

Improvement Dredging for Lamma Power Station Navigation Channel

Marine Ecological Baseline Review

October 2018

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The Hongkong Electric Co., Ltd.



ENVIRONMENTAL IMPACT ASSESSMENT (EIA) ORDINANCE, CAP. 499

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**IMPROVEMENT DREDGING FOR
LAMMA POWER STATION NAVIGATION CHANNEL**

Report Title	Marine Ecological Baseline Review Report (October 2018)
Date	31 October 2018
Certified by	 (Mr. Kenneth Fung, Environmental Team Leader)
Verified by	 Mr. Y T Tang (AECOM Asia Company Limited, Independent Environmental Checker)

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1 Introduction

An application for Environmental Permit (EP) for the “Improvement Dredging for Lamma Power Station Navigation Channel” (the Project) was submitted on 29 March 2017 (Application No. AEP-535/2017) with the support of an Environmental Impact Assessment Report (EIA). The EIA report was exhibited for public inspection from 9 June 2017 to 8 July 2017 and a consultation with the Advisory Council on the Environment (ACE) was held on 14 August 2017. On 10 October 2017, the Director of Environmental Protection (DEP) approved the EP application with conditions under Section 8(3) of the EIA Ordinance.

According to the approval conditions under Annex 1 (2): “The project proponent shall conduct marine ecological and fisheries baseline review before commencement of each dredging. The marine ecological baseline review shall cover species of conservation interest including but not limit to Green Turtle and Finless Porpoise. In preparing the detailed baseline report, the Director of Agriculture, Fisheries and Conservation Department shall be consulted and the report shall be submitted to the DEP for approval before each dredging, including selected high spot dredging and re-profiling;”

Based on the EP No. EP-535/2017 Clause 2.9 Submission of Marine Ecological Baseline Review Report: “The Permit Holder shall, no later than 3 months before the commencement of each dredging, including selected high spot dredging and re-profiling, submit 4 hard copies and 1 electronic copy of a Marine Ecological Baseline Review Report (the Report) to the Director for approval. The Report shall review/ update the marine ecological baseline in the Project area and its vicinity and the review shall cover species of conservation interest including but not limited to Green Turtle and Finless Porpoise. The Report shall be prepared by a qualified ecologist(s) and shall be certified by the Environmental Team (ET) Leader and verified by the Independent Environmental Checker (IEC).”

HK Electric has commissioned Mott MacDonald Hong Kong Limited as the environmental consultant for provision of qualified ecologist(s) for the preparation of this Marine Ecological Baseline Review Report. This Baseline Review Report provides the updated status of the marine ecological baseline of the Study Area, including the recent information collected after the EIA was approved and prior to the commencement of improvement dredging.

2 Background

2.1 Study Area

The Study Area of the Project is inside the Southern Water Control Zone (WCZ). In 2016, the Southern WCZ attained an overall 69% compliance with the Water Quality Objectives (WQOs). Among the four key WQOs, full compliance was attained for the dissolved oxygen (DO), unionised ammonia (UIA) and *E. coli* objectives, except the total inorganic nitrogen (TIN) objective. The non-compliance of the TIN objective was attributed to the combined influence of the Pearl River and the South China Sea. It is not likely that the TIN non-compliance would cause significant impact on the water quality since there were low occurrence rate of red tides in these waters (EPD, 2016).

According to EPD's marine water quality report in 2016, the monitoring station SM5 (which is the closest station to the Study Area) had temperatures ranging from 16.7 to 29.4 °C, salinity from 23.5 to 32.4 ppt, DO level for whole water column from 4.5 to 11.7 mg/L, and DO for bottom water from 3.7 to 10.2 mg/L. No hypoxia event was recorded.

2.2 Literature Review

Desktop literature review has been conducted to update the marine ecological baseline and status of the species of conservation interest (including Green Turtle, Finless Porpoise and Chinese White Dolphin) for this Project. The review includes approved EIAs of relevant projects, findings of related ecological studies / surveys in the Study Area, and published scientific papers relevant to the ecological resources of the Study Area, including:

