ANNEX 4A MARINE ECOLOGY - LITERATURE REVIEW

4A.1 Introduction

A literature review was conducted to review the baseline ecological characters of the Assessment Area, identify habitat resources and species of potential conservation importance, and identify information gaps to determine whether field surveys are required to provide sufficient information for the marine ecological impact assessment. This ***Annex*** presents the findings of this literature review.

4A.2 Legislative Requirements and Evaluation Criteria

4A.2.1 *Marine Parks Ordinance (Cap. 476) and its Subsidiary Legislation*

The *Marine Parks Ordinance (Cap. 476)* provides for the designation, control and management of marine parks and marine reserves. It also stipulates the Director of Agriculture, Fisheries and Conservation as the Country and Marine Parks Authority which is advised by the Country and Marine Parks Board. The *Marine Parks and Marine Reserves Regulation* was enacted in July 1996 to provide for the prohibition and control of certain activities in marine parks or marine reserves.

4A.2.2 *Wild Animals Protection Ordinance (Cap. 170)*

Under the *Wild Animals Protection Ordinance* (Cap. 170), designated wild animals are protected from being hunted, whilst their nests and eggs are protected from destruction and removal. All birds and most mammals including all cetaceans are protected under this Ordinance, as well as certain reptiles (including all sea turtles), amphibians and invertebrates. The Second Schedule of the Ordinance that lists all the animals protected was last revised in June 1997.

4A.2.3 *Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586)*

The *Protection of Endangered Species of Animals and Plants Ordinance* (Cap. 586) was enacted to align Hong Kong's control regime with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). With effect from 1 July 2006, it replaces the *Animals and Plants (Protection of Endangered Species) Ordinance* (Cap. 187). The purpose of the *Protection of Endangered Species of Animals and Plants Ordinance* is to restrict the import and export of species listed in CITES Appendices so as to protect wildlife from overexploitation or extinction. The Ordinance is primarily related to controlling trade in threatened and endangered species and restricting the local possession of them. Certain types of corals are CITES listed, including Blue coral (*Heliopora* coerulea), Organ pipe corals (family Tubiporidae), Black corals (order Antipatharia), Stony coral (order Scleractinia), Fire corals (family Milleporidae) and Lace corals (family Stylasteridae). The import, export and possession of listed species, no matter dead or living, is restricted.

4A.2.4 *Town Planning Ordinance (Cap. 131)*

The *Town Planning Ordinance* (Cap. 131) provides for the designation of areas such as "Coastal Protection Areas", "Sites of Special Scientific Interest (SSSIs)", "Green Belt" and "Conservation Area" to promote conservation or protection or protect significant habitat.

4A.2.5 *Environmental Impact Assessment Ordinance (Cap. 499) and the Technical Memorandum on Environmental Impact Assessment Process under the Environmental Impact Assessment Ordinance (EIAO-TM)*

The Environmental Impact Assessment Ordinance (Cap. 499) specifies designated projects under Schedule 2 of the Ordinance, unless exempted, must follow the statutory environmental impact assessment (EIA) process and require environmental permits for their construction and operation. *Annex 16* of the *EIAO-TM* sets out the general approach and methodology for assessment of

ecological impacts arising from a project or proposal, to allow a complete and objective identification, prediction and evaluation of the potential ecological impacts. *Annex 8* recommends the criteria that can be used for evaluating ecological impacts.

4A.2.6 *Environmental Impact Assessment Ordinance (EIAO) Guidance Notes No. 6/2010, 7/2010 and 11/2010*

The guidance notes provide respectively the observations on ecological assessment from the EIAO perspective, the general guidelines for conducting an ecological baseline survey for ecological assessment and methodologies for marine ecological baseline surveys in order to fulfil the requirements stipulated in the EIAO-TM in respect of ecological assessment for the proposed development.

4A.2.7 *Hong Kong Planning Standards and Guidelines Chapter 10 (HKPSG)*

Chapter 10 of the HKPSG covers planning considerations relevant to conservation. This chapter details the principles of conservation, the conservation of natural landscape and habitats, historic buildings, archaeological sites and other antiquities. It also addresses the issue of enforcement. The appendices list the legislation and administrative controls for conservation, other conservation related measures in Hong Kong and Government departments involved in conservation.

4A.2.8 *Other Relevant Legislation*

The Peoples' Republic of China (PRC) is a Contracting Party to the United Nations Convention on Biological Diversity (CBD) of 1992 and it was extended to Hong Kong on 9 May 2011. The Convention requires signatories to make active efforts to protect and manage their biodiversity resources. The HKSAR Government has stated that it will be "committed to meeting the environmental objectives" of the Convention [(1)]. In the tenth meeting of the conference in 2010, the Parties adopted a revised and updated Strategic Plan for Biodiversity, including the Aichi Biodiversity Targets, for 2011-2020. This plan aims to "take effective and urgent action to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life, and contributing to human well-being, and poverty eradication". The Strategic Plan consisted with five strategic goals, which included 20 headline Aichi Biodiversity targets. The goals and targets comprised a flexible framework for the establishment of national and regional targets for biodiversity conservation.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora of Wild Fauna and Flora (CITES) was drafted and agreed at a meeting of members of International Union for Conservation of Nature (IUCN) with representative of 80 countries in 1972 and entered in force in 1975. This international agreement adheres voluntarily between government and aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

The IUCN is the world's oldest and largest authority on the conservation status of species. The IUCN Red List of Threatened Species is widely recognised as the most comprehensive, objective global approach for evaluating the conservation status of plant and animal species. The goal of the IUCN Red List is to provide information and analyses on the status, trends and treats to species in order to inform and catalyse action for biodiversity conservation. In 1994, a scientifically rigorous approach was adopted to determine risks of extinction that is applicable to all species and it has become a world standard.

The PRC in 1988 ratified the Wild Animal Protection Law of the PRC, which lays down basic principles for protecting wild animals. The Law prohibits killing of protected animals, controls hunting, and protects the habitats of wild animals, both protected and non-protected. The Law also provides for the creation of lists of animals protected at the state level, under Class I and Class II. There are

(1) Planning Environment and Lands Bureaux 1996. Environmental Policy Commitments.

96 animal species in Class I and over 230 species in Class II. Class I provides a higher level of protection for animals considered to be more threatened.

4A.3 Baseline Conditions of Marine Ecological Resources of the Assessment Area

4A.3.1 Information Reviewed

Baseline information on the marine ecological resources of the Assessment Area for marine ecology is available from the following key sources:

- Field guides and published studies/literature for marine habitats and fauna of Hong Kong;
- Consultancy Study on Marine Benthic Communities in Hong Kong (Agreement No. CE 69/2000);
- AFCD Marine Mammal Monitoring Reports;
- Ecological Restoration and Conservation Laboratory, HKU. Reptiles of Hong Kong;
- EIA and Final Site Selection Report for Detailed Site Selection Study for a Proposed Contaminated Mud Disposal Facility within the Airport East/East of Sha Chau Area (Agreement No. CE 12/2002(EP));
- EIA Review Report for Contaminated Sediment Disposal at South of Brothers (Agreement No. FM 2/2009);
- EIA Report for Development of a 100MW Offshore Wind Farm in Hong Kong (Register No.: AEIAR-152/2010);
- EIA Report for a 1,800MW Gas-Fired Power Station at Lamma Extension. (Register No.: AEIAR-010/1999);
- EIA Report for Development of the Integrated Waste Management Facilities Phase 1 (Register No.: AEIAR-163/2012);
- EIA Report for Hong Kong Offshore LNG Terminal (Register No.: AEIAR-218/2018);
- EIA Report for Improvement Dredging for Lamma Power Station Navigation Channel (Register No.: AEIAR-212/2017);
- EIA Report for Outlying Islands Sewerage Stage 2 - South Lantau Sewerage Works (Register No.: AEIAR-210/2017);
- ERM (1998) Fisheries Resources and Fishing Operations in Hong Kong Waters, for AFD;
- Marine Ecological Baseline Review Report for Improvement Dredging for Lamma Power Station Navigation Channel, submitted under Environmental Permit No. EP-535/2017; and
- Provision of Compensatory Marine Park for Integrated Waste Management Facilities at an Artificial Island near Shek Kwu Chau – Investigation (Agreement No. CE 14/2012 (EP)).

Findings of the review of these key sources is summarised in the following sections.

4A.4 Recognized Sites of Conservation Importance

There are no Special Areas or Conservation Areas that are relevant to marine ecology within and in the vicinity of the Study 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. These are further discussed below and their locations are provided in ***Figure 4A.1***.

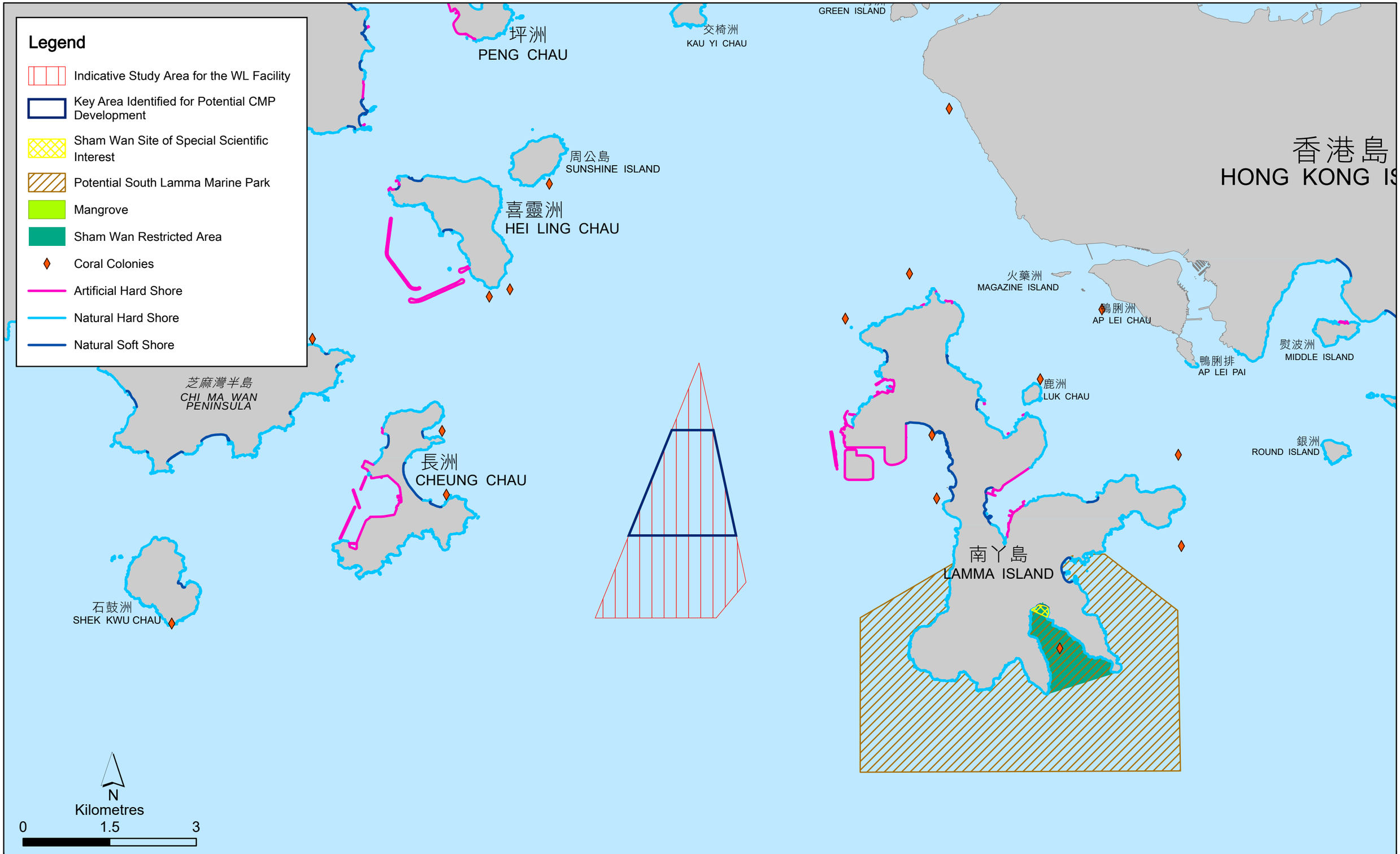


Figure 4A.1

Marine Habitats in the vicinity of the Study Area

File: T:\GIS\CONTRACT\0567994\mxd\0567994_Marine_Habitats_v2.mxd
Date: 6/12/2021

Environmental Resources Management

ERM

4A.4.1 Potential South Lamma Marine Park

A study was conducted in 1999 to investigate the feasibility of designating South Lamma as a marine park [(2)]. The study concluded that the coastal waters of South Lamma supported marine fauna of ecological value, mainly green turtles and finless porpoises. The indicative location of the potential South Lamma Marine Park is presented in ***Figure 4A.1***. There is no information on the proposed timeline for designation of South Lamma Marine Park.

4A.4.2 Sham Wan SSSI

Designated in June 1999, the Sham Wan SSSI covers the sandy beach and adjoining shallow shore of about 4 ha at Sham Wan of South Lamma (***Figure 4A.1***), for important nesting sites for the locally and regionally rare green turtles. This SSSI is more than 3 km to the east of the Study Area.

4A.4.3 Sham Wan Restricted Area

Encompassed within the Sham Wan SSSI, 0.5 ha of the sandy beach at Sham Wan of South Lamma was designated as a Restricted Area under the *Wild Animals Protection Ordinance (Cap. 170)* in July 1999. The Sham Wan Restricted Area is more than 5 km to the east of the Study Area.

To strengthen the protection of the Green Turtle, with effect from 1 April 2021, AFCD has expanded the Restricted Area to cover about 98 hectares of waters in the bay of Sham Wan adjoining the beach as indicated in ***Figure 4A.1*** as well as extend the restricted period of this area to seven months each year (i.e. from 1 April to 31 October) for protection of nesting and breeding of green turtles.

4A.5 Intertidal Assemblages

Intertidal hard shores of Hong Kong display characteristic zonation patterns consisting of different algal and invertebrate species along the vertical gradient from terrestrial to marine environments. The Study Area mainly consists of hard shores (both natural shores and artificial shores) with some natural soft shores (e.g. sandy shores) as shown in ***Figure 4A.1***. From the literature review, intertidal assemblages recorded in the vicinity of the Study Area are summarised in ***Table 4A.1***. The species recorded were all very common and widespread species of Hong Kong.

Table 4A.1 Summary of Review on Intertidal Assemblages in the vicinity of the Study Area

Survey Period	Location (see *Figure 4A.6*)	Total No. of Species Recorded	Mean Abundance of Mobile Fauna and Sessile Flora and Fauna	Dominant Species
August 1998 (Wet Season)	Natural Rocky Shores (T1 – T6, L1)	37	125.6 individuals m^{-2} (Mobile Fauna) 39.8% m^{-2} (Sessile Flora & Fauna)	Chiton *Liolophura japonica*, the Limpets (*Cellana grata*, C. *toreuma, Patelloida pygmaea, P. saccharina, Siphonaria atra* and *S. sirius*, the snails *Monodonta labio* and *Planaxis sulcatus*, the nerites *Nerita albicilla. N. chamaeleon, N. costat*a and *N. lineata,* littorinid snail *Echinolittorina radiata*, *E. trochoides* and *E. vidu*a, the common dog whelks *Reishia clavigera* and *Morula musiva*

(2) AFCD (1999). Study on the Suitability of South Lamma to be Established as Marine Park or Marine Reserve.

Survey Period	Location (see *Figure 4A.6*)	Total No. of Species Recorded	Mean Abundance of Mobile Fauna and Sessile Flora and Fauna	Dominant Species
October 2008 (Wet Season)	Artificial Sloping Seawall (T7, T8 & T9)	23	38 individuals m^{-2} (Mobile Fauna) 13% m^{-2} (Sessile Flora & Fauna)	Littorinid snail *Echinolittorina* spp. in, the topshell *Monodonta labio*, the limpet *Cellana toreuma*, *C. toreuma, Siphonaria japonica* and *Patelloida saccharina*, the common dogwhelk *Reishia clavigera*, barnacle *Tetraclita squamosa*, the oyster *Saccostrea cucullata*
February 2009 (Dry Season)	Artificial Sloping Seawall (T7, T8 & T9)	22	64 individuals m^{-2} (Mobile Fauna) 21% m^{-2} (Sessile Flora & Fauna)	
May 2014 and September 2015 (Wet Season)	Artificial Sloping Seawall	23	60 individuals m^{-2} (Mobile Fauna) 33% m^{-2} (Sessile Flora & Fauna)	The sea roach *Ligia exotica*, the limpet *Patelloida pygmaea*, *Patelloida saccharina*, *Siphonaria japonica* and the encrusting alga *Hildenbrandia rubra*
November 2015 and January 2016 (Dry Season)	Artificial Sloping Seawall	21	37 individuals m^{-2} (Mobile Fauna) 33% m^{-2} (Sessile Flora & Fauna)	Littorinid snail *Echinolittorina radiata*, the topshell *Monodonta labio*, the limpet *Patelloida saccharina*, the chiton *Liolophura japonica* and the encrusting alga *Hildenbrandia rubra*
May 2014 and August 2015 (Wet Season)	Natural Rocky Shores at Lo So Shing and Ha Mei Tsui	47	80 individuals m^{-2} (Mobile Fauna) 30% m^{-2} (Sessile Flora & Fauna)	Littorinid snail *Echinolittorina radiata*
November 2015 and January 2016 (Dry Season)	Natural Rocky Shores at Lo So Shing and Ha Mei Tsui	34-39	70 individuals m^{-2} (Mobile Fauna) 30% m^{-2} (Sessile Flora & Fauna)	Littorinid snail *Echinolittorina radiata*, topshell *Monodonta labio*, encrusting alga *Hildenbrandia rubra*
August 2016 (Wet Season) and February 2017 (Dry Season)	Artificial Sloping Seawall (T7, T8 & T9)	20-22	10.4 - 14.2 individuals m^{-2} (Mobile Fauna) 13.4 – 18.9% m^{-2} (Sessile Flora & Fanua)	Limpets *Patelloida* spp., barnacles *Capitulum mitella* and *Tetraclita* spp.

4A.6 Coral Communities

Coral communities are commonly regarded as the most ecologically important and valuable subtidal hard bottom assemblages. The AFCD report that there are over 80 species of corals recorded in Hong Kong waters [3]. The general trend for coral communities in Hong Kong is one of increasing abundance and diversity from west to east with the greatest diversity and abundance generally found in the eastern waters of Hong Kong. It has been suggested that the distribution of corals is primarily controlled by hydrodynamic conditions, in particular salinity level, turbidity and light penetration.

The western waters of Hong Kong, including the Deep Bay WCZ, North Western WCZ, North Western Supplementary WCZ, Second Southern Supplementary WCZ and western part of the Southern WCZ (i.e. southern waters of Lantau Island), are influenced by the Pearl River Estuary which reduces salinities, increases turbidity and therefore reduces light penetration. Due to the requirements for coral growth, the cumulative effect of these conditions results in sub-optimal conditions for recruitment and survival of most coral. Corals are therefore much less abundant and diverse in Hong Kong's western waters than eastern waters. Unlike the hermatypic hard corals, 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 greater depths.

Coral communities have been recorded in the vicinity of the Study Area and the records are summarised in ***Table 4A.2***. The indicative locations of coral communities are presented in ***Figure 4A.1***.

