7b. ECOLOGICAL IMPACT (BOTH TERRESTRIAL AND AQUATIC) (ARTIFICIAL ISLAND NEAR SKC)

7b.1 Introduction

7b.1.1.1 This section presents the baseline ecological resource conditions within the study area, and the results of assessment of the potential ecological impacts resulting from the IWMF at an artificial island near SKC. Baseline conditions for ecological components of the terrestrial and marine environment were evaluated based on information from available literatures and field surveys conducted for the purposes of this EIA. Measures required to mitigate any identified adverse impacts are recommended, where appropriate.

7b.1.1.2 The proposed Project Site is located at the southwest of the Shek Kwu Chau Island, where reclamation works would take place under this Project. Based on literature review, Shek Kwu Chau supports various species of herpetofauna, and that 3 out of 5 records of a very rare and endemic reptile species, Bogadek's Burrowing Lizard (*Dibamus bogadeki*), has been previously recorded at Shek Kwu Chau (Lazell, 2002). It is therefore considered that reclamation is a suitable option for the siting of the IWMF.

7b.2 Environmental Legislation, Policies, Plans, Standards and Criteria

7b.2.1.1 Guidelines, standards, documents and ordinances / regulations listed in the following sections were referred to during the course of the ecological impact assessment.

- The Environmental Impact Assessment Ordinance (Cap. 499) provides guidelines on the environmental impact assessment process.

- The Country Parks Ordinance (Cap. 208) provides for the designation and management of country parks and special areas. Country parks are designated for the purpose of nature conservation, countryside recreation and outdoor education. Special Areas are created mainly for the purpose of nature conservation.

- The Forests and Countryside Ordinance (Cap. 96) prohibits felling, cutting, burning or destroying of trees and growing plants in forests and plantations on government land. Related subsidiary regulations prohibit the selling or possession of listed restricted and protected plant species.

- Under the Wild Animals Protection Ordinance (Cap. 170), designated wild animals are protected from being hunted, whilst their nests and eggs are protected from injury, destruction and removal. All birds and most mammals, including marine cetaceans, are protected under this Ordinance.

- The Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586) provides protection for certain plant and animal species through controlling or prohibiting trade in the species. Certain types of corals are listed in Schedule 1 of the Ordinance, including Blue coral (*Heliopora coerulea*), Organ pipe corals (family Tubiporidae), Black corals (order Antipatharia), Stony corals (order Scleractinia), Fire corals (family Milleporidae) and Lace corals (family Stylasteridae). Cetacean including whales, dolphins, porpoises, and rorquals are also listed under Schedules 1 & 2 of the Ordinance. The import, export and possession of scheduled corals, no matter dead or living, is restricted.

- The amended Town Planning Ordinance (Cap. 131) provides for the designation of coastal protection areas, Sites of Special Scientific Interest (SSSIs), Conservation Area, Country Park, Green Belt or other specified uses that promote conservation or protection of the environment.

- Chapter 10 of the Hong Kong Planning Standard and Guidelines (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 describes enforcement issues. The appendices list the legislation and administrative controls for conservation, other conservation related measures in Hong Kong and government departments involved in conservation.

- Annex 16 of the Environmental Impact Assessment Ordinance – Technical Memorandum on Environmental Impact Assessment Process (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 habitat and ecological impact.

- Environmental Impact Assessment Ordinance (EIAO) Guidance Note No. 3/2002 provides general guidelines for assessing the recommended environmental mitigation measures in Environmental Impact Assessment reports.

- EIAO Guidance Note No. 6/2010 clarifies the requirements of ecological assessments under the EIAO.

- EIAO Guidance Note No. 7/2010 provides general guidelines for conducting ecological baseline surveys in order to fulfill requirements stipulated in the EIAO-TM.

- EIAO Guidance Note No. 10/2010 introduces general methodologies for conducting terrestrial and freshwater ecological baseline surveys.

- EIAO Guidance Note No. 11/2010 introduces general methodologies for conducting marine ecological baseline surveys.

- The IUCN Red List of Threatened Species provides taxonomic, conservation status and distribution information on taxa that have been evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those taxa that are facing a higher risk of global extinction. The IUCN Red List also includes information on taxa that are either close to meeting the threatened thresholds or that would be threatened were it not for an ongoing taxon-specific conservation programme.

- The Key Protected Wildlife Species List details Category I and Category II protected animal species under the PRC's Wild Animal Protection Law.

7b.3 Assessment Methodology

7b.3.1 Study Area

7b.3.1.1 As required under Clause 3.7.5.2 of the EIAO Study Brief, the study area for the purpose of terrestrial ecological impact assessment includes all areas within 500 m from the site boundary of the land based works areas, or the area likely to be impacted by the Project (**Figure 7b.1** for Shek Kwu Chau; **Figure 7b.2** for Cheung Sha).

7b.3.1.2 As required under Clause 3.7.5.2 of the EIAO Study Brief, the study area for marine ecological impact assessment shall be the same as the water quality impact assessment, covering the Southern, Southern Supplementary, Second Southern Supplementary, North

Western, North Western Supplementary, and Western Buffer Water Control Zones (WCZs), or the area likely to be affected by the Project

7b.3.1.3 After referring to the **Water Quality Impact Assessment**, in addition to the implementation of the proposed water quality control measures, with the proposed phasing of works, and low impact construction method, potential adverse impact on water quality is predicted to be minimised and localized in the vicinity of the Project. Marine ecological impact assessment for this study will therefore confine to the area where adverse water quality impact is predicted within and in vicinity of the Project Site (**Figure 7b.3**).

7b.3.2 Literature Review

7b.3.2.1 In accordance with Clause 3.7.5.4(i) of the EIAO Study Brief, collation and review of relevant studies and available information regarding the ecological character of the study area were carried out. Evaluation of the collected information was conducted to identify any information gap relating to the assessment of potential ecological impacts to the terrestrial and marine environment.

7b.3.3 Ecological Surveys

7b.3.3.1 Based on review of the findings from relevant studies and available information, field surveys were carried out to fill information gaps identified, and to verify the information collected, in order to fulfill the objectives of this EIA according to Clause 3.7.5.4 (iii) of the EIAO Study Brief. The methodologies for ecological surveys and impact assessment presented below were prepared in accordance with the criteria and guidelines in Annexes 8 and 16 of the EIAO-TM, EIAO Guidance Note No. 7/2010, 10/2010 and 11/2010.

Ecological Survey Programme

Shek Kwu Chau

7b.3.3.2 An eleven-month ecological survey programme was conducted from December 2008 to October 2009 covering both dry and wet seasons. The details of the survey programme are summarized in **Table 7b.1**.

Table 7b.1 Ecological Survey Programme at Shek Kwu Chau

Shek Kwu Chau	Dry Season				Wet Season						
	Dec 08	Jan 09	Feb 09	Mar 09	Apr 09	May 09	Jun 09	Jul 09	Aug 09	Sept 09	Oct 09
Habitat and Vegetation Survey			√				√				
Avifauna Survey (Day)		√	√	√	√	√	√				
Avifauna Survey (Night)			√		√						
Butterfly, Dragonfly and Damselfly Survey				√		√	√				
Herpetofauna Survey (Day)				√		√	√				
Herpetofauna Survey (Night)					√		√				
Wooden Cover Board						√	√	√			√

Shek Kwu Chau	Dry Season				Wet Season						
	Dec 08	Jan 09	Feb 09	Mar 09	Apr 09	May 09	Jun 09	Jul 09	Aug 09	Sept 09	Oct 09
Survey											
Terrestrial Mammal Survey (Day)				√		√	√				
Terrestrial Mammal Survey (Night)			√		√		√				
Freshwater Community Survey						√	√				
Intertidal Survey		√		√			√				
Dive Survey			√								
Benthos Survey			√				√				
Marine Mammal Survey	√	√	√	√	√	√					

Cheung Sha

7b.3.3.3 A six-month ecological survey programme was conducted from August 2009 to January 2010 covering both dry and wet seasons. The details of the survey programme are summarized in **Table 7b.2**.

Table 7b.2 Ecological Survey Programme for Cheung Sha

Cheung Sha	Wet Season			Dry Season		
	Aug 09	Sept 09	Oct 09	Nov 09	Dec 09	Jan 10
Habitat and Vegetation Survey	√					√
Avifauna Survey (Day)	√	√	√			√
Avifauna Survey (Night)		√				
Butterfly, Dragonfly and Damselfly Survey	√		√			
Herpetofauna Survey (Day)	√		√			
Herpetofauna Survey (Night)		√				
Terrestrial Mammal Survey (Day)	√					√
Terrestrial Mammal Survey (Night)		√				
Freshwater Community Survey		√	√			
Benthos Survey	√				√	
Intertidal Survey		√				√
Dive Survey		√				

Habitat Mapping and Vegetation Survey

7b.3.3.4 Habitats within the study area were identified, sized and mapped. Ecological characteristics of each habitat type including size, vegetation type, and species present, dominant species found, species diversity and abundance, community structure, seasonal patterns and inter-dependence of the habitats and species, and presence of any features of ecological importance were defined and characterized. Representative

photographs of the habitat types and of important ecological features identified were taken. A desktop review of aerial photographs and maps of a suitable scale (1:1000 to 1:5000) showing the types and locations of habitats within 500 m from the Project boundary was conducted. The habitat maps were then verified during ground truthing.

7b.3.3.5 Vegetation surveys were conducted throughout dry and wet seasons. Diversity and dominance of plant species present in different habitat types were recorded by direct observation. The location of any plant species of conservation interest was recorded. Identification of flora species and status in Hong Kong was made with reference to Hong Kong Herbarium (2004) and Corlett *et al*. (2000).

Avifauna Survey

7b.3.3.6 Avifauna species present and relative abundance of species in different habitats were surveyed visually and aurally by walk transects, as adopted in terrestrial ecological surveys (**Figure 7b.4** for Shek Kwu Chau; and **Figure 7b.5** for Cheung Sha). The location of any avifauna species of conservation interest encountered was recorded, along with notable behaviour (e.g. breeding behaviour such as nesting and presence of recently fledged juveniles, roosting, and feeding activities). Night surveys were also conducted to record nocturnal avifauna. Ornithological nomenclature in this report follows Carey *et al.* (2001).

Dragonfly, Damselfly and Butterfly Survey

7b.3.3.7 Dragonflies, damselflies and butterflies within the study area were surveyed along the walk transects adopted in terrestrial ecological surveys (**Figure 7b.4** for Shek Kwu Chau; and **Figure 7b.5** for Cheung Sha). Taking into consideration the potential habitats/breeding areas of dragonfly species near the pond and stream areas, special attention was paid to these habitats for sightings of dragonfly and damselfly species. Relative abundance of dragonfly, damselfly and butterfly encountered was recorded. Nomenclature of dragonfly and damselfly follows Wilson (2003a), and nomenclature of butterfly follows Lo and Hui (2004).

Herpetofauna Survey

7b.3.3.8 Herpetofauna within the study area were surveyed along the walk transects adopted in terrestrial ecological surveys (**Figure 7b.4** for Shek Kwu Chau; and **Figure 7b.5** for Cheung Sha). Taking into consideration the potential habitats/breeding areas of herpetofauna species near the pond and stream areas, and in vegetated areas with leaf litter, special attention was paid to these habitats for sightings of herpetofauna species. Potential microhabitats (e.g. leaf litter, underneath of rotten logs) were searched. All reptiles and amphibians sighted were recorded.