- EIA Study for Hong Kong Offshore LNG Terminal (ERM, 2018);
- Monitoring of marine mammals in Hong Kong waters (Hung, 2016; Hung, 2017; Hung, 2018);
- The behavioural ecology of Indo-Pacific Humpback Dolphins in Hong Kong (Würsig *et al.*, 2016);
- Characterization and conservation concerns of Green Turtles (*Chelonia mydas*) nesting in Hong Kong, China (Ng *et al.*, 2014);
- Rescued green turtle returned to the sea (AFCD, 2013);
- Outlying Islands Sewerage Stage 2 - Upgrading of Cheung Chau Sewage Collection, Treatment and Disposal Facilities (Atkins, 2013);
- EIA Study for Development of a 100MW Offshore Wind Farm in Hong Kong (ERM, 2010);
- Green Turtles in Hong Kong (Chan, 2004);
- Food habits of Finless Porpoises (*Neophocaena phocaenoides*) in Hong Kong waters (Barros *et al.*, 2002); and
- Surface and dive times of Finless Porpoises (*Neophocaena phocaenoides*) in Hong Kong's coastal waters (Beasley and Jefferson, 2002).

3 Baseline Review

3.1 Green Turtle

3.1.1 Findings from the EIA report

Among the five species of sea turtles that has been recorded in Hong Kong, green turtle is the only sea turtle species that nest locally in Hong Kong. Green turtle is listed as “Endangered” in the IUCN Red List of Threatened Species (IUCN, 2018), Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and Appendices I and II of the Convention on Migratory Species (CMS). In Hong Kong, green turtle is protected under the Wild Animals Protection Ordinance (Cap. 170) and the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586).

Historical records and anecdotes from local villagers revealed that several decades ago, sea turtles often nested in remote beaches of Hong Kong such as Tung O and Ha Mei Wan on Lamma Island, Tong Fok Miu Wan and Tai Long Wan on Lantau Island, and Shek O and Tai Tam Bay on Hong Kong Island (Chan, 2004). In recent years, sea turtles seldom nested in these areas and a sandy beach in Sham Wan of Lamma Island is the only regular nesting ground of green turtles in Hong Kong.

According to AFCD’s long-term study of green turtles, a green turtle was last seen in 2012 nesting in Sham Wan (AFCD, 2013). At most five green turtles were recorded in each nesting season at Sham Wan between 1998 and 2012, and 93 to 152 eggs were being laid per clutch in a nesting season (Ng *et al.*, 2014). Besides the regular nesting at Sham Wan, sporadic nesting of green turtles were observed in Shek Pai Wan, Tung O on Lamma Island (AFCD correspondence, 2015), Tai Wan in Sai Kung and Tai Long Wan in Shek O on Hong Kong Island in the last two decades (Ng *et al.*, 2014). From tracking of inter-nesting movement of green turtle by satellite telemetry, the female which nested at Sham Wan in 2003, 2008 and 2012 mainly appeared in the southern, southeastern and western waters of Lamma Island between nesting attempts within a nesting season (**Figures 1, 2 and 3**; ERM, 2010; AFCD, unpublished data). The green turtles nested in Sham Wan had an average of 11 to 13 days of inter-nesting interval in a nesting season (Ng *et al.*, 2014). Another recent study found that green turtles mainly used areas close to their nesting beach (i.e. within 10 km) and dived within 15 m from the water surface during the inter-nesting period (Clyde-Brockway, 2014).