Table 4A.2 Summary of Review on Coral Communities in the vicinity of the Study Area

Source	Location	Summary of findings
AFCD (2004)	Intensive surveys in 2001-2002 to survey corals at 240 sites covering about 70 km of coastline in territorial waters	Hard corals were found in western waters of Hong Kong, but limited to southern Lantau waters (Tong Fuk, Soko Islands) and eastern (Cheung Chau, Hei Ling Chau) Lantau waters. Only sparse colonies or low-coverage communities composed of extremely tolerant and species were found
ERM (2010)	Seawall of LPS Extension and submarine cable route	A total of three (3) hard corals were identified on the seawall, including *Oulastrea crispata, Porites* sp. and ahermatypic cup coral under Family Dendrophyllidae. The coverage are generally low with <5% on the seawall. The seabed along the submarine cable route was mainly comprised of soft substrata and they were only sparsely colonized on the hard substrata. Octocroals *Echinomuricea* sp., *Menella* sp. and *Dendronephthya* sp. and black coral *Cirripathes* sp. were recorded on the dumped materials along the submarine cable route.
Mott MacDonald (2017)	Seawall of LPS Extension and natural shores along the	At the sloping artificial seawalls along the LPS Extension, only one hard coral species, *Oulastrea crispata*, was recorded with low coral cover (<1%). Soft corals were also

(3) Chan A, Choi C, McCorry D, Chan K, Lee MW, Put A Jr (2005) *Field Guide to Hard Coral of Hong Kong*. Friends of the Country Parks

Source	Location	Summary of findings
	western coast of Lamma Island	recorded including *Dendronephthya gigantea*, *Echinomuricea* spp., *Echinogorgia* sp. and *Carijoa* sp.. A total of 18 hard coral species were recorded at the natural shores along the western coast of Lamma. Coral cover was, however, low in general (<1% to <5% cover).
ERM (2018)	Artificial seawall of LPS	The site comprised large boulders and the toe of the seawall was covered with a layer of mud. On the hard substrata, algae were absent and sessile benthos comprised of isolated barnacles. Only sparse colonies of hard coral *Duncanopsammia peltata*, *Porites* sp. and *Oulastrea crispata*, ahermatypic hard coral *Tubastrea* / *Dendrophyllia* sp. and *Balanophyllia* sp. and octocoral colonies *Dendronephthya* sp., *Echinomuricea* sp. and *Menella* sp./ *Paraplexaura* sp. were identified. The coral cover was low (<5%).

4A.7 Subtidal Soft Bottom Assemblages

4A.7.1 Epifaunal Assemblages

Subtidal epifauna are organisms (> 1 mm in size) living either on or within the surface sediments of the seabed. Due to the nature of the Hong Kong's fishery and the typical subtidal substratum in Hong Kong being soft bottom (sandy or silty) habitat, data on subtidal epifaunal assemblages in Hong Kong are primarily available from studies on fisheries resources, collected by trawling surveys.

Information on the epifaunal assemblages of the Study Area have been taken from the AFCD-commissioned study on Fisheries Resources and Fishing Operations in Hong Kong [(4)]. Trawl surveys undertaken as part of AFCD's study indicated that that the highest biomasses recorded in the waters were contributed by mantis shrimp (e.g. *Oratosquilla oratoria*) which are common and widespread species. Other common species recorded during the trawl surveys were croakers (e.g. *Collichthys lucida, Johnius belangerii,* etc.) (near South Cheung Chau and Soko Islands) and blood cockle (e.g. *Anadara granosa*) (near South Lantau).

Overall, findings from the previous surveys suggested that the epifaunal assemblages of the Study Area are dominated by common and widespread species.

4A.7.2 Infaunal Assemblages

Subtidal infauna are organisms (> 0.5 mm in size) living either on or within the surface sediments of the seabed. In order to provide an indication of the potential ecological value of the infaunal assemblages around the Study Area in the context of seabed of Hong Kong waters, it is considered useful to review studies that have investigated infaunal assemblages in Hong Kong on a wide scale. Territory-wide surveys of Hong Kong subtidal infauna assemblages were conducted in 2001 [(5)]. Findings of the surveys indicated that the benthic assemblages around the Study Area were mainly bivalves and polychaetes which were typical of Hong Kong waters and no species of conservation importance were found.

(4) ERM (1998) Fisheries Resources and Fishing Operations in Hong Kong Waters, for AFD.

(5) CityU Professional Services Limited (2002) Agreement No. CE 69/2000 *Consultancy Study on Marine Benthic Communities in Hong Kong, for AFCD.*

From the territory-wide surveys conducted in 2001, amphioxus *Branchiostoma belcheri* were not recorded in the vicinity of the Study Area. This species is regarded as a living fossil link in the evolution of marine invertebrates to vertebrates [(6)] and is listed as Class II protection species in China [(7)] due to over-exploitation, thus it is considered as a species with conservation importance.

4A.7.3 Horseshoe Crabs

Two species of horseshoe crab, *Tachypleus tridentatus* and *Carcinoscorpius rotundicauda*, have previously been recorded in around Hong Kong waters, whilst a third species of horseshoe crab *Tachypleus gigas* was not recorded in Hong Kong since March 1995 and its local status is uncertain, likely to be locally extinct [(8)] [(9)]. Juvenile horseshoe crabs can be found at mudflats at Ha Pak Nai/ Pak Nai in Deep Bay, and on intertidal sandy shores or mudflats at Tai Ho Bay, Tung Chung Bay, San Tau, Hau Hok Wan, Sha Lo Wan, Sham Wat Wan, Yi O and Shui Hau, Lantau Island [(10)(11)(12)(13)(14)]. In the vicinity of the Study Area, there was a historical record of juvenile horseshoe crabs in Sok Kwu Wan of Lamma Island back in a study from 1995 to 1998 [(15)]. However, there is no recent record of horseshoe crabs or confirmed nursery sites for horseshoe crabs in the vicinity of the Study Area.

4A.8 Marine Mammals

A total of 18 (and possibly up to 20) species of marine mammals (mostly cetaceans) have been recorded in Hong Kong waters (including one humpback whale sighted in 2009, one stranding of Omura's whale in 2014, one shortfin pilot whale sighted in 2015 and 2 false killer whale pods sighted in 2014 and 2020), two of which are considered residents, which are Finless Porpoise (FP) *Neophocaena phocaenoides* and the Chinese White Dolphin (CWD) *Sousa chinensis*. FP are mainly distributed in southern and eastern waters of Hong Kong, while CWD are mainly distributed in western and southwestern waters of Hong Kong. As the Study Area is located in southern waters of Hong Kong within the habitats utilized by FP, the following context focusses on FP.

FP is a tropical/ sub-tropical cetacean widely distributed in coastal marine waters, as well as some river mouths and estuaries, from the Arabian/Persian Gulf eastwards around the rim of the Indian Ocean to the Taiwan Strait area in southern Japan. It is protected locally by the *Wild Animals Protection Ordinance (Cap. 170)*, and is listed as "Vulnerable" in the IUCN Red List of Threatened Species [(16)]. FP is also listed in CITES Appendix I (i.e. highest protection), and is listed as "Grade II National Key Protected Species" in China. As such FP is considered a species of conservation importance, both locally in Hong Kong and regionally in China and across the Asia Pacific.

(6) AFCD Marine Benthic Communities Website. Available at http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_mar/con_mar_mar_ben/con_mar_mar_ben3.html

(7) Huang, Z.G. (ed.) (2006). Diversity of Species in Xiamen Bay, China. Ocean Press, Beijing, China, 587 pp.

(8) Chin, H. M., & Morton, B. (2000). The distribution of horseshoe crabs (*Tachypleus tridentatus* and *Carcinoscorpius rotundicauda*) in Hong Kong. *Asian Marine Biology 16*, *10*, 185-196.

(9) AFCD (2020): Horseshoe crabs in Hong Kong website. Available at http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_hor/con_mar_hor.html.

(10) Shin PKS, Li HY, Cheung SG (2009) *Horseshoe Crabs in Hong Kong: Current Population Status and Human Exploitation*. Biology and Conservation of Horseshoe Crabs. Springer US. 347-360.

(11) Morton B, Lee CN (2011) *Spatial and temporal distribution of juvenile horseshoe crabs (Arthropoda: Chelicerata) approaching extinction along northwestern shoreline of the New Territories of Hong Kong SAR, China*. Journal of Natural History 45:227-251.

(12) ARUP (2009) *Environmental Impact Assessment of the Hong Kong - Zhuhai - Macao Bridge Hong Kong Link Road*. Prepared for Highways Department.

(13) ARUP (2009) *Environmental Impact Assessment of the Hong Kong - Zhuhai - Macao Bridge Hong Kong Boundary Crossing Facilities.* Prepared for Highways Department.

(14) Mott McDonald (2014) E*nvironmental Impact Assessment of the Expansion of Hong Kong International Airport into a Three-Runway System. (EIA Study Brief ESB-250/2012).* Prepared for Airport Authority Hong Kong.

(15) Chiu HMC, Morton B (1999a) The biology, distribution and status of horseshoe crabs, *Tachypleus tridentatus* and *Carcinoscorpius rotundicauda* (Arthropoda: Chelicerata) in Hong Kong: Recommendations for conservation and management. Final Report. The Swire Institute of Marine Science, The University of Hong Kong

(16) Wang, J.Y., Reeves, R. (2017). *Neophocaena phocaenoides*. The IUCN Red List of Threatened Species 2017: e.T198920A50386795. http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T198920A50386795.en.

Studies on the distribution, abundance, habitat use, life history and behaviour of FP in Hong Kong have been undertaken since 1998. AFCD estimate indicated that there were at least 147 porpoises occurring in Chinese waters just south of Hong Kong, which makes the minimum population size estimate to be 217 animals [17].

In Hong Kong, FP occur year-round, and they can be found primarily in the southern (i.e Po Toi, Lamma, Southeast and Southwest Lantau) and eastern (i.e. Mirs Bay, Sai Kung and Ninepins) waters of the territory [18] [19]. The majority of porpoise sightings have been made to the south of Soko Islands and Cheung Chau, around Shek Kwu Chau, and between the waters of Soko Islands and Shek Kwu Chau. These areas are thus considered to be the main habitats for FP. The only area where FP and CWD showed overlap in distribution was in South Lantau waters especially around Soko Islands. A study adopting acoustic approach conducted in South Lantau, Southeast Lantau and East Lantau waters between 2018 and 2020 also showed that FPs were acoustically detected mainly around Soko Islands, South of Cheung Chau and between the waters of Soko Islands and Shek Kwu Chau [20].

Seasonal variation in distribution is evident for FP in Hong Kong. FP move into the waters of south Lantau and Lamma in winter (from December to February), and peak abundance was recorded in spring (from March to May) when significant numbers occurred in southern waters. During summer (from June to August), FP generally vacated the waters of south Lantau and Lamma and moved to Po Toi, Ninepins and Sai Kung, and abundance appears to reach a low point in autumn (from September to November) [21]. Their abundance in Hong Kong waters ranges from a high of approximately 152 individuals in spring to approximately 55 in autumn [22].

A review of long-term marine mammal monitoring data conducted by AFCD up to the year of 2021 has been conducted [23]. The results showed that FP were mainly sighted to the south of Tai A Chau, Shek Kwu Chau, south of Cheung Chau and at the offshore waters between Shek Kwu Chau and the Soko Islands as important porpoise habitats during dry season and at Po Toi Islands and at the juncture of Po Toi and Ninepins areas during wet season. In Lamma waters, a low density of FP was sighted during wet and dry seasons within and in the vicinity of the Study Area during 2016-2020 (***Figure 4A.2***).

4A.9 Sea Turtles

Of the seven extant species of sea turtles, loggerhead turtle (*Caretta caretta*), leatherback turtle (*Dermochelys coriacea*), hawksbill turtle (*Eretmochelys imbricata*), olive ridley turtle (*Lepidochelys olivacea*) and green turtle (*Chelonia mydas*), have been reported to occur in the waters of Hong Kong [24]. However, green turtle is the only species confirmed to nest in Hong Kong [25].

(17) AFCD (2020). Finless Porpoise. Available at: http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_fin/con_mar_fin_fin/con_mar_fin_fin_dis_howmany.html

(18) Jefferson TA, Braulik G T (1999) Preliminary report on the ecology of the finless porpoise in Hong Kong waters. *IBI Reports* 9: 41-54

(19) Jefferson TA, Hung SK, Law L, Torey M, Tregenza N (2002) Distribution and abundance of finless porpoises in Hong Kong and adjacent waters of China. Raffles Bulletin of Zoology 10: 43-55.

(20) SMRU Hong Kong (2021). What Do Dolphins Do At Night? MEEF2018010A Final Report. Funded by the Marine Ecology Enhancement Fund.

(21) AFCD (2020). Finless Porpoise. Available at: http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_fin/con_mar_fin_fin/con_mar_fin_fin_dis_is.html

(22) AFCD (2020). Finless Porpoise. Available at: http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_fin/con_mar_fin_fin/con_mar_fin_fin_dis_howmany.html

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

(24) AFCD (2020) Sea turtles recorded in Hong Kong website. Available at: http://www.afcd.gov.hk/english/conservation/con_fau/con_fau_sea/con_fau_sea_sea/con_fau_sea_sea.html

(25) Nesting refers to the laying of clutches of eggs by female turtles on their natal beaches. Female turtles usually migrate (up to thousands of kilometres) from their resident foraging areas to a coastal area, ie nesting beach, for nesting. Adult females return to their natal areas for breeding and both males and females show strong fidelity to their nesting and foraging areas

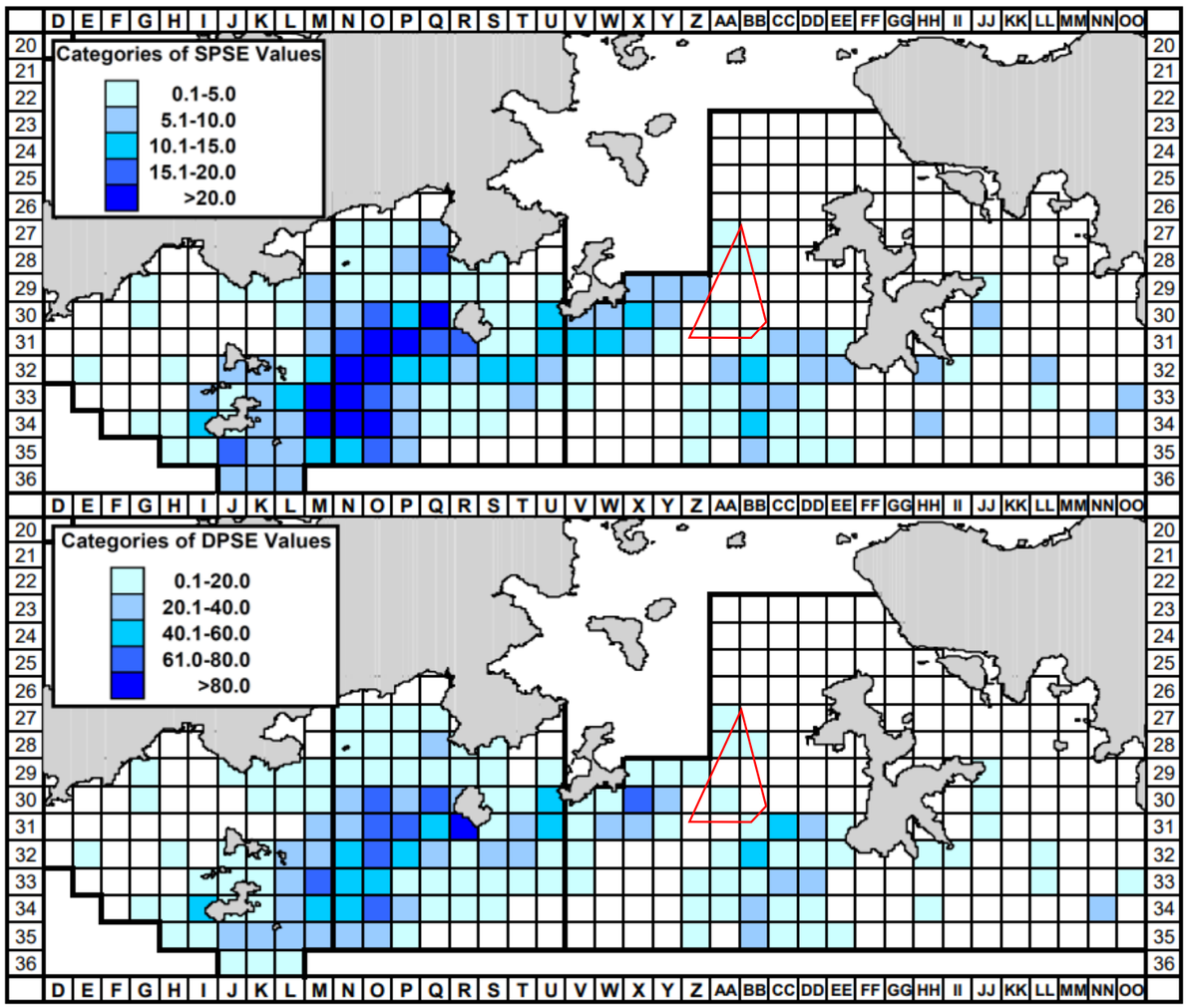


Figure 16. Density of finless porpoises with corrected survey effort per km^2 in southern waters of Hong Kong during dry season (December to May), using data collected during 2016-20 (SPSE = no. of on-effort porpoise sightings per 100 units of survey effort; DPSE = no. of porpoises per 100 units of survey effort)

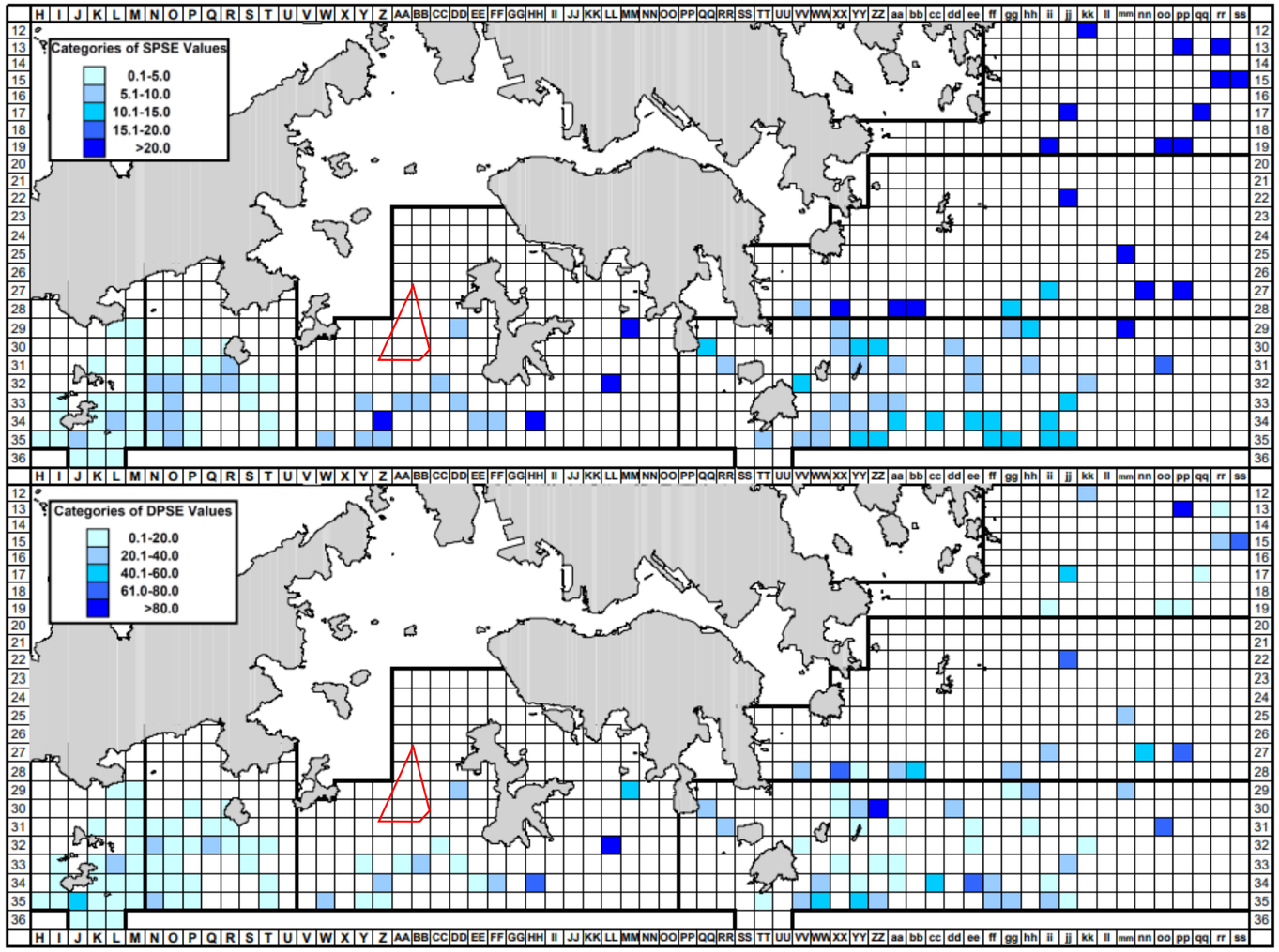


Figure 17. Density of finless porpoises with corrected survey effort per km^2 in southern and eastern waters of Hong Kong during wet season (June to November), using data collected during 2016-20 (SPSE = no. of on-effort porpoise sightings per 100 units of survey effort; DPSE = no. of porpoises per 100 units of survey effort

Figure 4A.2 **Density of Finless Porpoises in Dry and Wet Seasons during 2016-2020 (Source: AFCD Monitoring of Marine Mammals in Hong Kong Waters (2020 -2021)**

Green turtle *Chelonia mydas* is protected locally by the *Wild Animals Protection Ordinance (Cap. 170)*, and is listed as "Endangered" in the IUCN Red List of Threatened Species [26]. It is also listed in CITES Appendix I (i.e. highest protection), and is listed as “Critically Endangered” on the China Species Red List and a "Grade II National Key Protected Species" in China. As such green turtle is considered a species of conservation importance locally, regionally and globally.

