4. MARINE ECOLOGICAL IMPACT ASSESSMENT

4.1 Introduction

This *Section* presents an evaluation of the marine ecological impact assessment associated with the construction and operation of the proposed Project in accordance with *Clause 3.4.4* of the EIA Study Brief. It also summarises the key findings on the baseline ecological conditions, the details of which are presented in ***Annexes 4A*** to ***4E***.

4.2 Legislative Requirements and Evaluation Criteria

The criteria and scope for evaluating ecological impacts are laid out in the *Annexes 8 and 16* of the *EIAO-TM* and the EIA Study Brief. Legislative requirements and evaluation criteria relevant to this assessment are listed below. The details on each are presented in ***Annex 4A***.

- *Marine Parks Ordinance (Cap. 476) and its Subsidiary Legislation*;
- *Wild Animals Protection Ordinance (Cap. 170);*
- *Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);*
- *Town Planning Ordinance (Cap. 131);*
- *Environmental Impact Assessment Ordinance (Cap. 499) and the Technical Memorandum on Environmental Impact Assessment Process under the Environmental Impact Assessment Ordinance (EIAO-TM);*
- *Environmental Impact Assessment Ordinance (EIAO) Guidance Notes No. 6/2010, 7/2010 and 11/2010;*
- *Hong Kong Planning Standards and Guidelines Section 10 (HKPSG);*
- *United Nations Convention on Biological Diversity (CBD);*
- *The Convention on International Trade in Endangered Species of Wild Fauna and Flora of Wild Fauna and Flora (CITES);*
- *The International Union for Conservation of Nature (IUCN) Red List of Threatened Species; and*
- *Peoples' Republic of China (PRC) Regulations and Guidelines*.

4.3 Baseline Conditions

4.3.1 Assessment Area

With reference to *Clause 3.4.4.2* of the EIA Study Brief, the Assessment Area for the purpose of the marine ecological impact assessment shall be the same as that for water quality impact assessment, covering the Southern Water Control Zone (WCZ) and Western Buffer WCZ as designated under the WPCO. Also, some of the concurrent projects are located close to the Victoria Harbour WCZ and the Assessment Area is therefore extended to cover Victoria Harbour WCZ for cumulative assessment.

Water depth at the Assessment Area varies. In the East Lamma Channel, water depth typically exceeds -20 mPD with exception of coastal waters. In the West Lamma Channel (where the proposed CMPs are located), water depth is generally less than -10 mPD at water between Lamma and the Lantau Island. Waters south of Lamma is generally deeper and exceeds -20 mPD. Compliance with the WQOs is generally observed in most parameters at the selected monitoring stations at the relevant WCZs, except for total inorganic nitrogen (TIN) levels. A detailed description of the physical characteristics of the marine environment of the Assessment Area is provided in ***Section 3***.

Known important habitats and species for marine ecology within the Assessment Area include coral and benthic communities, FP, Green Turtle, as well as the potential South Lamma Marine Park. The ecological profiles and characteristics of these habitats and species are described in further detail below. Habitat map for marine ecology is provided in ***Figure 4.1***.

4.3.2 Marine Ecological Survey Findings

A literature review was conducted to review the baseline ecological conditions within the Assessment Area and to identify information gaps to determine whether field surveys are required to provide sufficient information for the ecological impact assessment. Findings of this literature review are presented in detail in ***Annex 4A***.

Some of the baseline information for marine ecology of the Assessment Area is available from other EIA studies conducted between 2008 and 2017, and the latest information on marine mammals was collected up to March 2021 [31]. The data sources provide up-to-date baseline information on important ecological habitats or habitats with conservation interest such as Marine Park, mangroves, habitats for FP, etc. of the Assessment Area. Baseline survey of these habitats is not considered necessary.

There are identified data gaps with regards to the status of the subtidal habitat within the WL Facility where no recent baseline information is available. In accordance with the requirements in *Appendix C* of the EIA Study Brief, marine ecological surveys at selected habitats within the Assessment Area where potential impact could occur and up-to-date baseline information is not present were conducted to update the latest ecological conditions in these areas. Furthermore, to better understand the occurrence, distribution and abundance of marine mammals especially FP in the Study Area, focused marine mammal surveys within and in the vicinity of the Study Area were also conducted. The detailed methodology of the surveys is presented in ***Annex 4B***. The survey findings are presented in detail in the following sections.

4.3.2.1 Survey Schedule

Marine ecological surveys were carried out between March and August 2021 and the survey schedule is summarised in ***Table 4.1***. The surveys were conducted in both wet and dry seasons for species with seasonality, such as subtidal infauna assemblage. Higher survey frequency was also conducted for species of interest, such as marine mammals. The survey effort is considered appropriate to meet relevant objectives of ecological baseline study for providing adequate information for the impact assessment.

Table 4.1 Summary of Marine Ecological Survey Schedule

Survey	Frequency	Location	Season & Date
Coral Survey	Once in the survey period	Qualitative spot-dive and rapid ecological assessment (REA): 2 locations at Lamma and 1 location at Cheung Chau Drop camera survey: 5 locations within the Study Area	29 Jun & 9 Jul 2021
Subtidal Benthos Survey	Once in each of the dry and wet season	7 locations within the Study Area	Dry season: 24 Mar 21 Wet season: 17 May 21

(31) AFCD (2021) Monitoring of Marine Mammals in Hong Kong Waters (2020-2021). Prepared by Hong Kong Cetacean Research Project.

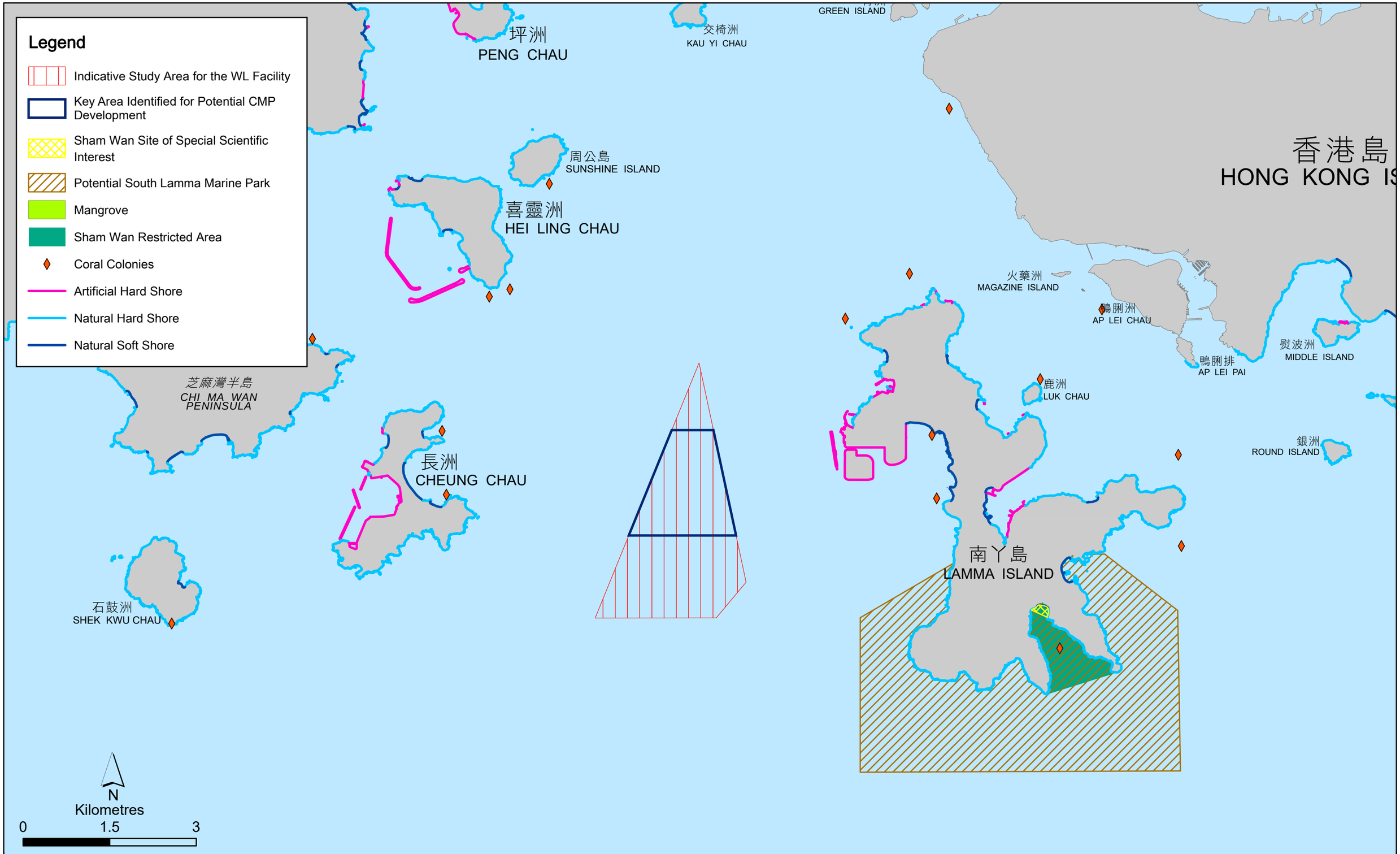

Figure 4.1

Marine Habitats Identified within the Assessment Area

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Survey	Frequency	Location	Season & Date
Marine Mammal Survey	Once per month between March and August 2021 (Peak and non-peak seasons of FP occurrence)	Marine waters within and in the vicinity of the Study Area	Peak season: 18 Mar, 12 Apr, 5 May 21 Non-peak season: 7 Jun, 16 Jul, 16 Aug 21

4.3.2.2 Coral Surveys

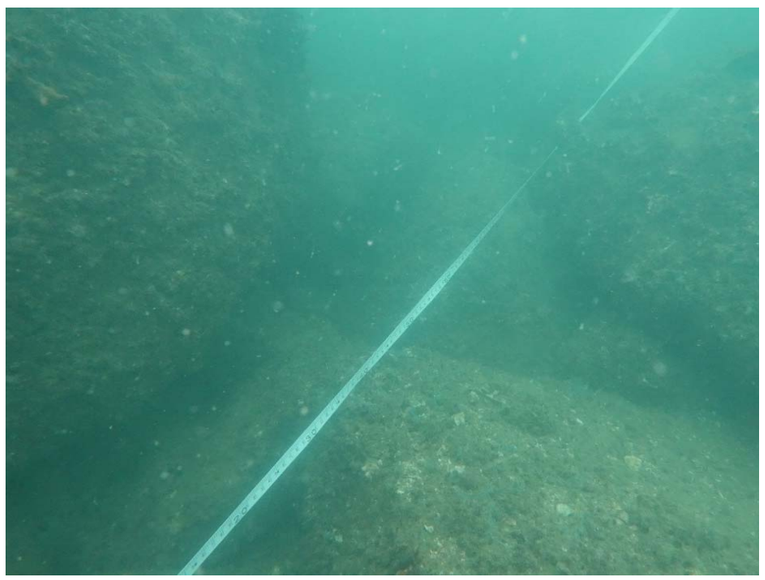
The weather was fine and sea was generally calm during the coral surveys. The underwater visibility ranged between 0.1 m and 3 m and was generally poorer in deeper region. REA surveys were conducted as corals were present in all the three survey locations (***Figure 2.1*** of ***Annex 4B***). The seabed composition was identified and the coral species was recorded. Common and widespread corals, including hard corals (9 species), ahermatypic hard corals (2 species) and octocorals (5 species), were recorded in low percentage cover (< 10%) at all the three survey locations. Representative photographs of the seabed and coral conditions at the survey transects are presented in ***Figures 4.2*** and ***4.3***. Detailed results of the REA survey can be found in ***Annex 4C***.

For the five survey locations for drop camera survey (***Figure 2.1*** of ***Annex 4B***), the seabed mainly consisted of silty mud and sandy substrates. Gorgonians were scarcely observed in very low abundance at some of the survey locations. It should be noted that due to limited underwater visibility, the recorded gorgonians from the drop camera survey could not be identified to genus/species level. Representative photographs from the drop camera survey are presented in ***Figure 4.4***. Detailed results of drop camera survey can be found in ***Annex 4C***.