3.1.2 Updated findings

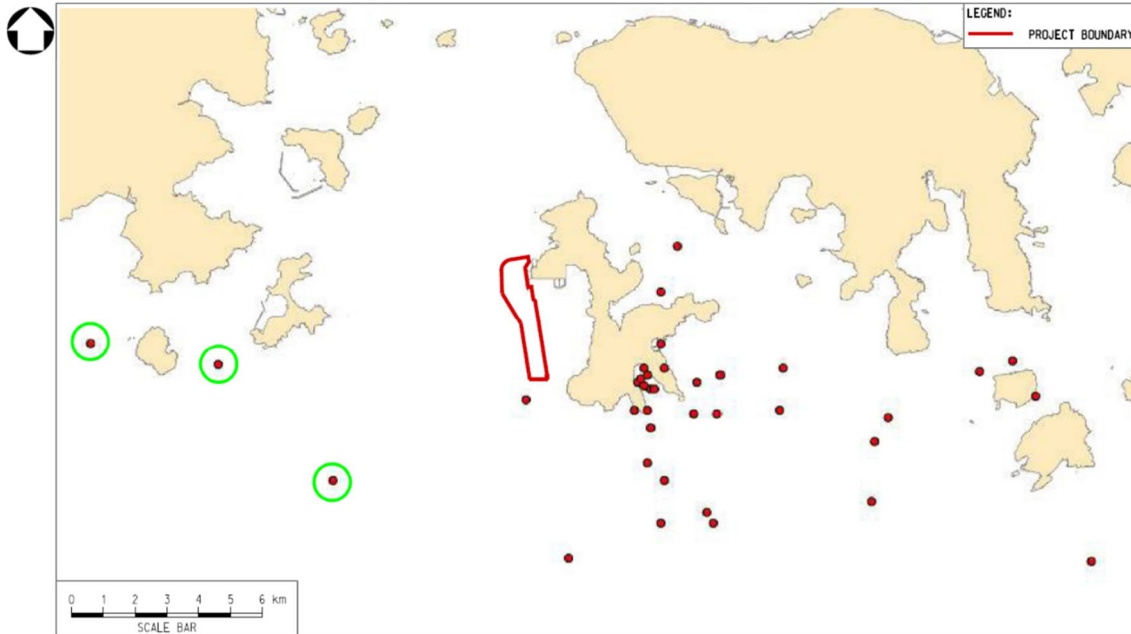
Based on a review of literature since the EIA was approved, no new sightings of green turtles nesting on the shores of Hong Kong has been recorded since 2012. Therefore, the findings of the EIA report remain valid and no additional mitigation / precautionary measures are required for the green turtles.

Figure 1: 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.



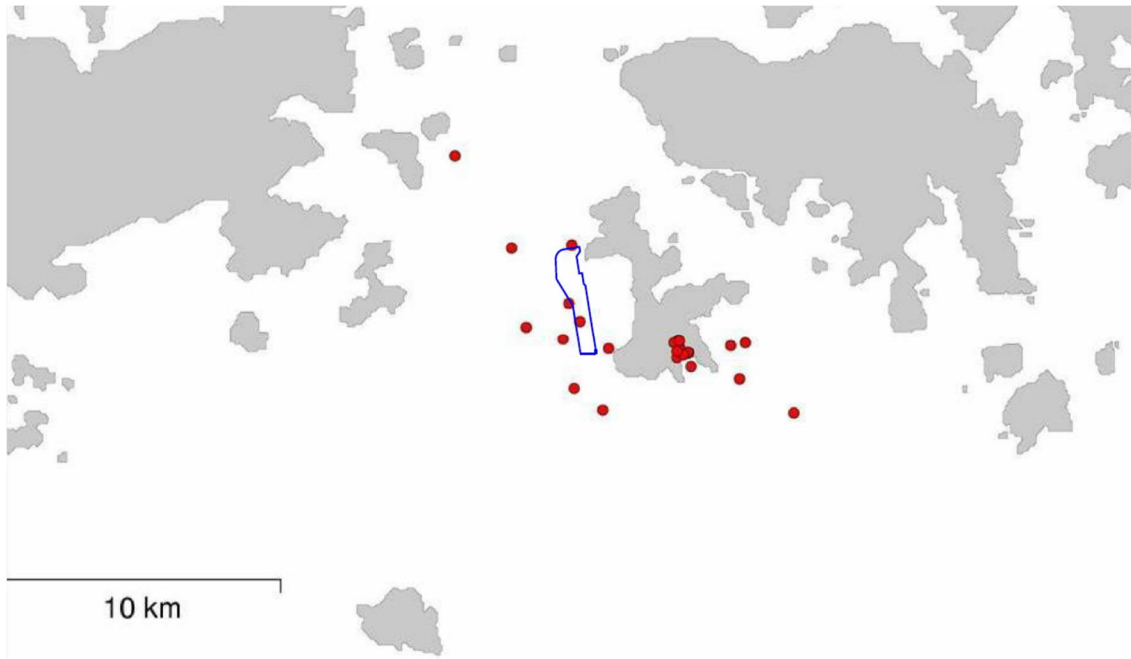
Source: ERM (2010). Development of an Offshore Wind Farm in Hong Kong – EIA Study.

Figure 2: 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. (The red dot circled green is the location at a distance over 10 km from the nesting beach)



Source: ERM (2010). Development of an Offshore Wind Farm in Hong Kong – EIA Study.

Figure 3: Inter-nesting locations (red dots) from 14 August to 30 September 2012 of the green turtle that nested on Sham Wan, Lamma Island. Map provided by AFCD.