The major nesting site for green turtles in Hong Kong is at Sham Wan, southern Lamma Island, which is over 5 km from the Study Area [27][28][29]. A small number of green turtles are known to nest at Sham Wan, although nesting does not occur every year. Some five green turtles were observed at Sham Wan in the nesting seasons between 1998 and 2012 [30]. The last record of green turtle nesting at Sham Wan was in 2012 when five clutches of eggs were laid, though none hatched [31].

Satellite tracking of female green turtles nesting at Sham Wan beach has been undertaken since 2002 to examine their regional migration patterns. Results of the tracking showed that the same nesting female (named “Hong Kong 2”) tracked in June 2003, August 2008 and August 2012 used the waters close to Sham Wan, in the south and southeast of Lamma Island, between subsequent clutches (***Figures 4A.3-4A.5***). She maintained a distance of within 10 km of the beach during inter-nesting periods for just over two months before migrating back to foraging grounds in the coastal waters of Dao Bach Long Vi, Vietnam [32].

Satellite tracking of a foraging green turtle in the Gangkou Sea Turtle National Nature Reserve populations in China indicated that it moved from its foraging grounds in Daya Bay to Wanshan Archipelago [33], migrating past or through Hong Kong, by Basalt Island, Tung Lung Chau and other parts of Hong Kong waters, between nesting and foraging grounds. Another tracking study conducted on post-nesting green turtles populations in Taiwan also indicated that the turtles often utilise several coastal areas as temporal residential forging sites as far as to the east coast of China [34].

Apart from the nesting records at Sham Wan, nesting of green turtles has been recorded in Shek Pai Wan and Tung O on Lamma Island, Tai Wan in Sai Kung and Tai Long Wan in Shek O in the last two decades [35]. The most recent nesting of green turtle was reported on a beach on Lantau Island in October 2016 [36]. It indicated that the turtle may use the sandy shores in South Lantau. However, no systematic survey or satellite tracking survey have been conducted on the turtles that occurred in Lantau Island and in Sai Kung. Recent news records reported green turtles in Northeastern waters and Lantau waters, including a live adult female in Tai Po in December 2012 [37], three juvenile turtles at Pak Lap Beach and Silverstrand Beach in Sai Kung and a refuse collection depot on Tin Hau

(26) Seminoff, J.A. (Southwest Fisheries Science Center, U.S.). 2004. Chelonia mydas. The IUCN Red List of Threatened Species 2004: e.T4615A11037468. http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T4615A11037468.en

(27) McGilvray F, Geermans S (1997) The status of the green turtle in Hong Kong and an action plan for its survival. Hong Kong: The Hong Kong Marine Conservation Society.

(28) Morton B (1999) On turtles, dolphins and, now, Asia's horseshoe crabs. Marine Pollution Bulletin 38: 845-846.

(29) Green turtle nesting was recorded in 2006 to the east of Hong Kong at Tai Long Wan, Sai Kung. However, this is the only record of nesting at this location and it is unlikely to be a major nesting site for green turtles in Hong Kong.

(30) Ng CK, Dutton PH, Chan SK, Cheung K, Qiu J, Sun Y (2014) Characterization and conservation concerns of Green Turtles (*Chelonia mydas*) nesting in Hong Kong, China. Pacific Science, vol. 68, no. 2:231-243.

(31) AFCD (2013) Rescued green turtle returned to the sea. Available at http://www.afcd.gov.hk/english/publications/publications_press/pr1819.html

(32) Hong Kong Wetland Park website. Available at: http://www.wetlandpark.gov.hk/en/whatsnew/press_20090325.asp

(33) Song X, Wang H, Wang W, Gu H, Chan SKF, Jiang H (2002) Satellite tracking of post-nesting movements of green turtles, *Chelonia mydas*, from Gangkou Sea Turtle National Nature Reserve, China, 2001. Marine Turtle Newsletter 97: 8-9.

(34) Cheng IJ (2000) Post-nesting migrations of green turtles (*Chelonia mydas*) at Wan-An Island, Penghu Archipelago, Taiwan. Marine Biology 137: 747-754.

(35) Ng CK, Dutton PH, Chan SK, Cheung K, Qiu J, Sun Y (2014) Characterization and conservation concerns of Green Turtles (*Chelonia mydas*) nesting in Hong Kong, China. Pacific Science, vol. 68, no. 2:231-243.

(36) http://www.ejinsight.com/20170904-marine-garbage-likely-to-keep-green-turtles-from-returning-to-hk/

(37) http://www.scmp.com/news/hong-kong/article/1138275/endangered-green-turtle-caught-tai-po-returned-sea

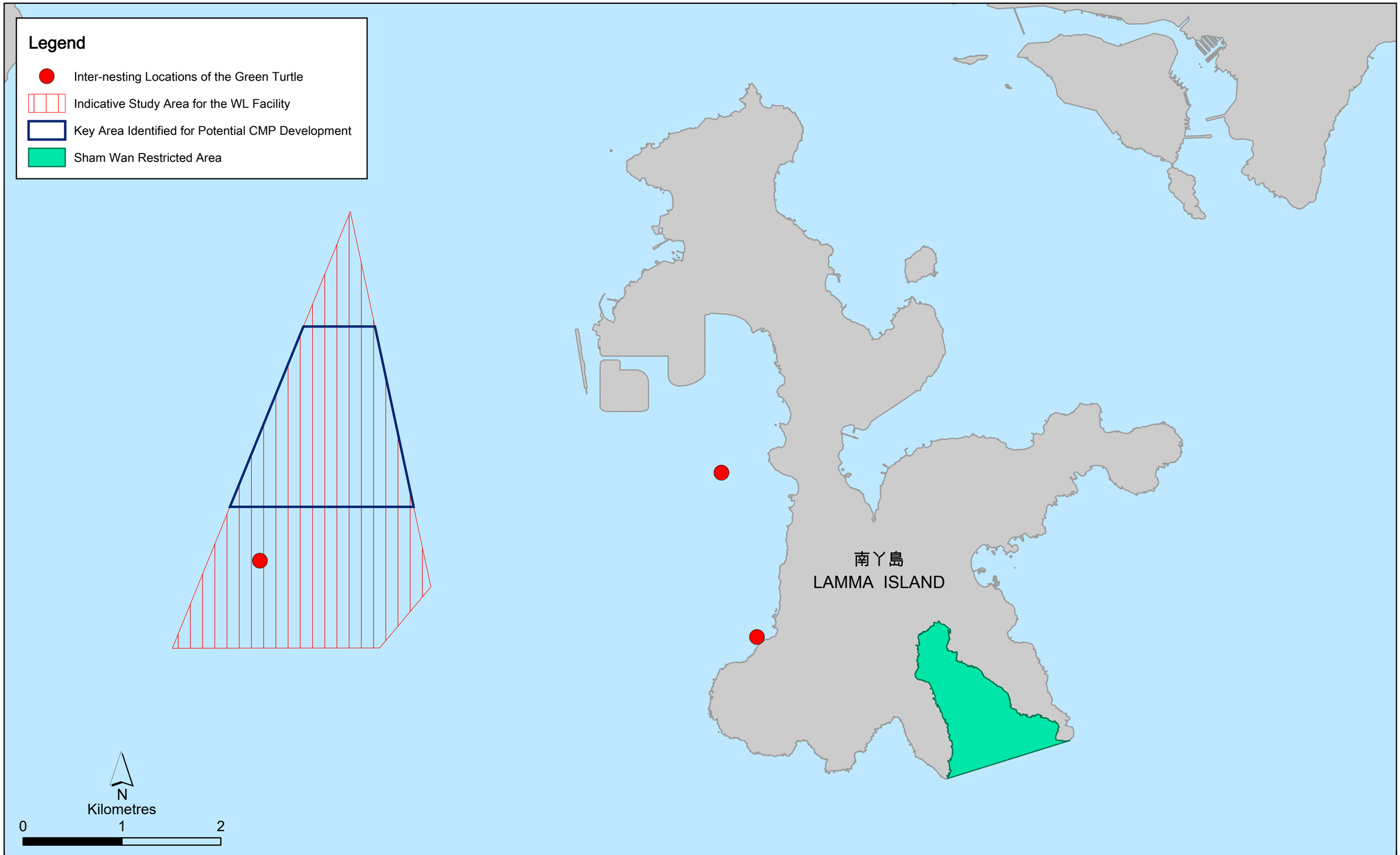


Figure 4A.3

Inter-nesting locations (red dots) from June 25 to September 4, 2003 of the green turtle (named “Hong Kong 2”) that nested on Sham Wan, Lamma Island. Map provided by AFCD

File: T:\GIS\CONTRACT\0567994\mxd\0567994_Previous_Green_Turtle_Nest_Location_2003.mxd
Date: 6/12/2021

Environmental Resources Management

ERM

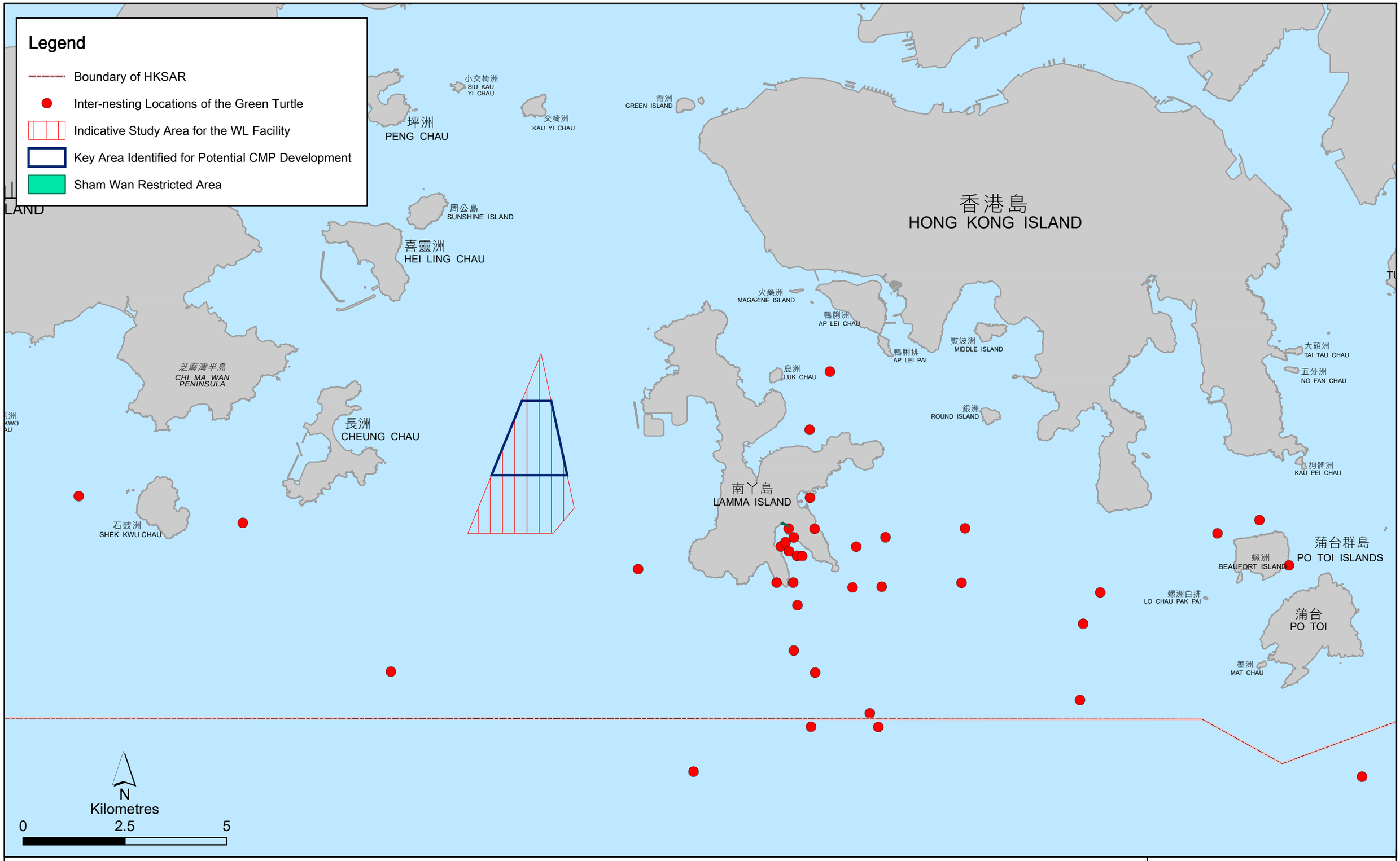


Figure 4A.4

Inter-nesting locations (red dots) from August 9 to October 12, 2008 of the green turtle (named “Hong Kong 2”) that nested on Sham Wan, Lamma Island. Map provided by AFCD

File: T:\GIS\CONTRACT\0567994\mxd\0567994_Previous_Green_Turtle_Nest_Location_2008.mxd
Date: 6/12/2021

Environmental Resources Management

ERM

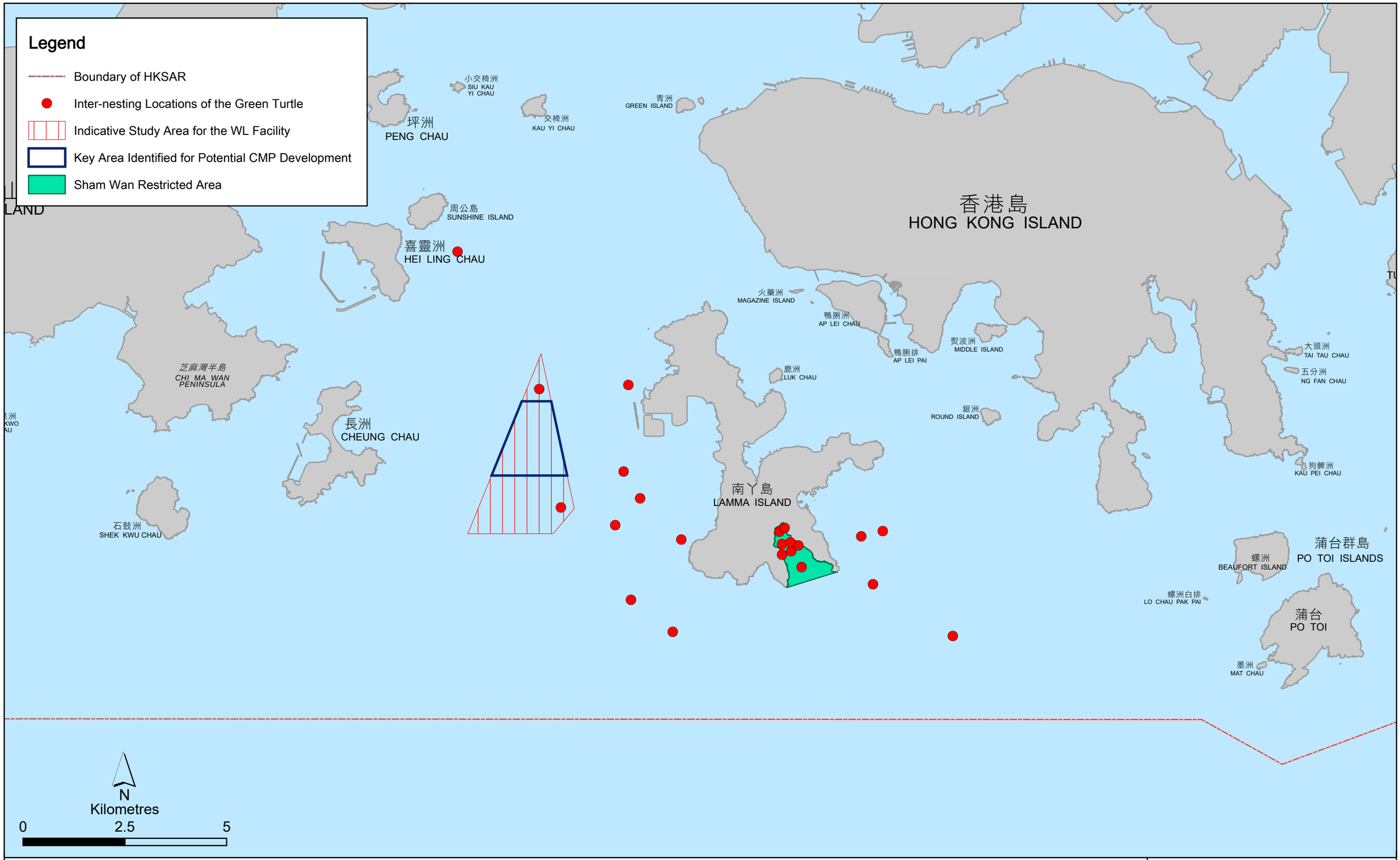


Figure 4A.5

Inter-nesting locations (red dots) from August 14 to September 30, 2012 of the green turtle that nested on Sham Wan, Lamma Island. Map provided by AFCD