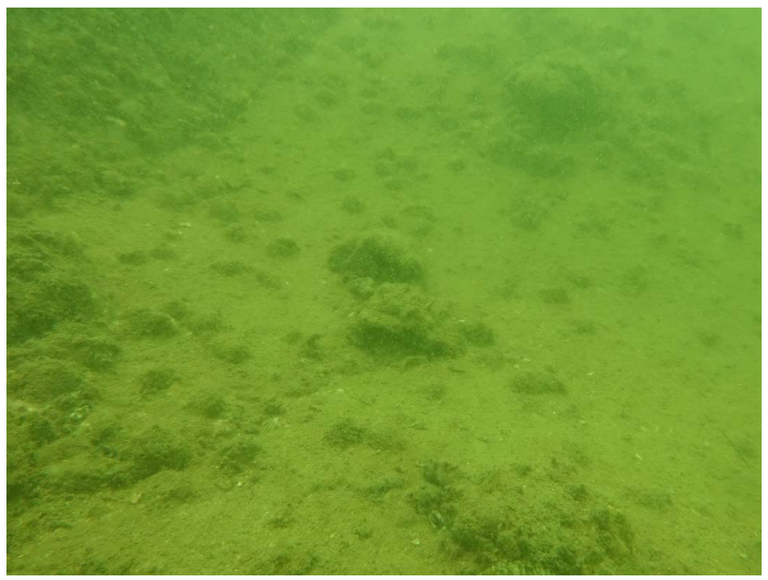
The general substrata and biological conditions along each transect noted during the qualitative spot dive reconnaissance check & REA survey and drop camera survey are presented in ***Table 4.2*** and ***4.3***, respectively.

Table 4.2 Summary of Results of Qualitative Spot Dive Reconnaissance Check and REA Survey

Survey Location (see *Figure 2.1* of Annex 4B)	Depth		Description
	Shallow	Deep	
C1	-2 to -3 mCD	-6 to -8 mCD	The transect is located at the southeastern coast of Cheung Chau. The site was dominated by large and small boulders with <5% hard coral coverage in both shallow and deep waters. Octocoral was only found in deep water region with <10% coverage. Hard coral *Psammocora profundacella* was relatively common in the shallow water region while *Cyphastrea serailia* and *Plesiastrea versipora* were uncommon. Ahermatypic hard coral *Balanophyllia* sp. was relatively common in the deep water region, and isolated colonies of hard coral *Oulastrea crispata* and *Bernardpora stutchburyi* were found common in the deep water region. Among the octocorals found in the deep water region, *Menella* sp./ *Paraplexaura* sp. and *Echinomuricea* sp. were relatively common. Other benthos had <10% coverage and bryozoans were the most commonly recorded benthos, followed by sponges.
C2	-2 to -4	-6 to -7	The transect is located at the northwestern tip of Lamma Island. It is



a) Rocky substratum was recorded at shallow area of Location C1



b) Rocky substratum was recorded at shallow area of Location C2

c) Rocky substratum was recorded at shallow area of Location C3

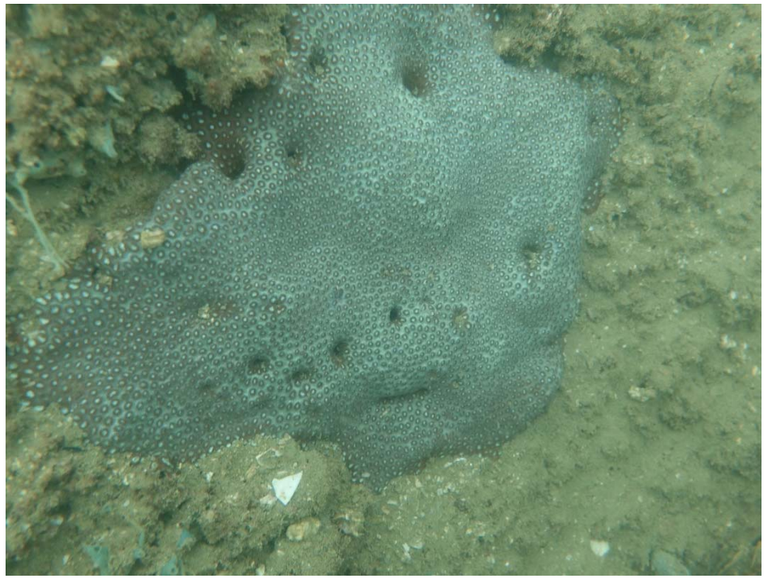
d) Large boulder (diameter >50cm) was recorded at deep area of Location C1

e) Sandy substratum was recorded at deep area of Location C2

c) Rocky substratum was recorded at deep area of Location C3

Figure 4.2 **Representative Photographic Records of Substratum from Qualitative Spot Dive Reconnaissance Check and REA Survey**

Date: Oct 2021

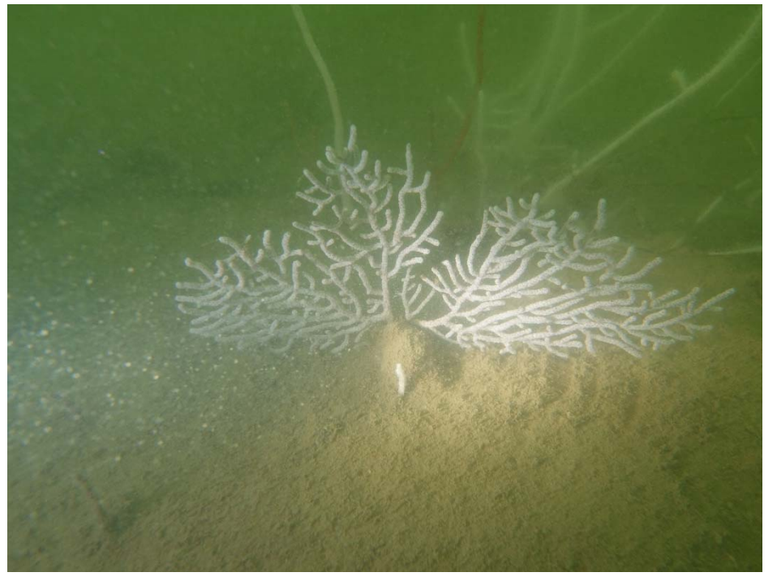


a) Hard coral (*Plesiastrea versipora)* was recorded at shallow area of Location C1

b) Hard coral (*Porites* sp.) was recorded at shallow area of Location C2

c) Other benthos (Bryozoan) was recorded at shallow area of Location C3

d) Hard coral (*Bernardpora stutchburyi)* was recorded at deep area of Location C1



e) Octocoral (*Menella* sp.) was recorded at deep area of Location C2

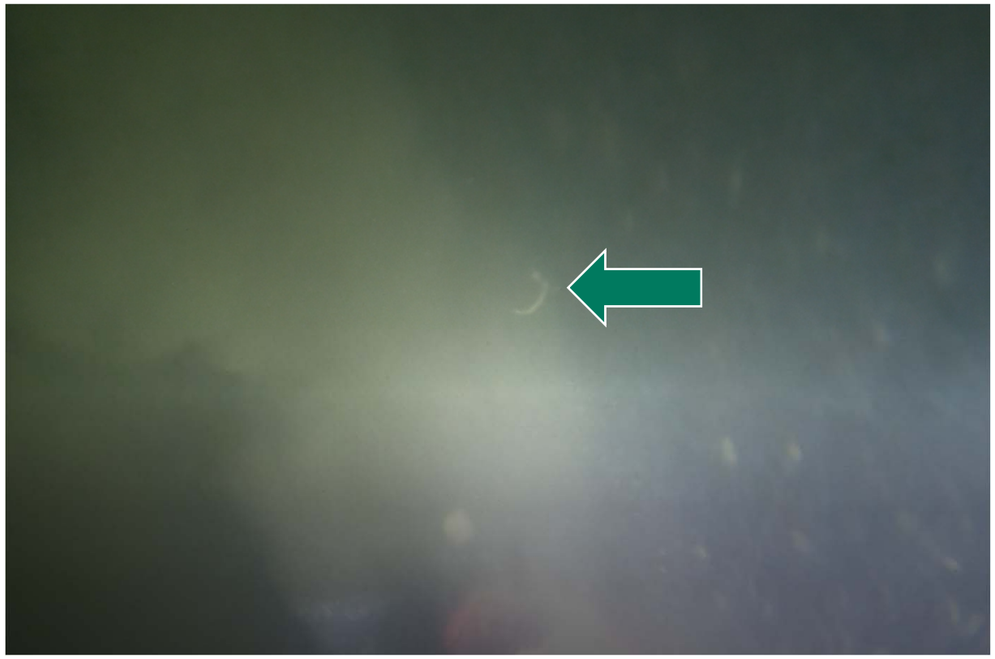
f) Ahermatypic hard coral (*Tubastraea* sp./ *Dendrophyllia* sp.) was recorded at deep area of Location C3

Figure 4.3 **Representative Photographic Records of Coral Species and Other Benthos from Qualitative Spot Dive Reconnaissance Check and REA Survey**

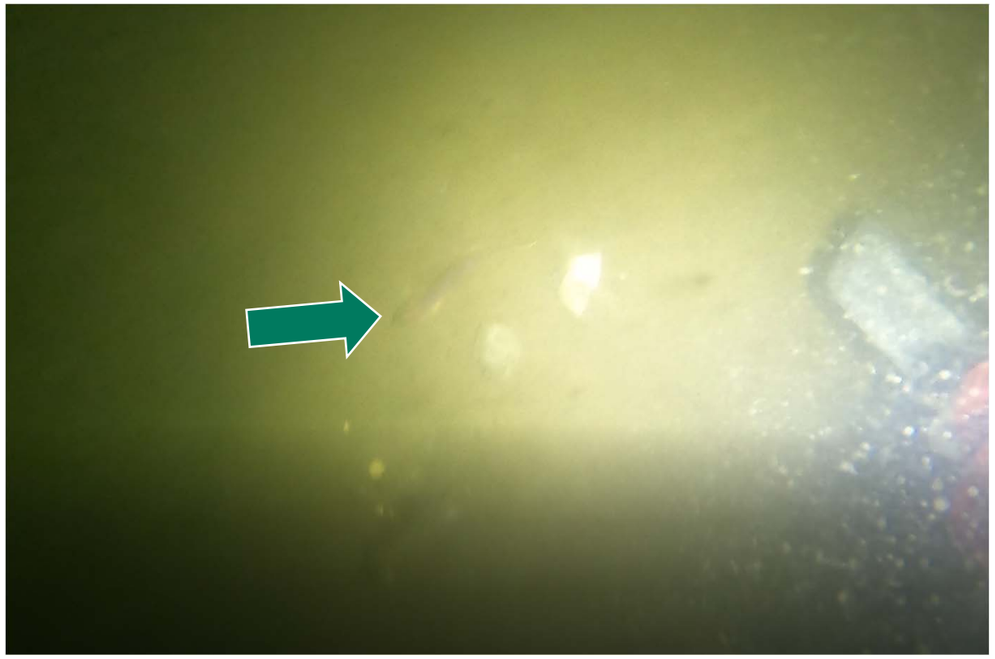
Date: Oct 2021

a) Silty mud substratum was recorded at Location D4

b) Gorgonian was recorded at Location D1



c) An unidentified worm was recorded at Location D3 (indicated at green arrow)



d) An unidentified fish was recorded at Location D5

Survey Location (see *Figure 2.1* of Annex 4B)	Depth		Description
	Shallow	Deep	
	mCD	mCD	mainly covered by bedrock in the shallow water region and large boulders in the deep water region, mixed with some sandy substrates at both shallow and deep waters. Hard corals and octocorals were found in both shallow and deep water regions with <10% coverage. Hard coral *Bernardpora stutchburyi*, *Porites* sp. and octocoral *Menella* sp. / *Paraplexaura* sp. were relatively common in the shallow water region. Octocoral *Menella* sp. / *Paraplexaura* sp was also relatively common in the deep water region, with occasional observation of hard coral *Bernardpora stutchburyi, a*hermatypic hard coral *Tubastrea/ Dendrophyllia* sp. and *Balanophyllia* sp., as well as octocoral *Echinomuricea* sp.. Other benthos had <10% coverage, of which bryozoans were the most commonly recorded benthos, followed by sponges.
C3	-2 to -3 mCD	-6 to -8 mCD	The transect is at the southwestern part of Lamma Island. Both shallow and deep water regions are dominated by large boulders, mixed with some sand, rubbles or bedrock. Hard coral coverage was <5% in both shallow and deep water regions. In the shallow water region, hard corals *Oulastrea crispata* and *Porites* sp. were relatively common. In the deep water region, hard corals *Psammocora haimiana, Psammocora profundacella*, ahermatypic hard coral *Tubastrea/ Dendrophyllia* sp. and octocoral *Dendronephthya* sp. were commonly encountered. Other benthos had <10% coverage, of which bryozoans were the most commonly recorded benthos.