7b.3.3.9 Amphibian surveys were conducted whenever possible on evening following or during periods of rainfall, focusing on areas suitable for amphibians. Records of calling amphibians formed the bulk of the data collected, but this was also supplemented when possible by visual observation of eggs, tadpoles and adult frogs and toads.

7b.3.3.10 During reptile surveys, careful searches of appropriate microhabitats and refugia were undertaken. All reptiles observed were identified. In addition to active searching, observation of exposed, basking or foraging reptiles was also recorded.

7b.3.3.11 Herpetofauna surveys were conducted during both daytime and night-time. Nomenclature of amphibian follows Chan *et al.* (2005), and reptile follows Karsen *et al.* (1998).

7b.3.3.12 Additional cover board surveys were further conducted in Shek Kwu Chau between May and October 2009. Cover board is an artificial cover object that attracts and allows

various species of amphibians and reptiles to use it as a refuge. Cover board is especially useful for sampling of fossorial species and in habitats with limited natural covers.

7b.3.3.13 In Shek Kwu Chau, the very rare and endemic Bogadek's Burrowing Lizard (*Dibamus bogadeki*) was previously recorded. While this species is known to live in soil, or under sheltered microhabitats such as rotting wood lying on the forest floor, cover boards were deployed in areas with their preferred environmental conditions. A total of 25 wooden cover boards of 80 cm x 80 cm were deployed at different habitats including shrubland, plantation, developed area, and near pond and watercourse (**Figure 7b.7**). The boards were placed on natural areas with flat soil surface. Warning signs were hung near the deployed boards to minimise potential human disturbance. During each of the cover board surveys, each of the boards was lifted to check for the potential presence of any hiding amphibians and reptiles. Cover boards were deployed on field on 18 May 2009. Checking of the cover boards were conducted on 29 May, 19 June, 22 June, 29 June, 28 July, and 16 October 2009.

Mammal Survey

7b.3.3.14 Mammal surveys were conducted along the walk transects adopted in terrestrial ecological surveys, as well as in areas which may be potentially utilized by terrestrial mammals during day and night time. The surveys focused on searching for field signs such as droppings, footprints, diggings or burrows left by terrestrial mammals. Mammal identification was made to the lowest possible taxon from the field signs. In addition, any mammal directly observed was also identified. Locations of mammal species of conservation interest were recorded. Nomenclature of mammal follows Shek (2006).

Freshwater Community Survey

7b.3.3.15 Freshwater fish and invertebrate communities were surveyed via active searching and direct observation at watercourse sections within the study area during dry and wet seasons at Shek Kwu Chau (2 watercourses) and Cheung Sha (2 watercourses) (**Figure 7b.4** for Shek Kwu Chau; **Figure 7b.5** for Cheung Sha). Boulders within the watercourse were turned over to locate any aquatic animals beneath. Hand net was used to collect organisms along the streams. Organisms encountered were recorded and identified to the lowest possible taxon level.

Intertidal Survey

7b.3.3.16 Survey on intertidal communities were conducted by line-transect method (**Figure 7b.4** for Shek Kwu Chau; and **Figure 7b.5** for Cheung Sha), in order to establish an ecological profile on the intertidal habitats located in the vicinity of the Project Site. In order to determine representative locations for transect deployment, a walk-through survey was conducted to actively search for, and find out any intertidal flora and epifauna along the shore. A general database on species composition and their relative occurrence in the survey location was established. It would help to assess whether the sampling exercise in the later quantitative survey has collected representative data (e.g. the number and type of species encountered) and whether the sampling effort is deemed adequate. A total of 2-3 surveyors were deployed and approximately 30-45 minutes was spent on walk-through survey.

7b.3.3.17 After the walk-through survey, quantitative survey was conducted using line transect method. A total of 6 representative locations were chosen at Shek Kwu Chau and 4 were chosen at Cheung Sha, covering areas within and outside the project area. One line transect was deployed at each of the survey locations. The transects were laid perpendicular to shoreline from high water mark down to low water mark during the low tide period (tide level below 1 m). Along each transect, standard ecological sampling quadrats (0.5m x 0.5m) were laid at 1 m intervals. Intertidal epifauna and flora within

each quadrat were identified and enumerated. In general, mobile fauna were counted in terms of abundance per unit area. Sessile organisms such as barnacles, oysters and algae were estimated in terms of percentage cover per fixed area. Intertidal fauna were identified to species level as far as possible. Representative photographs of intertidal habitat were also taken (**Appendix 7b.1** for Shek Kwu Chau; **Appendix 7b.12** for Cheung Sha).

Dive Survey

7b.3.3.18 Spot-check dive surveys covering the coastal areas at Shek Kwu Chau and Cheung Sha were conducted to locate the presence of corals (**Figure 7b.4** for Shek Kwu Chau; and **Figure 7b.5** for Cheung Sha). Subtidal substrata (hard substratum seabed etc.) along the proposed spot-check dive routes were surveyed for any presence of coral communities, including hard corals (order Scleractinia), octocorals (sub-class Octocorallia) and black corals (order Antipatharia).

7b.3.3.19 Spot-check dive routes with signs of corals observed were further surveyed by a more detailed Rapid Ecological Assessment (REA) with reference to DeVantier *et al.* (1998) (**Appendix 7b.2**). Sixteen 100-m REA transects were designed at the coasts of Shek Kwu Chau (**Figure 7b.9**), based on the preliminary results from the spot-check dives. For each transect, the locations (GPS) of dive routes, distance surveyed, number of colonies, sizes and types of corals, their coverage, abundance, condition, translocation feasibility and the conservation status of coral species in Hong Kong waters were recorded and representative photographs were taken (**Appendix 7b.3**).

Benthos Survey

7b.3.3.20 To survey marine soft bottom benthic fauna, grab sampling of seabed sediment was carried out once during both wet and dry seasons. Five benthos sampling sites were proposed within and near the proposed reclamation area (**Figure 7b.4**); and four benthos sampling sites were proposed along the proposed submarine cable alignment (**Figure 7b.6**).

7b.3.3.21 At each sampling site, three replicates of grab samples over a 0.1 m^2 area seabed substrate were collected using a van Veen grab. Samples were then sieved through 0.5 mm sieves and stained with Rose Bengal. Collected organisms were counted, weighed and identified to the lowest practicable taxon as possible.

7b.3.3.22 Abundance, biomass, species diversity *H'* and evenness *J* were calculated for pooled data, using the formulae:

$$H' = -\sum (Ni / N) \ln (Ni / N)$$; and

$$J = H' / \ln S$$

where S is the total number of species in the sample, N is the total number of individuals, and Ni is the number of individuals of the i^{th} *species.*

Marine Mammal Survey

7b.3.3.23 Finless Porpoise and Chinese White Dolphin are the key marine species with conservation interests within the proposed Project Site at Southeast Lantau waters. Vessel-based visual surveys covering the Southeast Lantau waters were conducted to collect systematic data on marine mammals, including Chinese White Dolphin and Finless Porpoise. The marine mammal survey methodology was in consistency with that adopted by the Hong Kong Cetacean Research Project (HKCRP) long-term research program (Hung, 2005a, 2005b, 2006, 2007, 2008a, 2009; Jefferson, 2000; Jefferson *et al.,* 2002a).

7b.3.3.24 Between December 2008 and May 2009, a 6-month study covering both dry and wet seasons was conducted along the line-transects, covering the whole of Southeast Lantau survey area of the long-term marine mammals monitoring programme by AFCD, in which the proposed Project Site would be located (**Figure 7b.8**). Two experienced observers (a data recorder and a primary observer) were involved in the on-effort survey team. The survey vessel moved along the transect lines at a constant speed of 13-15 km per hour. The data recorder searched for sightings of marine mammals with unaided eye and filled out the datasheets; while the primary observer searched with a pair of 7x50 Brunton marine binoculars. Both observers searched the sea ahead of the vessel, between 270^{o} and 90^{o} (in relation to the bow, which is defined as 0^{o}). During on-effort survey periods, the survey team recorded effort data including time, position (latitude and longitude), weather conditions (Beaufort sea state and visibility), and distance travelled in each series (a continuous period of search effort) with the assistance of a professional GPS (Garmin Geko 201). Two additional experienced observers were available on the boat to work in shift (i.e. rotate every 30 minutes) in order to minimize fatigue of the survey team members.

7b.3.3.25 When dolphins or porpoises were sighted, the survey team ended the survey effort, and immediately recorded the initial sighting distance and angle of the dolphin group from the survey vessel, as well as the sighting time and position. Then the research vessel diverted from its course to approach the animals for species identification, group size estimation, group composition assessment, behavioural observations, and collection of identification photos.

7b.3.3.26 The perpendicular distances (PSD) of the dolphin groups to the transect line were calculated from the initial sighting distance and angle. The recorded data can be analyzed by the established computer programmes (e.g. DISTANCE programme, ArcView GIS) for long-term monitoring of population status including trends in abundance, distribution and habitat use.

7b.4 Description of the Environment

7b.4.1 Area of Conservation Interest

7b.4.1.1 There are no recognized sites of conservation importance (such as Country Parks, Sites of Special Scientific Interest, Coastal Protection Area or Conservation Area) in the study area of Shek Kwu Chau and Cheung Sha. Other ecologically important habitats identified within the study area include habitats for marine mammals and coral communities, as well as a potential important fish spawning and nursery ground.

7b.4.2 Habitat and Vegetation

Shek Kwu Chau

Literature Review

7b.4.2.1 Studies on the habitat and vegetation at Shek Kwu Chau are scarce. Between 1960 and 1961, Shek Kwu Chau was burnt over for the construction of the Society for the Aid and Rehabilitation of Drug Abusers (SARDA). Since then, shrubs, palms, sedges and tall grasses had re-colonised the island; and reforestation of exotic species, mostly *Acacia confusa*, has increased the tree cover of the island (Lazell, 2002).

7b.4.2.2 During a detailed vegetation survey conducted in 1996, a total of 275 species of flora were recorded on the whole of Shek Kwu Chau (Chen *et al.*, 1996). Shrubland was identified as the dominant habitat on Shek Kwu Chau, with coverage of over 80% (*ibid.*). The most common species recorded include *Litsea glutinosa*, *L. rotundifolia* var. *oblongifolia*, *Sterculia lanceolata*, and *Microcos paniculata*; whereas exotic species

including *Cerbera manghas*, *Scaevola sericea*, *Phoenix hanceanum* and *Pandanus* spp. were also common (*ibid*.).

Recent Survey Results

7b.4.2.3 A total of 9 habitat types were identified during the ecological surveys, including shrubland, plantation, developed area, pond, watercourse, rocky shore, subtidal soft bottom, subtidal hard bottom, and coastal / marine waters (**Figure 7b.1** and **7b.3**).

7b.4.2.4 Representative photographs of habitats are given in **Appendix 7b.1**. Vegetation recorded within the study area is listed in **Appendix 7b.5**. No flora species recorded in the recent surveys was rare or considered of conservation interest.

7b.4.2.5 The following table presents the sizes of habitats within the study area. Further description of habitat types recorded in the study area is given in the followings sections.

