of through the public drainage system, it should be treated to the respective effluent standards applicable to foul sewers, storm drains or the receiving waters as set out in the *WPCO Technical Memorandum on Effluent Standards*;
- Before commencing any demolition works, all sewer and drainage connections should be sealed to prevent building debris, soil, sand etc. from entering public sewers/drains;
- Wastewater generated from building construction activities including concreting, plastering, internal decoration, 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; and
- Acidic wastewater generated from acid cleaning, etching, pickling and similar activities should be neutralized to within the pH range of 6 to l0 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.

6.7.2. By adopting the above mitigation measures with best management practices, it is anticipated that the impacts of construction site run-off will be reduced to an acceptable level.

6.7.3. There is a need to apply to the EPD for a discharge licence for discharge of effluent from the construction site under the *WPCO*. The discharge quality must meet the requirements as specified in the discharge licence. All the run-off and wastewater generated from the works areas should be treated so that it satisfies all the standards listed in the Technical Memorandum. Minimum distances of 100 m should be maintained between the discharge points of construction site effluent and the existing seawater intakes. Incorporation of these requirements in the contract document of the Project shall be considered. In addition, no new effluent discharges in nearby typhoon shelters should be allowed. The beneficial uses of the treated effluent for other on-site activities such as dust suppression, wheel washing and general cleaning etc., would minimise water consumption and reduce the effluent discharge volume.

Sewage Generated from On-site Construction Workers

6.7.4. Portable chemical toilets and sewage holding tanks are recommended for the handling of the construction sewage generated by the workforce. A licenced Contractor should be employed to provide appropriate and adequate portable toilets and be responsible for appropriate disposal and maintenance.

Accidental Spillage of Chemicals

6.7.5. The Contractor must register as a chemical waste producer if chemical wastes would be produced from the construction activities. The *Waste Disposal Ordinance (Cap. 354)* and its subsidiary regulations in particular the *Waste Disposal (Chemical Waste) (General) Regulation* should be observed and complied with for control of chemical wastes.

6.7.6. Any maintenance facilities should be located on hard standings within a bunded area, and sumps and oil interceptors should be provided. Maintenance of vehicles and equipment involving activities with potential for leakage and spillage should be undertaken within the areas appropriately equipped to control these discharges.

Operation Phase of the Project

6.7.7. All sewage arising from the Project should be collected and diverted to the public sewerage system via proper connections to minimise water quality impact from the operation of the Project and ensure compliance with TM-DSS on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters under the *WPCO*.

6.7.8. To minimise the impact from increased surface runoff, the Project should be designed with adequate drainage system to cater for the runoff from 50 year-return-period rainstorm; and provided with appropriate screening facilities (e.g., silt trap) and oil interceptors, as required. The design of stormwater drains shall follow the relevant guidelines and practices as given in the *ProPECC PN 1/23*. Manholes, gullies and oil interceptors should be cleaned and inspected regularly. Additional inspection and cleansing should be carried out before forecast heavy rainfall.

6.8. CUMULATIVE IMPACTS

6.8.1. The known concurrent projects to the Project, as described in *Section 3* of this EIA Report, would be included in the following ***Table 6.5***:

Table 6.5 List of Potential Concurrent Projects

Concurrent Projects	Potential Cumulative Water Quality Impacts	
	Construction Phase	Operation Phase
Agreement No. CE 41/2018 (DS) Drainage Improvement Works in Tsim Sha Tsui – Investigation, Design and Construction (construction works commenced on 29 Mar 2019 and scheduled to be completed in 2029 tentatively)	x	x

Project 3075RE "Expansion of Hong Kong Science Museum and Hong Kong Museum of History"	x	x

6.8.2. The water pollution source from construction phase of the drainage improvement work will be mainly site run-off and the sewage from the workforce. With the implementation of works practices and the associated environmental measures; and the provision of on-site portable chemical toilets, it is anticipated that no adverse cumulative water quality impact would be arisen during construction phase. For operation phase, no adverse cumulative water quality impact is expected.

6.8.3. The Expansion of Hong Kong Science Museum and Hong Kong Museum of History is currently undergoing design stage. Given that the expansion project will implement good site practices and water quality mitigation measures, unacceptable cumulative water quality impact is not anticipated during construction phase. It should be noted that the sewage generated from the operation phase will be discharged via a separate sewerage system along Granville Road, thus cumulative water quality impact is not anticipated.

6.9. RESIDUAL IMPACTS

6.9.1. With the implementation of the above mitigation measures, the Project is not anticipated to result in adverse residual impacts on the water system, with regards to the standards and guidelines as listed in *Section 6.2*, during the construction and operation phases.

6.10. ENVIRONMENTAL MONITORING AND AUDIT

6.10.1. With the implementation of good construction site practices as well as the recommended mitigation measures, no adverse water quality impact is envisaged during the construction phase of the Project. Nevertheless, regular site inspection is proposed to be conducted during the construction phase in order to ensure the recommended mitigation measures are properly implemented. Details of the EM&A programme are presented in the stand-alone EM&A Manual.

6.10.2. With the full implementation of the recommended mitigation measures during operation phase, no adverse water quality impact is anticipated. Therefore, no operation phase EM&A for water quality is considered required.

6.11. CONCLUSION

6.11.1. Potential water pollution sources have been identified as construction site run-off and sewage from workforce. Mitigation measures include the implementation of the construction site practices in accordance with the EPD's *ProPECC PN2/23.* Construction Site Drainage, provision and management of portable chemical toilets on-site as well as preventive measures for avoiding accidental chemical spillages are recommended to mitigate any adverse water quality impacts. With the implementation of these measures, adverse residual impacts would not be anticipated. Furthermore, there would be insignificant sewerage and sewage treatment implications during the operation of the Project, and adverse

water quality impact would not be anticipated with the implementation of the recommended mitigation measures based on the findings of this EIA study.