Table 4.3 Summary of Drop Camera Survey Results

Survey Location	Description
D1	The seabed consisted of a mixture of sandy bottom and silty mud. A very low abundance of gorgonians was observed. No rare species or species with conservation importance was observed.
D2	The seabed consisted of mainly silty mud substratum. A very low abundance of gorgonians was observed. No rare species or species with conservation importance was observed.
D3	The seabed consisted of mainly silty mud and a little sandy substratum. A worm was recorded in the drop camera survey. No gorgonian, rare species or species with conservation importance was observed.
D4	The seabed consisted of mainly sandy substrate. A very low abundance of gorgonians observed. No rare species or species with conservation importance was observed.
D5	The seabed consisted of mainly sandy substrate. A fish was recorded in the drop camera survey. No gorgonian, rare species or species with conservation importance was observed.

Overall, results of the coral surveys indicated that the subtidal hard substrate within and in the vicinity of the Study Area showed very limited sessile taxa. Common and widespread corals, including hard

coral, ahermatypic hard coral and octocoral, were recorded in low percentage cover (< 10%) at all the survey locations.

4.3.2.3 Subtidal Benthos Survey

Subtidal benthos surveys were conducted in the dry and wet seasons at seven locations, as shown in ***Figure 2.1*** of ***Annex 4B***, representative of the subtidal soft-bottom habitats of the Study Area.

Dry Season

A total of 271 individual organisms (3.2 grams in total) were collected from the seven grab samples from the seven sampling locations during the dry season survey. The specimens belong to eight phyla with a total of 12 classes, 58 families and 59 species identified. In terms of infaunal abundance, the majority of organisms recorded were from the Phylum Annelida (~64%) and Arthropoda (~17%). The species *Apionsoma trichocephalus* was the most abundant species (total abundance = 22 individuals). In terms of infaunal biomass, organisms from the Phylum Arthropoda contributed ~48% of the total biomass recorded, followed by Annelida which contributed ~29%. No rare species or uncommon species were recorded in the survey.

Wet Season

A total of 317 individual organisms (2.1 grams in total) were collected from the seven grab samples from the seven sampling locations during the wet season survey. The specimens belong to seven phyla with a total of nine classes, 50 families and 71 species identified. In terms of infaunal abundance, the majority of organisms recorded were from the Phylum Annelida (~66%) and Arthropoda (~16%). Polychaete worms *Maldanidae* spp. were found to be the most abundant among all organisms (total abundance = 34 individuals). In terms of infaunal biomass, organisms from the Phylum Annelida contributed ~42% of the total biomass recorded, followed by Echinodermata which contributed ~27%. No rare species or uncommon species were recorded in the survey.

Tables 4.4 and ***4.5*** provide a summary of the abundance, taxonomic richness, Pielou's Evenness, Shannon Diversity and biomass of infauna collected at each location in the dry and wet seasons respectively. A complete set of raw data is presented in ***Annex 4D***.

Table 4.4 Density and Indices of Richness, Evenness and Diversity of Infaunal Assemblages at the Sampling Locations for the Soft Bottom Habitat Surveys at the Study Area during the Dry Season

Survey Location	Abundance of Infaunal Individuals	Taxonomic Richness (No. Families) per Site	Taxonomic Richness (No. Species) per Site	Pielou's Evenness (*J*)	Shannon Diversity (*H'*)	Total Biomass (g wet weight)	Mean Biomass per Individual (g wet weight)
B1	23	10	11	0.86	2.07	0.2930	0.0127
B2	108	28	37	0.90	3.27	1.4196	0.0131
B3	18	11	13	0.98	2.51	0.1770	0.0098
B4	27	13	15	0.86	2.34	0.1676	0.0062
B5	19	9	11	0.97	2.33	0.2603	0.0137
B6	39	19	21	0.93	2.82	0.3883	0.0100
B7	37	16	18	0.95	2.76	0.4632	0.0125

Table 4.5 Density and Indices of Richness, Evenness and Diversity of Infaunal Assemblages at the Sampling Locations for the Soft Bottom Habitat Surveys at the Study Area during the Wet Season

Survey Location	Abundance of Infaunal Individuals	Taxonomic Richness (No. Families) per Site	Taxonomic Richness (No. Species) per Site	Pielou's Evenness (*J*)	Shannon Diversity (*H'*)	Total Biomass (g wet weight)	Mean Biomass per Individual (g wet weight)
B1	33	12	13	0.83	2.12	0.6665	0.0202
B2	97	32	40	0.93	3.41	0.5060	0.0052
B3	10	8	9	0.98	2.16	0.0350	0.0035
B4	37	14	18	0.91	2.64	0.1752	0.0047
B5	30	20	21	0.95	2.88	0.2467	0.0082
B6	56	25	30	0.93	3.15	0.3057	0.0055
B7	54	22	24	0.91	2.90	0.1828	0.0034

Results of the dry and wet season surveys showed that all sampling locations had low infaunal abundance and biomass, and low to moderate taxonomic richness. There was no observable seasonal difference in abundance and taxonomic richness amongst the survey locations. The abundance of infaunal individuals and taxonomic richness were higher at Site B2 in both dry and wet seasons. Pielou's Evenness and Shannon Diversity indices were similar across the sampling locations. Overall, the abundance and diversity of infauna within the Study Area is similar to other

areas in west of Lamma and southern waters of Hong Kong in other studies [32] [33], and no species of conservation importance were recorded.

4.3.2.4 Marine Mammal Survey

Survey Effort

During the six-month marine mammal survey from March to August 2021, six sets of line-transect surveys were completed to the west of Lamma Island. A total of 436.90 km of survey effort was collected from these line-transect surveys. All the survey effort was conducted under favourable weather conditions (i.e. Beaufort Sea State 3 or below with good visibility) throughout the six-month study period. Furthermore, 70.1% of the total survey effort was conducted in condition of Beaufort Sea State 2 or below, and survey data collected in such condition can be used for encounter rate analysis of FP. The marine mammal survey data are presented in ***Annex 4E***.

Marine Mammal Sightings

During the six-month marine mammal survey, only two groups of six FP were sighted along the transect lines to the west of Lamma Island outside the Study Area, while no Chinese White Dolphin (CWD) was sighted. The two porpoise groups were sighted along primary lines during on-effort search, which can be utilized for encounter rate analysis. The locations of the sightings are shown ***Figure 4.5.***

The two sightings of FP were made to the south of Cheung Chau on 5 May 2021, as well as between Hei Ling Chau and Lamma Island on 16 July 2021, respectively. One of each sighting was made in spring and summer months with no apparent seasonal variation in their occurrence during the six-month period. Among the two groups of porpoises, one was a small group of two animals, while another was a medium-sized group with four animals.

During the six-month marine mammal survey, the encounter rates of FP was 0.65 sightings per 100 km of survey effort. This encounter rate was considerably lower than the combined porpoise encounter rates in southern waters of Hong Kong as well as those recorded in Lamma survey area in the past AFCD monitoring periods from the past decade [34], indicating the area within and in the vicinity of the Study Area is not a key occurrence habitat for FP.

4.3.3 Ecological Profiles

The key findings of the literature review and field surveys are summarized below.

4.3.3.1 Recognized Sites of Conservation Importance

There are no Special Areas or Conservation Areas that are relevant to marine ecology within the Assessment Area. Recognized sites of conservation importance include potential Marine Park at South Lamma, Sham Wan Site of Special Scientific Interest (SSSI) and the Sham Wan Restricted Area, locating >2.6 km away from the Key Area for potential CMP development. The locations of these recognized sites of conservation importance are presented in ***Figure 4.1***. These sites are described in ***Annex 4A*** in detail.

4.3.3.2 Coral Communities

Hermatypic hard corals are less abundant and diverse in Hong Kong's western waters. Ahermatypic octocorals (including gorgonians, soft corals and black corals) which do not require light for zooxanthellae photosynthesis, are more widely distributed in western waters and often occur at

(32) EIA Report for Hong Kong Offshore LNG Terminal (Register No.: AEIAR-218/2018)
(33) EIA Report for Improvement Dredging for Lamma Power Station Navigation Channel (Register No.: AEIAR-212/2017)
(34) AFCD (2021) Monitoring of Marine Mammals in Hong Kong Waters (2020-2021). Prepared by Hong Kong Cetacean Research Project.