Table 7b.3 Habitats Recorded within the Study Area at Shek Kwu Chau

Habitat Type	Area (ha)
Shrubland	38.2
Plantation	0.7
Developed Area	2.7
Pond	0.3
Watercourse	0.04 Length of W1: 51 m; W2: 110 m
Rocky Shore	2.3
Subtidal Area and Coastal / Marine Waters (Southern Water Control Zone)	6,610

Shrubland

7b.4.2.6 Shrubland habitat occupies the majority of the study area and supports the most diverse vegetation species within the study area. Some of the commonly recorded species include tree species *Bridelia tomentosa*, *Celtis sinensis*, and *Macaranga tanarius*; shrub species *Ilex asprella*; herb species *Bidens alba*, and *Dicranopteris pedata*; and climber species *Bauhinia championii*. No rare plant species was recorded during the surveys. With a total of 114 species recorded, the diversity of vegetation species at shrubland is considered to be high.

Plantation

7b.4.2.7 Plantation habitat within the study area was mainly found on modified slopes surrounding the football court, near developed habitat, and along roadsides. These areas were dominated by commonly planted exotic tree species *Acacia confusa* and *Delonix regia.* Other species that were also commonly recorded include tree species *Mallotus apelta*, and *M. paniculatus*; shrub species *Litsea glutinosa*; and climber species *Pueraria* spp. No rare plant species was recorded. With a total of 30 species recorded, the diversity of vegetation species at plantation is considered to be low.

Developed Area

7b.4.2.8 Developed habitat refers to highly disturbed areas with constant and intensive human disturbance, such as the residence buildings, football court, and paved roads. Some of the commonly recorded species include shrub species *Duranta erecta* and *Hibiscus rosa-sinensis*; and herb species *Wedelia trilobata* and *Oxalis corniculata*. Other recorded tree species include *Sapindus saponaria* and *Ficus elastica*. No rare plant species was

recorded. With a total of 14 species recorded, the diversity of vegetation species at developed area is considered to be very low.

Pond

7b.4.2.9 The pond habitat is used as a reservoir by the residence of the island and is surrounded by shrubland. The exotic aquatic herb, *Nymphaea* sp., was observed over the pond surface. Some of the vegetation species recorded around the pond habitat include tree species *Macaranga tanarius* and *Thevetia peruviana*; shrub species *Sterculia lanceolata*; herb species *Pteris semipinnata* and *Colocasia esculenta*; and climber species *Mikania micrantha*. No rare plant species was recorded. With a total of 22 species recorded, the diversity of vegetation species around pond is considered to be low.

Watercourse

7b.4.2.10 The identified watercourses (W1 and W2) are considered to be natural with riparian vegetation. Some of the vegetation recorded along the watercourses include tree species *Ficus virens* and *Macaranga tanarius*; shrub species *Boehmeria nivea* and *Hedychium coronarium*; herb species *Acorus tatarinowii*, *Alocasia odora*, *Commelina* spp. and climber species *Lygodium scandens*. No rare plant species was recorded. With a total of 29 species recorded, the diversity of vegetation species along watercourse is considered to be low.

Rocky Shore

7b.4.2.11 Shek Kwu Chau is surrounded by natural rocky shore. The shore is composed of large boulders in various forms. The shore is similar to other typical exposed rocky shores in Hong Kong. Some of the boulders were covered with encrusting algae *Hildenbrandia occidentalis*; erect algae *Gelidium pusillum,* Coralline algae*, Hincksia mitchelliae, Porphyra suborbiculata,* and *Ulva* sp.; and cyanobacteria *Chroococcus* sp. and *Kyrtuthrix maculans*.

Subtidal Hard and Soft Bottom

7b.4.2.12 The subtidal hard bottom habitat is composed of bedrock sloping from the Shek Kwu Chau Island. The subtidal soft bottom habitat is composed of coarse sandy material and gravels; the substrate becomes finer and muddier towards the sea. The seabed substratum found near Shek Kwu Chau is similar to the substratum found across the Southern Water Control Zone.

Cheung Sha

Literature Review

7b.4.2.13 The most relevant EIA study which partly overlaps with this Project's study area was the EIA-075/2002 *Improvement to Tung Chung Road between Lung Tseng Tau and Cheung Sha* (HyD, 2002). Dominated tree species recorded include native species *Ficus microcarpa, Litsea glutinosa, Microcos paniculatus*, *Celtis tetrandra* and *Bridelia tomentosa*; whereas as fruit tree such as *Dimocarpus longan* and *Litchi chinensis* were also found near village houses.

Recent Survey Results

7b.4.2.14 A total of 7 habitat types were identified during the ecological surveys, including shrubland, developed area, watercourse, and rocky shore, subtidal soft bottom habitat, subtidal hard bottom habitat and coastal / marine waters (**Figure 7b.2** and **7b.3**).

7b.4.2.15 Representative photographs of habitats are given in **Appendix 7b.12**. Photographs of plant species of conservation interest are presented in **Appendix 7b.13**. Vegetation recorded within the study area is listed in **Appendix 7b.14**.

7b.4.2.16 The following table presents the sizes of habitats within the study area. Further description of habitat types recorded in the study area is given in the followings sections.

Table 7b.4 Habitats Recorded within the Study Area at Cheung Sha

Habitat Type	Area (ha)
Shrubland	18.2
Developed Area	8.2
Watercourse	0.2 Length of W1：499 m; W2: 103 m
Rocky Shore	0.8
Subtidal Area and Coastal / Marine Waters (Southern Water Control Zone)	6,610

Shrubland

7b.4.2.17 Shrubland habitat occupies the majority of the study area and supports the most diverse vegetation species within the study area. Some of the commonly recorded species include tree species *Bridelia tomentosa* and *Bischofia javanica*; shrub species *Alangium chinense* and *Sageretia thea*; and herb species *Ipomoea pes-caprae*, *Asclepias curassavica* and *Crotalaria pallida*.

7b.4.2.18 One locally protected species, *Aquilaria sinensis*, was recorded within the study area (**Appendix 7b.13**). With a total of 99 species recorded, the diversity of vegetation species at shrubland is considered to be moderate to high.

Developed Area

7b.4.2.19 Developed habitat refers to highly disturbed areas with constant and intensive human disturbance, such as the villages and paved roads. Some of the vegetation species recorded within developed area include tree species *Acacia mangium* and *Eucalyptus* spp.; shrub species *Codiaeum variegatum* and *Duranta erecta*; herb species *Euphorbia hirta* and *Hedyotis auricularia*; and climber species *Parthenocissus dalzielii*. No rare plant species was recorded. With a total of 62 species recorded, the diversity of vegetation species along watercourse is considered to be moderate.

Watercourse

7b.4.2.20 The identified watercourses (W1 and W2) are considered to be natural with riparian vegetation. Some of the vegetation species recorded along the watercourses include tree species *Melaleuca quinquenervia*; shrub species *Daphniphyllum* spp. and *Colocasia esculenta*; herb species *Alpinia hainanensis* and *Ludwigia perennis*; and climber species *Canavalia maritima* and *Asparagus cochinchinensis*.

7b.4.2.21 One rare plant species, *Ceratopteris thalictroides*, was recorded near W2, which is a seasonal stream. With a total of 30 species recorded, the diversity of vegetation species along watercourse is considered to be low.

Rocky Shore

7b.4.2.22 The majority of the shore within the study area is natural rocky shore. The shore is composed of large boulders in various forms. The shore is similar to other typical exposed rocky shores in Hong Kong. Some of the boulders were covered with encrusting

algae *Hildenbrandia rubra* and *Pseudulvella applanata*; erect algae *Ulva* spp., *Corallina* spp. and *Hincksia mitchelliae*; and cyanobacteria *Chroococcus* sp. and *Kyrtuthrix maculans*.

7b.4.2.23 Some of the recorded backshore vegetation in the vicinity of the rocky shore include tree species *Cerbera manghas* and *Hibiscus tiliaceus*; shrub species *Pandanus tectorius* and *Psychotria asiatica*; herb species *Ipomoea pes-caprae* and *Stachytarpheta jamaicensis*; and climber species *Ficus pumila* and *Gymnema sylvestre*. No rare plant species was recorded at the backshore vegetation.

Subtidal Hard and Soft Bottom

7b.4.2.24 The subtidal hard bottom habitat is composed of natural bedrock and boulders. The subtidal soft bottom habitat is composed of mud and sand. The seabed substratum found near Cheung Sha is similar to the substratum found across the Southern Water Control Zone.

Shek Kwu Chau and Cheung Sha

Coastal / Marine Waters

7b.4.2.25 The study area covers the Southern Water Control Zone. Marine water quality monitoring data routinely collected by EPD were used to establish the baseline condition. The EPD monitoring data collected in 2008 are summarised in **Table 7b.5** (EPD, 2009). The 4 selected stations close to the Project Site in Southern WCZ include SM12, SM13, SM17 and SM6. The locations of these monitoring stations are shown in **Figure 5b.1**.

Table 7b.5 Marine Water Quality Condition for Southern WCZ

Parameters		Lantau Island (South)			West Lamma	WPCO WQO (in marine waters)
		SM12	SM13	SM17	SM6	
Temperature (℃)		23.0 (13.7 – 28.9)	23.0 (13.9 – 29.0)	22.8 (14.1 – 27.6)	23.0 (14.1 – 27.1)	Not more than 2℃ in daily temperature range
Salinity		29.5 (14.9 – 32.9)	29.4 (13.9 – 32.9)	31.2 (25.5 – 33.8)	30.8 (24.3 – 33.1)	Not to cause more than 10% change
Dissolved Oxygen (DO) (mg/L)	Depth Average	6.8 (4.5 –9.8)	6.8 (4.7 – 9.8)	6.4 (3.5 – 10.0)	6.5 (4.7 – 9.7)	Not less than 4 mg/L for 90% of the samples
	Bottom	6.6 (3.0 – 9.7)	6.7 (3.3 – 9.6)	6.0 (2.1 – 10.0)	5.5 (1.1 – 9.5)	Not less than 2 mg/L for 90% of the samples
Dissolved Oxygen (DO) (% Saturation)	Depth Average	93 (63 – 121)	93 (66 – 122)	88 (549 – 123)	90 (66 – 118)	Not Available
	Bottom	91 (43 – 119)	92 (48 – 118)	82 (30 – 122)	76 (16 – 116)	Not Available
pH		8.1 (7.7 – 8.3)	8.2 (7.7 – 8.4)	8.1 (7.7 – 8.3)	8.2 (7.7 – 8.5)	6.5 - 8.5 (±0.2 from natural range)
Secchi Disc Depth (m)		1.8 (1.0 – 3.2)	1.9 (1.0 – 2.4)	2.1 (1.2 – 2.8)	2.0 (0.9 – 3.3)	Not Available
Turbidity (NTU)		13.5 (8.8 – 21.9)	11.7 (7.9 – 19.5)	11.1 (5.8 – 29.8)	9.4 (4.3 – 19.0)	Not Available
Suspended Solids (SS) (mg/L)		11.6 (2.8 – 21.0)	8.6 (3.0 – 16.7)	5.6 (2.7 – 12.3)	5.8 (2.1 – 9.9)	Not more than 30% increase
5-day Biochemical Oxygen Demand (BOD_5) (mg/L)		0.7 (0.2 – 1.8)	0.7 (0.2 – 1.5)	0.6 (0.1 – 1.5)	0.7 (0.1 – 1.4)	Not Available
Ammonia Nitrogen (NH_3-N) (mg/L)		0.07 (0.02 – 0.21)	0.06 (0.01 – 0.21)	0.03 (0.01 – 0.10)	0.04 (0.01 – 0.10)	Not Available
Unionised Ammonia (UIA) (mg/L)		0.004 (<0.001 – 0.018)	0.004 (<0.001 – 0.016)	0.002 (<0.001 – 0.005)	0.003 (<0.001 – 0.007)	Not more than 0.021 mg/L for annual mean
Nitrite Nitrogen (NO_2-N) (mg/L)		0.041 (0.006 – 0.160)	0.038 (0.005 – 0.150)	0.022 (0.002 – 0.046)	0.038 (0.007 – 0.173)	Not Available
Nitrate Nitrogen (NO_3-N) (mg/L)		0.194 (0.019 – 0.940)	0.193 (0.019 – 0.977)	0.126 (0.009 – 0.537)	0.159 (0.010 – 0.628)	Not Available
Total Inorganic Nitrogen (TIN) (mg/L)		0.31 (0.07 – 1.31)	0.29 (0.06 – 1.33)	0.18 (0.04 – 0.65)	0.24 (0.04 – 0.87)	Not more than 0.1 mg/L for annual mean