File: T:\GIS\CONTRACT\0567994\mxd\0567994_Previous_Green_Turtle_Nest_Location_2012.mxd
Date: 6/12/2021

Environmental Resources Management

ERM

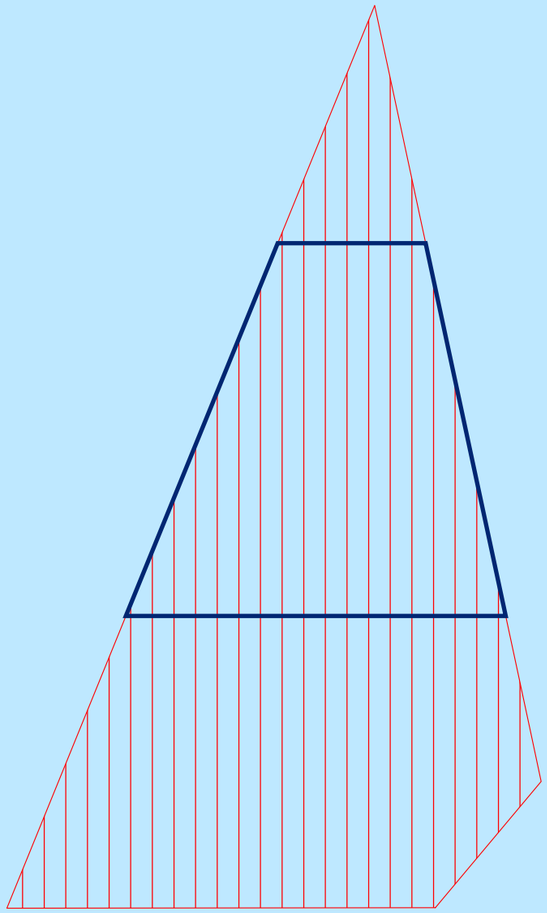
Legend

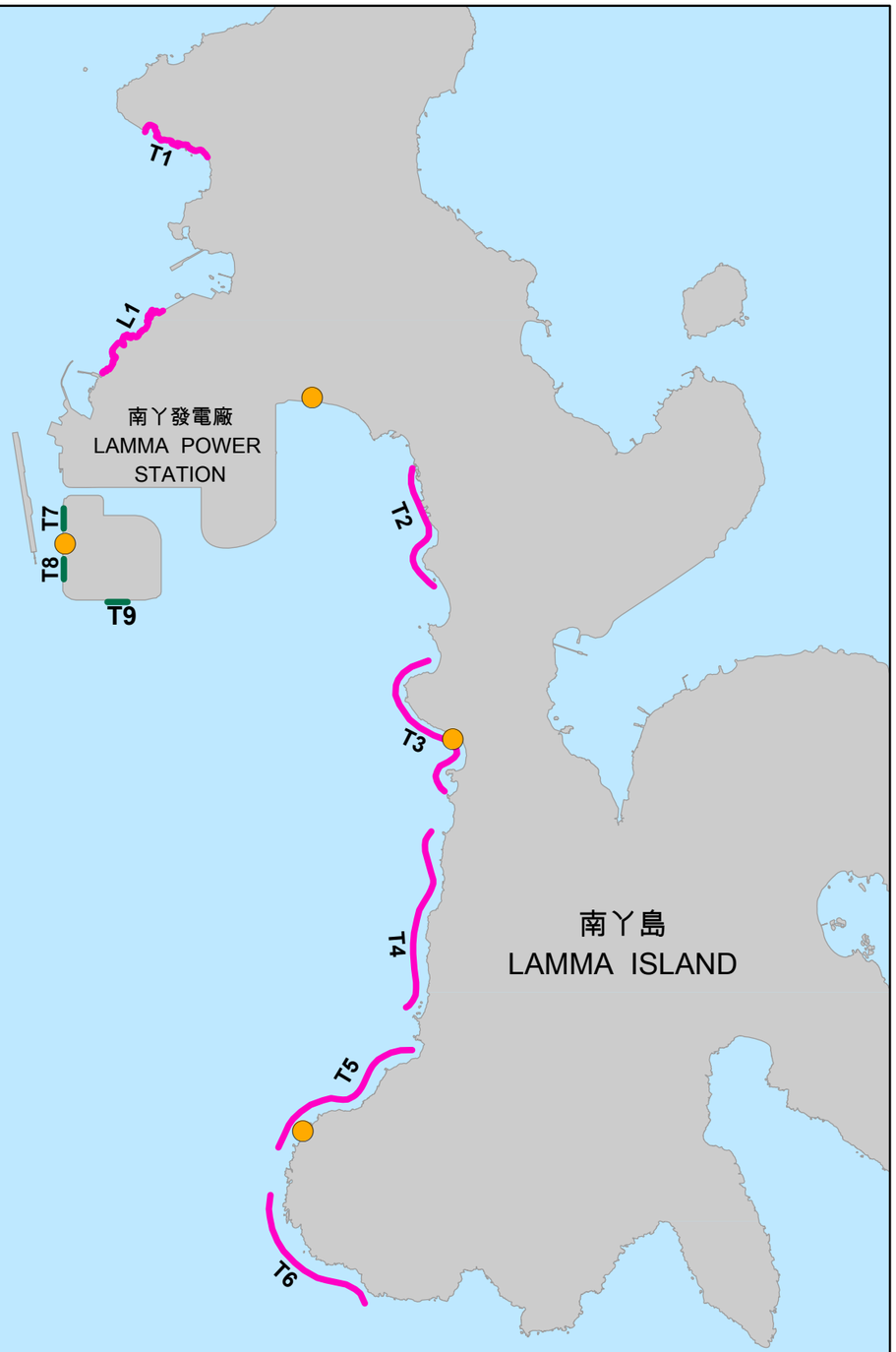
- Indicative Study Area for the WL Facility
- Key Area Identified for Potential CMP Development
- Intertidal Survey Transect in 1998
- Intertidal Survey Transect in 2008-2009 and 2016-2017
- Intertidal Survey in 2014 to 2016

T7

T8

T9





N

Kilometres

0 1 2

Figure 4A.6

Previous Intertidal Survey Transect in Lamma Power Station
(Reproduced from ERM (1998, 2008 to 2009 and 2014 to 2017))

File: T:\GIS\CONTRACT\0567994\mxd\0567994_Previous_Intertidal_Survey_Transect.mxd
Date: 6/12/2021

Environmental Resources Management

ERM

Temple Street in North Point in 2014 to 2016 [38], a dead individual with marine debris inside its stomach on Pak Lap Beach in Sai Kung in October 2015 [39], a dead juvenile turtle entangled with fishing net in Pui O Wan in January 2016 [40] and a tagged individual (HK303) in Tai She Wan in Sai Kung in November 2017 [41]. A green turtle was rescued in the waters of South Lantau in January 2021 and was then released into the southern waters of Hong Kong on 25 June 2021 with satellite transmitter attached to its carapace for tracking the movement and feeding grounds of the green turtle for future identification and monitoring [42]. Another green turtle was rescued in the Yung Shue Au Fish Culture Zone in July 2021 and was then released into the southern waters of Hong Kong on 29 October 2021 with satellite transmitter attached to its carapace for tracking the movement and feeding grounds of the green turtle for future identification and monitoring [43].

Overall, it was reported that the nesting population of green turtles in Hong Kong was relatively small, while the potential for occurrences of this species in the Study Area exist as Hong Kong lies within the wider Pacific region where green turtles use as nesting, inter-nesting and foraging habitats [44][45].

(38) AFCD (2016) Three green turtles returned to sea. Available at: https://www.afcd.gov.hk/english/publications/publications_press/pr2088.html

(39) WWF (2015) Dead Green Turtle Found Stranded in Sai Kung Shocking quantities of marine litter had accumulated inside its digestive system. Available at: https://www.wwf.org.hk/en/?14281/Press-release-cons-greenturtle-rapidresponse-Chinese-version-only

(40) https://coconuts.co/hongkong/news/young-sea-turtle-found-dead-and-entangled-fishing-net-south-lantau-island/

(41) https://tw.appledaily.com/international/20171127/VQHEUYW2URT4DVI7FWEUIFSPZE/

(42) AFCD: Press Release. Available at: https://www.afcd.gov.hk/english/publications/publications_press/pr2473.html

(43) AFCD: Press Release. Available at: https://www.afcd.gov.hk/english/publications/publications_press/pr2490.html

(44) Ng CKY, Dutton PH, Chan SKF, Cheung KS, Qiu JW, Sun YA (2014) *Op cit.*

(45) Ng CKY (2015) Conservation Implications of the Genetic Structure and Habitat Use of Green Turtles (*Chelonia mydas*) in the South China Region and Baseline Contaminant Levels in Green Turtles and Burmese Pythons (*Python bivittatus*). PhD Thesis.

土木工程拓展署
Civil Engineering and Development Department

Agreement No. CE 72/2019 (EP) Contaminated Sediment Disposal Facility at West of Lamma Island - Investigation

Method Statement for Marine Ecological Survey

20 January 2021

Project No.: 0567994

The business of sustainability

ERM

CONTENTS

1. INTRODUCTION 2
1.1 Background 2
1.2 Objectives and Scopes of this Method Statement 2
1.3 Structure of this Method Statement 3

2. MARINE ECOLOGICAL SURVEYS 4
2.1 Coral Surveys 4
2.1.1 Qualitative Spot-dive Reconnaissance Check 4
2.1.2 Semi-quantitative Rapid Ecological Assessment (REA) Survey 4
2.1.3 Drop Camera Survey 6
2.2 Subtidal Benthos Survey 8
2.2.1 Benthic Grab Survey 8
2.2.2 Parameters Measured 8
2.2.3 Laboratory Analyses 8
2.2.4 Quality Assurance & Control (QA/QC) Procedures 9
2.3 Marine Mammal Survey 9
2.4 Proposed Survey Schedule 10

List of Tables

Table 2.1 Tier I Benthic Attribute Categories 5
Table 2.2 Tier I Ordinal Ranks of Percentage Cover of Benthic Attributes 6
Table 2.3 Ordinal Ranks of Taxon Abundance 6
Table 2.4 Tentative Survey Schedule for Marine Ecological Surveys 11

List of Figures

Figure 1.1 Indicative Study Area for the Contaminated Sediment Disposal Facility at West of Lamma Island (WL Facility)
Figure 1.2 Relevant Water Control Zones for the Project
Figure 2.1 Proposed Locations for the Marine Ecological Surveys
Figure 2.2 Geophysical Survey Area and Location of Sonar Contacts
Figure 2.3 Representative Photo of the Drop Camera System Set Up
Figure 2.4 Proposed Vessel-based Marine Mammal Survey Location

Appendices

Appendix A Sighting Sheet for Marine Mammal Surveys

1. INTRODUCTION

1.1 Background

Since 1992, the Civil Engineering and Development Department (CEDD) of the Hong Kong Special Administrative Region (HKSAR) Government has been managing a number of contaminated sediment disposal facilities in the Hong Kong waters, including the contaminated mud pits (CMPs) to the east of Sha Chau (ESC) and the south of The Brothers (SB). These facilities consist of some series of seabed pits, formed by the removal of existing marine sediments, for disposal of contaminated dredged/ excavated sediment generated from works within Hong Kong. According to the latest estimate, the total remaining capacity of the existing disposal facilities at ESC can only cope with the demand up to 2027 for the public and private projects. A new sediment disposal facility has to be planned for in order to meet the sediment disposal demand after 2027 arising from routine harbour / channel / river maintenance dredging works and other projects.

To address the sediment disposal requirements upon the exhaustion of the existing CMPs, CEDD commissioned a preliminary study to assess the potential sites suitable for development into future CMPs. The study has identified that a portion of the seabed in the West Lamma Channel, between Cheung Chau and Lamma Island, will have good potential for development into a new contaminated sediment disposal facility. It was recommended to develop a new disposal facility consisting of three CMPs with a total capacity of approximate 6 million m^3 to the west of Lamma Island ("the Project").

The Project covers a new marine contaminated sediment disposal facility involving marine dumping and dredging operation (with quantity more than 500,000 m^3). In accordance with Items C.10 and C.12, Part I of Schedule 2 under the Environmental Impact Assessment Ordinance (EIAO), the Project is classified as a designated project and therefore a statutory environmental impact assessment (EIA) is required. In accordance with the requirements of Section 5(1) of the EIAO, application for EIA study brief with the Project Profile for the New Contaminated Sediment Disposal Facility to the West of Lamma Island (No. PP-594/2019) was submitted to the Environmental Protection Department (EPD) on 9 December 2019. The EIA Study Brief of the Project (No. ESB-328/2019) were then issued by EPD on 20 January 2020. The Study Area is indicatively shown in *Figure 1.1*.

1.2 Objectives and Scopes of this Method Statement

With reference to Clause 3.4.4.2 of the EIA Study Brief of the Project (ESB-328/2019), the Assessment Area for the purpose of the marine ecological impact assessment shall be the same as the Assessment Area for water quality impact assessment, covering the Southern Water Control Zone (WCZ) and Western Buffer WCZ as designated under the Water Pollution Control Ordinance (Cap. 358) (*Figure 1.2*). Baseline information within the Assessment Area is available from the following key sources:

- AFCD Marine Mammal Monitoring Reports. Available at: https://www.afcd.gov.hk/english/conservation/con_mar/con_mar_chi/con_mar_chi_chi/con_mar_chi_chi.html
- Consultancy Study on Marine Benthic Communities in Hong Kong (Agreement No. CE 69/2000)
- EIA Report for Development of a 100MW Offshore Wind Farm in Hong Kong (Register No.: AEIAR-152/2010)
- EIA Report for Development of the Integrated Waste Management Facilities Phase 1 (Register No.: AEIAR-163/2012)
- EIA Report for Hong Kong Offshore LNG Terminal (Register No.: AEIAR-218/2018)
- EIA Report for Improvement Dredging for Lamma Power Station Navigation Channel (Register No.: AEIAR-212/2017)

- Marine Ecology Baseline Review Report for Lamma Power Station Navigation Channel (Environmental Permit No. EP-535/2017)
- EIA Report for Outlying Islands Sewerage Stage 2 - South Lantau Sewerage Works (Register No.: AEIAR-210/2017)
- Provision of Compensatory Marine Park for Integrated Waste Management Facilities at an Artificial Island near Shek Kwu Chau – Investigation (Agreement No. CE 14/2012 (EP))

It is understood that the baseline information for marine ecology of the Assessment Area is available from other EIA studies conducted between 2008 and 2017 as described above, and the latest information on marine mammals was collected up to March 2020 (1). The above data sources provide up-to-date baseline information on important ecological habitats or habitats with conservation interest such as proposed Marine Park, mangroves, habitats for Finless Porpoise, 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 proposed Study Area of the WL Facility where no recent baseline information is available. Therefore, baseline surveys at selected habitats within the Assessment Area where potential impact could occur and up-to-date baseline information is not present are proposed to be conducted to update the latest ecological conditions in these areas. Furthermore, to better understand the occurrence, distribution and abundance of marine mammals especially Finless Porpoises (*Neophocaena phocaenoides*) in the Study Area, focussed marine mammal surveys within the Study Area is also proposed to be conducted.

In accordance with the requirements in *Appendix C* of the EIA Study Brief, marine ecological surveys shall be conducted for at least 6 months to fill in the identified data gaps as well as verify and update the desktop information on existing conditions of the Assessment Area. Subsequently, the information collected from desktop review and ecological surveys will be used to establish the general ecological profile and characterise the identified habitats within the Assessment Area. The proposed ecological surveys comprise:

- Coral survey;
- Subtidal benthos survey; and
- Marine mammal survey.

This *Method Statement* presents the methodology of the aforementioned marine ecological surveys. Reference has been made to the guidelines of for evaluating and assessing marine ecological impact as outlined in Annexes 8 and 16 of the EIAO-TM, the relevant Guidance Notes (GN 7/2010, GN 10/2010 and GN 11/2010), and approved EIA reports on the EIA Register.

It should be noted that the presence of species of conservation importance such as Green Turtles in the Assessment Area, if any, is likely to be opportunistic and hence is difficult to be studied by systematic dedicated field surveys. The existing uses of the Assessment Area by these species will be studied by a desktop review.

1.3 Structure of this Method Statement

Following this introductory section, the remainder of this *Method Statement* is arranged as follows:

- *Section 2* presents the methodologies for the marine ecological surveys, including coral survey and subtidal benthos survey.

