5. WATER QUALITY

5.1 Introduction

This *Section* presents an evaluation of the potential water quality impacts from the decommissioning and construction of the Project, and the results were assessed with reference to the relevant environmental legislation, standards and criteria. As there is no cooling water discharge associated with the operation of the Project, water quality issues during the operation phase are not expected. Evaluation of the potential water quality impacts during operation phase is not required in the EIA Study Brief.

5.2 Legislative Requirements and Evaluation Criteria

The following legislation and relevant guidance or non-statutory guidelines are applicable to the evaluation of water quality impacts associated with the decommissioning and construction of the Project:

- *Water Pollution Control Ordinance (WPCO);*
- *Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM- ICW);*
- *Environmental Impact Assessment Ordinance (EIAO) and the Technical Memorandum on EIA Process (EIAO-TM), Annexes 6 and 14;* and
- *Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN1/94).*

5.2.1 Water Pollution Control Ordinance (WPCO)

The Water Pollution Control Ordinance (WPCO) is the primary legislation for the control of water pollution and water quality in Hong Kong. Under the WPCO, Hong Kong waters are divided into 10 Water Control Zones (WCZs). Each WCZ has a designated set of statutory Water Quality Objectives (WQOs).

The proposed Project is located in the Southern WCZ. The applicable WQOs for Southern WCZ are presented in ***Table 5.1***.

Table 5.1 Summary of Water Quality Objectives for Southern WCZ

	Water Quality Objective	Southern WCZ
A	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 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
B	BACTERIA	
a)	Annual geometric mean not to exceed 610 cfu/100mL	Secondary Contact Recreation Subzone & Fish Culture Zones
b)	Annual geometric mean not to exceed 180 cfu/100mL	Bathing Beach Subzones
C	DISSOLVED OXYGEN	

	Water Quality Objective	Southern WCZ
a)	Depth average not less than 4 mg L^{-1} for 90% of samples; and Bottom value not less than 2 mg L^{-1} for 90% of samples.	Marine waters excepting Fish Culture Subzones
b)	Depth average not less than 5 mg L^{-1} for 90% of samples; and Bottom value not less than 2 mg L^{-1} for 90% of samples.	Fish Culture Subzones
c)	Not less than 4 mg L^{-1} due to waste discharge	Inland waters of the Zone
D	pH	
a)	To be in the range 6.5 - 8.5, change due to waste discharge not to exceed 0.2	Marine waters excepting Bathing Beach Subzones; Mui Wo (A), Mui Wo (B), Miu Wo (C), Mui Wo (E) and Mui Wo (F) Subzones.
b)	To be in the range 6.0 - 9.0	Mui Wo (D) Sub-zone and other inland waters.
c)	To be in the range 6.0 - 9.0 for 95% of samples; change due to waste discharge not to exceed 0.5	Bathing Beach Subzones
E	TEMPERATURE	
	Change due to waste discharge not to exceed 2°C	Whole zone
F	SALINITY	
	Change due to waste discharge not to exceed 10% of natural ambient level	Whole zone
G	SUSPENDED SOLIDS	
a)	Waste discharge not to raise the natural ambient level by 30% nor cause the accumulation of suspended solids which may adversely affect aquatic communities	Marine waters
b)	Waste discharges not to cause the annual median to exceed 20 mg L^{-1}.	Mui Wo (A), Mui Wo (B), Mui Wo (C), Mui Wo (E) and Mui Wo (F) Subzones.
c)	Waste discharges not to cause the annual median to exceed 25 mg L^{-1}.	Mui Wo (D) Sub-zone and other inland waters.
H	UNIONISED AMMONIA	
	Annual mean not to exceed 0.021 mg L^{-1}	Whole zone
I	NUTRIENTS	
a)	Nutrients not to cause excessive or nuisance growth of algae or other aquatic plants.	Marine waters
b)	Annual mean depth-averaged total inorganic nitrogen not to exceed 0.1 mg L^{-1}	Marine waters
J	5-DAY BIOCHEMICAL OXYGEN DEMAND	
a)	Waste discharges not to cause to exceed 5 mg L^{-1}.	Inland waters of the zone
K	CHEMICAL OXYGEN DEMAND	
	Waste discharges not to cause to exceed 30 mg L^{-1}.	Inland waters of the zone
L	TOXIC SUBSTANCES	
a)	Not to be present at levels producing significant toxic effect	Whole zone
b)	Not to cause a risk to any beneficial uses of the aquatic environment.	Whole zone