Parameters	Lantau Island (South)			West Lamma	WPCO WQO (in marine waters)
	SM12	SM13	SM17	SM6	
Total Kjeldahl Nitrogen TKN) (mg/L)	0.27 (0.15 – 0.46)	0.26 (0.14 – 0.42)	0.20 (0.15 – 0.27)	0.22 (0.14 – 0.27)	Not Available
Total Nitrogen (TN) (mg/L)	0.51 (0.19 – 1.56)	0.49 (0.17 – 1.53)	0.35 (0.17 – 0.80)	0.41 (0.18 – 1.04)	Not Available
Orthophosphate Phosphorus (OrthoP) (mg/L)	0.016 (0.004 – 0.028)	0.014 (0.005 – 0.028)	0.012 (0.005 – 0.021)	0.013 (0.008 – 0.025)	Not Available
Total Phosphorus (TP) (mg/L)	0.03 (0.02 – 0.05)	0.03 (0.02 – 0.05)	0.03 (0.02 – 0.03)	0.03 (0.02 – 0.04)	Not Available
Silica (as SiO_2) (mg/L)	1.3 (0.1 – 4.9)	1.3 (0.1 – 5.2)	1.0 (0.2 – 2.9)	1.1 (0.3 – 3.4)	Not Available
Chlorophyll-*a* (μg/L)	3.5 (1.2 – 10.4)	3.2 (0.9 – 8.3)	2.3 (0.6 – 7.0)	4.9 (1.2 – 12.7)	Not Available
E. coli (cfu/100 mL)	21 (2 – 200)	5 (1 – 81)	2 (1 – 23)	2 (1 – 150)	Not Available
Faecal Coliforms (cfu/100 mL)	43 (3 – 480)	9 (1 – 300)	3 (1 - 70)	4 (1 – 330)	Not Available

Note:
1. Data source: Marine Water Quality in Hong Kong in 2008 (EPD, 2009).
2. Unless otherwise specified, data presented are depth-averaged values calculated by taking the means of three depths: Surface, Mid-depth, Bottom.
3. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.
4. Data in brackets indicate the ranges.

7b.4.2.26 The Southern WCZ is directly open to the South China Sea. It is a large expanse of open sea and enjoys good levels of dissolved oxygen (DO). Nevertheless, the western part is affected by the discharge from Pearl River, in particular during the wet summer months when the river's fresh water flow increases. Higher levels of SS and TIN are often recorded at the western stations than those at the east. The situation reverses for salinity.

7b.4.2.27 According to the latest Marine Water Quality Report 2008 (EPD, 2009), the temperature, salinity and dissolved oxygen concentration (bottom layer) in the surrounding water ranged between 13.9-29℃, 13.9-32.9 ppt and 3.3-9.6 mg/L respectively in 2008 (data from the closest water quality monitoring station SM13). Shek Kwu Chau is under adverse influence of Pearl River runoff in wet season (EPD, 2009; EPD, 2006). High concentration of TIN was recorded and that the compliance rate with water quality objective was consistently low from 1998 to 2007 (EPD, 2006; 2007; 2008). The SS level ranged from 2.8 to 21.0 mg/L and 3.0 to 16.7 mg/L at the closest water quality monitoring station SM12 and SM13 in 2008, respectively. However, full compliance with the water quality objectives for dissolved oxygen, unionized ammonia and *E. coli* levels were achieved in 2008 (EPD, 2009). No hypoxia has ever occurred at Shek Kwu Chau.

Spawning and Nursery Ground for Commercial Fisheries Resources

7b.4.2.28 According to the "Fisheries Resources and Fishing Operations in Hong Kong Waters" (AFD, 1998), nursery ground of commercial fisheries resources was identified at Northeast Waters, Port Shelter, Lamma Island and South Lantau; whilst spawning ground of commercial fisheries resources were identified at Northeast Waters, Eastern Waters, Southeast Hong Kong in Mirs Bay, South Lamma, South Cheung Chau, Northeast Lantau, and South Lantau.

7b.4.2.29 The footprint of the previously identified spawning and nursery grounds at South Lantau waters covers the proposed Project Site at Shek Kwu Chau and submarine cable alignment. During the fisheries baseline surveys (ichthyoplankton and post-larvae) conducted under *EIA-125/2006 Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities: Part 2 South Soko* (CLP, 2006), two sampling stations were located at the offshore waters at Shek Kwu Chau (SKC1 and SKC2). The survey results concluded that the densities for fish larva and eggs at all sampling stations at South and West Lantau waters were generally low; the degree of difference in densities between

stations were small, and therefore it was concluded that there was no observable difference in fish larvae and egg densities between the identified spawning and nursery grounds at southern waters of Hong Kong, and the waters at Western Lantau, which was not identified to be important spawning and nursery grounds (*ibid.*).

7b.4.2.30 In addition, important nursery areas for fish can be identified by commercial fry collection areas. Fry collection in Hong Kong has diminished in scale in recent years. Based on the most recent 2006 Port Survey Report (AFCD, 2009b), the Project Site and the area in the vicinity that may be affected by water quality impacts are not major areas of fry collection.

7b.4.3 Avifauna

Shek Kwu Chau

Literature Review

7b.4.3.1 Literature on avifauna at Shek Kwu Chau is very scarce. An Eurasian Eagle Owl (*Bubo bubo*) was previously recorded at Shek Kwu Chau (HKU, 1998). Eurasian Eagle Owl is a scarce resident but is widely distributed in Hong Kong, and it favours open hillsides and offshore islands (AFCD, 2006a; Viney *et al.*, 2005).

7b.4.3.2 Records of nesting White-bellied Sea Eagle (*Haliaeetus leucogaster*) have also been made at Shek Kwu Chau (AFCD, 2010a). White-bellied Sea Eagle (WBSE) is uncommon in Hong Kong and favours coastal areas and offshore islands (*ibid.*). Shek Kwu Chau was reported to be one of the 17 breeding sites for WBSE in Hong Kong, where a breeding pair has been found since 2006, with a territory size of about 15.8 km (*ibid.*). Up until the survey season in 2009/2010, three active breeding years have been recorded at Shek Kwu Chau (*ibid.*; AFCD, 2010d). The WBSE nest was recorded at the southwest of Shek Kwu Chau, located approximately 130 m in-land from the shore, and 60 m above ground level within hillside shrubland habitat (AFCD, 2009c).

7b.4.3.3 The aforementioned two species are considered as rare and indeterminate in the China Red Data Book respectively. Both are protected under the local regulations (**Table 7b.6**).

Table 7b.6 Avifauna Species of Conservation Interest Previously Recorded at Shek Kwu Chau

Common Name [1]	Scientific Name	Distribution in Hong Kong [2]	Level of Concern [3]	IUCN Red List [4]
Eurasian Eagle Owl [5]	*Bubo bubo*	Scarce resident. Widely distributed in Hong Kong.	RC	-
White-bellied Sea Eagle [5]	*Haliaeetus leucogaster*	Uncommon	(RC)	-

Note:
1. All wild birds are Protected under Wild Animal Protection Ordinance (Cap. 170)
2. AFCD (2006a)
3. Fellowes *et al.* (2002); RC=Regional Concern; letter in parentheses indicate that the assessment is based on restrictedness in breeding and/or roosting sites.
4. IUCN (2009)
5. Protected under Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586)

Recent Survey Results

7b.4.3.4 A total of 46 avifaunal species were recorded within the study area during the current study. The most common species recorded include Red-whiskered Bulbul (*Pycnonotus*

jocosus), Chinese Bulbul (*Pycnonotus sinensis*), Masked Laughingthrush (*Garrulax perspicillatus*), and Japanese White-eye (*Zosterops japonica*). A full list of avifaunal species recorded is given in **Appendix 7b.6**.

7b.4.3.5 Among the recorded species within the study area, a total of 7 species are considered to be of conservation interest, as listed in the following table:

Table 7b.7 Avifauna Species of Conservation Interest Recorded within the Study Area at Shek Kwu Chau

Common Name [1]	Scientific Name	Distribution in Hong Kong [2]	Level of Concern [3]	IUCN Red List [4]
Pacific Reef Egret	*Egretta sacra*	Uncommon	(LC)	-
Black Kite	*Milvus migrans*	Common	(RC)	-
White-bellied Sea Eagle [5]	*Haliaeetus leucogaster*	Uncommon	(RC)	-
Emerald Dove	*Chalcophaps indica*	Scarce	-	-
Pacific Swift	*Apus pacificus*	Common	LC	-
White-throated Kingfisher	*Halcyon smyrnensis*	Common	(LC)	-
Japanese Paradise Flycatcher	*Terpsiphone atrocaudata*	Scarce	LC	Near Threatened

Note:
1. All wild birds are Protected under Wild Animal Protection Ordinance (Cap. 170)
2. AFCD (2006a)
3. Fellowes *et al.* (2002); RC=Regional Concern; LC=Local Concern; letter in parentheses indicate that the assessment is based on restrictedness in breeding and/or roosting sites.
4. IUCN (2009)
5. Protected under Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586)

7b.4.3.6 Among the 7 recorded avifauna species of conservation interest, Pacific Reef Egret and White-bellied Sea Eagle were recorded in proximity to the works area. The rest were recorded further inland above the elevation of the works area. Pacific Reef Egret (*Egretta sacra*) was recorded at the rocky shore in proximity to the works area, while White-bellied Sea Eagle (*Haliaeetus leucogaster*) was found within shrubland habitat close to rocky shore. Conservation status of each species is described in **Table 7b.7**, and more details are provided as follows:

Pacific Reef Egret

7b.4.3.7 Pacific Reef Egret is a locally uncommon resident and is confined to coastal rocky areas (HKBWS, 2009; Viney *et al.*, 2005). Three individuals were recorded resting and flying along the rocky shore near the proposed reclamation area. There was no sighting of stick nest among rocks during site observation.