3.2 Finless Porpoise

3.2.1 Findings from the EIA report

Indo-Pacific Finless Porpoise *Neophocaena phocaenoides* is protected under the Wild Animals Protection Ordinance (Cap. 170) and the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586) in Hong Kong and listed as a “China Grade II National Key Protected Species” in Mainland China. Globally, this species is listed as “Vulnerable” in the IUCN Red list (IUCN, 2018) and Appendix I of CITES.

Finless porpoises seldom approach boats and exhibit aerial behaviour. In Hong Kong, they spend more than half of their time (i.e. about 60%) at or near the water surface and nearly half of their time (i.e. about 40%) on long dives (Beasley and Jefferson, 2002). Barros *et al.* (2002) suggested that the finless porpoises feed at different water depths and in various habitats including reef areas and sandy substrates.

Finless porpoises display marked seasonal distribution pattern in Hong Kong. They are sparse in southern Lantau and southern Lamma in wet season (June to November) but more abundant in those waters during dry season (December to May).

In the long-term monitoring programme of marine mammals in Hong Kong waters commissioned by AFCD, quantitative grid analysis of habitat use was conducted and plotted onto 1 km² grids to estimate dolphin/porpoise density and usage in terms of number of Dolphin/porpoise density Per 100 units of Survey Effort (DPSE). Between 2006 and 2015, south of Tai A Chau, Shek Kwu Chau, south of Cheung Chau and the waters between Shek Kwu Chau and the Soko Islands are important porpoise habitat (DPSE>60; Hung, 2016).

In dry season, finless porpoises occur in eastern, southern and western waters of Lamma in moderate to low density. The south of the Channel (which was identified as key porpoise habitat in a 2003 approved EIA) and east Lamma off Tung O Wan have moderate porpoise density (DPSE 40-60). However, the porpoise density within the Project Area is relatively low (DPSE 0-20) when compared to southern, eastern and western waters of Lamma in dry season (Hung, 2016).

3.2.2 Updated findings

According to the latest monitoring report of marine mammals in Hong Kong waters (Hung, 2018), finless porpoises still appear all year round in southern and eastern waters of Hong Kong and display marked seasonality in distribution. Long-term results (2013-17) still consider 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 (DPSE>60) during dry season. In wet season, the porpoises mainly aggregate around the Po Toi Islands and at the juncture of Po Toi and Ninepins areas (**Figure 4**; Atkins, 2013; Hung, 2018).