(1) Hung KYS (2020). Monitoring of Marine Mammals in Hong Kong Waters (2019-20). Submitted to AFCD under AFCD/SQ/232/18

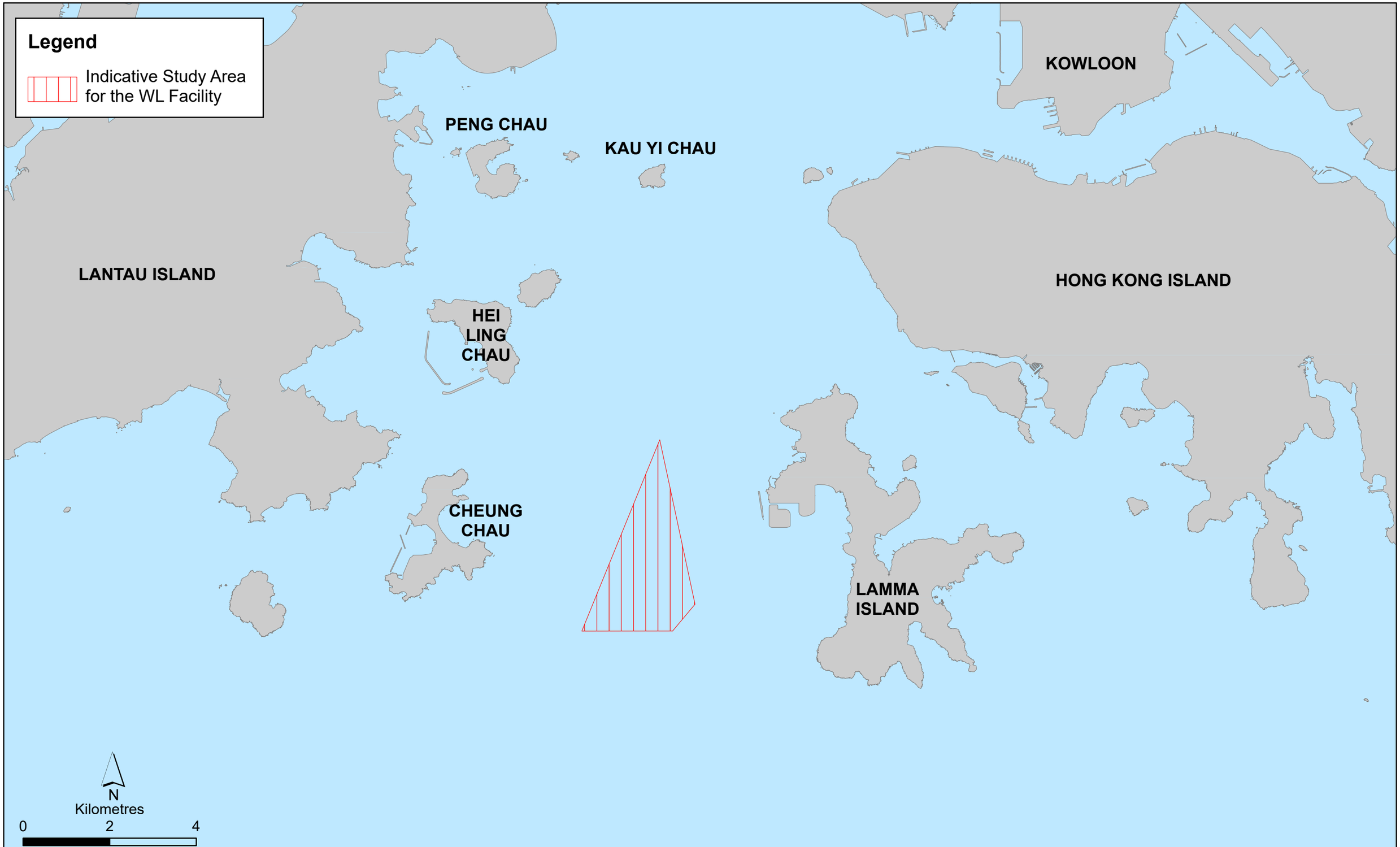


Figure 1.1

Indicative Study Area for the Contaminated Sediment Disposal Facility at West of Lamma Island (WL Facility)

File: T:\GIS\CONTRACT\0567994\mxd\0567994_Indicative_Study_Area.mxd
Date: 7/12/2020

Environmental Resources Management

ERM

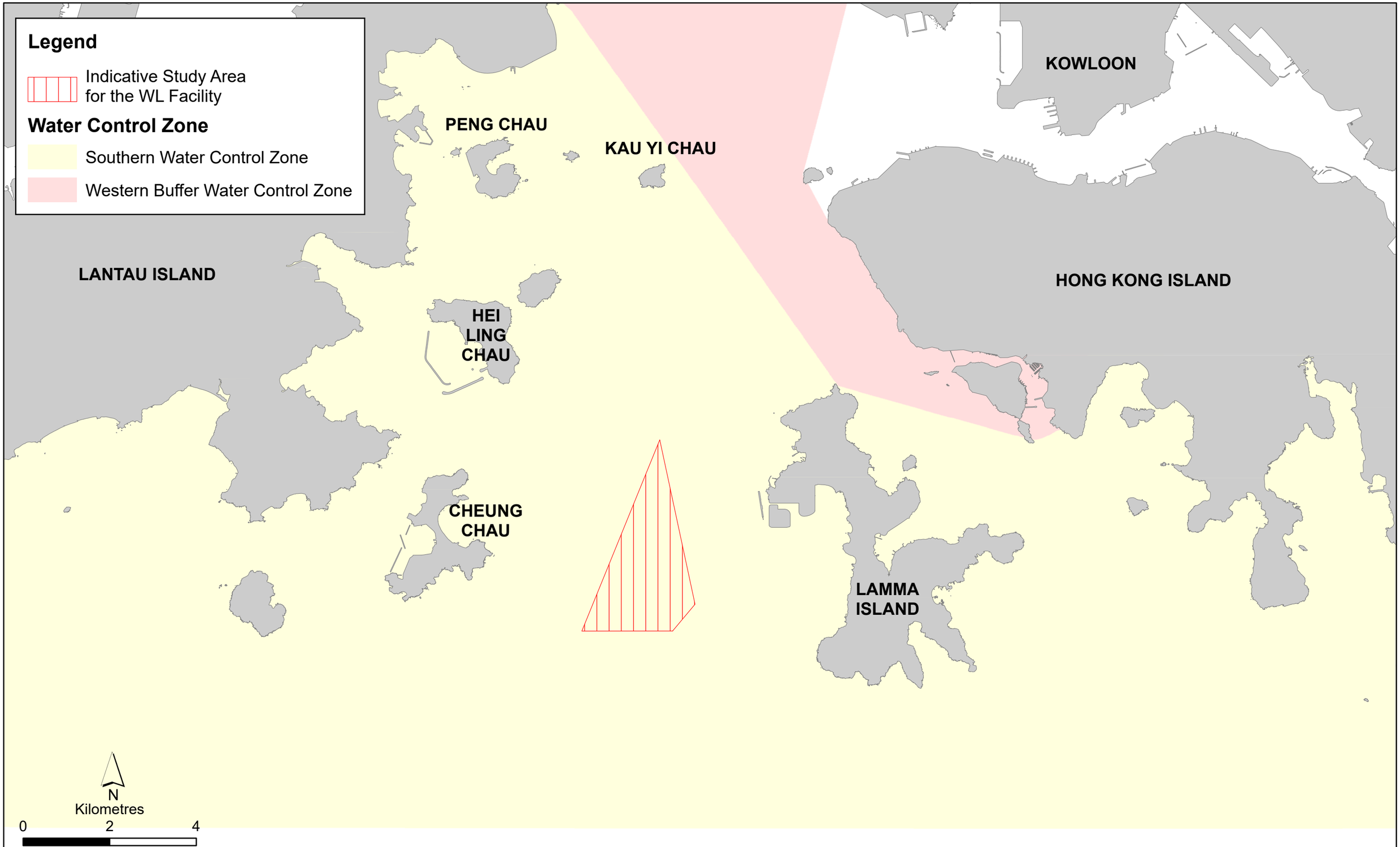


Figure 1.2

Relevant Water Control Zones for the Project

File: T:\GIS\CONTRACT\0567994\mxd\0567994_Relevant_Water_Control_Zones.mxd
Date: 7/12/2020

Environmental Resources Management

ERM

2. MARINE ECOLOGICAL SURVEYS

2.1 Coral Surveys

Coral surveys will be conducted to identify and characterize the existing ecological conditions of the seabed and shoreline within and in the vicinity of the Study Area. Coral survey locations are proposed in areas which have not been surveyed previously or in areas within the Study Area having potential as habitats for corals in order to fill information gaps. The coral surveys, which will be conducted once, will comprise of the following three components:

- Qualitative spot dive reconnaissance check;
- Semi-quantitative Rapid Ecological Assessment (REA) survey; and
- Drop Camera Survey.

2.1.1 Qualitative Spot-dive Reconnaissance Check

The qualitative spot dive reconnaissance check will investigate if coral communities e.g. (hard corals, soft corals, sea pen and black corals) are present at the areas along the natural shores in the vicinity of the Study Area. The proposed survey locations are presented in *Figure 2.1*. As the Study Area is located near principal fairways, in view of safety considerations, drop camera survey will be conducted within the Study Area instead of coral surveys on Self Contained Underwater Breathing Apparatus (SCUBA) and the details are discussed in *Section 2.1.3*.

At each survey location, a spot dive reconnaissance check will be conducted along a 100 m transect by coral specialists using SCUBA to identify the substrate type and associated sessile benthos, particularly the presence of hard and soft coral communities. The dive surveys will generally follow the bathymetry of the survey transect and will be separated into shallow water (< -5 mCD) and deep water (> -5 mCD) (to be adjusted based on the site condition and substrates). The characteristics of seabed and associated fauna along the survey transect will be recorded by photographs and videos to characterise the biological nature of the subtidal area along the survey transect. All organisms and coral colonies encountered will be identified to the lowest possible taxonomic level. This technique is regarded as standard practice for EIA marine baseline surveys in Hong Kong, with many previously approved EIA's utilising the same or similar methodology [(2) (3) (4) (5) (6) (7)].

2.1.2 Semi-quantitative Rapid Ecological Assessment (REA) Survey

When corals are recorded during the qualitative spot-dive reconnaissance check, semi-quantitative survey, Rapid Ecological Assessment (REA), will then be undertaken with reference to the EIAO Guidance Notes (*GN 11/2010*) to provide information on the relative coverage of coral and other benthic groups, in addition to creating an inventory of sessile benthic taxa used to define the community types. This technique is regarded as standard practice for EIA marine baseline surveys in

(2) ERM (2016) Hong Kong Offshore LNG Terminal. EIA Study (AEIAR-218/2018). Prepared for CLP Power Hong Kong Limited.

(3) ERM (2015) Additional Gas-fired Generation Units Project. EIA Study (AEIAR-197/2016). Prepared for Castle Peak Power Company Limited (CAPCO).

(4) ERM (2010) Development of a 100MW Offshore Wind Farm in Hong Kong. EIA Study (AEIAR-152/2010). Prepared for Hong Kong Electric

(5) ERM (2003) The Proposed Submarine Gas Pipeline From Cheng Tou Jiao Liquefied Natural Gas Receiving Terminal, Shenzhen to Tai Po Gas Production Plant, Hong Kong. EIA Study (EIA-089/2003). Prepared for The Hong Kong and China Gas Company Limited.

(6) AECOM (2016) Sha Tin Cavern Sewerage Treatment Works. EIA Study (AEIAR-202/2016). Prepared for the Drainage Services Department.

(7) Black & Veatch Hong Kong Limited (2016) Outlying Islands Sewerage Stage 2 – South Lantau Sewerage Works. EIA Study (AEIAR-210/2017). Prepared for Drainage Services Department.

Legend

- Indicative Study Area for the WL Facility
- Proposed Location for Coral Surveys
- Proposed Location for Drop Camera Survey
- Proposed Location for Benthic Grab Survey

C1
C2
C3
D1
D2
D3
D4
D5
B1
B2
B3
B4
B5
B6
B7

CHEUNG CHAU

LAMMA ISLAND

N

Kilometres

0 0.5 1

Figure 2.1

Proposed Locations for the Marine Ecological Surveys

File: T:\GIS\CONTRACT\0567994\mxd\0567994_Marine_Ecological_Surveys.mxd
Date: 10/12/2020

Environmental Resources Management

ERM

Hong Kong, with many previously approved EIA's utilising the same or similar methodology [8] [9] [10] [11] [12] [13]. The methodology outlined has been modified from the standardised REA survey technique established for the assessment of coral communities on the Great Barrier Reef [14] for the marine environment of Hong Kong [15].

Based upon the information gathered in the qualitative spot-dive reconnaissance check, such areas where coral appear to be the most abundant, the REA survey will then be performed along a 100 m transect. REA surveys are proposed to be conducted at shallow and deep water (< -5 mCD and > -5 mCD zones dependent on the bathymetry of the site; to be adjusted based on the site condition and substrates) along the shoreline to search for hard coral, octocoral and black coral. After the transect line has been laid, video footage will be taken for the benthos along the transect and the assessment of the benthic cover (Tier I) and taxon abundance (Tier II) will be conducted in a swathe ~ 2 m wide, 1 m either side of each transect. The belt transect width is dependent on underwater visibility experienced, with regards to the marine environment in Hong Kong this generally consists of a swathe ~2 m wide, 1 m either side of the each transect. An explanation of the two assessment categories (Tiers) used in the survey is presented below.

Tier I - Categorisation of Benthic Cover

Upon the completion of each survey transect, ecological and substratum attributes (*Table 2.1*) will be assigned to standard ranked (ordinal) categories (*Table 2.2*).

Table 2.1 Tier I Benthic Attribute Categories

Ecological Attributes	Substratum Attributes
Hard coral	Bedrock
Dead coral	Continuous pavement
Octocoral (Soft corals and Gorgonians)	Rocks (<26 cm)
Black coral	Large boulders (>50 cm)
Dead standing coral	Small boulders (<50 cm)
Macroalgae	Rubble
Other Benthos (including sponges, zoanthids, ascidians and bryozoans)	Sand
	Mud/ Silt
	Other

(8) ERM (2016) (AEIAR-218/2018). *Op. Cit.*

(9) ERM (2015) (AEIAR-197/2016). *Op. Cit.*

(10) ERM (2010) (AEIAR-152/2010). *Op. Cit.*

(11) ERM (2003) (EIA-089/2003). *Op. Cit*

(12) AECOM (2016) (AEIAR-202/2016). *Op. Cit.*

(13) Black & Veatch Hong Kong Limited (2016) (AEIAR-210/2017). *Op. Cit.*

(14) DeVantier LM, De'Ath G, Done TJ, Turak E (1998) Ecological assessment of a complex natural system: A case study from the Great Barrier Reef. *Ecological Applications* 8: 480-496.

(15) Fabricius KE, McCorry D (2006) Changes in octcoral communities and benthic cover along a water quality gradient in reefs of Hong Kong. *Marine Pollution Bulletin* 52: 22-33.

Table 2.2 Tier I Ordinal Ranks of Percentage Cover of Benthic Attributes

Rank	Percentage Cover (%)
0	None recorded
1	1-5
2	6-10
3	11-30
4	31-50
5	51-75
6	76-100

Tier II - Taxonomic Inventories to Define Types of Benthic Communities

An inventory of benthic taxa will be compiled for each transect. Taxa will be identified *in situ* to the following levels:

- Scleractinian (hard) corals to species, where possible;
- Soft corals, anemones and conspicuous macroalgae to genus level where possible;
- Other benthos (including sponges, zoanthids, ascidians and bryozoans) recorded to genus level, where possible, or phylum plus growth form.

Following the completion of the survey of each transect, each taxon in the inventory will be ranked in terms of abundance in the community (*Table 2.3*). These broad categories rank taxa in terms of relative abundance of individuals, rather than the contribution to benthic cover along each transect. The ranks are visual assessments of abundance, rather than quantitative counts of each taxon. Representative photos of organisms will be taken.

Table 2.3 Ordinal Ranks of Taxon Abundance

Rank	Abundance
0	Absent
1	Sparse
2	Uncommon
3	Common
4	Abundant
5	Dominant

The photographs and videos recorded for each REA transect will be reviewed in order to compile the REA data. Species lists, species richness and the relative coverage for ecological and substratum attributes will be presented.

2.1.3 Drop Camera Survey

Marine geophysical surveys were conducted for the Project to study the seabed features and shallow geology within and in the vicinity of the Study Area. Review of the survey findings identified 17 sonar contacts (SC01 to SC17) within and in the vicinity of the Study Area as shown in *Figure 2.2*. Amongst these sonar contacts, a number of small patches of hard substrate (e.g. buoy clump weight, possible tire, rope/chain, high relief object) were identified..

In order to characterise the substrate and benthic communities of the seabed within the Study Area, in particular the small patches of hard substrate, taking safety into consideration, the use of handheld drop camera / underwater drone system will be utilised and deployed on vessel, mitigating the need of any person working underwater. This technique has been used for marine baseline surveys in Hong

Legend

- Sonar Contacts
- Indicative Study Area for the WL Facility
- Geophysical Survey Area

Sonar Contact	Description
SC01	Buoy clump weight
SC02	Debris
SC03	Buoy clump weight
SC04	Possible tire
SC05	Possible tire
SC06	Debris
SC07	Debris
SC08	High relief object
SC09	Possible tire
SC10	Possible tire
SC11	Debris
SC12	Debris
SC13	Debris
SC14	Debris
SC15	Possible rope/ chain
SC16	Possible tire
SC17	Debris

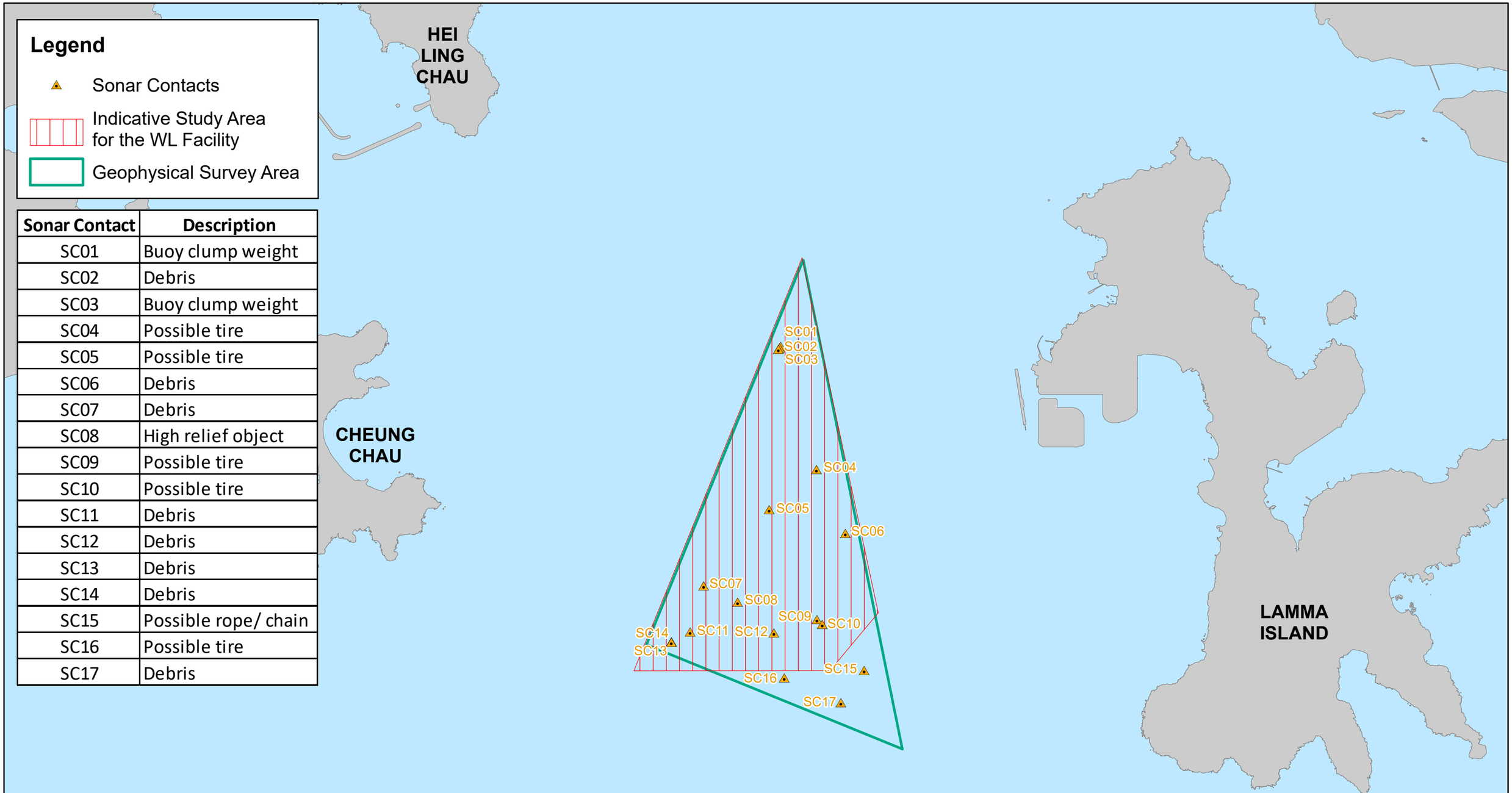


Figure 2.2

Geophysical Survey Area and Location of Sonar Contacts

File: T:\GIS\CONTRACT\0567994\mxd\0567994_Geophysical_Survey_Area_and_Sonar_Contact_v2.mxd
Date: 21/12/2020

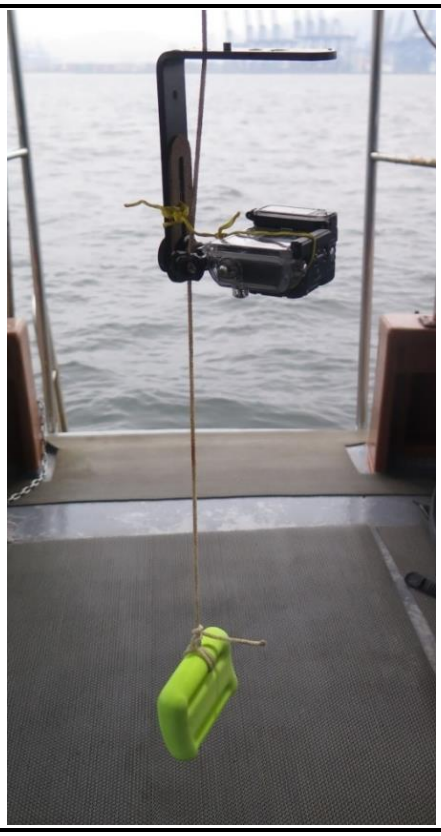
Environmental Resources Management

ERM

Kong and overseas, with previously approved EIA and projects utilising the same or similar methodology [16] [17] [18]. The drop camera system will consist of a high quality digital video camera (e.g. GoPro HERO3+ or equivalent) mounted to a weight that could be lowered onto the seabed and towed above it to collect video footages and photographs (*Figure 2.3)*. These techniques allow greater survey coverage in a relatively short period of time compared to the SCUBA surveys especially for areas which are exposed and offshore.