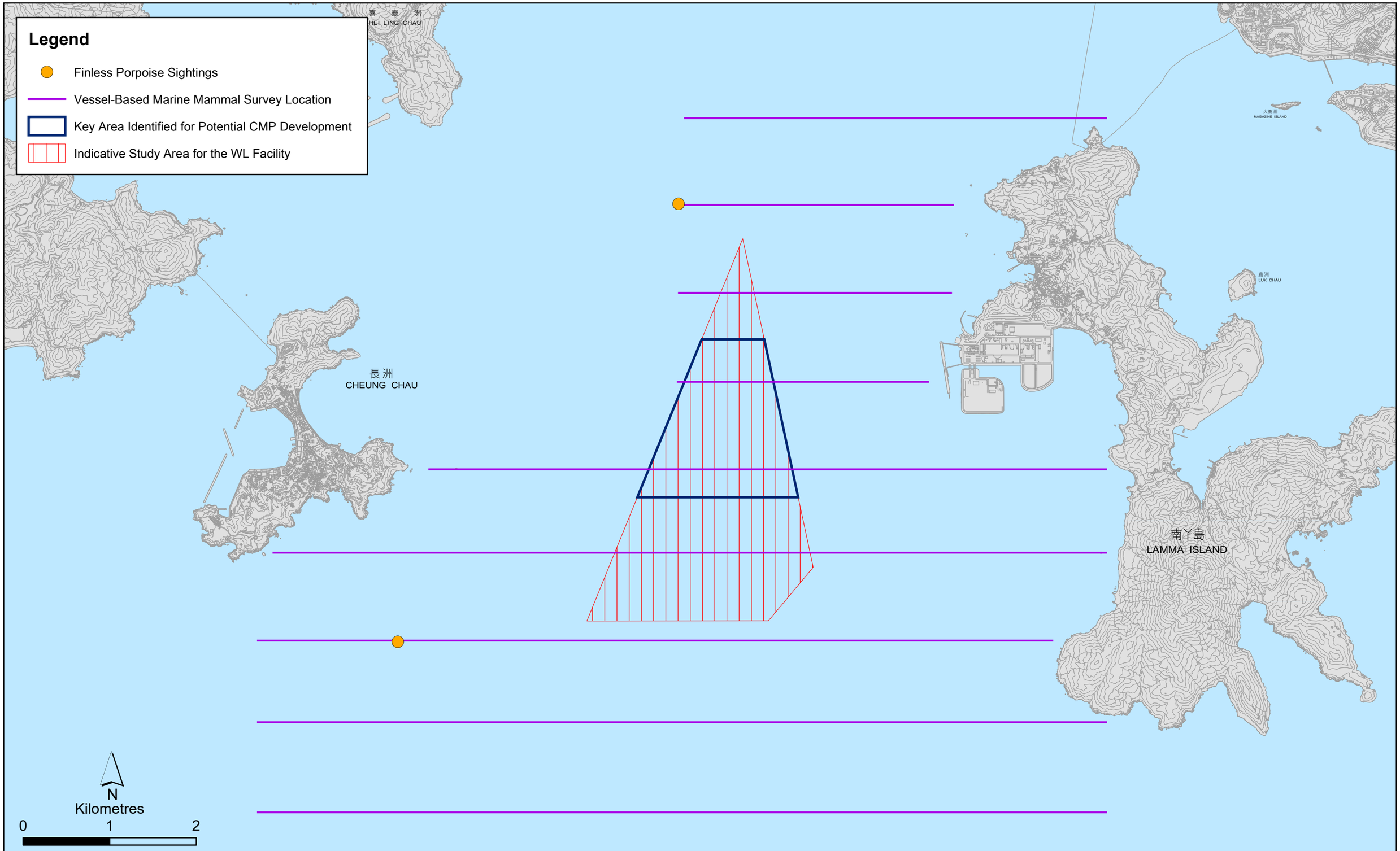


Figure 4.5

Location of Finless Porpoise Sightings during Marine Mammal Survey

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greater depths. For Southern WCZ, although the coral colonies were also sparse and isolated, the species diversity were relatively higher in these waters. Hard corals, including *Bernardpora stutchburyi*, *Porites* sp., *Psammocora* spp. and ahermatypic cup coral under Family *Dendrophyllidae*, octocoral, including *Echinomuricea* sp., *Menella* sp. and *Dendronephthya* sp. were recorded. The ecological survey results indicated that only isolated colonies of hard corals, cup corals, and octocorals in low percentage cover (< 10%) were recorded in the Assessment Area.

4.3.3.3 Benthic Communities

All the benthos species recorded in the Assessment Area from the marine ecological surveys and literature review are common and widespread in Hong Kong without any species of conservation importance. Amphioxus was not recorded within and in the vicinity of the Study Area.

4.3.3.4 Finless Porpoises

Only one of the two Hong Kong's resident marine mammal species FP has been reported to utilise the waters in the Assessment Area, including the area within and in the vicinity of the Study Area. FP are present in South Lantau waters year-round and their occurrence is greater and more widespread in these waters in the dry season (December to May). FP use a broad swathe of South Lantau waters, particularly extending across the waters between the Soko Islands and Shek Kwu Chau, with the proposed CMP to be located at the east of their main habitat, where FP occurrence is recorded to be low from the literature review and the field surveys. The area within and in the vicinity of the Study Area is not a key habitat for FP.

4.3.3.5 Green Turtles

The literature suggested the presence of species of conservation importance such as Green Turtle *Chelonia mydas* in the Assessment Area. Very occasional records of a few animals were reported previously and no opportunistic sightings of any sea turtle occurred during the marine ecological surveys.

The major nesting site for Green Turtle in Hong Kong is located at Sham Wan, southern Lamma Island, which is more than 5 km from the Key Area for potential CMP development.

4.3.4 Ecological Importance

4.3.4.1 Evaluation of Ecological Habitats

The existing conditions of the marine ecological habitats and resources within the Assessment Area have been assessed. These baseline conditions have been based on available literature and, where considered necessary, focussed field surveys and data review to update and supplement the data. Based on this information presented in ***Sections 4.3.2*** and ***4.3.3***, ***Annexes 4A***, ***4C***, ***4D*** and ***4E***, the ecological importance of each habitat has been determined according to the *EIAO-TM Annex 8* criteria.

Within the Assessment Areas of this EIA, which covers quite a large areal extent, variations in the ecological characteristics of habitats across different locations (which are kilometres apart) are likely to be present. To provide information of key relevance to the marine ecological assessment, the ecological importance of habitats presented in this baseline is therefore primarily focussed on the vicinity of the Study Area for the WL Facility.

The ecological importance of the habitats was determined through reference to the following:

- Literature review;
- Findings of the marine ecological surveys;
- Comparison with other areas in Hong Kong; and

- Annexes 8 and 16 of the *EIAO-TM*.

Outcomes of the evaluation of ecological importance of the marine habitats and species within the Assessment Area are presented in ***Tables 4.6*** to ***4.9***.

Table 4.6 Ecological Importance of Recognised Sites of Conservation Importance in the vicinity of the Project

Criteria	Sham Wan SSSI and Restricted Area	Potential South Lamma Marine Park
Naturalness	Natural sandy shore and marine waters	Natural intertidal and subtidal hard and soft bottom habitat and marine waters
Size	~4 ha for the SSSI; ~98 ha for the Restricted Area	~1,400 ha
Diversity	Low	Low
Rarity	The sandy shore habitat is common in the southern waters in Hong Kong. The habitat is the major nesting site of Green Turtle in Hong Kong	Habitats and species are common in the southern waters in Hong Kong. Species with conservation importance includes FP and Green Turtle
Re-creatability	Not re-creatable	Not re-creatable
Fragmentation	Unfragmented	Unfragmented
Ecological Linkage	Linked to the subtidal habitat and marine waters off the island	Linked to the subtidal habitats and FP habitats nearby
Potential Value	Protected area for Green Turtle	Moderate upon designation as a Marine Park
Nursery/Breeding Area	Key known nesting ground for Green Turtle	Potential nursery area for FP and Green Turtle
Age	Designated as SSSI and Restricted Area in 1999; the Restricted Area was expanded in 2021	N/A
Abundance	Historically a small number of Green Turtles were recorded to nest in Sham Wan	Some records of FP, historically a small number of Green Turtles were recorded
Ecological Importance	**High**	**Moderate**

Table 4.7 Ecological Importance of Sub-tidal Hard Bottom Habitat (Coral Communities) in the vicinity of the Project

Criteria	LPS Seawall	Eastern coast of Cheung Chau	Western coast of Lamma Island
Naturalness	Artificial, constructed habitat	Natural	Natural
Size	Large, approximately 2km in length at depth of 2-7m	Large, approximately 2km in length at depth of 2-7 m	Large, approximately 2km in length at depth of 2-8 m
Diversity	Low	Low	Low
Rarity	Habitats similar to the man-	Common hard coral	Common hard coral

Criteria	LPS Seawall	Eastern coast of Cheung Chau	Western coast of Lamma Island
	made habitats in the southern and eastern waters of Hong Kong. Hard corals *Duncanopsammia peltata*, *Porites* sp. and *Oulastrea crispata*, ahermatypic cup coral *Tubastrea / Dendrophyllia* sp. and *Balanophyllia* sp., was recorded	species were recorded, including hard corals such as *Bernardpora stutchburyi*, *Oulastrea crispata*, *Plesiastrea versipora* and *Psammocora profundacella* and ahermatypic hard coral *Balanophyllia sp*.	species were recorded, including hard corals such as *Bernardpora stutchburyi*, *Oulastrea crispata*, *Psammocora profundacella* and *Porites* sp., Ahermatypic hard coral *Tubastrea/ Dendrophyllia* sp. and *Balanophyllia* sp.
Re-creatability	Re-creatable; substrata may be re-colonised by subtidal organisms including corals	Not re-creatable	Not re-creatable
Fragmentation	Low. The surrounding coastlines comprise artificial and natural shores	Unfragmented	Unfragmented
Ecological Linkage	Not functionally linked to any high value habitat in a significant way	Not functionally linked to any high value habitat in a significant way	Not functionally linked to any high value habitat in a significant way
Potential Value	Low since it is common artificial habitat and it is unlikely to be an area of coral conservation	Habitat is relatively undisturbed, some potential value	Habitat is relatively undisturbed, some potential value
Nursery/Breeding Area	No significant records identified	No significant records identified	No significant records identified
Age	The artificial seawall has been in place since the 2000s	N/A	N/A
Abundance	Very low coverage of coral is present in the artificial seawall	Low coverage of coral is present	Low coverage of corals is present
Ecological Importance	**Low**	**Low**	**Low**

Table 4.8 Ecological Importance of Subtidal Soft Benthos Assemblages in the vicinity of the Project

Criteria	Subtidal Soft Benthos Assemblages of the Study Area
Naturalness	Natural
Size	~600 ha (~235 ha for the Key Area for potential CMP development)
Diversity	Low to moderate taxonomic richness of infauna
Rarity	Common habitat and species in Hong Kong; No rare species or species of

Criteria	Subtidal Soft Benthos Assemblages of the Study Area
	conservation importance recorded
Re-creatability	Re-creatable; substrata may be recolonised by benthic organisms
Fragmentation	Unfragmented
Ecological Linkage	Linked to the subtidal habitats nearby
Potential Value	It is unlikely that the habitat could develop conservation importance
Nursery/Breeding Area	No significant records identified
Age	N/A
Abundance	In comparison to other parts of the southern waters the assemblages are of low infaunal abundance and biomass
Ecological Importance	**Low**

Table 4.9 Ecological Importance of Marine Waters in the vicinity of the Project

Criteria	Marine Waters of the Study Area
Naturalness	Natural
Size	~600 ha (~235 ha for the Key Area for potential CMP development)
Diversity	Scarce records of FP and no record of CWD
Rarity	FP is a resident species in Hong Kong
Re-creatability	Not re-creatable
Fragmentation	Unfragmented
Ecological Linkage	Linked to FP and marine habitats nearby
Potential Value	Limited value, though near to the potential South Lamma Marine Park
Nursery/Breeding Area	No significant records identified
Age	N/A
Abundance	Low density of FP in comparison to other waters of Hong Kong. Green Turtle might be present but transient only at very low abundance.
Ecological Importance	**Low**

4.3.4.2 Species of Conservation Importance

In accordance with *EIAO-TM Annex 8* criteria, an evaluation of species of conservation importance recorded within the Assessment Area is presented in ***Table 4.10***.

Table 4.10 Species of Conservation Importance within the Assessment Area

Common Name	Scientific Name	Protection Status	Distribution, Rarity and other Notes	Literature	Surveys	Recorded Location
Cup Coral	*Balanophyllia sp.*	■ Protection of Endangered Species of Animals and Plants Ordinance (Cap.586)	Common and widely distributed in Hong Kong, especially in western and southern waters	✓	✓	Along the coastline of Cheung Chau and Lamma
Cup Coral	*Tubastrea/ Dendrophyllia* sp.	■ Protection of Endangered Species of Animals and Plants Ordinance (Cap.586)	Common and widely distributed in eastern and southern waters in Hong Kong	✓	✓	Along the coastline of Cheung Chau and Lamma
Hard Coral	*Bernardpora stutchburyi* *Cyphastrea serailia* *Duncanopsammia peltata* *Oulastrea crispata* *Plesiastrea versipora* *Psammocora haimiana* *Psammocora profundacella* *Leptastrea purpurea* *Porites* sp.	■ Protection of Endangered Species of Animals and Plants Ordinance (Cap.586)	Common and widely distributed in the eastern waters of Hong Kong	✓	✓	Along the coastline of Cheung Chau and Lamma
Black Coral	*Antipathes* sp.	■ Protection of Endangered Species of Animals and Plants Ordinance (Cap.586)	Common and widely distributed in Hong Kong, especially in the north-eastern waters of Hong Kong	✓	✓	Along the coastline of Lamma
Green Turtle	*Chelonia mydas*	■ Wild Animals Protection Ordinance (Cap.170) ■ Protection of Endangered Species of Animals and Plants Ordinance (Cap.586) ■ Listed as “Critically Endangered” in the China Species Red List ■ Listed as “Grade II	Known to nest mainly at Sham Wan, south of Lamma Island. Nesting was also recorded in Shek Pai Wan and Tung O on Lamma Island, Tai Wan in Sai Kung, Tai Long Wan in Shek O, and a beach on Lantau Island. Inter-nesting areas largely located to the south and southeast of Lamma Island	✓		Not specific, in southern waters of Hong Kong

Common Name	Scientific Name	Protection Status	Distribution, Rarity and other Notes	Literature	Surveys	Recorded Location
		National Key Protected Species" in China ■ Listed as " Endangered" in the IUCN Red List of Threatened Species				
Finless Porpoise	*Neophocaena phocaenoides*	■ Wild Animals Protection Ordinance (Cap.170) ■ Protection of Endangered Species of Animals and Plants Ordinance (Cap.586) ■ Listed as "Endangered" in the China Species Red List ■ Listed as "Grade II National Key Protected Species" in China ■ Listed as "Vulnerable" in the IUCN Red List of Threatened Species	Range across Hong Kong southern and eastern waters from Soko Islands to Tung Ping Chau, and in PRC waters	✓	✓	In the vicinity of the Study Area

4.3.5 Marine Ecological Sensitive Receivers

Based on the review of available information within the Assessment Area, marine ecological sensitive receivers that may be affected by the Project activities have been identified in accordance with the *EIAO-TM* criteria, and are consistent with the ones identified in the water quality impact assessment (***Section 3***). These sensitive receivers and their distance from the Project are listed in ***Table 4.11*** and presented in ***Figure 3.3***.