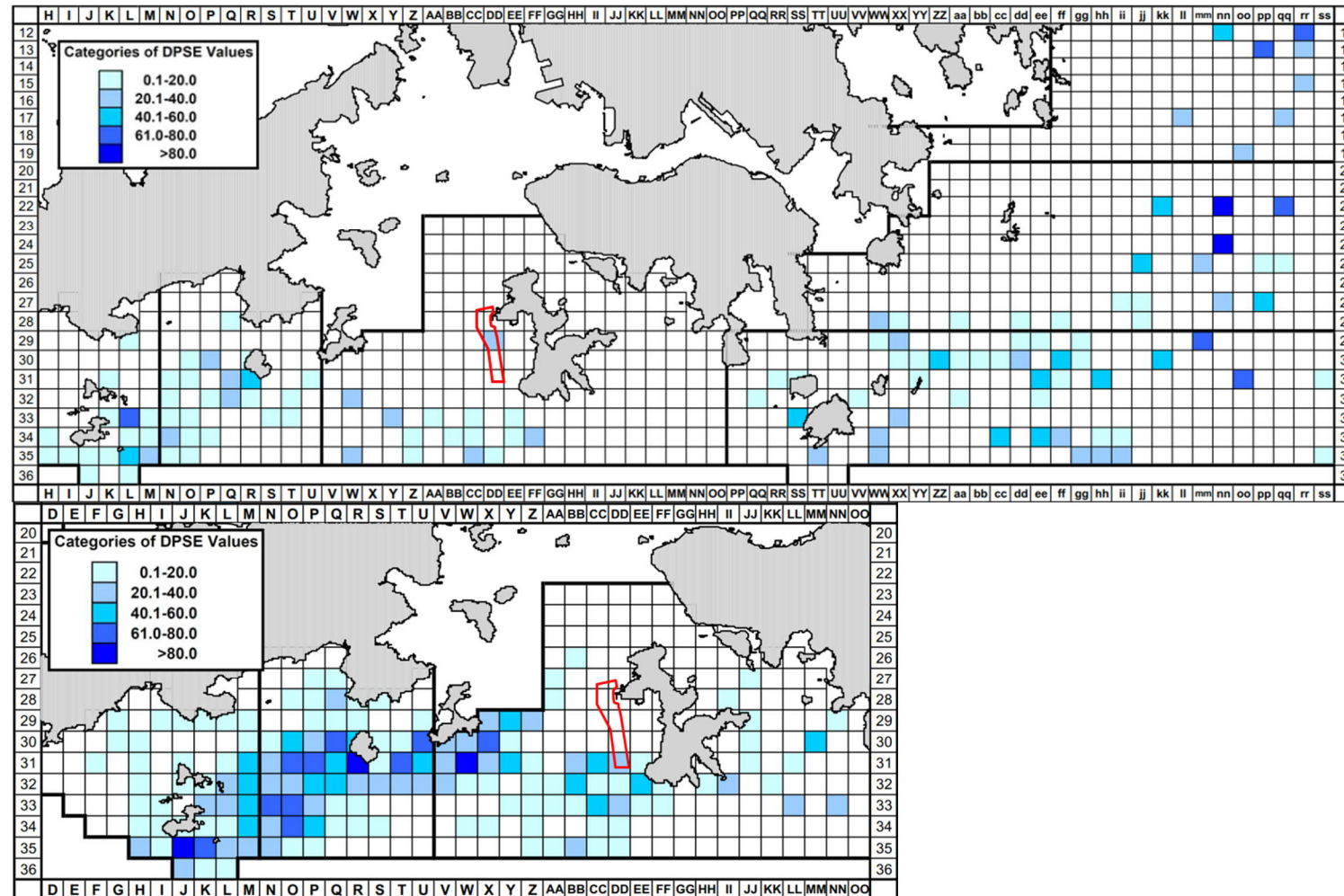
In Lamma waters, the finless porpoises still mainly occur in the eastern, southern and western waters in the dry season. During the wet season, the entire Lamma waters have low to moderately low porpoise density (DPSE 0-40), suggesting no particular habitat preference of the porpoises in these waters. Within the Project Area, no porpoises have been sighted in most of the area, while one grid located at Zone 4 of the navigation channel has moderately low porpoise density (DPSE 20-40) during the dry season. In the wet season, porpoise density of one grid is moderately low (DPSE 20-40) but the other grids within the Project Area have no porpoises (**Figure 4**; Hung, 2018).

Since there are no significant changes of the distribution of finless porpoises compared to the findings of the approved EIA, the mitigation / precautionary measures proposed in the EIA report for protecting the porpoises are still relevant and appropriate. During both construction and operation (operation dredging) phases, a number of measures targeting at protecting the porpoises should be put in place, including:

- Avoidance of dredging at Zone 4 of the navigation channel from February to April (which is calving season of the finless porpoises), except necessary hotspot / localised dredging being kept under the recommended maximum allowable dredging rates;
- Restriction of vessel movements in southwest and east Lamma and implementation of a maximum speed limit of 10 knots in south and east Lamma waters; and
- Thorough briefing to all vessel operators working on the Project about the possible occurrence of finless porpoise within and in the vicinity of the Project Area and along routes to the Project Area, as well as rules for safe vessel operation around cetaceans and slowing down to 10 knots in the presence of cetaceans in south and east Lamma waters.

In addition, the implementation of water quality mitigation measures as well as water quality monitoring programme recommended in the EIA report and subsequent review of the Environmental and Monitoring (EM&A) Manual will also be in place, to further minimise the impact on the finless porpoises and other marine fauna.

Figure 4: Density of finless porpoises with corrected survey effort per km² in southern and eastern waters of Hong Kong during wet season (June to November) (top) and dry season (December to May) (bottom), using data collected during 2013-17 (DPSE = no. of porpoises per 100 units of survey effort).



Source: Hung (2018). Monitoring of Marine Mammals in Hong Kong Waters (2017-18).