White-bellied Sea Eagle

7b.4.3.8 White-bellied Sea Eagle (WBSE) is an uncommon resident that occurs in coastal areas, offshore islands and sometimes at large reservoirs in Hong Kong (HKBWS, 2009; Viney *et al.*, 2005; Carey *et al.*, 2001). Nests are often built close to water, on trees and cliffs, or on the ground with the absence of predators (AFCD, 2010a). One adult WBSE was recorded among shrubland habitat near to the rocky shore within the study area during site observation. It was observed to be in good health condition. Although records of nesting White-bellied Sea Eagle were previously made under another study at Shek Kwu

Chau (AFCD, 2010a), nevertheless no foraging or breeding behaviour was noted during site observation.

Outside the Study Area

7b.4.3.9 One sighting of White-bellied Sea Eagle was recorded among hillside shrubland habitat near the rocky shore outside the boundary of the study area (over 500 m away). Two other individuals were observed at flight over the island; and another one was observed carrying a fish flying towards Shek Kwu Chau over open waters.

7b.4.3.10 In addition, two individuals of Black-naped Tern (*Sterna sumatrana*) were recorded flying and resting along the rocky shore outside the study area (about 600 m away). This species is a common summer visitor that breeds on rocky islets (HKBWS, 2009; Viney *et al.* 2005). No breeding behaviour was recorded during site observation.

Cheung Sha

Literature Review

7b.4.3.11 A total of 46 avifauna species were recorded in the vicinity of the study area of this Project, along the Tung Chung Road (HyD, 2002); where most of the recorded species are commonly recorded in similar habitats in Hong Kong. Although no avifauna species of conservation interest were recorded within the study area of this Project, nevertheless, Grey Nightjar (scarce and of local concern) were recorded outside the study area along the Tung Chung Road (*ibid.*).

Recent Survey Results

7b.4.3.12 A total of 20 avifaunal species were recorded within the study area during the current study. The most common species recorded include Red-whiskered Bulbul (*Pycnonotus jocosus*), Chinese Bulbul (*Pycnonotus sinensis*), and Japanese White-eye (*Zosterops japonica*). A full list of avifaunal species recorded is given in **Appendix 7b.15**.

7b.4.3.13 Among the recorded species within the study area, a total of 4 species is considered to be of conservation interest, as listed in the following table:

Table 7b.8 Avifauna Species of Conservation Interest Recorded within the Study Area at Cheung Sha

Common Name[1]	Scientific Name	Distribution in Hong Kong[2]	Level of Concern[3]	IUCN Red List[4]
Little Egret	*Egretta garzetta*	Common	PRC (RC)	-
Pacific Reef Egret	*Egretta sacra*	Uncommon	(LC)	-
Black Kite	*Milvus migrans*	Common	(RC)	-
White-throated Kingfisher	*Halcyon smyrnensis*	Common	(LC)	-

Note:
1. All wild birds are Protected under Wild Animal Protection Ordinance (Cap. 170)
2. AFCD (2006a)
3. Fellowes *et al.* (2002); RC=Regional Concern; LC=Local Concern; PRC=Potential Regional Concern; letter in parentheses indicate that the assessment is based on restrictedness in breeding and/or roosting sites.
4. IUCN (2009)

7b.4.3.14 Among the 4 recorded avifaunal species of conservation interest, Pacific Reef Egret and Black Kite were recorded in proximity to the works area. The rest were recorded further inland above the elevation of the works area. The conservation status of each species is described in **Table 7b.8**, and more details are provided as follows:

Pacific Reef Egret

7b.4.3.15 Pacific Reef Egret is a locally uncommon resident and is confined to coastal rocky areas (HKBWS, 2009; Viney *et al.*, 2005). Two individuals were recorded resting on an isolated rock off the shore, and foraging at the coastal waters approximately 500 m from the works area. There was no sighting of stick nest among rocks during site observation.

Black Kite

7b.4.3.16 Black Kites are abundant winter visitors and occur in the urban areas (Carey *et al.*, 2001). A Black Kite was recorded resting on an isolated rock off the shore, and foraging at the coastal waters approximately 500 m from the works area. Further inland within developed habitat, a potential nest of Black Kite was observed at a metal tower (**Appendix 7b.13**). Nevertheless, no breeding behaviour, juvenile or egg was observed. Black Kites are considered of conservation interest in Hong Kong due to the restricted nesting and roosting ranges (Fellowes *et al.,* 2002). The current breeding population is thought to be around 30 pairs (Carey *et al.*, 2001).

7b.4.4 Terrestrial Mammals

Shek Kwu Chau

Literature Review

7b.4.4.1 No existing literature on terrestrial mammal at Shek Kwu Chau was identified.

Recent Survey Results

7b.4.4.2 Only 1 species of terrestrial mammal, Japanese Pipistrelle (*Pipistrellus abramus*), was recorded at flight over the pond and shrubland habitats during the current study (**Appendix 7b.6**). Japanese Pipistrelle is abundant and widespread in Hong Kong (Shek, 2006). It is considered to be of local concern by Fellowes *et al*. (2002) and locally protected under Wild Animal Protection Ordinance (Cap. 170). Japanese Pipistrelle roosts frequently in towns and villages, and are also abundant in wetland areas (Shek, 2006).

Cheung Sha

Literature Review

7b.4.4.3 No existing literature on terrestrial mammal within the study area at Cheung Sha was reported. Nevertheless, along the Tung Chung Road outside the study area, mammal species including Chinese Muntjac (*Muntiacus reevesi*), Civet, and Small-toothed Ferret Badger (*Melogale moschata*) were previously recorded; which are all locally protected under Wild Animal Protection Ordinance (Cap. 170).

Recent Survey Results

7b.4.4.4 Only 1 species of terrestrial mammal, Domestic Ox (*Bos taurus*), was recorded at along the roadside and near W2 within the study area (**Appendix 7b.15**). Domestic Ox is abundant and widespread in Hong Kong (Shek, 2006).

7b.4.5 Herpetofauna

Shek Kwu Chau

Literature Review

7b.4.5.1 According to relevant literatures, herpetofauna previously recorded at Shek Kwu Chau include snake species Painted Bronze Back (*Dendrelaphis pictus*), Common Rat Snake (*Ptyas mucosus*), Jade Vine Snake (*Ahaetulla prasina*), Burmese Python (*Python molurus*), Copperhead Racer (*Elaphe radiata*), and Many-banded Krait (*Oligodon formosanus*); gecko species Tree Gecko (*Hemiphyllodactylus* sp.); and lizard species Bogadek's Burrowing Lizard (*Dibamus bogadeki*); frog species Three-striped Grass Frog (*Rana macrodactyla*); and tortoise species Reeve's Terrapin (*Chinemys reevesii*) (AFCD, 2006a; Chan *et al.*, 2006a; Chan *et al.*, 2006b; Chan *et al.*, 2005; Karsen *et al.*, 1998; HKU, 1997; HKU, 1993).

7b.4.5.2 Based on the amassed historical data from 1984 to 1999, Lazell (2002) documented a total of 24 herpetofauna species at Shek Kwu Chau, where 10 of them are considered to be of conservation interest and are rare in Hong Kong. Bogadek's Burrowing Lizard (*Dibamus bogadeki*) is one of the recorded reptiles. Among the 5 collected specimens of this species in Hong Kong, 3 were collected from Shek Kwu Chau (Lazell, 2002).

7b.4.5.3 Details of the previously recorded reptile species of conservation interest are listed in the following table (no amphibian species of conservation interest were noted):

Table 7b.9 Herpetofauna Species of Conservation Interest Previously Recorded at Shek Kwu Chau

Common Name	Scientific Name	Distribution in Hong Kong [(1)]	Level of Concern [(2)]	IUCN Red List [(5)]
Reptile				
Painted Bronze Back	*Dendrelaphis pictus*	Rare, only 1 record from Hong Kong Island, and 1 recorded from Shek Kwu Chau	LC	-
Common Rat Snake[4]	*Ptyas mucosus*	Widely distributed	PRC	-
Jade Vine Snake	*Ahaetulla prasina*	Uncertain	LC	-
Burmese Python [(3), (4)]	*Python molurus bivittatus*	Widely distributed	PRC	Lower Risk/ Near Threatened
Copperhead Racer	*Elaphe radiata*	Widely distributed	PRC	-
Many-banded Krait	*Bungarus multicinctus*	Widely distributed	PRC	-
Chinese Cobra [(3)]	*Naja atra*	Widely distributed	PRC	-
Tree Gecko	*Hemiphyllodactylus* sp.	Found in Po Toi, Aberdeen, Shek Kwu Chau	RC	-
Bogadek's Burrowing Lizard	*Dibamus bogadeki*	Rare, only recorded from 3 islands: Hei Ling Chau, Shek Kwu Chau and Sunshine Island	GC	-

Common Name	Scientific Name	Distribution in Hong Kong (1)	Level of Concern (2)	IUCN Red List (5)
Reeve's Terrapin (3)	*Chinemys reevesii*	Widespread in reservoirs	-	Endangered

Note:
1. AFCD (2006a)
2. Fellowes *et al.* (2002); GC=Global concern; RC=Regional Concern; LC=Local Concern; PRC=Potential Regional Concern.
3. Protected under Wild Animal Protection Ordinance (Cap. 170)
4. Protected under Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586)
5. IUCN (2009)

Recent Survey Results

Active search

7b.4.5.4 A total of 6 reptile species and 5 amphibian species were recorded within the study area during the active search survey. Relatively high diversity and abundance were recorded at the developed and plantation habitats for reptile species; and pond habitat for amphibian species. Asian Common Toad (*Bufo melanostictus*) was the most abundant species, whereas Three-striped Grass Frog (*Rana macrodactyla*) was also commonly found. Within puddles and pools, tadpoles of Asian Common Toad (*Bufo melanostictus*), Asiatic Painted Frog (*Kaloula pulchra pulchra*), and Ornate Pigmy Frog (*Microhyla ornata*) were occasionally observed. A full list of herpetofauna species recorded is given in **Appendix 7b.6.**

7b.4.5.5 Among the recorded species during active search, Tree Gecko (*Hemiphyllodactylus* sp.) is considered to be of regional concern (Fellowes *et al.*, 2002) (**Table 7b.10**). This species was recorded on the side of a tree trunk among the plantation habitat. Tree Gecko is rare, mostly nocturnal, and is usually found on large tree trunks and abandoned buildings in or near forest (Karsen *et al.*, 1998).

Table 7b.10 Herpetofauna Species of Conservation Interest Recorded within the Study Area at Shek Kwu Chau

Common Name	Scientific Name	Distribution in Hong Kong[1]	Level of Concern[2]	IUCN Red List[3]
Tree Gecko	*Hemiphyllodactylus* sp.	Found in Po Toi, Aberdeen, Shek Kwu Chau	RC	-

Note:
1. AFCD (2006a)
2. Fellowes *et al.* (2002); RC=Regional Concern.
3. IUCN (2009)

Cover Board Survey

7b.4.5.6 One amphibian species, Asian Common Toad (*Bufo melanostictus*), was recorded within the study area during cover board survey. A total of 3 individuals were recorded underneath the cover boards: 1 was recorded near pond, and 2 were recorded at developed area. No record of the previously recorded herpetofauna species of conservation interest, including Bogadek's Burrowing Lizard, was made during the cover board survey. Detailed results are presented in **Appendix 7b.7**.