The survey locations for drop camera survey are presented in *Figure 2.1*. During the survey, the drop camera /underwater drone system will be deployed from a support vessel at the survey location. Once the drop camera system reaches the bottom, the operator will allow the system to drift with the current, or alternatively move the system slowly and steadily over the substrate. Video footage and imagery of the seabed will be taken continuously throughout this deployment for at least two (2) minutes, with ~4m^2 of seabed recorded per second under wide angle camera setting (i.e. ~480m^2 for 2 minutes) if the camera is placed ~1m above seabed, to characterise the seabed substrate and benthic communities. Following retrieval, the footage and photographs will be examined ex-situ and verify the presence / absence of corals or other habitats / organism of interest.

Figure 2.3 Representative Photo of the Drop Camera System Set Up



(16) ERM (2010) (AEIAR-152/2010). *Op. Cit.*

(17) ERM-HK and ERM-Malaysia (2009) Marine Survey for Coral Habitats: Photo Quadrat Assessment (PQA) of Mampak, For Confidential Client.

(18) ERM-Hong Kong and ERM-Malaysia (2008) Coral Habitat Verification and Assessment Study for Block A-1 and Block A-3 Gas Development, Myanmar. For Confidential Client.

2.2 Subtidal Benthos Survey

Subtidal soft bottom surveys will be conducted as described below to characterize the existing ecological conditions of the seabed within the Study Area. Sampling locations, equipment involved, sampling procedure, laboratory analytical procedures, and QA/QC requirements for the proposed surveys are detailed below, with the methods similar to that of previously approved EIAs in Hong Kong.

2.2.1 Benthic Grab Survey

Benthic sediment samples will be collected within the Study Area for biological analyses (i.e. taxonomic identification and abundance of subtidal benthos) with particular attention on the presence of amphioxus or any notable marine benthos. Seabed sediment samples will be collected from seven (7) sampling locations representative of the subtidal soft-bottom habitats (*Figure 2.1)*. Amphioxus habitat has not been identified at or in vicinity of the Study Area from the literature, and as reported in the literature, amphioxus are mostly found in shallow, subtidal sand flats [(19)]. Consequently the muddy soft bottom of the Study Area may not be suitable habitats for amphioxus and the sampling locations are proposed within the Study Area to confirm this. At each location, one grab sample will be collected from the seabed. The number of sampling locations is considered sufficient given the scale of the Project and the relatively homogenous nature of sediments at the Study Area. Sampling will be conducted twice, once in the wet season and once in the dry season.

The benthic grab surveys will be conducted utilizing a modified Van Veen grab sampler (960 cm^2 sampling area; 11,000 cm^3 capacity) with a supporting frame attached to a swiveling hydraulic winch cable. Sediments for biological analysis will be sieved on board the survey vessel. The sediments will be washed into a sieve stack (comprising 1 mm^2 and 500 μm^2 meshes) and gently rinsed with seawater to remove all fine material. Following rinsing, any material remaining on the two screens will be combined and carefully rinsed using a minimal volume of seawater into pre-labelled thick triple-bagged ziplock plastic bags. A 5% solution of borax-buffered formalin containing Rose Bengal in seawater will then be added to the bag to ensure tissue preservation. Samples will be sealed in plastic containers for transfer to the taxonomy laboratory for sorting and identification.

2.2.2 Parameters Measured

The parameters to be measured for subtidal benthos analysis are:

- Total number of species (diversity)
- Abundance of each species recorded (biomass)

In addition to the above parameters, other relevant data will also be measured and recorded, inclusive but not limited to; time, weather conditions, sea conditions, special phenomena (if any), and other activities undertaken around the sampling location that may influence the sampling results.

2.2.3 Laboratory Analyses

The benthic laboratory will perform sample re-screening after the samples have been held in formalin for a minimum 24 hours to ensure adequate fixation of the organisms. Individual samples from the 500 μm^2 and 1 mm^2 mesh sieves will be gently rinsed with fresh water into a 250 μm^2 sieve to remove the formalin from the sediments. Sieves will be partially filled while rinsing a specific sample to maximize washing efficiency and prevent loss of material. All material retained on the sieve will be placed in a labeled plastic jar, covered with 70% ethanol, and lightly agitated to ensure complete mixing of the alcohol with sediments. Original labels will be retained with the re-screened sample material.

(19) Chen Y, Cheung SG, Shin PKS (2013). A baseline study of benthic community associated with Amphioxus Sand in subtropical Hong Kong. Marine Pollution Bulletin. 72, 274–280.

Standard and accepted techniques will be used for sorting organisms from the sediments. Small fractions of a sample will be placed in a petri dish under a 10-power magnification dissecting microscope and scanned systematically with all animals and fragments removed using forceps. Each petri dish will be sorted at least twice to ensure removal of all animals. Organisms representing major taxonomic groups, such as Polychaeta, Arthropoda, Mollusca and miscellaneous taxa will be sorted into separate, labeled vials containing 70% ethanol.

Taxonomic identifications will be performed by qualified and experienced specialist using stereo dissecting and high-power compound microscopes. These are generally to the species level except for unidentified taxa, which will be identified to genera as far as practical. The careful sampling procedure employed minimizes fragmentation of organisms. If breakage of soft-bodied organisms occurred, only anterior portions of fragments will be counted, although all fragments will be retained and weighed for biomass determinations (wet weight).

2.2.4 Quality Assurance & Control (QA/QC) Procedures

The sediment samples will be evaluated for acceptance based upon the degree of disturbance, penetration depth, and amount of leakage from the grab. In the following cases, a sediment sample would be rejected and another sample collected:

- The sediment sampler doors open in recovery, causing possible surface washout.
- Half sample obtained where the sediment sampler had not struck a flat area of seabed, or improper deployment of benthic grab, or half sample of sediment.
- Disruption of the sample by heavy shaking or contamination (these can occur when a sample is badly handled or if the sediment sampler strikes the side of the vessel during operations).
- The sample represents less than 30% of the sediment sampler's total capacity (i.e. less than 15 cm penetration).
- Grab deployment location deviates from the designated position [20].

Before sieving each sample on site, the grab, frame and sample containers will be washed with seawater to avoid cross contamination of samples.

Sample integrity for subtidal benthos analyses should be maintained for the duration of the survey, demobilization through to delivery to the appropriate laboratory. All samples should be accompanied with a Chain of Custody form to document sample management and delivery.

2.3 Marine Mammal Survey

To better understand the occurrence, distribution and abundance of marine mammals especially Finless Porpoises (*Neophocaena phocaenoides*) in the Study Area, vessel-based marine mammal survey by means of systematic line-transect boat survey will be undertaken to examine the distribution, abundance, encounter rate and density of marine mammals within the Study Area. The methodology of the proposed survey is consistent and compatible with that adopted in the long-term marine mammal monitoring programme conducted by AFCD since 1995 to allow potential comparisons and pooling data for analysis. Line-transect boat survey technique for marine mammals has been standardised in Hong Kong waters so that data from all surveys are directly comparable.

The survey areas will focus on the Study Area and the proposed survey transects are presented in *Figure 2.4*. The transect boat survey will be conducted from a 15 m inboard vessels (with an open upper deck above the pilothouse, providing a mostly unobstructed 180° view of the area ahead of the vessel), weather permitting (Beaufort 0-5, no heavy rain, and visibility > 1,200 m). The marine mammal observer (MMO) team will conduct searches and observations from the flying bridge area, 4-

(20) Concerns about positional errors must be weighed against the aims of the survey. Horizontal accuracies to within a few metres are acceptable distance.

Legend

Vessel-Based Marine Mammal Survey Location

Indicative Study Area for the WL Facility

CHEUNG CHAU

LAMMA ISLAND

N

Kilometres

0 1 2

Figure 2.4

Proposed Vessel-based Marine Mammal Survey Location

File: T:\GIS\CONTRACT\0567994\mxd\0567994_Proposed_Vessel-based_Marine_Mammal_Survey_Location.mxd
Date: 14/1/2021

Environmental Resources Management

ERM

5 m eye height above the water surface. In order to ensure the quality of the data and allow consistency with the long-term AFCD database, and take consideration of the sea conditions of the monitoring site, a team of three qualified and trained MMOs will make up the survey team. As the vessel transits the transect lines at a relatively constant speed of 13-15 km/hr, the primary MMO searches for marine mammals continuously through 7 X 50 marine binoculars. A second MMO searches with unaided eye and fills out data sheets. Both MMOs search ahead of the vessel, between 270° and 90° (in relation to the bow, which is defined as 0°). MMOs rotate positions approximately every 30 minutes. There will be an additional MMO on the boat, who rotate into position to give observers a rest after each hour of search effort, thereby minimizing fatigue. Effort data collected during on-effort monitoring periods includes time and position for the start and end of search effort, vessel speed, sea state (Beaufort scale), visibility, and distance travelled in each series (a continuous period of search effort). When marine mammals are sighted, the MMO fills out a sighting sheet (*Appendix A*), and generally the team is taken off-effort and the vessel is diverted from its course to approach the marine mammal group for group size estimation, behavioural observations, and collection of identification photos. The sighting sheet includes information on initial sighting angle and distance, position of initial sighting, sea state, group size and composition, and behaviour, such as response to the survey vessel and associations with vessels. Position, distance travelled, and vessel speed are obtained from a hand-held Global Positioning System (GPS) unit. All records of marine mammal sightings will be collated, compiled and integrated with Geographic Information System (GIS).

Positions of sightings together with group sizes, activities and calf occurrence will be plotted on figures for illustration of spatial and temporal patterns of dolphin and porpoise distribution, if any. The method for line transect analysis of marine mammal abundance and encounter rate will follow the established approach for AFCD long-term marine mammal monitoring. It should be noted that as Finless Porpoises are cryptic and difficult to identify as unique individuals with no useful natural markings, the potential of double counting cannot be eliminated and hence rendering any abundance estimation confounded with serious violation of assumption under the line-transect survey method; therefore such analysis is not proposed to be completed for Finless Porpoises, which is the same approach for the AFCD long-term marine mammal monitoring.

Vessel-based marine mammal surveys are proposed to be conducted for six months between March and August 2021, covering both the peak (March to May) and non-peak (June to August) season of occurrence for Finless Porpoises based on the data from long-term marine mammal monitoring programme conducted by AFCD [21]. Each transect line is proposed to be surveyed once per month (i.e. one (1) survey day per month will be conducted).

2.4 Proposed Survey Schedule

The proposed survey schedule for marine ecological surveys to be conducted for the Project, as outlined in *Sections 2.1* to *2.3*, is presented in ***Table 2.4***.

(21) Hung KYS (2020). *Op cit.*

Table 2.4 Tentative Survey Schedule for Marine Ecological Surveys

Survey	Method	Mar 21	Apr 21	May 21	Jun 21	Jul 21	Aug 21
Coral Survey	Qualitative Spot-dive Reconnaissance Check				✓		
	REA				✓		
	Drop Camera Survey					✓	
Subtidal Benthos Survey	Benthic Grab Survey	✓		✓			
Marine Mammal Survey	Systematic line-transect boat survey	✓	✓	✓	✓	✓	✓

APPENDIX A

SIGHTING SHEET FOR MARINE MAMMAL SURVEY

DOLPHIN / PORPOISE SIGHTING SHEET

HIGH PRIORITY DATA (Record at Initial Sighting)

Date _____ Time _____ Sighting No. _____

Sighting Distance (metres) _____ Sighting Angle (O) _____

Sighting Angle – Dolphins _____ Sighting Angle – Bow of Boat _____

Sighting Position (Initial) _____

Sighting Position (dolphin) _____ (Trip: _____ km)

LOW PRIORITY DATA (Record During or After Sighting)

Species □ Humpback Dolphin **Effort** □ On

□ Finless Porpoise □ Off

□ Other

Seen By _____

Group Size Best _____ High _____ Low _____

CWD* Group Composition† UC _____ UJ _____ SJ _____

SS _____ SA _____ UA _____

FP‡ Group Composition Calves _____ Adults _____

Beaufort □ 0 □ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7+

Boat Assoc. □ None □ Pair □ Shrimp □ Hang

□ Other _____

Photos □ Yes □ No

Survey Area _____

Survey Type _____

BEHAVIOUR / COMMENTS

□ Feeding □ Socializing □ Travelling □ Milling/Resting

□ Breaching □ Spy-hopping □ Porpoising

Other Behaviour _____

Identified Individual(s) _____

Other Comments _____

_____

_____

* CWD = Chinese White Dolphin

† UC = Unspotted Calf, UJ = Unspotted Juvenile, SJ = Spotted Juvenile, SS = Spotted Sub-Adult, SA = Spotted Adult, UA = Unspotted Adult

‡ Finless Porpoise

Table 4C.1 Benthic Attributes along the Survey Transects at Survey Locations

	C1		C2		C3	
	Shallow	**Deep**	**Shallow**	**Deep**	**Shallow**	**Deep**
Transect depth (mCD)	-2 to -3	-6 to -8	-2 to -4	-6 to -7	-2 to -3	-6 to -8
Seabed attributes						
Bedrock	0	1	5	3	2	0
Continuous pavement	0	0	0	0	0	0
Rock (<26cm)	0	0	0	0	0	0
Large Boulder (diameter >50cm)	5	4	3	5	6	6
Small Boulder (diameter <50cm)	3	3	0	0	0	0
Rubble	1	1	0	0	0	1
Sand	1	2	2	2	1	1
Mud/Silt	1	1	0	0	0	0
Other	0	0	0	0	0	0
Ecological attributes						
Hard coral	1	1	2	1	1	1
Dead coral	0	0	0	0	0	0
Octocoral (Soft corals and gorgonians)	0	2	1	2	0	1
Black coral	0	0	0	1	0	0
Dead standing coral	0	0	0	0	0	0
Macroalgae	1	0	1	1	0	0
Other Benthos (sponges, zoanthids, ascidians and bryozoans)	2	1	2	1	2	0

Notes:

(1) 0 = 0%, 1 = <5%, 2= 6 -10%, 3 = 11 – 30%, 4 = 31- 50%, 5 = 51 – 75%, 6 = 76 – 100%

Table 4C.2 Coral Species and other Benthos Recorded Along the Survey Transects

	C1 Shallow	C1 Deep	C2 Shallow	C2 Deep	C3 Shallow	C3 Deep
Hard Coral						
Bernardpora stutchburyi	0	1	3	2	0	0
Cyphastrea serailia	2	0	0	0	0	0
Duncanopsammia peltata	0	0	0	1	0	0
Oulastrea crispata	0	2	1	1	3	0
Plesiastrea versipora	2	0	1	0	0	0
Psammocora haimiana	0	0	1	0	0	3
Psammocora profundacella	3	0	0	1	0	3
Leptastrea purpurea	0	0	1	0	0	0
Porites sp.	0	0	3	0	3	0
Ahermatypic Hard Coral						
Tubastrea/ Dendrophyllia sp.	0	0	0	2	0	3
Balanophyllia sp.	0	3	0	2	0	1
Octocoral						
Dendronephthya sp.	0	1	0	1	0	3
Echinogorgia sp.	0	0	1	1	0	0
Echinomuricea sp.	0	3	0	2	0	1
Euplexaura sp.	0	1	1	1	0	0
Menella sp. / *Paraplexaura* sp.	0	3	3	3	0	1
Black Coral						
Antipathes sp.	0	0	0	1	0	0
Other Benthos						
Bryozoans	4	3	3	3	4	1
Zoanthids	0	0	0	0	0	0
Sponges	3	1	3	1	0	0
Spheractis cheungae	1	0	0	0	2	2
Nemanthus sp.	0	0	0	1	0	0
Pennaria sp.	0	1	0	1	0	1
Ascidians	1	1	1	1	1	0
Cerianthus sp.	0	1	0	0	0	0
Perna viridis	1	0	1	0	1	0
Sabellastarte japonica	1	1	0	0	0	0
Amphiroa sp.	1	0	1	1	0	0
Corallina sp.	0	0	1	0	0	0

Notes:

(1) 0=absent, 1=rare, 2=uncommon, 3=common, 4=abundant, 5=dominant

(2) The ranks shown in the Table above indicate the relative abundance of each coral in relation to other corals in the community. In other words, these broad categories rank taxa in terms of relative abundance of individuals, rather than the contribution to benthic cover along each transect. The ranks are subjective assessments of abundance, rather than quantitative counts of each taxon. For instance, if a coral is ranked as 'common', it means it was more frequent than other coral species along the transect. It should be borne in mind that coral cover along all of the transects where corals occurred was very low (<5% cover).