3.3 Chinese White Dolphin

3.3.1 Findings from the EIA report

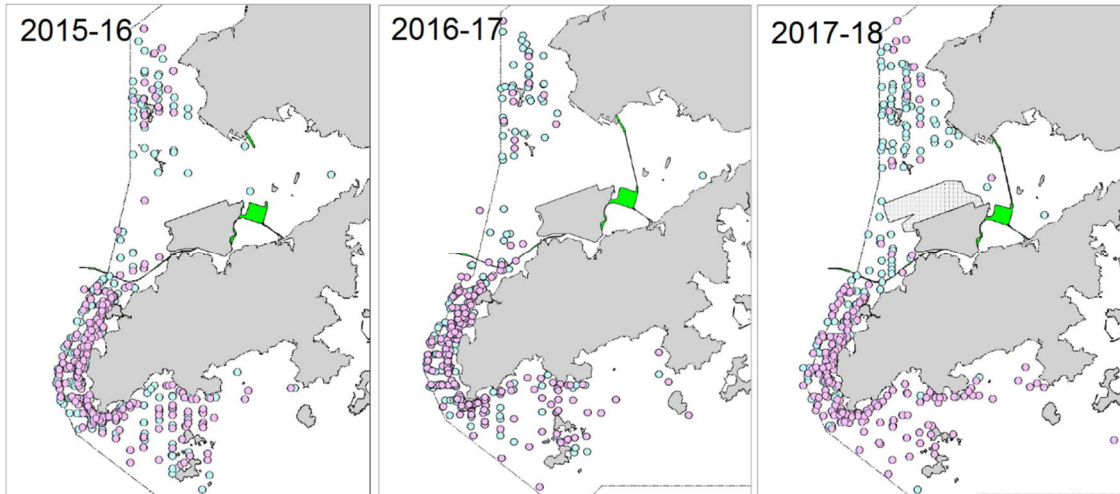
Indo-Pacific Humpback Dolphin *Sousa chinensis* (usually called as Chinese White Dolphin, hereafter as “CWD”) is protected under the Wild Animals Protection Ordinance (Cap. 170) and the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586) locally. It is listed as a “China Grade I National Key Protected Species” in Mainland China and “Vulnerable” in the IUCN Red list (IUCN, 2018) and in the Appendix I of CITES.

CWD is a very active cetacean species and exhibit lots of aerial behaviour when compared to finless porpoise. They extend as far to West Lamma in southern waters of Hong Kong in wet season, albeit with very low usage of the Channel. Long-term monitoring data from AFCD revealed that the eastern edge of their range has shifted west to the area around Shek Kwu Chau and the CWD appear to avoid Lamma waters in recent years (Hung, 2016).

3.3.2 Updated findings

According to the latest findings, the distribution of CWD is confined to estuarine waters around Lantau Island and no observations in other areas (including the Project Area) were recorded in recent years (**Figure 5**; Würsig *et al.*, 2016; Hung, 2018). The Project would therefore bring negligible impacts on CWD and no additional mitigation / precautionary measures is required for the CWD.

Figure 5: Distribution of all CWD sightings in Hong Kong waters from 2015 to 2018.
(purple dots: AFCD survey sightings; blue dots: Hong Kong Link Road survey sightings)



Source: Hung (2016-18). Monitoring of Marine Mammals in Hong Kong Waters (2015-18).

3.4 Other Marine Fauna

3.4.1 Findings from the EIA report

3.4.1.1 Coral Communities and Subtidal Hard Bottom Habitat

All hard corals are protected in Hong Kong by the Protection of Endangered Species of Animals and Plants Ordinances (Cap. 586). In the approved EIA report, coral dive surveys were conducted in June 2014 and October 2015. The sloping artificial seawalls along the Lamma Power Station Extension where the subtidal habitat is close to the Project Area and the natural subtidal hard bottom habitats along the western coast of Lamma near the Project Area were surveyed. At the sloping artificial seawalls, the hard and soft corals recorded were sediment-tolerant species, and only one common hard coral species, *Oulastrea crispata*, was recorded with low coral cover (<1%). At the natural subtidal hard bottom habitats, the survey results revealed that the coral communities vary in diversity with a total of 18 hard coral species recorded. More diverse communities with more than 10 coral species were recorded at the northern side, while less diverse communities with only one to three coral species were found at the southern side. All the hard coral found at the natural subtidal hard bottom habitats were common species and no rare or endangered species were recorded. In summary, the subtidal hard bottom habitats within the Study Area were of low to moderate ecological values.