Table 4.11 Approximate Shortest Distance to Marine Ecological Sensitive Receivers in the vicinity of the Project

Description	Location	Shortest Geodesic Distance from Key Area (km)
Marine Park	Potential South Lamma Marine Park	2.6
Corals	Cheung Chau	3.2
	Hei Ling Chau	3.7
	Chi Ma Wan Peninsula	6.4
	Sunshine Island	4.7
	Kau Yi Chau	6.8
	Siu Kau Yi Chau	7.8
	Hung Shing Yeh	3.7
	Ha Mei Wan	3.5
	Pak Kok	4.3
	Shek Kok Tsui	3.0
	Sandy Bay	7.0
	Green Island	7.9
	Peng Chau	7.3
	Sham Wan	5.4
Green Turtle Nesting Ground	Sham Wan	5.4

4.4 Assessment Methodology

A desktop literature review and supporting field surveys were conducted in order to establish the ecological profile of the area within and surrounding the Project. The importance of potentially-impacted ecological resources identified within the Assessment Area was evaluated using the methodology defined in the *EIAO-TM*. Potential impacts to these resources due to the construction and operation activities of the Project were assessed (following the *EIAO-TM Annex 16* guidelines) and the impacts evaluated (based on the criteria in *EIAO-TM Annex 8*). Findings of water quality modelling (***Section 3***) are used, where appropriate, to assess potential impacts on the identified marine ecological resources.

The key construction and operation activities of the Project are discussed in ***Section 2.6.4***. Potential sources of impacts to marine ecology arising from the Project may occur during both construction and operation activities, including:

Construction activities:

- Dredging of the seabed for the formation of CMP

Operation activities:

- Disposal of contaminated sediment in the formed CMP
- Capping of the exhausted CMP by uncontaminated sediment up to the original seabed level

Note that the construction activities (dredging) could overlap with operation activities (backfilling and capping) to maintain uninterrupted disposal service of the proposed WL Facility. The potential ecological impacts associated with the construction and operation activities of the Project are assessed as a whole and presented in separate sections for marine ecological resources (excluding FP) (***Section 4.5***) and FP (***Section 4.6***).

4.5 Potential Impacts and Impact Assessment on Marine Ecological Resources (Excluding FP)

Potential impacts to marine ecological resources (excluding FP) that may arise from the construction and operation activities are summarized in ***Table 4.12*** and discussed further in the following sections. It should be noted that the proposed CMPs are located >2 km away from the nearby intertidal habitats at Lamma Island and disturbance to these habitats is not expected to occur. Unacceptable impacts on these habitats are not expected and thus these intertidal habitats will not be discussed further in this EIA study.

Table 4.12 Potential Impacts to Marine Ecological Resources (Excluding FP)

Nature of Impact	Habitat Affected	Potential Impact
Temporary habitat loss and disturbance	Subtidal habitats and marine waters within and in the vicinity of the CMPs	Temporary loss of ~100ha seabed within Key Area during construction and operation activities of the CMPs at any one time; Temporary loss of a total of ~190ha seabed for all the seven proposed CMPs within the Key Area
Underwater sound from construction and operation activities	Marine waters within and in the vicinity of the CMPs	Vibration and disturbance to nearby organisms
Changes in water quality from construction and operation activities	Marine waters and subtidal habitats within and in the vicinity of the CMPs	Potential water quality impacts and deposition of sediment onto the seabed affecting organisms
Increased marine traffic from construction and operation activities	Marine waters within and in the vicinity of the CMPs	Potential for injury of Green Turtles from vessel strike
Effects of glare from light sources of construction and operation activities	Marine waters within and in the vicinity of the CMPs	Potential for disturbance impacts resulting in behavioral changes of Green Turtles
Accidental spillage/leakage of fuels/ chemicals	Marine waters and subtidal habitats within and in the vicinity of the CMPs	Potential water quality impacts on organisms

4.5.1 Temporary Habitat Loss and Disturbance

Direct impacts to subtidal bottom assemblages will occur as a result of the dredging, backfilling and capping works of the CMPs. However, once capping works of CMP are completed, the seabed and hydrodynamic regime at the CMP will be reinstated to the original condition. Benthic communities are expected to recolonize the seabed at CMP after the capping works.

Findings from the literature review, supplemented by the field surveys, indicate that the benthic assemblages within the Study Area were dominated by polychaetes and characterised by low to moderate species richness and low abundance and biomass of species found elsewhere in Hong Kong. The seabed of the Study Area is covered by marine sediment comprised primarily of silt / clay and hard corals were not recorded within the Study Area. All of the species recorded occur frequently in Hong Kong and no rare species or species of conservation importance were recorded. As a result, the assemblages were considered as of low ecological importance (***Table 4.8***).

As the CMPs will be constructed and operated sequentially depending on the disposal demand, it is expected that ~100ha of seabed habitats within the Key Area will be temporarily lost or disturbed due to the construction and operation activities of the proposed CMPs at any one time throughout the service lifetime of the WL Facility. The areas of affected habitats are expected to be similar to surrounding seabed areas. As such, the potentially directly impacted subtidal habitats within the Key Area are well-represented in the region and losses will represent a very small fraction of widely available habitat. Given the low ecological value of the associated benthic assemblages, and the recolonization of similar organisms following completion of capping works of the CMP, unacceptable impacts on the benthic communities are not expected.

Furthermore, although Green Turtles have been reported in the habitats near the Project, their occurrence is highly opportunistic. It is unlikely that these habitats represent unique habitats that the species would rely on. The Green Turtle nesting ground at Sham Wan and the Potential South Lamma Marine Park are located > 5 km and > 2.5 km away, respectively, from the Key Area and unacceptable impacts on Green Turtles and the potential South Lamma Marine Park are not expected.

4.5.2 Underwater Sound

Intermittent sounds, which occur during construction and operation activities such as dredging works, backfilling and capping works and marine vessel movement, may have an impact on marine ecological resources. Potential effects of increased underwater sound include physiological stress, avoidance and injury (at high pressure levels). The level of impact is however dependent upon background sound, number and type of species affected, proximity of organism to the sound source, attenuation properties of seabed sediments and hearing capabilities of the species affected, etc..

Most marine invertebrates do not possess air-filled space and thus it is generally considered that sound would have limited physiological or behavioural effects on marine invertebrates, except if they are located within a few metres of the sound source. In addition, waters within the Assessment Area and its vicinity is subject to relatively high levels of marine traffic by similar types of vessels; therefore it is reasonable to assume that marine invertebrates and Green Turtles in these waters are habituated to a relatively high background level of underwater sound, and a small increase in vessel activity associated with the construction and operation of this Project is not anticipated to result in unacceptable impacts on these marine ecological resources.

4.5.3 Changes in Water Quality from Construction and Operation Activities

4.5.3.1 Suspended Solids (SS) Elevation

Dredging, backfilling and capping activities are expected to generate suspended solids (SS) and may result in increased sediment deposition on the seabed in close proximity to the works areas.

Computational modelling has been undertaken to analyse suspended sediment dispersion from such works (***Section 3.7***).

Impacts to benthic communities immediately outside of the works areas are expected to occur temporarily as the modelling results indicate that dredging, backfilling and capping activities would only result in localised elevations of SS. Benthic communities in the vicinity of the CMPs are considered to be of low ecological value (***Table 4.8***). As the areas affected are often exposed to SS laden discharges from the Pearl River, the organisms present are thus assumed to be adapted to SS elevation. Based on the assumption that eventually the affected areas will be recolonised by benthos typical of the area, then the temporary loss of these low ecological value benthic assemblages is not considered to be unacceptable.

Coral communities are located >3 km away from the Key Area where CMPs of the Project are situated. The elevations in SS and sedimentation rate are not predicted to affect coral colonies in the vicinity of the CMPs at levels of concern (as defined by the WQO and tolerance criterion and assessed in ***Section 3.7***). Based on literature and the field surveys, the coral communities within the Assessment Area were generally recorded to be of low coverage (< 10%) and of low ecological value (***Table 4.7***). The coral species recorded in the Assessment Area are generally adapted to the turbid conditions in southern waters. As such, unacceptable impacts to the coral colonies due to elevation in SS and sedimentation rate are not anticipated. Similarly, water quality modelling results (***Section 3.7***) indicated that there will be minor elevation of SS at the potential South Lamma Marine Park and Green Turtle nesting ground at Sham Wan and such SS elevation complied with the WQO criterion.

With the proposed mitigation measures of implementation of cage-type silt curtain during dredging works by grab dredgers and controlled work rates for dredging, backfilling and capping works, unacceptable residual impacts are not anticipated. Consequently, unacceptable impacts on marine ecological resources, including coral and benthic communities, Green Turtles and the potential South Lamma Marine Park, are not expected.

4.5.3.2 Dissolved Oxygen (DO) Depletion

The relationships between SS and DO are complex, with increased SS in the water column combining with a number of other factors to reduce DO concentrations in the water column. Elevated SS (and turbidity) reduces light penetration, lowers the rate of photosynthesis by phytoplankton (primary productivity) and thus lowers the rate of oxygen production in the water column, also release organic matter and thus lead to DO depletion. This has a particularly adverse effect on the eggs and larvae of fish, as at these stages of development, high levels of oxygen in the water are required for growth due to their high metabolic rate. DO depletions are most likely to affect sessile organisms as they cannot move away from areas where DO is low (unlike mobile species such as fish).

With reference to the water quality modelling results (***Section 3.7***), dredging, backfilling and capping of CMPs would only generate temporary and localised low level SS elevation and not significant depletions of DO. Depletions of DO as a result of the construction and operation activities of the Project have been predicted to be undetectable and compliant with the relevant WQOs. It is thus expected that no unacceptable impacts to the marine ecological resources, including coral and benthic communities, Green Turtles and the potential South Lamma Marine Park, present in the vicinity of the CMPs will occur.

4.5.3.3 Release of Sediment-bounded Nutrients

High levels of nutrients (TIN and UIA) released from disturbed sediments to seawater may potentially cause rapid increases in phytoplankton to the point where an algal bloom may occur. An intense bloom of algae can lead to sharp increases in DO levels in surface water. However, at night and when these algae die there is usually a sharp decrease in the levels of dissolved oxygen in the water, as dead algae fall through the water column and decompose on the bottom. Anoxic conditions may

result if DO concentrations are already low or are not replenished. This may result in mortality to marine organisms due to oxygen deprivation.

The water quality modelling results (***Section 3.7***) have indicated that dredging, backfilling and capping of CMPs would generate low level TIN and UIA elevation in a localised area close to the works. Consequently TIN and UIA levels are not expected to increase from background conditions during the construction and operation activities of the Project. Algal blooms and unacceptable impacts to the marine ecological assemblages and habitats present in the vicinity of the marine works areas are not expected to arise due to the works.