Cheung Sha

Literature Review

7b.4.5.7 Amphibian species of conservation interest previously recorded within the study area of this Project include frog species *Xenophrys brachykolos* (upper reach of W1 and shrubland) and *Philautus romeri* (shrubland); and snake species *Naja atra* near W1 (HyD, 2002).

7b.4.5.8 Details of the previously recorded herpetofauna species are listed in the following table:

Table 7b.11 Herpetofauna Species of Conservation Interest Previously Recorded at Cheung Sha

Common Name	Scientific Name	Distribution in Hong Kong [1]	Level of Concern [2]	IUCN Red List [4]
Reptile				
Chinese Cobra [3]	*Naja atra*	Widely distributed	PRC	-
Amphibian				
Short-legged Toad	*Xenophrys brachykolos*	Common	PGC	Endangered
Romer's Tree Frog [3]	*Philautus romeri*	Distributed in woodlands on Lantau Island, Po Toi Island, Lamma Island, Hong Kong Island and New Territories	PGC	Endangered

Note:
1. AFCD (2006a)
2. Fellowes *et al.* (2002); PRC=Potential Regional Concern; PGC=Potential Global Concern
3. Protected under Wild Animal Protection Ordinance (Cap. 170)
4. IUCN (2009)

Recent Survey Results

7b.4.5.9 A total of 5 reptile species and 5 amphibian species were recorded within the study area during the active search survey. Comparatively higher diversity and abundance were recorded at the developed and plantation habitats for reptile species; and shrubland habitat for amphibian species. Asian Common Toad (*Bufo melanostictus*) was the most commonly recorded species, whereas the rest were only occasionally observed. A full list of herpetofauna species recorded is given in **Appendix 7b.15.**

7b.4.5.10 Among the recorded species during active search, a total of 1 reptile and 2 amphibian species are considered to be of conservation interest. Chinese Cobra (*Naja atra*) was recorded moving along a roadside concrete channel within developed habitat; Short-legged Toad (*Xenophrys brachykolos*) was heard near the upper reach of watercourse (W1), while Lesser Spiny Frog (*Paa exilispinosa*) was observed within shrubland habitat near the lower reach of W1 (**Figure 7b.2**). Details of these species are listed as follows:

Table 7b.12 Herpetofauna Species of Conservation Interest Recorded within the Study Area at Cheung Sha

Common Name	Scientific Name	Distribution in Hong Kong [1]	Level of Concern [2]	IUCN Red List [4]
Reptile				
Chinese Cobra [3]	*Naja atra*	Widely distributed	PRC	-
Amphibian				
Short-legged Toad	*Xenophrys brachykolos*	Common	PGC	Endangered
Lesser Spiny Frog	*Paa exilispinosa*	Widely distributed in mountain streams	PGC	Vulnerable

Note:
1. AFCD (2006a)
2. Fellowes *et al.* (2002); PRC=Potential Regional Concern; PGC=Potential Global Concern
3. Protected under Wild Animal Protection Ordinance (Cap. 170)
4. IUCN (2009)

7b.4.6 Dragonflies and Butterflies

Shek Kwu Chau

Literature Review

7b.4.6.1 An uncommon damselfly species, Eastern Lilysquatter (*Cercion melanotum*), was observed in tandem at Shek Kwu Chau in 1997, and the female was seen to oviposit on lily leaves (HKU, 1998; Wilson *et al.*, 2003a). This species is considered to be of local conservation concern by Fellowes *et al.* (2002).

7b.4.6.2 Another uncommon damselfly species, Dusky Lilysquatter (*Cercion calamorum dyeri*), was previously recorded at Shek Kwu Chau (AFCD, 2009c). Adults are known to occur on floating vegetation such as water lily leaves and grasses in pond habitat (Wilson *et al.*, 2003a). This species is considered to be of local conservation concern by Fellowes *et al.* (2002).

7b.4.6.3 Details of the previously recorded dragonfly species of conservation interest are listed in the following table:

Table 7b.13 Dragonfly Species of Conservation Interest Previously Recorded at Shek Kwu Chau

Common Name	Scientific Name	Distribution in Hong Kong[1]	Level of Concern[2]	IUCN Red List[3]
Damselfly				
Eastern Lilysquatter	*Cercion melanotum*	Uncommon	LC	-
Dusky Lilysquatter	*Cercion calamorum dyeri*	Uncommon	LC	-

Note:
1. AFCD (2006a)
2. Fellowes *et al.* (2002); LC=Local Concern
3. IUCN (2009)

7b.4.6.4 Between 1990 and 2000, a total of 71 butterfly species were recorded at Shek Kwu Chau, whereas the most common species include Forest Hopper (*Astictopterus jama)*, Angled Castor (*Ariadne ariadne)*, Ceylon Blue Glassy Tiger (*Ideopsis similis)*, Common Grass

Yellow (*Eurema hecabe)*, Blue-spotted Crow (*Euploea midamus)*, Large Faun (*Faunis eumeus)*, Common Mormon (*Papilio polytes)*, and Pale Grass Blue (*Zizeeria maha)* (Lutman, 2000). Uncommon species recorded include Orange Owlet (*Bibasis oedipodea)*, Cornelian (*Deudorix epijarbas)*, and Three-spot Grass Yellow (*Eurema blanda)* (*ibid.*).

Recent Survey Results

Butterfly

7b.4.6.5 A total of 40 butterfly species were recorded within the study area during the current study. Relatively high diversity and abundance were recorded at the shrubland habitat. Common Mormon (*Papilio polytes*), Indian Cabbage White (*Pieris canidia*), and Common Grass Yellow (*Eurema hecabe*) were the most abundant species; whereas Great Mormon (*Papilio memnon*), Plum Judy (*Abisara echerius*), and Large Fauna (*Faunis eumeus*) were also commonly found. A full list of butterfly species recorded is given in **Appendix 7b.6.**

7b.4.6.6 Among the recorded species, Small Grass Yellow (*Eurema brigitta*) is considered to be of conservation interest. This species was recorded at the shrubland habitat during site observation. It is known to be often found in shrubland and abandoned agricultural area near their host plant *Cassia mimosoides* (Lo, 2005; Young *et al.*, 2002). Details of this species are listed in **Table 7b.14**.

Dragonfly and Damselfly

7b.4.6.7 A total of 6 damselfly species and 13 dragonfly species were recorded within the study area during the current study. Relatively high diversity and abundance were recorded at the pond habitat. Yellow Fetherlegs (*Copera marginipes*) was the most abundant species; whereas Wandering Glider (*Pantala flavescens*) was also commonly found. A full list of dragonfly and damselfly species recorded is given in **Appendix 7b.6.**

7b.4.6.8 Among the recorded species, Eastern Lilysquatter (*Cercion melanotum*) is considered to be of conservation interest. This species was recorded at the pond habitat resting on a lily leaf during site observation. Details of this species are listed in **Table 7b.14**.

7b.4.6.9 No record of the uncommon damselfly species, Dusky Lilysquatter (*Cercion calamorum dyeri*), was made during the surveys.

Table 7b.14 Dragonflies and Butterflies Species of Conservation Interest Recorded within the Study Area at Shek Kwu Chau

Common Name	Scientific Name	Distribution in Hong Kong[1]	Level of Concern[2]	IUCN Red List[3]
Butterfly				
Small Grass Yellow	*Eurema brigitta*	Uncommon	LC	-
Damselfly				
Eastern Lilysquatter	*Cercion melanotum*	Uncommon	LC	-

Note:
1. AFCD (2006a)
2. Fellowes *et al.* (2002); LC=Local Concern;
3. IUCN (2009)

Cheung Sha

Literature Review

7b.4.6.10 Outside of the study area, 2 butterfly species of conservation interest were recorded at the upper reach of W1, including Large Branded Swift (*Pelopidas subochraceus*) (distribution in Hong Kong is uncertain), and Common Rose (*Pachliopta aristolochiae*) (uncommon distribution in Hong Kong) (HyD, 2002). Further up, a damselfly species of conservation interest, Short-winged Shadowdamsel (*Protosticta beaumonti*), was also recorded at W1 outside the study area (*ibid.*). This species is uncommon in Hong Kong and is of global concern.

Recent Survey Results

Butterfly

7b.4.6.11 A total of 25 butterfly species were recorded within the study area during the current study. Relatively high diversity and abundance were recorded at the shrubland and developed habitats. Common Mormon (*Papilio polytes*), Great Mormon (*Papilio memnon*), and Common Grass Yellow (*Eurema hecabe*) were the most abundant species; whereas Red Helen (*Papilio helenus*), and Pale Grass Blue (*Zizeeria maha*) were also commonly found. No butterfly species of conservation interest was recorded within the study area. A full list of butterfly species recorded is given in **Appendix 7b.15.**

Dragonfly and Damselfly

7b.4.6.12 A total of 3 damselfly species and 2 dragonfly species were recorded within the study area during the current study. Relatively high diversity and abundance were recorded at the watercourse and shrubland habitats. Wandering Glider (*Pantala flavescens*) was the most commonly recorded species; whereas the rest was only occasionally found. No dragonfly and damselfly species of conservation interest was recorded within the study area. A full list of dragonfly and damselfly species recorded is given in **Appendix 7b.15.**

7b.4.7 Freshwater Communities

Shek Kwu Chau

Literature Review

7b.4.7.1 No existing literature on freshwater communities at Shek Kwu Chau was identified.

Recent Survey Results

7b.4.7.2 A total of 21 species were recorded within the study area during the current study. Shrimp species, *Caridina* sp., was the most abundant species; whereas *Ptilomera tigrina*, Helicopsychidae, and Chironomidae were also commonly found. A full list of freshwater species recorded is given in **Appendix 7b.6**. No species of conservation interest was recorded at the 2 streams identified within the study area.

Cheung Sha

Literature Review

7b.4.7.3 An uncommon fish species *Stiphodon atropurpureus*, and a rare fish species *Awaous melanocephalus*, were previously recorded from W1; other fish species recorded at W1 include *Ctenogobius duospilus*, *Ctenogobius giurinus*, *Liniparhomaloptera disparis*, *Noemacheilus fasciolatus*, and *Oreonectes platycephalus* (HyD, 2002). No fish was reported at W2 (*ibid.*).

7b.4.7.4 Details of the previously recorded freshwater species of conservation interest are listed in the following table:

Table 7b.15 Freshwater Species of Conservation Interest Previously Recorded at Cheung Sha

Common Name	Scientific Name	Distribution in Hong Kong[1]	Level of Concern[2]	IUCN Red List[3]
Fish				
-	*Stiphodon atropurpureum*	Uncommon	GC	-
Largesnout Goby	*Awaous melanocephalus*	Rare	RC	-

Note:
1. AFCD (2006a)
2. Fellowes *et al.* (2002); GC=Global concern; RC=Regional Concern.
3. IUCN (2009)

Recent Survey Results

7b.4.7.5 A total of 27 species were recorded within the study area during the current study. Hemiptera, *Ptilomera tigrina* (Gerridae), and shrimp, *Caridina* sp., were the most abundant species recorded; whereas caddisfly Chimarra (Philopotamidae) and Herbertorossia (Hydropsychidae), and hemiptera *Metrocoris* sp. (Gerridae) were also commonly recorded. No species of conservation interest was recorded at the 2 watercourses identified within the study area. A full list of freshwater species recorded is given in **Appendix 7b.15**.