Table 4C.3 Records of Substratum and Ecological Attributes from the Drop Camera Survey

Survey Location	Substratum Attributes			Ecological Attributes				Others Observations
	Silty Mud	Sand	Rock	Hard coral	Soft coral	Gorgonian	Black coral	
D1	✓	✓	-	-	-	✓	-	-
D2	✓	-	-	-	-	✓	-	-
D3	✓	✓	-	-	-	-	-	Unidentified Worm
D4	-	✓	-	-	-	✓	-	
D5	-	✓	-	-	-	-	-	Unidentified Fish

Table 4D.1 Subtidal Benthos Survey Raw Data - Dry Season Abundance

Kingdom	Phylum	Class	Order	Family	Species	B1	B2	B3	B4	B5	B6	B7
Animalia	Annelida	Polychaeta	Amphinomida	Amphinomidae	*Linopherus paucibranchiata*	0	0	0	0	0	1	0
Animalia	Annelida	Polychaeta	Eunicida	Eunicidae	*Eunice indica*	0	1	0	0	0	0	0
Animalia	Annelida	Polychaeta	Eunicida	Eunicidae	*Lysidice ninetta*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Eunicida	Eunicidae	*Paucibranchia stragulum*	0	0	0	0	0	2	0
Animalia	Annelida	Polychaeta	Eunicida	Lumbrineridae	*Sergioneris nagae*	0	2	1	1	0	0	0
Animalia	Annelida	Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris* sp.	0	0	0	0	2	0	2
Animalia	Annelida	Polychaeta	Eunicida	Onuphidae	*Onuphis eremita*	0	1	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Chrysopetalidae	*Paleaequor breve*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Glyceridae	*Glycera alba*	0	4	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Goniadidae	*Glycinde bonhourei*	0	1	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Hesionidae	*Oxydromus angustifrons*	0	1	1	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus dibranchis*	1	0	0	1	1	1	4
Animalia	Annelida	Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus sinensis*	0	0	0	0	0	1	1
Animalia	Annelida	Polychaeta	Phyllodocida	Nephtyidae	*Micronephtys sphaerocirrata*	0	0	0	1	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Nereididae	*Nectoneanthes oxypoda*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Nereididae	Nereididae spp.	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Nereididae	*Paraleonnates uschakovi*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Paralacydoniidae	*Paralacydonia paradoxa*	0	3	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Phyllodocidae	*Eteone* sp.	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Phyllodocidae	*Nereiphylla castanea*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Pilargidae	*Otopsis* sp.	0	1	1	0	0	1	0
Animalia	Annelida	Polychaeta	Phyllodocida	Pilargidae	*Pilargis* sp.	0	1	1	0	0	0	2
Animalia	Annelida	Polychaeta	Phyllodocida	Pilargidae	*Sigambra hanaokai*	0	5	0	0	1	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Polynoidae	*Harmothoe* sp.	1	2	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Sigalionidae	*Ehlersileanira incisa*	0	1	0	0	0	0	0
Animalia	Annelida	Polychaeta	Sabellida	Oweniidae	*Owenia fusiformis*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Magelonidae	*Magelona* sp.	0	0	1	0	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Poecilochaetidae	*Poecilochaetus* sp.	1	2	0	1	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Aonides oxycephala*	0	1	0	0	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Laonice cirrata*	0	1	1	1	1	0	1
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Paraprionospio pinnata*	0	1	0	0	2	0	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Prionospio ehlersi*	1	6	2	1	2	0	1
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Prionospio malmgreni*	1	7	0	0	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Scolelepis* sp.	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Ampharetidae	*Anobothrus* sp.	0	0	0	0	0	3	0
Animalia	Annelida	Polychaeta	Terebellida	Ampharetidae	*Isolda pulchella*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Cirratulidae	*Chaetozone* sp.	0	0	1	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Cirratulidae	*Cirriformia* sp.	0	6	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Cirratulidae	*Tharyx* sp.	0	4	0	0	2	0	4
Animalia	Annelida	Polychaeta	Terebellida	Flabelligeridae	*Piromis congoense*	0	0	2	1	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Pectinariidae	*Pectinaria conchilega*	0	2	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Sternaspidae	*Sternaspis scutata*	0	0	0	1	0	1	1
Animalia	Annelida	Polychaeta	Terebellida	Terebellidae	*Amaeana* sp.	0	1	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Terebellidae	*Pista* sp.	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Terebellidae	Terebellidae spp.	0	0	0	0	0	1	0
Animalia	Annelida	Polychaeta	Terebellida	Trichobranchidae	*Terebellides stroemii*	0	5	0	1	0	0	0
Animalia	Annelida	Polychaeta	-	Capitellidae	*Capitella* sp.	8	6	1	2	0	2	0
Animalia	Annelida	Polychaeta	-	Capitellidae	*Mediomastus* sp.	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	-	Capitellidae	*Notomastus* sp.	0	4	0	0	0	2	1
Animalia	Annelida	Polychaeta	-	Cossuridae	*Cossura dimorpha*	2	1	0	1	0	0	2
Animalia	Annelida	Polychaeta	-	Maldanidae	Maldanidae spp.	3	1	0	2	2	3	2
Animalia	Annelida	Polychaeta	-	Opheliidae	*Ophelina acuminata*	0	0	0	0	0	1	0
Animalia	Annelida	Polychaeta	-	Orbiniidae	*Phylo ornata*	1	0	0	0	0	1	2
Animalia	Annelida	Polychaeta	-	Paraonidae	*Aricidea* sp.	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	-	Paraonidae	*Cirrophorus miyakoensis*	0	0	0	0	0	2	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	*Ampelisca* sp.	0	7	0	0	0	1	3
Animalia	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	*Byblis* sp.	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Caprellidae	*Caprella* sp.	0	6	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Corophiidae	*Cheiriphotis* sp.	0	14	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Liljeborgiidae	*Idunella* sp.	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Maeridae	*Ceradocus* sp.	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Cumacea	Bodotriidae	*Eocuma hilgendorfi*	0	0	0	0	0	2	0
Animalia	Arthropoda	Malacostraca	Decapoda	Alpheidae	*Alpheus digitalis*	0	2	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Alpheidae	*Alpheus* sp.	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Callianassidae	*Neotrypaea japonica*	0	0	2	0	0	2	2
Animalia	Arthropoda	Malacostraca	Decapoda	Goneplacidae	*Typhlocarcinops denticarpes*	0	1	0	0	0	0	3
Animalia	Arthropoda	Malacostraca	Decapoda	Hexapodidae	*Mariaplax granulifera*	0	0	0	0	0	2	0
Animalia	Arthropoda	Malacostraca	Decapoda	Ogyrididae	*Ogyrides orientalis*	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Pasiphaeidae	*Leptochela* sp.	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Pinnotheridae	*Neoxenophthalmus obscurus*	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Scalopidiidae	*Scalopidia spinosipes*	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	-	Unidentified crab	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	-	Unidentified shrimp	0	0	0	0	0	0	0
Animalia	Chordata	Actinopterygii	Perciformes	Gobiidae	*Trypauchen vagina*	1	0	0	0	0	0	0
Animalia	Cnidaria	Anthozoa	Pennatulacea	Virgulariidae	*Virgularia* sp.	0	0	0	0	0	0	0
Animalia	Echinodermata	Echinoidea	Spatangoida	Schizasteridae	*Schizaster lacunosus*	0	0	0	0	0	0	0
Animalia	Echinodermata	Holothuroidea	Apodida	Synaptidae	*Protankyra bidentata*	0	1	0	0	0	0	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Amphiuridae	*Amphioplus depressus*	0	0	0	0	0	0	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Amphiuridae	*Amphioplus laevis*	0	0	0	0	0	0	1
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Ophiuridae	*Ophioplinthus inconveniens*	0	1	0	0	0	0	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Ophiuridae	*Ophiura pteracantha*	0	2	0	0	0	0	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Ophiuridae	Ophiurida spp.	0	0	0	9	3	1	0
Animalia	Mollusca	Bivalvia	Veneroida	Mactridae	*Mactra cuneata*	0	0	0	0	1	0	0
Animalia	Mollusca	Gastropoda	Cephalaspidea	Cylichnidae	*Cylichna biplicata*	0	0	0	0	0	0	0
Animalia	Mollusca	Gastropoda	Cephalaspidea	Philinidae	*Philine* sp.	0	0	0	0	0	0	0
Animalia	Mollusca	Scaphopoda	Dentaliida	Gadilinidae	*Episiphon kiaochowwanense*	0	0	0	0	0	0	0
Animalia	Nemertea	-	-	-	Nemertea spp.	0	1	2	3	0	1	1
Animalia	Sipuncula	Phascolosomatidea	Phascolosomatiformes	Phascolosomatidae	*Apionsoma trichocephalus*	3	2	2	1	2	8	4

Table 4D.2 Subtidal Benthos Survey Raw Data - Wet Season Abundance

Kingdom	Phylum	Class	Order	Family	Species	B1	B2	B3	B4	B5	B6	B7
Animalia	Annelida	Polychaeta	Amphinomida	Amphinomidae	*Linopherus paucibranchiata*	0	0	0	0	0	2	0
Animalia	Annelida	Polychaeta	Eunicida	Eunicidae	*Eunice indica*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Eunicida	Eunicidae	*Lysidice ninetta*	0	1	0	0	0	0	0
Animalia	Annelida	Polychaeta	Eunicida	Eunicidae	*Paucibranchia stragulum*	0	0	0	0	1	1	1
Animalia	Annelida	Polychaeta	Eunicida	Lumbrineridae	*Sergioneris nagae*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris* sp.	0	5	1	2	2	1	1
Animalia	Annelida	Polychaeta	Eunicida	Onuphidae	*Onuphis eremita*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Chrysopetalidae	*Paleaequor breve*	0	0	0	0	1	1	0
Animalia	Annelida	Polychaeta	Phyllodocida	Glyceridae	*Glycera alba*	0	3	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Goniadidae	*Glycinde bonhourei*	0	5	0	0	1	0	1
Animalia	Annelida	Polychaeta	Phyllodocida	Hesionidae	*Oxydromus angustifrons*	0	2	0	0	2	1	2
Animalia	Annelida	Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus dibranchis*	3	0	1	1	1	2	2
Animalia	Annelida	Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus sinensis*	0	0	0	2	0	1	0
Animalia	Annelida	Polychaeta	Phyllodocida	Nephtyidae	*Micronephtys sphaerocirrata*	0	4	0	2	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Nereididae	*Nectoneanthes oxypoda*	0	1	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Nereididae	Nereididae spp.	0	0	0	0	0	0	1
Animalia	Annelida	Polychaeta	Phyllodocida	Nereididae	*Paraleonnates uschakovi*	0	2	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Paralacydoniidae	*Paralacydonia paradoxa*	0	2	0	0	0	0	1
Animalia	Annelida	Polychaeta	Phyllodocida	Phyllodocidae	*Eteone* sp.	0	2	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Phyllodocidae	*Nereiphylla castanea*	0	2	0	0	1	1	0
Animalia	Annelida	Polychaeta	Phyllodocida	Pilargidae	*Otopsis* sp.	0	4	0	1	3	1	3
Animalia	Annelida	Polychaeta	Phyllodocida	Pilargidae	*Pilargis* sp.	1	0	2	0	1	3	4
Animalia	Annelida	Polychaeta	Phyllodocida	Pilargidae	*Sigambra hanaokai*	2	0	1	3	0	2	0
Animalia	Annelida	Polychaeta	Phyllodocida	Polynoidae	*Harmothoe* sp.	0	1	0	0	0	1	0
Animalia	Annelida	Polychaeta	Phyllodocida	Sigalionidae	*Ehlersileanira incisa*	0	1	0	0	0	0	1
Animalia	Annelida	Polychaeta	Sabellida	Oweniidae	*Owenia fusiformis*	0	0	0	0	0	1	0
Animalia	Annelida	Polychaeta	Spionida	Magelonidae	*Magelona* sp.	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Poecilochaetidae	*Poecilochaetus* sp.	0	1	0	1	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Aonides oxycephala*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Laonice cirrata*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Paraprionospio pinnata*	0	0	0	0	0	2	1
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Prionospio ehlersi*	1	0	0	0	0	1	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Prionospio malmgreni*	0	9	0	1	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Scolelepis* sp.	0	0	0	0	0	1	0
Animalia	Annelida	Polychaeta	Terebellida	Ampharetidae	*Anobothrus* sp.	0	1	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Ampharetidae	*Isolda pulchella*	1	1	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Cirratulidae	*Chaetozone* sp.	0	0	0	0	0	2	0
Animalia	Annelida	Polychaeta	Terebellida	Cirratulidae	*Cirriformia* sp.	0	1	0	2	1	0	0
Animalia	Annelida	Polychaeta	Terebellida	Cirratulidae	*Tharyx* sp.	0	8	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Flabelligeridae	*Piromis congoense*	0	0	0	0	0	0	2
Animalia	Annelida	Polychaeta	Terebellida	Pectinariidae	*Pectinaria conchilega*	0	1	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Sternaspidae	*Sternaspis scutata*	0	0	1	0	1	2	1
Animalia	Annelida	Polychaeta	Terebellida	Terebellidae	*Amaeana* sp.	0	1	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Terebellidae	*Pista* sp.	0	0	0	1	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Terebellidae	Terebellidae spp.	0	1	0	0	1	0	2
Animalia	Annelida	Polychaeta	Terebellida	Trichobranchidae	*Terebellides stroemii*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	-	Capitellidae	*Capitella* sp.	3	5	0	1	0	2	0
Animalia	Annelida	Polychaeta	-	Capitellidae	*Mediomastus* sp.	0	2	0	0	0	0	0
Animalia	Annelida	Polychaeta	-	Capitellidae	*Notomastus* sp.	0	0	0	0	1	0	0
Animalia	Annelida	Polychaeta	-	Cossuridae	*Cossura dimorpha*	0	1	0	0	1	0	3
Animalia	Annelida	Polychaeta	-	Maldanidae	Maldanidae spp.	2	3	0	9	1	8	11
Animalia	Annelida	Polychaeta	-	Opheliidae	*Ophelina acuminata*	0	0	0	0	0	1	0
Animalia	Annelida	Polychaeta	-	Orbiniidae	*Phylo ornata*	0	1	0	0	0	1	0
Animalia	Annelida	Polychaeta	-	Paraonidae	*Aricidea* sp.	0	0	0	0	1	0	0
Animalia	Annelida	Polychaeta	-	Paraonidae	*Cirrophorus miyakoensis*	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	*Ampelisca* sp.	0	1	1	1	0	0	3
Animalia	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	*Byblis* sp.	0	0	0	3	0	0	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Caprellidae	*Caprella* sp.	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Corophiidae	*Cheiriphotis* sp.	0	7	0	0	0	2	2
Animalia	Arthropoda	Malacostraca	Amphipoda	Liljeborgiidae	*Idunella* sp.	0	0	0	0	1	2	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Maeridae	*Ceradocus* sp.	0	2	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Cumacea	Bodotriidae	*Eocuma hilgendorfi*	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Alpheidae	*Alpheus digitalis*	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Alpheidae	*Alpheus* sp.	0	2	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Callianassidae	*Neotrypaea japonica*	0	0	1	0	1	2	3
Animalia	Arthropoda	Malacostraca	Decapoda	Goneplacidae	*Typhlocarcinops denticarpes*	0	0	0	1	2	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Hexapodidae	*Mariaplax granulifera*	0	0	0	0	0	0	3
Animalia	Arthropoda	Malacostraca	Decapoda	Ogyrididae	*Ogyrides orientalis*	0	2	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Pasiphaeidae	*Leptochela* sp.	0	2	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Pinnotheridae	*Neoxenophthalmus obscurus*	0	0	0	0	0	1	0
Animalia	Arthropoda	Malacostraca	Decapoda	Scalopidiidae	*Scalopidia spinosipes*	0	0	0	0	1	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	-	Unidentified crab	0	1	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	-	Unidentified shrimp	0	2	0	0	0	0	1
Animalia	Chordata	Actinopterygii	Perciformes	Gobiidae	*Trypauchen vagina*	0	0	0	0	0	0	0
Animalia	Cnidaria	Anthozoa	Pennatulacea	Virgulariidae	*Virgularia* sp.	0	1	0	0	0	0	0
Animalia	Echinodermata	Echinoidea	Spatangoida	Schizasteridae	*Schizaster lacunosus*	1	0	0	0	0	0	0
Animalia	Echinodermata	Holothuroidea	Apodida	Synaptidae	*Protankyra bidentata*	0	0	0	0	0	0	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Amphiuridae	*Amphioplus depressus*	0	0	0	0	0	1	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Amphiuridae	*Amphioplus laevis*	0	0	0	0	0	0	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Ophiuridae	*Ophioplinthus inconveniens*	0	0	0	0	0	0	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Ophiuridae	*Ophiura pteracantha*	0	0	0	0	0	0	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Ophiuridae	Ophiurida spp.	2	1	0	2	0	0	1
Animalia	Mollusca	Bivalvia	Veneroida	Mactridae	*Mactra cuneata*	0	0	0	0	0	0	0
Animalia	Mollusca	Gastropoda	Cephalaspidea	Cylichnidae	*Cylichna biplicata*	1	0	0	0	0	0	0
Animalia	Mollusca	Gastropoda	Cephalaspidea	Philinidae	*Philine* sp.	0	0	0	0	0	2	0
Animalia	Mollusca	Scaphopoda	Dentaliida	Gadilinidae	*Episiphon kiaochowwanense*	1	0	0	0	0	0	0
Animalia	Nemertea	-	-	-	Nemertea spp.	2	4	1	2	5	7	3
Animalia	Sipuncula	Phascolosomatidea	Phascolosomatiformes	Phascolosomatidae	*Apionsoma trichocephalus*	13	1	1	2	0	1	1

Table 4D.3 Subtidal Benthos Survey Raw Data - Dry Season Biomass (g)