5.2.2 *Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-ICW)*

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

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

5.2.3 Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM)

Annexes 6 and 14 of the *EIAO-TM* provide general guidelines and criteria to be used in assessing water quality impacts.

The *EIAO-TM* recognises that, in the application of the above water quality criteria, it may not be possible to achieve the WQO at the point of discharge as there are areas which are subjected to greater impacts (which are termed by the EPD as the mixing zones), where the initial dilution of the discharge takes place. The definition of this area is determined on a case-by-case basis. In general, the criteria for acceptance of the mixing zones are that it must not impair the integrity of the water body as a whole and must not damage the ecosystem.

5.2.4 Practice Note for Professional Persons, Construction Site Drainage

Apart from the above statutory requirements, the *Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN 1/94)*, issued by EPD in 1994, also provide useful guidelines on the prevention of water pollution associated with construction activities.

5.3 Baseline Conditions

5.3.1 Assessment Area

In accordance with *Clause 3.4.5.2* of the EIA Study Brief, the Assessment Area for the water quality impact assessment covers the Southern WCZ under the *WPCO* **(*Figure 5.1*)**. Considering the nature and extent of potential impacts, water sensitive receivers (WSRs) within and in the vicinity of the Assessment Area were identified.

5.3.2 Marine Water Quality

Baseline marine water quality of the Assessment Area has been determined through a review of EPD routine water quality monitoring data collected between 1986 and 2019. This dataset provides Hong Kong's most comprehensive long-term water quality monitoring data and allows an indication of temporal and spatial change in marine water quality in Hong Kong. Water quality monitoring data from EPD monitoring stations which are located within or close to the Assessment Area were used to provide the baseline water quality conditions of the Assessment Area. The monitoring results from 1986 to 2019 at the selected monitoring stations are summarised in ***Table 5.2***. Locations of these stations are presented in ***Figure 5.1***.

Table 5.2 Summary of EPD Routine Water Quality Monitoring Data from Selected Stations of the Southern WCZ in 1986-2019

Parameter	SM5	SM6	SM7
Temperature (°C)	23.6	23.3	23.5
	(14.2-29.6)	(14.0-29.4)	(14.2-29.8)
Salinity (psu)	31.2	31.4	30.7
	(18.8-34.3)	(22.9-34.3)	(20.0-34.4)
Dissolved Oxygen (mg L^{-1}) - Depth Average	6.7	6.6	6.5
	(4.1-11.7)	(3.5-10.4)	(3.4-10.9)
Dissolved Oxygen (mg L^{-1}) - Bottom	6.3	5.9	6.2
	(2.0-10.4)	(0.3-9.6)	(2.2-11.1)
Dissolved Oxygen (% saturation)	95	92	91
	(57-171)	(50-132)	(49-157)
Dissolved Oxygen (% saturation) - Bottom	88	83	86
	(29-148)	(4-120)	(31-166)