7b.4.8 Intertidal Fauna

Shek Kwu Chau

Literature Review

7b.4.8.1 No recent record of intertidal survey at Shek Kwu Chau was noted during literature review. During the *EIA-065/2001 - 132 KV Supply Circuit from Pui O via Chi Ma Wan Peninsula via Sea Crossing towards Cheung Chau*, the majority of intertidal areas at Cheung Chau, which is approximately 2.5 km from Shek Kwu Chau, are artificial seawalls; where common species including algae, sponges, bryozoans, molluscs and polychaetes have been previously recorded (CLP, 2001).

Recent Survey Results

7b.4.8.2 At Shek Kwu Chau, each of the 6 deployed transects were approximately 4 m in length, stretching from high tide mark to low tide mark. The shoreline within the study area was composed of natural bedrock and big boulders.

7b.4.8.3 A total of 34 floral and faunal species were recorded during the walk-through and transect surveys. All of the recorded species were common and widespread in Hong Kong. *Tetraclita squamosa* and *Saccostrea cucullata* were the dominant species at the lower tidal level; while *Echinolittorina radiata* and *Echinolittorina trochoides* were dominant at the higher tidal level. No species of conservation importance was recorded. The intertidal community at the study area is considered to have low diversity and low abundance. The species composition of the rocky shore at Shek Kwu Chau is considered to be similar to the rest of the rocky shores in Hong Kong. A full list of intertidal species recorded is given in **Appendix 7b.6**.

7b.4.8.4 The following table summarises the intertidal line-transect survey results:

Table 7b.16 Summary of Intertidal Line-transect Survey Results at Shek Kwu Chau

	R1	R2	R3	R4	R5	R6
	Dry Season (January 2009)					
Total no. of species (of the whole transect)	23	26	26	27	24	27
Average no. of mobile individuals per 0.25 m^2	26.5	27.8	33.3	31.5	31.3	40.8
Average percentage cover of sessile organisms	43%	50.3%	47.5%	43%	40.3%	41.3%
	Dry Season (March 2009)					
Total no. of species (of the whole transect)	22	24	25	27	27	28
Average no. of mobile individuals per 0.25 m^2	32.8	33.3	37.3	31	39.3	37.8
Average percentage cover of sessile organisms	40.5%	49.8%	44.5%	48.8%	45.5%	49%
	Wet Season (June 2009)					
Total no. of species (of the whole transect)	22	27	25	24	24	25
Average no. of mobile individuals per 0.25 m^2	56.8	64.3	69.5	52	63.8	73.3
Average percentage cover of sessile organisms	33.5%	42.5%	38%	34%	35%	38.3%

Cheung Sha

Literature Review

7b.4.8.5 Along the shore of Lantau South Road, dominant intertidal species recorded include gastropod *Monodonta australis,* bivalve *Barbatia virescens*, and stalked barnacle *Capitulum mitella* (HyD, 2002). The mid-shore was dominated by *Capitulum mitella*, and the low and mid-shore was dominated by *Monodonta australis* and *Barbatia virescens (ibid.)*. Some of the other species recorded include crab species *Hemigrapsus sanguineus*, sea slater *Ligia exotica,* as well as Littorinids *Nodilittorina millegrana* and *N. pyramidal (ibid*.). No rare or species of conservation interest were recorded.

7b.4.8.6 At the shore of Tai Long Wan at Chi Man Wan Peninsula, a total of 15 species of intertidal fauna and 3 species of macroalgae were recorded on the natural rocky shore (CLP, 2001). Dominant species recorded include limpets *Notoacmaea schrenkii*, *Patelloida saccharina*, and *Cellana toreuma*; and periwinkles *Nodilittorina radiata*, *N. vidua,* and *N. trochoides* (ibid.).

Recent Survey Results

7b.4.8.7 At Cheung Sha, among the 4 deployed transects (R1 to R4), one was approximately 16 m in length, and the rest were approximately 4 m in length, stretching from high tide mark to low tide mark. The shoreline within the study area was composed of natural bedrock and big boulders.

7b.4.8.8 A total of 53 floral and faunal species were recorded during the walk-through and transect surveys. All of the recorded species were common and widespread in Hong Kong.

Echinolittorina radiate, Thais luteostoma, Patelloida saccharina and *Saccostrea cucullata* were the dominant species during the surveys. No species of conservation importance was recorded. The intertidal community at the study area is considered to have low to moderate diversity and low abundance. The species composition of the rocky shore at Cheung Sha is considered to be similar to the rest of the rocky shores in Hong Kong. A full list of intertidal species recorded is given in **Appendix 7b.15**.

7b.4.8.9 The following table summarises the intertidal survey results:

Table 7b.17 Summary of Intertidal Survey Results at Cheung Sha

	R1	**R2**	**R3**	**R4**
	Wet Season (September 2009)			
Total no. of species (of the whole transect)	25	14	10	14
Average no. of mobile individuals per 0.25 m^2	21.4	27.8	1.7	9.3
Average percentage cover of sessile organisms	34%	26%	48.3%	10.3%
	Dry Season (January 2010)			
Total no. of species (of the whole transect)	31	18	15	21
Average no. of mobile individuals per 0.25 m^2	30.7	22.7	37.7	17
Average percentage cover of sessile organisms	54%	59.3%	89%	90.8

7b.4.9 Subtidal Fauna

Shek Kwu Chau

Coral

Literature Review

7b.4.9.1 Previous coral surveys on coastal areas around the whole of Shek Kwu Chau suggested that coral habitats around the island were of low ecological value (AFCD, 2004). Only few colonies of *Guaiagorgia* sp., *Porites* sp., and a patch of dead corals were recorded (*ibid.*). Spot-check reconnaissance dive revealed low diversity (2 species) and coverage (1-5%) of hard corals on the coastal subtidal-hard substratum around the island (AFCD, 2002a).

Recent Survey Results

7b.4.9.2 The natural coastline of Shek Kwu Chau is mainly composed of natural bedrocks and big boulders near the coast, and muddy substrate towards to sea. A total of 15 coral species (8 hard coral species and 7 octocoral species) were recorded during the spot check reconnaissance dive (**Figure 7b.1**). Rapid Ecological Assessment (REA) surveys were conducted according to the results from the spot check dive, and a total of 16 REA transects (REA T1 to T16) of 100 m each were deployed (**Figure 7b.9**). Details of the spot check and REA surveys are included in **Appendix 7b.11**. The following **Table 7b.18** presents coral species recording during the spot check and REA dive survey.

Table 7b.18 Coral Species Found within the Study Area at Shek Kwu Chau

Species Name	Rarity in Hong Kong
Hard Corals [(1)]	
Psammocora superficialis	Abundant
Oulastrea crispata	Common
Goniopora stutchburyi	Common
Turbinaria peltata	Common
Coscinaraea n sp.	Uncommon
Tubastrea sp.	Common
Tubastrea diaphana	Common
Dendrophyllia sp.	Common
Octocorals	
Dendronephthya sp.	Common
Menella sp.	Common
Euplexaura sp.	Common
Echinomuricea sp.	Common
Echinogorgia sp. A	Common
Echinogorgia sp. B	Common
Paraplexaura sp.	Common

Note:
1. All hard coral species are protected under Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586)

7b.4.9.3 Sparse and patchy cover (<1%) of coral communities were recorded in the study area. The hard corals were in small size, ranging from 2 to 30 cm in diameter for hard corals, and from 4 to 30 cm in height for octocorals. The corals were considered to be in fair health condition.

7b.4.9.4 *Oulastrea crispata* was the dominant species along the shallow coastal area (REA T1-9). One uncommon hard coral species, *Coscinaraea* n sp., was recorded at REA T9. All hard coral species are protected under the Protection of Endangered Species of Animals and Plants Ordinance (Cap 586). Established coral communities of any size are regarded as important habitat in Hong Kong as defined in Annex 8 of EIAO-TM.

7b.4.9.5 The muddy bottom offshore to the coastal area (REA T10-13) was dominated by octocorals, which were grown on the surface of scattered boulders. *Echinomuricea* sp. and *Echinogorgia* sp. were the dominant species on the scattered boulders at muddy substrate. The recorded octocorals are common species in Hong Kong.

7b.4.9.6 During the survey, common rock oyster, common green mussel, common tunicate, sea urchins, tubeworm, sponges, sea cucumber, and algae were recorded on the rock surface; whereas common tube anemone was found at the muddy bottom during the survey. All species recorded were common in Hong Kong and were found in low abundance and diversity.

Benthos

Literature Review

7b.4.9.7 During the territory-wide study on marine benthic in Hong Kong, the 2 sampling stations in the vicinity of Shek Kwu Chau (Station Number 27 and 31) recorded low to moderate species richness (25-50 taxa per 0.5 m^2 in summer; 40-60 taxa per 0.5 m^2 in winter), and

abundance (116-408 individuals per m^2 in summer; 308-496 individuals per m^2 in winter) for benthos communities (AFCD, 2002b).

Recent Survey Results

7b.4.9.8 Benthos surveys were conducted at 5 sampling points (P1 to P5) within the boundary of the Project Site (**Figure 7b.4**). The sediments at sampling points P1 and P2 represent typical offshore substratum receiving coarse runoff materials from nearby coast. The muddy sediments at P3-P5 are similar to those at Southern WCZ. Photographic records of sediment collected at the sampling points during dry and wet and seasons are presented in **Appendix 7b.8**.

7b.4.9.9 A total of 1,949 specimens were collected in dry and wet seasons. The most diverse phylum was polychaete (60 species), followed by 13 species of crustacean, 8 species of mollusk, 5 species of cnidarian, 5 species of echinoderm, 3 species of fish, 2 species of echiurans, and 2 species of sipunculan. No species of conservation importance was recorded.

7b.4.9.10 During dry season, a total of 1,210 individuals were recorded, where 87%, 5%, and 8% of total abundance were polychaete, crustacean and other phyla respectively. During wet season, a total of 739 individuals were recorded, where 76%, 10%, 8%, and 6% of total abundance were polychaete, crustacean, echiuran and other phyla respectively. Polychaete was the most abundant group at all sampling points during both wet and dry seasons.

7b.4.9.11 The Diversity Index (*H'*) and Evenness Index (*J*) had a range of 2.00-2.93 and 0.57-0.83 respectively among the 5 sampling points. Both *H'* and *J* remained similar across seasons. **Table 7b.19** presents the total abundance, total biomass, *H'* and *J* at every sampling point during both wet and dry seasons.

7b.4.9.12 The complete list of collected specimens is provided in **Appendix 7b.8**.

Table 7b.19 Summary of Benthos Survey Results in Dry and Wet Seasons at Shek Kwu Chau

	Sampling Points									
	P1		**P2**		**P3**		**P4**		**P5**	
	Dry	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**
Total number of species (spp. 0.3 m^{-2})	34	29	37	36	30	23	29	23	24	34
Total abundance (ind. m^{-2})	1470	527	1497	957	340	320	383	350	343	310
Total biomass (g m^{-2})	25.99	16.21	19.99	13.47	48.44	32.17	22.38	45.98	35.51	47.24
Shannon-Weaver Diversity Index – *H'*	2	2.62	2.29	2.44	2.81	2.54	2.45	2.48	2.52	2.93
Pielou's Species Evenness – *J*	0.57	0.78	0.64	0.68	0.83	0.81	0.73	0.79	0.79	0.83

7b.4.9.13 The following **Table 7b.20** compares the Diversity Index (*H'*) and Evenness Index (*J*) of benthic communities of the current study with other waters in Hong Kong.