4.5.3.4 Release of Sediment-bounded Contaminants

Heavy metals, metalloid and trace organic compounds from the sediment samples analysed under this EIA indicated that the levels of these contaminants are below the corresponding proposed assessment criteria (***Section 3.7***). Dredging works of CMPs would unlikely result in significant release of sediment-bounded pollutants into the water column. Similarly, as uncontaminated sediments will be used for capping works of CMPs, it is unlikely to result in significant release of sediment-bounded pollutants into the water column. The water quality modelling results (***Section 3.7***) have indicated that backfilling of contaminated sediments would not result in unacceptable water quality impacts. Therefore, no unacceptable adverse impact to the marine ecological assemblage and habitats with the release of sediment-bounded pollutants from dredging, backfilling and capping works would be expected.

4.5.4 Increased Marine Traffic

Dredging, backfilling and capping works of the CMPs will require the use of works vessels such as dredgers, tug boats, hopper barges, etc.. There are two main ways of increased vessel movements due to the construction and operation activities that may potentially impact Green Turtles. Firstly, vessel movements may potentially increase physical risks to Green Turtles. Secondly, the physical presence of works vessels may cause short-term avoidance of the area where works vessels are operating, and this has been discussed in ***Section 4.5.1*** in terms of temporary disturbance.

It has been reported that sea turtles have been killed or injured by vessel collisions and the risk is mainly associated with high-speed vessels such as high-speed ferries [35]. In terms of potential impacts arising from works vessel movements of this Project, the risk of vessel collision is considered to be very small, as works vessels would be slow-moving. Works vessels would typically travel at up to about 10-12 knots during transit. Slow-moving vessels would not pose a significant risk to Green Turtles.

The Project is expected to involve a relatively small number of works vessels (e.g. up to 2 dredgers, some tugs/ supporting vessels, some hopper barges for sediment handling at any one time), and the frequency/ trip of works vessels would also be relatively low in general (expected to be no more than 84 trips per day at the peak work rates) when comparing to the traffic densities at the nearby fairways (e.g. Adamasta Channel TSS and East Lamma Channel TSS with a range of a daily average of 368-432 numbers of marine traffic volume in December 2019 based on Automatic Identification System and radar data). Works vessels would make use of designated fairways and route to access the CMP area. It should be noted that waters off southern Hong Kong have high levels of existing marine traffic. In this context, vessel traffic associated with the proposed Project would represent only a minor incremental increase in marine traffic in the area.

Given the slow-moving nature of the relatively small number of works vessels involved in the construction and operation activities of the Project, unacceptable adverse impacts of increased marine traffic on Green Turtles are not anticipated.

(35) Schoeman RP, Patterson-Abrolat C, Plon S (2020). A Global Review of Vessel Collisions With Marine Animals. Frontiers in Marine Science.

Cage-type silt curtain are proposed to be deployed for dredging works by grab dredgers. The extent of the silt curtain deployment would be managed and controlled to minimize disturbance to Green Turtles in the area. Similar arrangements for silt curtain deployment have been adopted for marine projects in Hong Kong and no incidents of injury or entanglement of sea turtles have been reported. Therefore unacceptable adverse impacts on Green Turtles are not anticipated.

4.5.5 Effects of Glare from Light Sources of Construction and Operation Activities

The CMPs will be constructed and operated during both daytime and night-time. The works vessels for the dredging, backfilling and capping works of the CMPs will require operational and navigational lightings to meet operational need and in line with the maritime requirements. The lighting is expected to be similar to the nearby marine traffic travelling around the Project area through the nearby fairways.

Of the marine ecological resources, potential impacts to Green Turtles from glare effect of light sources are relevant and assessed. Marine turtle behaviour at nesting beaches is largely guided by light cues and they have a tendency to orientate towards brightness [(36)]. As a result, lighting from coastal developments has a potential to disrupt the behaviour of nesting adult turtles and hatchlings [(37)]. Hatchlings use light as a cue to locate the ocean and are often attracted or disorientated by artificial light rather than being deterred by it, which can lead to mortality through exhaustion, dehydration or predation. Adults have been observed to continue nesting despite the introduction of artificial light on beaches and sea-finding behaviour by adults is rarely disrupted by artificial lighting [(38)].

Given the Project is located > 5 km away from the Green Turtle nesting ground at Sham Wan and shielded by the landmass at southwest of Lamma Island, there is no potential for glare effect of light sources to interfere with the behaviour of any turtle hatchlings or affect normal adult nesting behaviour. Unacceptable adverse impacts from glare effect of light sources on Green Turtles are not anticipated.

4.5.6 Accidental Spillage or Leakage of Fuel/ Chemicals

The use of fuel/chemicals associated with the works vessels and construction plants would mean there is a potential of spillage or leakage of such materials if not properly managed. It is expected that chemicals used on the works vessels would be held in low quantities. Fuel spill or leaks would tend to float on the water surface and will evaporate into the atmosphere and dissipate rapidly. The potential for impact to specific biota would depend on the nature and degree of exposure received by a particular individual. However, given the risk of spillage and leakage would generally be limited to minor volumes, no significant impacts would be expected in the event that an unplanned accidental spill or leak occurred. Measures would be implemented for the safe storage, handling and disposal of chemicals and oils to prevent the release into the marine environment. Precautionary measures such as bunding of machinery areas and availability of spill clean-up kits would be in place to prevent spillage or leakage of fuel/chemical to reach the marine environment. Unacceptable impacts on marine ecological resources, including coral and benthic communities, Green Turtles and the potential South Lamma Marine Park, are thus not expected.

4.6 Potential Impacts and Impact Assessment on Finless Porpoises

As FP is the only resident marine mammal species utilising the water within the Assessment Area, the impact assessment for this EIA Study focusses on FP. Potential impacts to FP that may arise from

(36) Witheringtom BE and Martin RE (2003) Understanding, assessing and resolving light-pollution problems on sea turtle nesting beaches. Third Edition. Florida Marine Research Institute Technical Report TR-2 73pp.
(37) Environmental Protection Authority (2010) Environmental Assessment Guidelines No.5 Environmental Assessment Guideline for Protecting Marine Turtles from Light Impacts.
(38) Witheringtom BE and Martin RE (2003) *Op cit.*

the construction and operation activities are summarized in ***Table 4.13*** and discussed further in the following sections.

Table 4.13 Potential Impacts to Finless Porpoises

Nature of Impact	Habitat Affected	Potential Impact
Temporary habitat loss and disturbance	Marine waters within and in the vicinity of the CMPs	Disturbance to habitats within the areas of active CMPs
Underwater sound from construction and operation activities	Marine waters within and in the vicinity of the CMPs	Potential for acoustic disturbance resulting in behavioural changes and hearing injury
Increased marine traffic from construction and operation activities	Marine waters within and in the vicinity of the CMPs	Potential for injury from vessel strike
Changes in water quality from construction and operation activities	Marine waters within and in the vicinity of the CMPs	Potential indirect impacts due to changes in water quality
		Potential for secondary impacts due to changes in prey resource distribution
		Potential for secondary impacts from contaminant release from seabed disturbance leading to potential bioaccumulation effects
Accidental spillage/leakage of fuels/ chemicals	Marine waters within and in the vicinity of the CMPs	Potential for sublethal toxicity effects and irritation

4.6.1 Temporary Habitat Loss and Disturbance

The construction and operation of the proposed CMPs will result in a temporary habitat loss and disturbance of seabed within the Key Area. The CMPs will be constructed and operated sequentially depending on the disposal demand and it is expected that ~100ha of seabed habitats within the Key Area will be temporarily lost or disturbed due to the construction and operation activities of the proposed CMPs at any one time throughout the service lifetime of the WL Facility.

From the literature review and the field surveys, while FP utilise the waters in the Assessment Area, including the area within and in the vicinity of the Study Area, FP occurrence was recorded to be consistently low over the past years and the area within and in the vicinity of the Study Area is not a key habitat for FP. Therefore, the marine waters of the Study Area is considered of low ecological importance (***Table 4.9***).

The construction and operation activities of the Project will involve dredging, backfilling and capping works. These activities will use a small number of works vessels at the Key Area (e.g. up to 2 dredgers, some tugs/ supporting vessels, some hopper barges for sediment handling at any one time). Considering the temporary nature of the disturbance and with controlled work rates for dredging, backfilling and capping works, impacts on FP are expected to be of minor significance. Upon cessation of the disturbance, no significant change in marine mammal distribution, abundance and usage pattern in the wider Hong Kong waters is expected.

4.6.2 Underwater Sound

Dredging, backfilling and capping works of the CMPs are expected to result in a minor increase in underwater sound from the dredging works (e.g. sediment removal using grab or draghead of TSHD), transit of works vessels (e.g. sound from engine/ propeller) and sediment discharge onto seabed of CMPs (e.g. bottom dumping or pump-out from TSHD).

Small cetaceans are acoustically sensitive at certain frequencies, and sound is important to their behavioural activities. Sound that masks communications for socializing and group cohesion or echolocation for foraging could have a potential impact. The reactions from impacted cetaceans can range from brief interruption of normal activities to short- or long-term displacement from noisy areas. Although pulsed high-energy sound also has the potential to induce physical hearing injury in marine mammals, this is unlikely other than in the immediate vicinity of the noisy activities. Most small cetaceans can hear with the range of 1 to 150 kHz, though the peak for a variety of species is between 8 kHz and 90 kHz and between 20 kHz and 145 kHz reported for dolphins and porpoises respectively [(39)(40)]. FP produce high frequency ultrasonic narrowband clicks at a peak frequency of 142 kHz, which are inaudible to the human ear [(41)].

Dredging works and large vessel traffic (e.g. tugs and barges) generally results in low frequency noise, typically in the range of 0.02 to 1 kHz [(42)(43)], which is below the good hearing range between 20 kHz and 145 kHz reported for porpoises. A local study was conducted to investigate the underwater sound levels produced during the installation of submarine cable in southeastern waters of Hong Kong [(44)]. The results indicated that the cable installation barge and other large vessel traffic (e.g. tugs and barges) (with total up to 4 nos. vessels) generated sound with frequency between 40 Hz and 25 kHz and the underwater sound generated was concentrated between 50 Hz and 400 Hz, which were lower than the sound used for foraging and communication for FPs.

Regarding the noise generated from dredging works which are the key underwater noise source of the Project, the source level of dredging activity can be affected by various factors including type of dredging vessels, sediment type for dredging, water depth, salinity and temperature [(45)(46)]. It was reported that different types of dredgers can emit sound at a source level of ~160-180 dB re 1 μPa^2m^2 [(47)]. By applying underwater noise propagation modelling by the geometrical spreading laws for sound intensity, it is expected that the underwater sound levels could be lowered to <153 dB re 1µPa within a localised area of ~63 m from the sound source [(48)] which is below the temporary threshold shift (TTS) for porpoises (i.e. very high-frequency cetaceans) [(49)].