Parameter	SM5	SM6	SM7
pH	8.1	8.1	8.1
	(7.6-8.9)	(7.6-8.9)	(7.6-8.7)
Secchi Disc Depth (M)	2.3	2.4	2.2
	(0.5-6.0)	(0.5-10.0)	(0.5-6.0)
Turbidity (NTU)	6.7	6.7	7.2
	(0.4-88.8)	(0.2-32.2)	(0.4-40.4)
Suspended Solids (mg L^{-1})	5.9	5.7	6.8
	(0.8-23.7)	(0.8-33.7)	(0.9-45.3)
5-day Biochemical Oxygen Demand (mg L^{-1})	0.9	0.9	1.0
	(0.1-3.5)	(0.1-3.7)	(0.1-4.5)
Ammonia Nitrogen (mg/L)	0.035	0.039	0.068
	(0.01-0.18)	(0.01-0.21)	(0.01-0.24)
Unionised Ammonia (mg/L)	0.002	0.002	0.003
	(0.001-0.018)	(0.001-0.025)	(0.001-0.016)
Nitrite Nitrogen (mg/L)	0.023	0.024	0.034
	(0.002-0.183)	(0.002-0.173)	(0.002-0.207)
Nitrate Nitrogen (mg/L)	0.102	0.107	0.151
	(0.003-0.717)	(0.002-0.628)	(0.003-0.790)
Total Inorganic Nitrogen (mg L^{-1})	0.16	0.17	0.25
	(0.02-0.95)	(0.01-0.87)	(0.01-1.17)
Total Kjeldahl Nitrogen (mg/L)	0.25	0.26	0.30
	(0.07-1.30)	(0.06-1.04)	(0.09-1.13)
Total Nitrogen (mg/L)	0.37	0.39	0.48
	(0.09-1.36)	(0.10-1.16)	(0.11-1.34)
Orthophosphate Phosphorus (mg L^{-1})	0.012	0.013	0.017
	(0.003-0.102)	(0.002-0.047)	(0.002-0.040)
Total Phosphorus (mg L^{-1})	0.04	0.04	0.05
	(0.02-0.23)	(0.02-0.23)	(0.02-0.25)
Silica (mg/L)	0.84	0.90	1.05
	(0.08-4.13)	(0.08-3.76)	(0.07-3.77)
Chlorophyll-a (µg/L)	4.4	4.2	5.2
	(0.3-36.3)	(0.3-37.3)	(0.3-31.7)
E. coli (cfu/100mL)	2	3	13
	(1-790)	(1-267)	(1-2887)
Faecal Coliforms (cfu/100mL)	4	5	21
	(1-1667)	(1-597)	(1-6102)

Notes:
(a) Data presented are depth-averaged values calculated by taking the means of three depths, i.e. surface (S), mid-depth (M) and bottom (B), except as specified.
(b) Data presented are annual arithmetic means except for *E. coli*, which are geometric means.
(c) Shaded cells indicate non-compliance with the WQOs.

Water quality near the Assessment Area is generally good except for WQO exceedance of Total Inorganic Nitrogen (TIN), which is a result of both the relatively high contributions from the Pearl River as well as the stringent criterion for TIN at the Southern WCZ.

5.3.3 Water Sensitive Receivers

The WSRs that may be affected by changes in water quality arising from the Project have been identified in accordance with the *EIAO-TM*. For each of the WSRs, established threshold criteria or guidelines have been utilised for establishing the significance of impacts to water quality. Note that

the only WSRs within the 500 m Assessment Area for water quality are the seawater intakes for the Lamma Power Station itself. The nearest bathing beach at Hung Shing Yeh is about 1.5 km away, while the second nearest is the Lo So Shing Beach at 2.3 km away. The nearest marine ecological sensitive receiver is the coral identified at the northern Hung Shing Yeh, which is about 1.4 km away.

The locations of the identified WSRs are provided in ***Figure 5.1***. The approximate shortest distances by sea from the Project are detailed in ***Table 5.3***.

Table 5.3 Water Sensitive Receivers in the Vicinity of the Project

Description	Location	Approximate geodesic distance from project site (km)
Water Sensitive Receivers		
Gazetted Beaches	Hung Shing Yeh Beach	1.5
Gazetted Beaches	Lo So Shing Beach	2.3
Seawater Intakes	Lamma Power Station Intake (North)	0.3
Seawater Intakes	Lamma Power Station Intake (South)	0.4
Marine Ecological Sensitive Receivers		
Corals	Northern Hung Shing Yeh	1.4

Other sensitive receivers within Southern Water Control Zone beyond the 500 m Assessment Area are considered too far away to be affected by the Project. They are therefore not considered in this assessment.