3.4.1.2 Benthic Infauna and Subtidal Soft Bottom Habitat

In the approved EIA report, benthic surveys were conducted in May 2014 and September and December 2015. Sediments within the navigation channel were mainly composed of soft mud, while those outside the channel were a mix of soft mud and fine sand. A total of 61 and 126 taxa (identified to genus or species levels) were found during the 2014 and 2015 surveys, respectively. All recorded benthic infauna were common with no conservation interest. Species recorded at the proposed dredging area within the navigation channel were dominated by stress-tolerant polychaete and bivalve species. The subtidal soft bottom habitats within and outside the navigation channel were of low and moderate-low ecological values, respectively.

3.4.1.3 Intertidal Communities and Habitats

In the approved EIA report, intertidal surveys were conducted in May 2014, August, September and November 2015 and January 2016 at three representative habitats, i.e. artificial seawall, sandy shore and rocky shore at the west Lamma. Species diversity and abundance at the sandy shores were very low. At the rocky shores, a total of about 50 intertidal species were recorded and majority of them were commonly found in semi-exposed and exposed shores. The artificial seawall of Lamma Power Station Extension had low species diversity with presence of common and widespread species such as littorinid snails and limpets. All recorded species were common with no conservation interest. Ecological values of the sandy shores, rocky shores and artificial seawall were thus considered of low, moderate-low and low, respectively.

3.4.2 Updated findings

After the EIA of this Project was approved, updated subtidal and intertidal surveys were conducted around the Study Area of this Project by the Hong Kong Offshore LNG Terminal Project (ERM, 2018). In the LNG Project, subtidal coral surveys were conducted at the artificial seawall of Lamma Power Station (LPS) and along the proposed route of LPS Pipeline in June and October 2017. At the artificial seawall of LPS, coral cover was low (<5%). Most of the coral species were common and widespread in Hong Kong waters, including *O. crispata* and ahermatypic hard coral *Tubastrea/ Dendrophyllia* sp. and *Balanophyllia* sp.. Other corals were only present in isolated

colonies. Along the proposed route of LPS Pipeline, coral cover was low (<5%) and only isolated patchy octocoral *Echinomuricea* sp. were found on the scattered boulders. *Echinomuricea* sp. was a common and widespread species in the western waters of Hong Kong. No hard corals were recorded due to high sedimentation and low light intensity of the habitats along the proposed route. Therefore, the subtidal hard bottom habitats at the LPS seawall and LPS Pipeline were of low ecological value.

In the LNG Project, subtidal benthos surveys were conducted in March and June 2017 along the proposed route of LPS Pipeline. The sampling site B16 located the closest to the Project Area of this Project. Low infaunal abundance, biomass and taxonomic richness were recorded at B16 in both dry and wet seasons. The benthic community was dominated by polychaetes and no species recorded were rare or of conservation importance. The subtidal soft bottom habitat was thus of low ecological value.

Intertidal surveys were conducted at the artificial sloping seawall of LPS in August 2016 and February 2017 under the LNG Project. Low species abundance and diversity were recorded. All the species found were common and widespread on artificial shores of Hong Kong, such as the limpets *Patelloida* spp. and the barnacles *Capitulum mitella* and *Tetraclita* spp.. No rare species or species of conservation importance were sampled and the intertidal habitats at the LPS seawall were considered of low ecological value.

The updated survey results of the LNG Project were similar to those found in the approved EIA Report of this Project. Since the corals, benthos and intertidal fauna were mostly sessile or in low mobility, and no maintenance dredging and other marine works have been conducted in the Study Area after the EIA was approved, while the surveys conducted for the EIA report were relatively recent and similar results were obtained in the updated surveys of the LNG Project, it is considered that the findings of the EIA report remain valid. Therefore, no additional mitigation / precautionary measures are required for the subtidal hard bottom habitats, subtidal soft bottom habitats and intertidal habitats within the Study Area.

4 Conclusion

The marine ecological baseline and the species of conservation interest (including Green Turtle, Finless Porpoise, Chinese White Dolphin, coral communities and subtidal hard bottom habitats, benthic infauna and subtidal soft bottom habitats, and intertidal communities and habitats) are reviewed and updated where appropriate. No significant changes in their status and distribution are found when compared to the approved EIA report. Therefore, the mitigation / precautionary measures proposed, and the conclusion drawn in the EIA report remain valid, and no additional mitigation measures are required.

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