For these reasons, noise generated by dredging works and large vessel traffic (e.g. tugs and barges) is not expected to acoustically interfere significantly with FP. FP may have short-term avoidance of the immediate works areas of sound generating activities, but are expected to return when the

(39) Richardson WJ, Greene CR Jr., Malme CI, Thomson DH (1995) Marine Mammals and Noise. Academic Press
(40) Wang ZT, Li J, Duan PX, Mei ZG, Niu FQ, Akamatsu T, Lei PY, Zhou L, Yuan J, Chen YW, Ya Supin A, Wang D, Wang KX (2020) Evoked-potential audiogram variability in a group of wild Yangtze finless porpoises (*Neophocaena asiaeorientalis asiaeorientalis*). Journal of Comparative Physiology A: Neuroethology, Sensory, Neural, and Behavioral Physiology 206(4):527-541.
(41) Goold JC, Jefferson TA (2002) Acoustic signals from free-ranging finless porpoises (*Neophocaena phocaenoides*) in waters around Hong Kong. The Raffles Bulletin of Zoology Supplement 10:131-139.
(42) Richardson WJ, Greene CR Jr., Malme CI, Thomson DH (1995) *Op cit.*
(43) Jones D, Marten K (2016) Dredging Sound Levels, Numberical Modelling and EIA. Terra et Aqua No. 144.
(44) EGS (2017) Measurement of Underwater Sound Levels around Submarine Cable Installation Barge. Prepared for CLP Power Hong Kong Limited
(45) Robinson SP, Lepper PA, Hazelwood RA (2014) Good Practice Guide for Underwater Noise Measurement. NPL Good Practice Guide No. 133. National Measurement Office, Marine Scotland, The Crown Estate.
(46) Jensen F, Kuperman W, MB P and Schmidt H (2000) Computational Ocean Acoustics. Modern Acoustics and Signal Processing. New York: Springer-Verlag.
(47) Robinson SP, Theobald PD, Hayman G, Wang LS, Lepper PA, Humphrey V, Mumford S (2011) Measurement of noise arising from marine aggregate dredging operations. Marine Aggregate Levy Sustainability Fund (MALSF). MEPF Ref no. 09/P108.
(48) Considering shallow water depths in the Project area, *15 log R* law of intermediate geometrical spreading was applied.
(49) Southall BL, Finneran JJ, Reichmuth C, Nachtigall PE, Ketten DR, Bowles AE, Ellison WT, Nowacek DP, Tyack PL (2019). Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. Aquatic Mammals 45(2): 125-232.

disturbance ceases. Unacceptable adverse impacts of increased underwater sound level on FP are not anticipated.

Overall, the sound produced during the dredging, backfilling and capping works of the CMPs would be audible and may overlap and mask frequencies of FP including those used for socializing, but would not likely mask the ultrasonic frequencies used in echolocation for foraging. The waters in the vicinity of the proposed CMPs is a potential habitat for FP, though is not a key occurrence habitat and hence of low ecological importance. FP would be expected to respond by avoiding a localised works area near the CMPs and the effect would be limited to behavioural disturbance impacts on affected individuals only without affecting the functionality of key habitats such as the waters between the Soko Islands and Shek Kwu Chau. In the context of the size of the range of these animals, the size of the disturbed area would be small, and no significant long-term change in marine mammal distribution, abundance and usage pattern in the wider Hong Kong waters is expected. Unacceptable adverse impacts of increased underwater sound level on FP are not anticipated.

4.6.3 Increased Marine Traffic

As discussed in ***Section 4.5.4***, works vessels such as dredgers, tug boats, hopper barges, etc. will be used for the construction and operation activities of the Project. There are two main ways of increased vessel movements due to the construction and operation activities that may potentially impact FP. Firstly, vessel movements may potentially increase physical risks to FP. Secondly, the physical presence of works vessels may cause short-term avoidance of the area where works vessels are operating, and this has been discussed in ***Section 4.6.1*** in terms of temporary disturbance.

In Hong Kong, there have been instances when marine mammals have been killed or injured by vessel collisions [50][51][52], but it is thought that this risk is mainly associated with high-speed vessels such as high-speed ferries. As discussed in ***Section 4.5.4***, a relatively small number of slow-moving works vessels (e.g. up to 2 dredgers, some tugs/ supporting vessels, some hopper barges for sediment handling at any one time), and the frequency/ trip of works vessels would also be relatively low in general (expected to be no more than 84 trips per day at the peak work rates) when comparing to the traffic densities at the nearby fairways (e.g. Adamasta Channel TSS and East Lamma Channel TSS with a range of a daily average of 368-432 numbers of marine traffic volume in December 2019 based on Automatic Identification System and radar data). The waters off southern Hong Kong have high levels of existing marine traffic and the vessel traffic associated with the proposed Project would represent only a minor incremental increase in marine traffic in the area. Works vessels would make use of designated fairways and route to access the CMP area. Given the slow-moving nature of the relatively small number of works vessels involved in the Project, unacceptable adverse impacts of increased marine traffic on FP are not anticipated.

Cage-type silt curtain are proposed to be deployed for dredging works by grab dredgers. The extent of the silt curtain deployment would be managed and controlled to minimize disturbance to FP in the area. Similar arrangements for silt curtain deployment have been adopted for marine projects in Hong Kong and no incidents of injury or entanglement of marine mammals have been reported. Therefore unacceptable adverse impacts on FP are not anticipated.

4.6.4 Changes in Water Quality

Elevation of SS and depletion of DO do not appear to have a direct impact on FP since these animals are air breathing and therefore SS in the water column as a result of dredging, backfilling and capping works have no effect on their respiratory surfaces. Also marine mammals, including FP, have evolved to inhabit areas near river mouths and estuarine-influenced coastal waters and are therefore well-

(50) Parsons ECM, Jefferson TA (2000) Post-mortem investigations on stranded dolphins and porpoises from Hong Kong waters. Journal of Wildlife Diseases 36: 342-356
(51) Jefferson TA, Curry BE, Kinoshita R (2002) Mortality and morbidity of Hong Kong finless porpoises, with special emphasis on the role of environmental contaminants. Raffles Bulletin of Zoology (Supplement) 10: 161- 171
(52) OPCFHK (2021). Local Marine Life Stranding Investigation.

adapted for hunting in turbid waters, owing to their use of echolocation, in addition to visual information.

With reference to the water quality modelling results (***Section 3.7***), fisheries resources are not predicted to be adversely affected, as the SS and nutrient elevations and DO depletion are localised to the areas of active CMPs (and sites of dredged sediment disposal). It should be noted that marine mammals and their prey species are naturally exposed to high levels of SS in the Pearl River Estuary. Therefore, impacts to FP through loss of localised feeding habitat (fisheries resources) are not predicted to occur. It is thus expected that adverse impacts to FP arising from potential change in water quality will not occur.

Another potential impact on FP associated with the construction and operation activities of the Project is the potential bioaccumulation of released contaminants from contaminated sediments. The potential for release of contaminants from disturbed sediments has been assessed in ***Section 3.7***. Sediment samples collected within the Study Area indicated low levels of sediment contamination within the Project Site. Therefore, risk of release of sediment-bounded contaminant from dredging works of the Project is minimal and impact to fisheries resources and thus to FP due to potential contaminant release is not expected. The water quality modelling results (***Section 3.7***) have indicated that the levels of the contaminants released during backfilling are below the corresponding proposed assessment criteria and backfilling of contaminated sediments would not result in unacceptable water quality impacts. An assessment on bioaccumulation was also conducted for this study and the results showed that the increase in contaminants' concentration of fisheries resources is insignificant (see ***Section 8***). In addition, with reference to the long-term environmental monitoring data from ESC CMPs, the concentrations of contaminants for tissues/ whole body samples of fisheries resources (including pelagic fish, molluscs, predatory crabs, predatory fish and predatory shrimps) collected between reference area (i.e. away from CMPs) and impact area (i.e. closer to the CMPs) were found to be similar over the years [(53)], indicating there is no evidence of adverse impact to bioaccumulation of prey resources collected near the CMP area due to the potential release of sediment-bounded contaminant. Impacts on FP due to bioaccumulation of released contaminants from dredging, backfilling and capping works are not expected to occur.

4.6.5 Accidental Spillage or Leakage of Fuel/ Chemicals

As discussed in ***Section 4.5.4***, the risk of spills and leaks would generally be limited to minor volumes and with implementation of preventative measures including bunding areas and provision of spill kit, no significant impacts to FP would be expected.

4.7 Impact Evaluation

From the information presented in ***Sections 4.5*** and ***4.6***, the significance of the ecological impacts associated with the construction and operation activities of the proposed Project has been evaluated in accordance with the *EIAO-TM (Annex 8, Table 1)*. The outcomes of this evaluation are summarised in ***Table 4.14***.

(53) ERM (2021). Annual Risk Assessment Report for the Contaminated Mud Pits to the East of Sha Chau - April 2020 to March 2021. Submitted under Agreement No. CE 63/2016 (EP).

Table 4.14 Significance of Ecological Impacts Associated with the Construction and Operation Activities of the Proposed Project Evaluated in accordance with EIAO-TM

Potential Impact	Ecological Sensitive Receiver	Nature of Impact						Overall Impact Significance	Mitigation / Precautionary Measures Required
		Habitat Quality	Species Affected	Size	Duration	Reversibility	Magnitude		
Marine Ecological Resources (excluding Finless Porpoises)									
Temporary habitat loss and disturbance	Coral and benthic communities, Green Turtles	Low	Common and widespread coral species; Common benthic fauna dominated by polychaete bristleworms	A total of ~190ha of seabed within Key Area	Temporary	Reversible	Small	Minor	No
Underwater sound from construction and operation activities	Marine invertebrates, Green Turtles, potential South Lamma Marine Park	Low to moderate	Common and widespread species	In the vicinity of active CMP areas and vessel transit routes	Temporary	Reversible	Small	Minor	No; precautionary measures would further reduce impacts
Changes in water quality from construction and operation activities	Coral and benthic communities, Green Turtles, potential South Lamma Marine Park	Low to moderate	Common and widespread species	The area affected is expected to be within a short distance of the active CMP areas	Temporary	Reversible	Small	Minor	No; water quality mitigation measures would further reduce impacts
Increased marine traffic from construction and operation activities	Green Turtles	Low	Green Turtle	In the vicinity of active CMP areas and vessel transit routes	Temporary	Reversible	Small	Minor	No; precautionary measures would further reduce impacts
Effects of glare from light sources of construction and operation activities	Green Turtles	Low	Green Turtle	In the vicinity of active CMP areas and vessel transit routes	Temporary	Reversible	Small	Minor	No
Accidental spillage/leakage of fuels/ chemicals	Coral and benthic communities, Green Turtles, potential South Lamma Marine	Low to moderate	Common and widespread species	Area affected in the vicinity of the spill/leak, scale dependent on spill	Temporary	Reversible	Very small	Negligible	No; precautionary measures would further reduce impacts

Potential Impact	Ecological Sensitive Receiver	Nature of Impact						Overall Impact Significance	Mitigation / Precautionary Measures Required
		Habitat Quality	Species Affected	Size	Duration	Reversibility	Magnitude		
	Park			volume and trajectory					
Finless Porpoises (FP)									
Temporary habitat loss and disturbance	FP	Low	FP	Confined to localised active CMP areas	Temporary	Reversible	Small	Minor	No
Underwater sound from construction and operation activities	FP	Low	FP	Confined to localised active CMP areas	Temporary	Reversible	Small	Minor	No; precautionary measures would further reduce impacts
Increased marine traffic from construction and operation activities	FP	Low	FP	In the vicinity of active CMP areas and vessel transit routes	Temporary	Reversible	Small	Minor	No; precautionary measures would further reduce impacts
Changes in water quality from construction and operation activities	FP	Low	FP	The area affected is expected to be within a short distance of the active CMP areas	Temporary	Reversible	Small	Minor	No; water quality mitigation measures would further reduce impacts
Accidental spillage/leakage of fuels/ chemicals	FP	Low	FP	Area affected in the vicinity of the spill/leak, scale dependent on spill volume and trajectory	Temporary	Reversible	Very small	Negligible	No; precautionary measures would further reduce impacts

4.8 Cumulative Impacts

Information from publicly available sources suggested that the construction/ implementation programmes of a number of projects would coincide with this Project (see ***Annex 2A*** for concurrent projects identified). The water quality impact assessment (***Section 3***) was based on the worst-case scenarios of concurrent construction and operation activities of this Project as well as relevant concurrent projects (see ***Annex 3A*** for the detailed consideration) and thus has also incorporated potential cumulative impacts. The cumulative impacts of the various construction and operation activities of this Project and other relevant concurrent projects have been demonstrated in ***Section 3.9*** as not causing unacceptable impacts to water quality. Consequently, unacceptable cumulative impacts to marine ecological resources are not predicted to occur.