5.4 Identification and Evaluation of Potential Sources of Impact

Potential sources of impacts to water quality arising from the Project may occur during both the decommissioning/ demolition and construction phases. Each is discussed in turn below.

5.4.1 Decommissioning/ Demolition Phase

The decommissioning and demolition of existing OCGTs will not involve marine, civil or earth works. Therefore, nil or minimal exposed soil would be expected. Minimal disturbance to sediment is expected as well. Before the decommissioning/ demolition, the existing OCGTs will be cleaned to remove excessive fuel / chemical retained to minimise safety hazard as well as potential loss to the surrounding. The wastewater, chemical waste or effluent generated from the cleaning process would be stored and treated and / or disposed of by licensed contractor. Before removal, such waste would be properly stored at safe locations following the guideline of relevant *Cap. 354C Waste Disposal (Chemical Waste) (General) Regulation*. The dismantled parts of the existing OCGTs would be stored on impervious surface and covered to avoid rainfall from carrying residual contaminants to the surrounding. The dismantled parts would be removed from site for disposal as soon as practicable to reduce risk on runoff contamination.

With the implementation of the recommended measures, no adverse water quality impact is expected from the decommissioning/ demolition phase of the Project.

5.4.2 Construction Phase

No marine works, major site formation or earth works will be required during the construction phase of the Project. Potential sources of water quality impact from the land-based construction works include:

- Sewage effluent from construction workforce;
- Runoff from land-based work sites;
- Chemical cleaning during pre-commissioning activities.

5.4.2.1 Sewage effluent from construction workforce

The presence of construction workforce would result in increased generation of sewage from toilets and site kitchen. Suitable number of chemical toilets would be provided onsite where necessary to cater for the need of construction workforce. Chemical toilets would be regularly cleaned and emptied to avoid any environmental nuisance. Wastewater from site kitchen and other facilities would be properly stored and then collected for disposal by licensed contractor. No onsite discharge from these chemical toilets would be allowed. Therefore, no adverse water quality impact to sensitive receivers is anticipated.

5.4.2.2 Runoff from Land-based Work Sites

Based on the latest available information, the construction works involve mostly aboveground replacement of existing OCGTs with new OCGTs, and there will be very limited civil / earth works. Civil / earth works required would be the construction of new 132kV cable trenches, staircase and lift, as well as reconstruction works inside GTAB which occupies very limited footprint. Also, the existing drainage system of the LPS, with incorporated pollution removal design, would be retained. Therefore, site runoff is expected to be controlled and no adverse water quality impact on the nearby bodies of water is expected.

5.4.2.3 Accidental Spill Events

Chemicals will be used in the construction of the new OCGTs which carry risk of spillage. These chemicals are also currently used within the LPS and also used by the existing OCGTs for maintenance. There would be no significant change in the usage and associated risk levels for use in the new OCGTs. Appropriate clean up kits would be provided onsite to facilitate any required clean up action in case of any spillage. Also, existing spill control arrangement and response plan in the LPS would be implemented during the construction phase of this Project. In view of routine use of chemicals with existing control measures, the above are considered sufficient to control any potential spillage of chemicals onsite during construction phase. No adverse water quality impact from spillage of storage chemicals is expected.

5.5 Mitigation Measures

5.5.1 Decommissioning/ Demolition Phase

Wastewater, chemical waste and effluent from cleaning of the existing OCGTs would be collected, stored for proper disposal by licensed contractor. Dismantled parts of the existing OCGTs would be removed from the site as soon as practicable. Before their removal, these parts would be placed at impervious surface and be protected from rain.

5.5.2 Construction Phase

Standard site practices outlined in *ProPECC PN 1/94* "*Construction Site Drainage*" will be followed as far as practicable in order to reduce surface runoff, and also to retain and reduce any SS prior to discharge. These practices include the following:

- Silt removal facilities such as silt traps or sedimentation facilities will be provided where necessary to remove silt particles from runoff to meet the requirements of the TM standard under the *WPCO*. The design of silt removal facilities will be based on the guidelines provided in *ProPECC PN 1/94*. All drainage facilities and erosion and sediment control structures will be inspected on a regular basis and maintained to confirm proper and efficient operation at all times and particularly during rainstorms. Deposited silt and grit will be removed regularly.
- Appropriate surface drainage will be designed and provided where necessary.