Kingdom	Phylum	Class	Order	Family	Species	B1	B2	B3	B4	B5	B6	B7
Animalia	Annelida	Polychaeta	Amphinomida	Amphinomidae	*Linopherus paucibranchiata*	0	0	0	0	0	0.0069	0
Animalia	Annelida	Polychaeta	Eunicida	Eunicidae	*Eunice indica*	0	0.0102	0	0	0	0	0
Animalia	Annelida	Polychaeta	Eunicida	Eunicidae	*Lysidice ninetta*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Eunicida	Eunicidae	*Paucibranchia stragulum*	0	0	0	0	0	0.1246	0
Animalia	Annelida	Polychaeta	Eunicida	Lumbrineridae	*Sergioneris nagae*	0	0.0009	0.0061	0.0021	0	0	0
Animalia	Annelida	Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris* sp.	0	0	0	0	0.0039	0	0.0067
Animalia	Annelida	Polychaeta	Eunicida	Onuphidae	*Onuphis eremita*	0	0.0081	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Chrysopetalidae	*Paleaequor breve*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Glyceridae	*Glycera alba*	0	0.0314	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Goniadidae	*Glycinde bonhourei*	0	0.0017	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Hesionidae	*Oxydromus angustifrons*	0	0.0006	0.0003	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus dibranchis*	0.0069	0	0	0.0061	0.003	0.0063	0.0205
Animalia	Annelida	Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus sinensis*	0	0	0	0	0	0.005	0.0024
Animalia	Annelida	Polychaeta	Phyllodocida	Nephtyidae	*Micronephtys sphaerocirrata*	0	0	0	0.0018	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Nereididae	*Nectoneanthes oxypoda*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Nereididae	Nereididae spp.	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Nereididae	*Paraleonnates uschakovi*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Paralacydoniidae	*Paralacydonia paradoxa*	0	0.0019	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Phyllodocidae	*Eteone* sp.	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Phyllodocidae	*Nereiphylla castanea*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Pilargidae	*Otopsis* sp.	0	0.0006	0.0003	0	0	0.0018	0
Animalia	Annelida	Polychaeta	Phyllodocida	Pilargidae	*Pilargis* sp.	0	0.0006	0.0027	0	0	0	0.0123
Animalia	Annelida	Polychaeta	Phyllodocida	Pilargidae	*Sigambra hanaokai*	0	0.0018	0	0	0.0003	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Polynoidae	*Harmothoe* sp.	0.0001	0.0088	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Sigalionidae	*Ehlersileanira incisa*	0	0.0014	0	0	0	0	0
Animalia	Annelida	Polychaeta	Sabellida	Oweniidae	*Owenia fusiformis*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Magelonidae	*Magelona* sp.	0	0	0.0007	0	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Poecilochaetidae	*Poecilochaetus* sp.	0.014	0.0077	0	0.0005	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Aonides oxycephala*	0	0.0011	0	0	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Laonice cirrata*	0	0.0033	0.0434	0.0817	0.005	0	0.0175
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Paraprionospio pinnata*	0	0.0066	0	0	0.0024	0	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Prionospio ehlersi*	0.0003	0.0073	0.007	0.002	0.0001	0	0.0003
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Prionospio malmgreni*	0.0004	0.0424	0	0	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Scolelepis* sp.	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Ampharetidae	*Anobothrus* sp.	0	0	0	0	0	0.001	0
Animalia	Annelida	Polychaeta	Terebellida	Ampharetidae	*Isolda pulchella*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Cirratulidae	*Chaetozone* sp.	0	0	0.0002	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Cirratulidae	*Cirriformia* sp.	0	0.0011	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Cirratulidae	*Tharyx* sp.	0	0.0017	0	0	0.0007	0	0.002
Animalia	Annelida	Polychaeta	Terebellida	Flabelligeridae	*Piromis congoense*	0	0	0.0421	0.0026	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Pectinariidae	*Pectinaria conchilega*	0	0.006	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Sternaspidae	*Sternaspis scutata*	0	0	0	0.0017	0	0.0321	0.0021
Animalia	Annelida	Polychaeta	Terebellida	Terebellidae	*Amaeana* sp.	0	0.0002	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Terebellidae	*Pista* sp.	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Terebellidae	Terebellidae spp.	0	0	0	0	0	0.0037	0
Animalia	Annelida	Polychaeta	Terebellida	Trichobranchidae	*Terebellides stroemii*	0	0.0376	0	0.0018	0	0	0
Animalia	Annelida	Polychaeta	-	Capitellidae	*Capitella* sp.	0.0025	0.0038	0.0027	0.001	0	0.0032	0
Animalia	Annelida	Polychaeta	-	Capitellidae	*Mediomastus* sp.	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	-	Capitellidae	*Notomastus* sp.	0	0.0937	0	0	0	0.0017	0.0083
Animalia	Annelida	Polychaeta	-	Cossuridae	*Cossura dimorpha*	0.0018	0.0017	0	0.0004	0	0	0.0007
Animalia	Annelida	Polychaeta	-	Maldanidae	Maldanidae spp.	0.0019	0.0076	0	0.0072	0.0015	0.0022	0.0036
Animalia	Annelida	Polychaeta	-	Opheliidae	*Ophelina acuminata*	0	0	0	0	0	0.0901	0
Animalia	Annelida	Polychaeta	-	Orbiniidae	*Phylo ornata*	0.0001	0	0	0	0	0.0003	0.0015
Animalia	Annelida	Polychaeta	-	Paraonidae	*Aricidea* sp.	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	-	Paraonidae	*Cirrophorus miyakoensis*	0	0	0	0	0	0.0012	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	*Ampelisca* sp.	0	0.001	0	0	0	0.0002	0.001
Animalia	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	*Byblis* sp.	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Caprellidae	*Caprella* sp.	0	0.0023	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Corophiidae	*Cheiriphotis* sp.	0	0.0034	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Liljeborgiidae	*Idunella* sp.	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Maeridae	*Ceradocus* sp.	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Cumacea	Bodotriidae	*Eocuma hilgendorfi*	0	0	0	0	0	0.0015	0
Animalia	Arthropoda	Malacostraca	Decapoda	Alpheidae	*Alpheus digitalis*	0	0.9796	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Alpheidae	*Alpheus* sp.	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Callianassidae	*Neotrypaea japonica*	0	0	0.0411	0	0	0.0131	0.0276
Animalia	Arthropoda	Malacostraca	Decapoda	Goneplacidae	*Typhlocarcinops denticarpes*	0	0.0728	0	0	0	0	0.3034
Animalia	Arthropoda	Malacostraca	Decapoda	Hexapodidae	*Mariaplax granulifera*	0	0	0	0	0	0.0622	0
Animalia	Arthropoda	Malacostraca	Decapoda	Ogyrididae	*Ogyrides orientalis*	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Pasiphaeidae	*Leptochela* sp.	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Pinnotheridae	*Neoxenophthalmus obscurus*	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Scalopidiidae	*Scalopidia spinosipes*	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	-	Unidentified crab	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	-	Unidentified shrimp	0	0	0	0	0	0	0
Animalia	Chordata	Actinopterygii	Perciformes	Gobiidae	*Trypauchen vagina*	0.2636	0	0	0	0	0	0
Animalia	Cnidaria	Anthozoa	Pennatulacea	Virgulariidae	*Virgularia* sp.	0	0	0	0	0	0	0
Animalia	Echinodermata	Echinoidea	Spatangoida	Schizasteridae	*Schizaster lacunosus*	0	0	0	0	0	0	0
Animalia	Echinodermata	Holothuroidea	Apodida	Synaptidae	*Protankyra bidentata*	0	0.0391	0	0	0	0	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Amphiuridae	*Amphioplus depressus*	0	0	0	0	0	0	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Amphiuridae	*Amphioplus laevis*	0	0	0	0	0	0	0.0329
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Ophiuridae	*Ophioplinthus inconveniens*	0	0.0014	0	0	0	0	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Ophiuridae	*Ophiura pteracantha*	0	0.001	0	0	0	0	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Ophiuridae	Ophiurida spp.	0	0	0	0.0538	0.0263	0.0238	0
Animalia	Mollusca	Bivalvia	Veneroida	Mactridae	*Mactra cuneata*	0	0	0	0	0.2143	0	0
Animalia	Mollusca	Gastropoda	Cephalaspidea	Cylichnidae	*Cylichna biplicata*	0	0	0	0	0	0	0
Animalia	Mollusca	Gastropoda	Cephalaspidea	Philinidae	*Philine* sp.	0	0	0	0	0	0	0
Animalia	Mollusca	Scaphopoda	Dentaliida	Gadilinidae	*Episiphon kiaochowwanense*	0	0	0	0	0	0	0
Animalia	Nemertea	-	-	-	Nemertea spp.	0	0.0285	0.0288	0.0038	0	0.0012	0.0122
Animalia	Sipuncula	Phascolosomatidea	Phascolosomatiformes	Phascolosomatidae	*Apionsoma trichocephalus*	0.0014	0.0007	0.0016	0.0011	0.0028	0.0062	0.0082

Table 4D.4 Subtidal Benthos Survey Raw Data - Wet Season Biomass (g)

Kingdom	Phylum	Class	Order	Family	Species	B1	B2	B3	B4	B5	B6	B7
Animalia	Annelida	Polychaeta	Amphinomida	Amphinomidae	*Linopherus paucibranchiata*	0	0	0	0	0	0.0088	0
Animalia	Annelida	Polychaeta	Eunicida	Eunicidae	*Eunice indica*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Eunicida	Eunicidae	*Lysidice ninetta*	0	0.0008	0	0	0	0	0
Animalia	Annelida	Polychaeta	Eunicida	Eunicidae	*Paucibranchia stragulum*	0	0	0	0	0.0012	0.0141	0.0042
Animalia	Annelida	Polychaeta	Eunicida	Lumbrineridae	*Sergioneris nagae*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris* sp.	0	0.0086	0.0007	0.0026	0.0106	0.0007	0.0012
Animalia	Annelida	Polychaeta	Eunicida	Onuphidae	*Onuphis eremita*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Chrysopetalidae	*Paleaequor breve*	0	0	0	0	0.0031	0.0004	0
Animalia	Annelida	Polychaeta	Phyllodocida	Glyceridae	*Glycera alba*	0	0.1768	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Goniadidae	*Glycinde bonhourei*	0	0.0055	0	0	0.0006	0	0.0004
Animalia	Annelida	Polychaeta	Phyllodocida	Hesionidae	*Oxydromus angustifrons*	0	0.0011	0	0	0.0016	0.0001	0.0008
Animalia	Annelida	Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus dibranchis*	0.0133	0	0.0059	0.0001	0.0055	0.0083	0.0019
Animalia	Annelida	Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus sinensis*	0	0	0	0.0574	0	0.0575	0
Animalia	Annelida	Polychaeta	Phyllodocida	Nephtyidae	*Micronephtys sphaerocirrata*	0	0.0013	0	0.0018	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Nereididae	*Nectoneanthes oxypoda*	0	0.1096	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Nereididae	Nereididae spp.	0	0	0	0	0	0	0.0001
Animalia	Annelida	Polychaeta	Phyllodocida	Nereididae	*Paraleonnates uschakovi*	0	0.0036	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Paralacydoniidae	*Paralacydonia paradoxa*	0	0.0006	0	0	0	0	0.0001
Animalia	Annelida	Polychaeta	Phyllodocida	Phyllodocidae	*Eteone* sp.	0	0.0017	0	0	0	0	0
Animalia	Annelida	Polychaeta	Phyllodocida	Phyllodocidae	*Nereiphylla castanea*	0	0.0131	0	0	0.0016	0.0001	0
Animalia	Annelida	Polychaeta	Phyllodocida	Pilargidae	*Otopsis* sp.	0	0.0012	0	0.0001	0.0007	0.0001	0.0002
Animalia	Annelida	Polychaeta	Phyllodocida	Pilargidae	*Pilargis* sp.	0.0025	0	0.006	0	0.0019	0.0082	0.0038
Animalia	Annelida	Polychaeta	Phyllodocida	Pilargidae	*Sigambra hanaokai*	0.0023	0	0.0011	0.0023	0	0.0009	0
Animalia	Annelida	Polychaeta	Phyllodocida	Polynoidae	*Harmothoe* sp.	0	0.0117	0	0	0	0.0001	0
Animalia	Annelida	Polychaeta	Phyllodocida	Sigalionidae	*Ehlersileanira incisa*	0	0.0029	0	0	0	0	0.0008
Animalia	Annelida	Polychaeta	Sabellida	Oweniidae	*Owenia fusiformis*	0	0	0	0	0	0.0081	0
Animalia	Annelida	Polychaeta	Spionida	Magelonidae	*Magelona* sp.	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Poecilochaetidae	*Poecilochaetus* sp.	0	0.0002	0	0.0012	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Aonides oxycephala*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Laonice cirrata*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Paraprionospio pinnata*	0	0	0	0	0	0.0011	0.0001
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Prionospio ehlersi*	0.0041	0	0	0	0	0.0001	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Prionospio malmgreni*	0	0.0252	0	0.0001	0	0	0
Animalia	Annelida	Polychaeta	Spionida	Spionidae	*Scolelepis* sp.	0	0	0	0	0	0.0001	0
Animalia	Annelida	Polychaeta	Terebellida	Ampharetidae	*Anobothrus* sp.	0	0.0009	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Ampharetidae	*Isolda pulchella*	0.0045	0.0119	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Cirratulidae	*Chaetozone* sp.	0	0	0	0	0	0.0001	0
Animalia	Annelida	Polychaeta	Terebellida	Cirratulidae	*Cirriformia* sp.	0	0.0001	0	0.0002	0.0008	0	0
Animalia	Annelida	Polychaeta	Terebellida	Cirratulidae	*Tharyx* sp.	0	0.0041	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Flabelligeridae	*Piromis congoense*	0	0	0	0	0	0	0.0108
Animalia	Annelida	Polychaeta	Terebellida	Pectinariidae	*Pectinaria conchilega*	0	0.0544	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Sternaspidae	*Sternaspis scutata*	0	0	0.0106	0	0.0031	0.0148	0.0245
Animalia	Annelida	Polychaeta	Terebellida	Terebellidae	*Amaeana* sp.	0	0.0011	0	0	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Terebellidae	*Pista* sp.	0	0	0	0.0122	0	0	0
Animalia	Annelida	Polychaeta	Terebellida	Terebellidae	Terebellidae spp.	0	0.0037	0	0	0.0021	0	0.0009
Animalia	Annelida	Polychaeta	Terebellida	Trichobranchidae	*Terebellides stroemii*	0	0	0	0	0	0	0
Animalia	Annelida	Polychaeta	-	Capitellidae	*Capitella* sp.	0.0008	0.0104	0	0.0006	0	0.0008	0
Animalia	Annelida	Polychaeta	-	Capitellidae	*Mediomastus* sp.	0	0.0049	0	0	0	0	0
Animalia	Annelida	Polychaeta	-	Capitellidae	*Notomastus* sp.	0	0	0	0	0.0003	0	0
Animalia	Annelida	Polychaeta	-	Cossuridae	*Cossura dimorpha*	0	0.0009	0	0	0.001	0	0.0017
Animalia	Annelida	Polychaeta	-	Maldanidae	Maldanidae spp.	0.0065	0.0014	0	0.0056	0.0004	0.0083	0.0061
Animalia	Annelida	Polychaeta	-	Opheliidae	*Ophelina acuminata*	0	0	0	0	0	0.0693	0
Animalia	Annelida	Polychaeta	-	Orbiniidae	*Phylo ornata*	0	0.0011	0	0	0	0.0001	0
Animalia	Annelida	Polychaeta	-	Paraonidae	*Aricidea* sp.	0	0	0	0	0.0004	0	0
Animalia	Annelida	Polychaeta	-	Paraonidae	*Cirrophorus miyakoensis*	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	*Ampelisca* sp.	0	0.0002	0.0001	0.0001	0	0	0.0001
Animalia	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	*Byblis* sp.	0	0	0	0.0001	0	0	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Caprellidae	*Caprella* sp.	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Corophiidae	*Cheiriphotis* sp.	0	0.0062	0	0	0	0.0001	0.0004
Animalia	Arthropoda	Malacostraca	Amphipoda	Liljeborgiidae	*Idunella* sp.	0	0	0	0	0.0005	0.0007	0
Animalia	Arthropoda	Malacostraca	Amphipoda	Maeridae	*Ceradocus* sp.	0	0.0017	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Cumacea	Bodotriidae	*Eocuma hilgendorfi*	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Alpheidae	*Alpheus digitalis*	0	0	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Alpheidae	*Alpheus* sp.	0	0.0184	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Callianassidae	*Neotrypaea japonica*	0	0	0.0043	0	0.0804	0.0475	0.0417
Animalia	Arthropoda	Malacostraca	Decapoda	Goneplacidae	*Typhlocarcinops denticarpes*	0	0	0	0.0795	0.0612	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Hexapodidae	*Mariaplax granulifera*	0	0	0	0	0	0	0.0784
Animalia	Arthropoda	Malacostraca	Decapoda	Ogyrididae	*Ogyrides orientalis*	0	0.0034	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Pasiphaeidae	*Leptochela* sp.	0	0.0032	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	Pinnotheridae	*Neoxenophthalmus obscurus*	0	0	0	0	0	0.0001	0
Animalia	Arthropoda	Malacostraca	Decapoda	Scalopidiidae	*Scalopidia spinosipes*	0	0	0	0	0.0386	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	-	Unidentified crab	0	0.0001	0	0	0	0	0
Animalia	Arthropoda	Malacostraca	Decapoda	-	Unidentified shrimp	0	0.0006	0	0	0	0	0.0001
Animalia	Chordata	Actinopterygii	Perciformes	Gobiidae	*Trypauchen vagina*	0	0	0	0	0	0	0
Animalia	Cnidaria	Anthozoa	Pennatulacea	Virgulariidae	*Virgularia* sp.	0	0.0007	0	0	0	0	0
Animalia	Echinodermata	Echinoidea	Spatangoida	Schizasteridae	*Schizaster lacunosus*	0.5066	0	0	0	0	0	0
Animalia	Echinodermata	Holothuroidea	Apodida	Synaptidae	*Protankyra bidentata*	0	0	0	0	0	0	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Amphiuridae	*Amphioplus depressus*	0	0	0	0	0	0.0275	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Amphiuridae	*Amphioplus laevis*	0	0	0	0	0	0	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Ophiuridae	*Ophioplinthus inconveniens*	0	0	0	0	0	0	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Ophiuridae	*Ophiura pteracantha*	0	0	0	0	0	0	0
Animalia	Echinodermata	Ophiuroidea	Ophiurida	Ophiuridae	Ophiurida spp.	0.0269	0.003	0	0.0088	0	0	0.0028
Animalia	Mollusca	Bivalvia	Veneroida	Mactridae	*Mactra cuneata*	0	0	0	0	0	0	0
Animalia	Mollusca	Gastropoda	Cephalaspidea	Cylichnidae	*Cylichna biplicata*	0.042	0	0	0	0	0	0
Animalia	Mollusca	Gastropoda	Cephalaspidea	Philinidae	*Philine* sp.	0	0	0	0	0	0.0111	0
Animalia	Mollusca	Scaphopoda	Dentaliida	Gadilinidae	*Episiphon kiaochowwanense*	0.0376	0	0	0	0	0	0
Animalia	Nemertea	-	-	-	Nemertea spp.	0.0009	0.008	0.0053	0.0011	0.0311	0.0159	0.0012
Animalia	Sipuncula	Phascolosomatidea	Phascolosomatiformes	Phascolosomatidae	*Apionsoma trichocephalus*	0.0185	0.0017	0.001	0.0014	0	0.0007	0.0005

Table 4E.1 Survey Effort Database (March-August 2021)

(Abbreviations: BEAU = Beaufort Sea State; P = Primary Line Effort; S = Secondary Line Effort)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
18-Mar-21	LAMMA	2	24.15	SPRING	STANDARD36826	P
18-Mar-21	LAMMA	3	33.10	SPRING	STANDARD36826	P
18-Mar-21	LAMMA	2	11.05	SPRING	STANDARD36826	S
18-Mar-21	LAMMA	3	5.40	SPRING	STANDARD36826	S
12-Apr-21	LAMMA	2	46.38	SPRING	STANDARD36826	P
12-Apr-21	LAMMA	3	14.12	SPRING	STANDARD36826	P
12-Apr-21	LAMMA	2	10.20	SPRING	STANDARD36826	S
12-Apr-21	LAMMA	3	1.00	SPRING	STANDARD36826	S
5-May-21	LAMMA	2	46.73	SPRING	STANDARD36826	P
5-May-21	LAMMA	3	13.55	SPRING	STANDARD36826	P
5-May-21	LAMMA	2	11.42	SPRING	STANDARD36826	S
7-Jun-21	LAMMA	2	8.70	SUMMER	STANDARD36826	P
7-Jun-21	LAMMA	3	51.70	SUMMER	STANDARD36826	P
7-Jun-21	LAMMA	2	5.30	SUMMER	STANDARD36826	S
7-Jun-21	LAMMA	3	6.30	SUMMER	STANDARD36826	S
16-Jul-21	LAMMA	0	3.90	SUMMER	STANDARD138716	P
16-Jul-21	LAMMA	1	34.02	SUMMER	STANDARD138716	P
16-Jul-21	LAMMA	2	26.95	SUMMER	STANDARD138716	P
16-Jul-21	LAMMA	3	1.00	SUMMER	STANDARD138716	P
16-Jul-21	LAMMA	1	3.40	SUMMER	STANDARD138716	S
16-Jul-21	LAMMA	2	7.73	SUMMER	STANDARD138716	S
16-Aug-21	LAMMA	1	10.31	SUMMER	STANDARD138716	P
16-Aug-21	LAMMA	2	47.87	SUMMER	STANDARD138716	P
16-Aug-21	LAMMA	3	3.30	SUMMER	STANDARD138716	P
16-Aug-21	LAMMA	1	2.47	SUMMER	STANDARD138716	S
16-Aug-21	LAMMA	2	5.75	SUMMER	STANDARD138716	S
16-Aug-21	LAMMA	3	1.10	SUMMER	STANDARD138716	S

Table 4E.2 Finless Porpoise Sighting Database (March-August 2021)

(Abberviations: STG# = Sighting Number; HRD SZ = Dolphin Herd Size; BEAU = Beaufort Sea State;
PSD = Perpendicular Sighting Distance; P/S: Sighting Made on Primary/Secondary Lines)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	NORTHING	EASTING	SEASON	P/S
5-May-21	1	1234	4	LAMMA	2	70	ON	805433	822163	SPRING	P
16-Jul-21	1	1023	2	LAMMA	2	338	ON	810491	825405	SUMMER	P