Coral and benthic communities to be impacted by the Project are considered as of low ecological value and impacts were assessed to be minor. Effects on these habitats and assemblages as a result of this Project are not anticipated to contribute to unacceptable cumulative impacts with other developments in the Assessment Area and the wider Hong Kong waters. As for the potential cumulative impacts on FP, impacts presented in ***Section 4.6*** were examined to evaluate potential cumulative impacts with other developments in the Assessment Area, including the South of Cheung Chau Open Sea Sediment Disposal Area, Improvement Dredging for Lamma Power Station Navigation Channel, Development of an Offshore Wind Farm in Hong Kong and the Artificial Islands in the Central Waters located within a few kilometres from the Project. Outcomes of this evaluation are summarised as follows:

- **Habitat Loss and Disturbance:** the extent of disturbance of the Project is expected to be small, temporary and confined to localised active CMPs at the Key Area (~100 ha habitat loss at any one time for dredging, backfilling and capping activities). The South of Cheung Chau Open Sea Sediment Disposal Area is expected to result in a temporary disturbance of a maximum of 600 ha seabed habitat at any one time, though the seabed disturbance is expected to be confined in particular areas where disposal activities would occur. The Improvement Dredging for Lamma Power Station Navigation Channel is expected to result in a temporary disturbance of 262 ha seabed habitat. The Development of an Offshore Wind Farm in Hong Kong is expected to result in a loss of 0.16 ha seabed habitat. The severity of such cumulative habitat loss is expected to be significantly reduced to acceptable levels by mitigation measures proposed as part of the EIAs for the Improvement Dredging for Lamma Power Station Navigation Channel and Development of an Offshore Wind Farm in Hong Kong. Most of the habitat loss and disturbance from these projects are temporary and the habitats will recover once the projects are completed. Benthic communities are expected to recolonize the seabed, which will become habitats for fisheries resources and then provide feeding habitat (fisheries resources) for FP. Considering the temporary nature and relatively small size (~100 ha habitat loss at any one time for dredging, backfilling and capping activities) of the Project, it is not expected to exert an unacceptable cumulative effect. On the other hand, the development of the Artificial Islands in the Central Waters are expected to result in a permanent loss of ~1,000 ha seabed. The KYCAI development is currently in early planning stage and effective and feasible mitigation measures, including compensation measures, will be investigated under the CW Study to address the permanent loss of seabed due to the proposed development (54). The acceptability of residual cumulative impacts on marine ecology from the said concurrent projects will largely depend on the environmental acceptability of the reclamation of KYCAI and the HKI-NEL Link in the Central Waters.
- **Underwater Sound:** the Project is located at sufficient distance from other projects and only a relatively small number of slow-moving works vessels would be used for the Project. Given the

(54) Subject to further investigation on the details of the proposed KYCAI development under the CW Study, the detailed cumulative impacts to marine ecology due to habitat loss and disturbance, increase in underwater sound, increase in marine traffic, if any, will be addressed under the EIAs for the CW Study.

similarity in underwater acoustic profiles generated by works vessels of this Project and other projects (e.g. by the use of large vessels generating low-frequency sound), cumulative effects of works vessels operational sound, if any, are anticipated to be negligible.

- **Marine Traffic:** the Project is located at sufficient distance from other projects in the vicinity. It is expected to involve a relatively small number of works vessels (e.g. up to 2 dredgers, some tugs/ supporting vessels, some hopper barges for sediment handling at any one time), and the frequency/ trip of works vessels would also be relatively low in general (expected to be no more than 84 trips per day at the peak work rates) when comparing to the traffic densities at the nearby fairways (e.g. Adamasta Channel TSS and East Lamma Channel TSS with a range of a daily average of 368-432 numbers of marine traffic volume in December 2019 based on Automatic Identification System and radar data). Given the waters off southern Hong Kong have high levels of existing marine traffic, the cumulative effects of marine traffic disturbance and marine mammal collision risk, if any, are anticipated to be minor. It is expected that similar, slow-moving works vessels would be used in this Project and other projects, and similar mitigation measures, e.g. regular routes (***Section 4.9***) would be adopted in different projects to minimise the magnitude of potential cumulative impacts.

Other projects either do not have a marine element or are at more than a few kilometres from this Project, and so no unacceptable cumulative impact on marine ecological resources, including FPs, is expected. On the basis of the above, no unacceptable cumulative impact on marine ecological resources, including FPs, is expected.

4.9 Mitigation Measures

In accordance with the guidelines in the *EIAO-TM* on marine ecological impact assessment, the approach adopted in this EIA for mitigating impacts to marine ecology, in order of priority, includes:

- **Avoidance:** Potential impacts should be avoided to the maximum extent practicable by adopting suitable alternatives;
- **Minimisation:** Unavoidable impacts should be minimised by taking appropriate and practicable measures such as confining works in specific area or season; and
- **Compensation:** The loss of important species and habitats may be provided for elsewhere as compensation. Enhancement and other conservation measures should always be considered whenever possible.

Impacts to marine ecological resources have largely been avoided (i.e. avoid direct and indirect impacts to ecologically sensitive habitats as far as practicable through site selection; see ***Section 2.5***) and reduced through proper planning and design of the CMPs (e.g. CMPs to be developed within Key Area, CMPs to be constructed and operated sequentially and no more than three pits will be active (dredging / backfilling / capping) at any one time). The construction and operation activities have been designed (e.g. appropriate work rates for dredging, backfilling and capping) to confirm compliance with the assessment criteria at sensitive receivers and control water quality impacts to within acceptable levels and water quality mitigation measures (e.g. deployment of cage-type silt curtain during dredging works, good site practices) will be implemented to further avoid/reduce potential impacts (see ***Section 3***). These measures are expected to control and reduce potential impacts to marine ecological resources as well. Other precautionary measures for marine ecological resources are also recommended in the following sections.

4.9.1 Measures for Marine Ecological Resources

The following precautionary measures to reduce potential impacts from the construction and operation activities of the Project on the marine ecological resources, including Green Turtles and FP, are recommended:

- Vessel operators will be required to control and manage all effluent from vessels. These kinds of wastewater shall be brought back to port where possible and discharged at appropriate collection and treatment system to prevent avoidable water quality impacts;
- A policy of no dumping of rubbish, food, oil, or chemicals will be strictly enforced;
- Only well-maintained and inspected vessels would be used to limit any potential discharges to the marine environment;
- Safe storage, handling and disposal of chemicals and oils to prevent the release into the marine environment;
- Bunding of machinery areas and availability of spill clean-up kits would be in place to prevent spillage or leakage of fuel/chemical to reach the marine environment;
- The vessel operators for the construction activities of this Project will be required to use predefined and regular routes, make use of designated fairways to access the active CMPs, and would avoid traversing sensitive habitats such as existing and proposed marine parks. This measure will further serve to minimise disturbance to Green Turtles and FP due to vessel movements; and
- The vessel operators working on the construction activities of the Project will be given a briefing, alerting them to the possible presence of FP in the active CMP areas, and the guidelines for safe vessel operation in the presence of these animals. The vessels will avoid using high speed as far as possible. By observing the guidelines, vessels will be operated in an appropriate manner so that FP will not be subject to undue disturbance or harassment.

4.10 Residual Impacts

Recolonisation of benthos is expected after capping of the CMPs and the habitats are expected to return to pre-dredged conditions. With the implementation of mitigation and precautionary measures during construction and operation activities of the Project as mentioned in ***Section 4.9***, potential impacts on marine ecological resources will be further minimised. No adverse residual impacts on marine ecological resources due to the dredging, backfilling and capping works of the Project are expected.

4.11 Environmental Monitoring and Audit

As no unacceptable impacts have been predicted to occur during construction and operation of the Project, monitoring of marine ecological resources during these construction and operation activities is not considered necessary.

Monitoring activities designed to detect and mitigate impacts to water quality during construction and operation activities are also expected to serve to protect against impacts to marine ecological resources. The details of the water quality monitoring programme will be presented in the EM&A Manual attached to this EIA Report.

The EIA has indicated that benthic fauna are expected to recolonise the CMPs following capping with uncontaminated mud. It is expected that recolonisation of the natural benthic assemblage will occur and eventually the benthic assemblage will resemble that of the surrounding areas. Recolonisation may be achieved by larval recruitment, influx of juveniles or adults carried in water currents, or through the active swimming or crawling of individuals. However, other natural (e.g. storm events, hypoxia, salinity fluctuations) or anthropogenic (e.g. pollution, fisheries operations) activities may hinder recolonisation of capped pits. As a result, the factors contributing to the composition of the benthic assemblage may be difficult to determine. It is also important for any recolonisation studies to be aware of any cap maintenance (or "topping up") activities which may also impact the resident benthic assemblages. In order to verify the recolonisation of benthic assemblage on the capped

CMPs, a benthic recolonisation monitoring programme is recommended and the details will be presented in the EM&A Manual attached to this EIA Report.

4.12 Summary and Conclusions

Based on literature review and field survey findings, the key habitats within and in the vicinity of the Project include coral and benthic communities and marine waters. Although FP are present in the vicinity of the Project, their occurrence was recorded to be consistently low over the past years and the area within and in the vicinity of the Study Area is not a key habitat for FP. Marine ecological resources in close proximity to the Project are regarded as of low ecological values. The presence of species of conservation importance such as Green Turtles in the Assessment Area is very occasional.

The loss and disturbance of subtidal habitats throughout the construction and operation activities of the Project is considered as environmental acceptable to marine ecological resources and marine mammals as the areas affected are relatively small in the context of the extent of similar habitats available in the vicinity and the low ecological value of the affected assemblages. Recolonisation of benthos is expected after capping of the CMPs and the habitats are expected to return to pre-dredged conditions. The temporary loss of these benthic assemblages of low ecological value is not considered to be unacceptable. FP are expected to temporarily avoid the areas of active CMPs, and would return upon cessation of the construction and operation activities. With the implementation of mitigation and precautionary measures including site selection to avoid impacts to ecologically sensitive habitats as far as practicable, proper planning and design of the CMPs, control of work rates for dredging, backfilling and capping, briefing to vessel operators and the use of predefined and regular routes, no unacceptable impacts are anticipated.

The impacts of changes in water quality arising from the construction and operation activities of the Project are predicted to be largely confined to the active CMP areas. With the implementation of mitigation measures, the predicted elevations of suspended sediment due to the Project are not predicted to cause exceedances of the WQO at sensitive receivers, unacceptable adverse impacts to water quality, and hence marine ecological resources, FP, Green Turtles and the Potential South Lamma Marine Park, are not anticipated. The assessment of water quality impacts demonstrated that the marine ecological sensitive receivers within the Assessment Area would not be unacceptably affected as defined by the relevant assessment criteria.

The Project is expected to involve a relatively small number of works vessels and the frequency/ trip of works vessels would also be relatively low in general when comparing to the traffic densities at the nearby fairways. Vessel traffic associated with the proposed Project would represent only a minor incremental increase in marine traffic in the area. Underwater sound and increase marine traffic generated from the construction and operation activities are not expected to result in unacceptable impacts to marine ecological resources, including FP and Green Turtles, considering the relatively small number of works vessels and trips involved, slow-moving nature of these vessels and the habituation of similar sounds by the species in the current underwater soundscape.

The effects of glare from light sources of construction and operation activities are considered to be minor as the Project is located away from the Green Turtle nesting ground at Sham Wan and shielded by the landmass at southwest of Lamma Island. Accidental spill events at a scale that may impact marine ecological resources are also extremely unlikely to occur, and precautionary measures will be in place to reduce potential impacts.

The mitigation measures designed to reduce impacts to water quality to acceptable levels (compliance with WQOs) during construction and operation activities of the Project are also expected to mitigate impacts to marine ecological resources, FP, Green Turtles and the potential South Lamma Marine Park. With the implementation of mitigation and precautionary measures during construction and operation activities of the Project, potential impacts on marine ecological resources will be further minimised. No adverse residual impacts on marine ecological resources due to the dredging, backfilling and capping works of the Project are expected.