- The precautions to be taken at any time of year when rainstorms are likely together with the actions to be taken when a rainstorm is imminent or forecasted and actions to be taken during or after rainstorms are summarised in *Appendix A2* of *ProPECC PN 1/94*.
- Oil interceptors will be provided in the drainage system where necessary and regularly emptied to prevent the release of oil and grease into the storm water drainage system after accidental spillages.
- Temporary and permanent drainage pipes and culverts provided to facilitate runoff discharge, if any, will be adequately designed for the controlled release of storm flows.
- The temporary diverted drainage, if any, will be reinstated to the original condition when the construction work has finished or when the temporary diversion is no longer required.
- Appropriate numbers of chemical toilets shall be provided by a licensed contractor where necessary to serve the construction workers over the construction site to prevent direct disposal of sewage into the water environment.

5.6 Cumulative Impact

The construction of the Hong Kong Offshore LNG Terminal is currently in progress and the associated land-based works at the Lamma Power Station Extension (LMX) may coincide with the decommissioning/ demolition and construction works of the Project. In addition, the construction of the proposed L12 and L13 at LMX may also take place during the decommissioning/ demolition and construction phases of the Project. These land-based construction works at LMX are relatively minor and would require limited excavation only, with site runoff expected to be relatively low and well controlled. No other land-based construction works in the vicinity of the Project are expected during the decommissioning/ demolition and construction phases of the Project. Adverse cumulative water quality impact is not anticipated during the decommissioning/ demolition and construction phases of the Project.

5.7 Residual Impact

No adverse residual water quality impact is anticipated from the decommissioning/ demolition and construction of the Project.

5.8 Environmental Monitoring and Audit

No adverse water quality impact is anticipated during the decommissioning/ demolition and construction phases of the Project with appropriate mitigation measures in place. However, it is recommended to conduct regular environmental site inspections during the decommissioning/ demolition and construction phases to ensure that mitigation measures as recommended in ***Section 5.5*** are properly implemented.

5.9 Conclusion

The only nearby WSRs identified within the 500 m Assessment Area are seawater intakes of the LPS itself. Limited water quality impact is expected in view of the nature of the project and therefore these nearby WSRs (as well as those further away) are not expected to be impacted. Standard mitigation measures and good site practices are however recommended as good practices. Water quality monitoring for decommissioning/ demolition and construction phases is not required.

Legend

- 500m Assessment Area
- Project Site
- EPD monitoring station

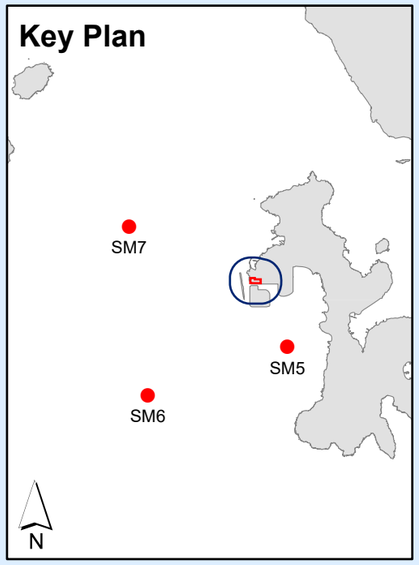
Water Sensitive Receivers

- Gazetted Beach
- Coral
- Seawater Intake

Water Control Zone

- Southern Water Control Zone

Key Plan



Lamma Power Station Intake (North)

Lamma Power Station Intake (South)

Hung Shing Yeh Beach

Lo So Shing Beach

Southern Water Control Zone

N
Meters
0 250 500

Figure 5.1

Locations of Water Sensitive Receivers (WSRs)

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Date: 15/6/2021

Environmental Resources Management

ERM