Table 7b.20 Comparison of Diversity Index (*H'*) and Evenness Index (*J*) of Benthic Communities at Shek Kwu Chau with Other Waters in Hong Kong

Water Zone	Shek Kwu Chau		Sampling Point #31	Tolo Harbour	Eastern and Southern Waters	Victoria Harbour	Deep Bay
	Dry	Wet					
H'	2.42	2.60	2.85	1.36	2.82	1.64	2.32
J	0.71	0.78	0.89	0.83	0.81	0.44	0.73
References	Present Study		AFCD, 2002b	Shin *et al.*, 2004			

7b.4.9.14 The biodiversity of benthic community at Shek Kwu Chau in the present survey is slightly lower than that at 'Eastern and Southern Waters'. It is higher than that of 'Tolo Harbour' and 'Victoria Harbour', where long term sewage pollution has been recorded (EPD, 2006). These results indicate that the environmental condition at Shek Kwu Chau is comparable to some unpolluted water zones (e.g. eastern waters of Hong Kong), considering that it is under pollution stress from Pearl River runoff.

7b.4.9.15 It is supported by the relatively high species evenness at Shek Kwu Chau. Relative to the nearest sampling point #31 in previous territory-wide survey (AFCD, 2002b), the biodiversity and evenness are lower around the southern coast of Shek Kwu Chau. The sampling point #31 located farther from coast and received stronger flushing from open sea, that the adverse effects of pollution were minimized.

7b.4.9.16 In general, sign of organic enrichment was detected at southern coast of Shek Kwu Chau based on the dominance of opportunistic, deposit-feeding polychaetes. Relatively, P3, P4, and P5 were less polluted than P1 and P2, due to their higher species evenness and lower abundance of opportunistic species.

Cheung Sha

Coral

Literature Review

7b.4.9.17 No recent record of coral survey at Cheung Sha coastline was noted during literature review. Coral surveys previously conducted at Tai Long Wan at Chi Ma Wan (4.5 km away) recorded 5 species of hard corals, including *Psammocora superficialis*, *Cyphastrea serailia*, *Porites lobata*, *Goniopora stutchburyi*, and *Oulastrea crispata*; and 2 species of soft corals, including *Dendronephthya* sp. and *Euplexaura* spp. (CLP, 2001). The diversity recorded was low, size was small, and the distribution is common in Hong Kong.

Recent Survey Results

7b.4.9.18 The natural coastline of Cheung Sha is mainly composed of natural bedrocks, big boulders, and muddy/sandy substrates. No hard corals or octocorals were recorded during the spot check reconnaissance dive (**Figure 7b.5**).

7b.4.9.19 During the survey, common rock oyster *Saccostrea cucullata* and common green mussel *Perna viridis* were found on the surfaces of the big boulders. Both species are commonly found in Hong Kong waters. Turf algae *Corallina* spp., bryozoan, sea anemone *Spheractis cheungae*, sea urchins *Anthocidaris crassispina* and *Salmacis sphaeroides* were also found at these sites. All species recorded were common in Hong Kong and were found in low abundance and diversity.

Along the Proposed Submarine Cable

Benthos

Literature Review

7b.4.9.20 A previous benthos survey conducted near to Shek Kwu Chau recorded polychaete worms, corophiid amphipods and pinnotherid crabs as the dominant groups; it was also suggested that the benthos assemblages between Chi Man Wan and Cheung Chau would be similar in composition (CLP, 2001).

Recent Survey Results

7b.4.9.21 Benthos surveys were conducted at 4 sampling points (P1 to P4) within and in the vicinity of the proposed alignment.

7b.4.9.22 The sediments at sampling point P1 was mainly fine sand. P1 was the closest to Cheung Sha coast in comparison with other sampling sites. While this point constantly receives wave action, the fine mud was dragged away hence only fine sand was remained. Other sampling sites (P2, P3 and P4) located far from coasts and had muddy substrate. Similar substratum was reported at southern coast of Shek Kwu Chau. Photographic records of sediment collected at the sampling points during dry and wet and seasons are presented in **Appendix 7b.16**.

7b.4.9.23 A total of 919 and 955 specimens were collected in wet and dry seasons respectively. The most diverse faunal group was polychaete (42 species), followed by 15 species of crustaceans, 12 species of mollusk, 4 species of echinoderm, 2 species of cnidarian, 1 species of echiuran and 1 species of sipunculan. No species of conservation importance was recorded.

7b.4.9.24 During wet season, 69%, 15%, 8% and 8% of total abundance were polychaete, echiuran, mollusk and other phyla respectively. During dry season, 72%, 9%, 7% and 12% of total abundance were polychaete, echiuran, crustacean and other phyla respectively.

7b.4.9.25 The complete list of collected specimens is provided in **Appendix 7b.16**.

7b.4.9.26 The Diversity Index (*H'*) and Evenness Index (*J*) had a range of 2.17-3.07 and 0.63-0.84 respectively among the 3 sampling points (P2 to P4) within and in the vicinity of the proposed alignment; while *H'* and *J* of the sampling point P1, adjacent to Cheung Sha coast, were comparatively low, with the values of 1.03-1.99 and 0.35-0.59. Both *H'* and *J* remained similar across seasons. **Table 7b.21** presents the total abundance, total biomass, *H'* and *J* at every sampling point during both wet and dry seasons.

Table 7b.21 Summary of Benthos Survey Results in Dry and Wet Seasons along the Proposed Submarine Cable

	Sampling Points							
	P1		P2		P3		P4	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Total number of species (spp. 0.3 m^{-2})	29	18	35	31	39	35	37	31
Total abundance (ind. m^{-2})	830	953	763	830	650	420	940	860
Total biomass (g m^{-2})	2.296	0.9493	12.3237	15.032	19.0793	10.021	57.76	38.0247
Shannon-Weaver Diversity Index – *H'*	1.99	1.03	2.3	2.54	2.36	3.07	2.3	2.17
Pielou's Species Evenness – *J*	0.59	0.35	0.65	0.74	0.64	0.84	0.64	0.63

7b.4.9.27 The following **Table 7b.22** compares the Diversity Index (*H'*) and Evenness Index (*J*) of benthic communities of the current study with other waters in Hong Kong.

Table 7b.22 Comparison of Diversity Index (*H'*) and Evenness Index (*J*) of Benthic Communities along the Proposed Submarine Cable with Other Waters in Hong Kong

Water Zone	Shek Kwu Chau submarine cable alignment		Shek Kwu Chau (southern coast)	Benthos sampling point 26	Benthos sampling point 27	Tolo Harbour	Eastern and Southern waters	Victoria Harbour	Deep Bay
	Dry	Wet							
H'	2.24	2.2	2.51	2.9	3.26	1.39	2.85	1.72	1.89
J	0.63	0.65	0.75	0.69	0.82	0.78	0.82	0.46	0.63
References	Present Study		Present Study	AFCD, 2002		Shin *et al*., 2004			

7b.4.9.28 The biodiversity of benthic community along the proposed submarine cable lied between the unpolluted group and polluted groups. The species evenness was moderate. The benthic community in the present survey area was generally in healthy condition. Flushing from open sea might dilute the effects of Pearl River runoff. At a small spatial scale, there was no clear spatial difference of biodiversity and species evenness relative to nearby sampling sites at Shek Kwu Chau. Since the hydrological factors were similar in water of southern Lantau Island, the differences of benthic communities were believed a natural, patchy distribution.

Shek Kwu Chau

Horseshoe Crab

Literature Review

7b.4.9.29 A study conducted between 1995 and 1998 recorded adult horseshoe crab, an individual of *Tachypleus tridentatus*, at the northwestern waters offshore from Shek Kwu Chau, approximately 600 m away from the Project Site (Chiu & Morton, 1999). While no nursery

ground for juvenile horseshoe crabs was previously recorded at the coasts of Shek Kwu Chau, with the nearest nursery grounds at Shui Hau Wan in South Lantau (over 7.5 km away from the Project Site). Considering that no intertidal soft shore habitat, suitable breeding and nursery ground for juvenile horseshoe crab, was recorded within the 500 m boundary from the Project Site, no specific survey on juvenile horseshoe crab was conducted in the recent study.

7b.4.10 Marine Mammals

Literature Review

Chinese White Dolphin

7b.4.10.1 From April 2009 to March 2010, Chinese White Dolphin (*Sousa chinensis*) was widely distributed throughout Lung Kwu Chau, along the west coast of Lantau, near the Brothers Islands, and between the Soko Islands; where the west coast of Lantau was being identified as the most important dolphin habitat from 2002 to 2010 (AFCD, 2010c). Between April 2009 to March 2010, a total of 271 groups of Chinese White Dolphin, of 1,062 individuals, were sighted during the surveys. As only 1 sighting of Chinese White Dolphin was recorded at Southeast Lantau, where Shek Kwu Chau is located, the waters around Shek Kwu Chau is not considered to be an important habitat for Chinese White Dolphin.

Finless Porpoise

7b.4.10.2 Between the 2009 to 2010 study period, a total of 72 groups of Finless Porpoise of 148 individuals were sighted during the surveys across Hong Kong waters (AFCD, 2010c). Waters that were the most intensely used by Finless Porpoise (*Neophocaena phocaenoides*) include waters at the south of Tai A Chau, the offshore waters of Southeast Lantau, around Shek Kwu Chau (except the northeast), near Pui O Peninsula, near Tung O Wan (east of Lamma), and around Po Toi Islands (in particular near Waglan Island) (**Figure 7b.10**) (*ibid.*). The most important habitats for Finless Porpoise (*Neophocaena phocaenoides*) with the highest concentration of sightings were identified at just south of Soko Islands, between Shek Kwu Chau and Tai A Chau, around Shek Kwu Chau (except northeast), and around Po Toi Islands (*ibid.*).

Group size

7b.4.10.3 During the AFCD long-term marine mammal monitoring survey period in 2009-10, group sizes of Finless Porpoise in Hong Kong waters ranged from 1-2 individuals to over 10 individuals, with an overall mean of 2.1 ± 1.66 (AFCD, 2010c). The overall mean in 2009-10 was identified to be much lower than the overall mean in 1996-2006 (3.1), and was considerably lower than the previous two monitoring survey periods in 2007-08 (2.6) and 2008-09 (3.1) (*ibid.*). Finless Porpoise is often found in small groups, where 70.9% of the groups encountered in 2009-10 composed of 1-2 individuals (*ibid.*).

7b.4.10.4 According to the long term marine mammal monitoring results between 2001 and 2009, large porpoise groups were mostly found in three locations: the southwest corners of Cheung Chau, Pui O Peninsula and Shek Kwu Chau (AFCD, 2009a; survey results under this study). Most porpoise groups sighted near the IWMF and submarine cables were small to medium sized.

Seasonal Variation

7b.4.10.5 Distinct seasonal variations in the occurrence of Finless Porpoise had been observed. Between 2004 and 2009, South Lantau waters (south of Tai A Chau, offshore waters of Southeast Lantau, west and southwest of Shek Kwu Chau, and southeast former of Cheung Chau) was an important habitat for porpoise during winter and spring months

(95% of all sightings made during December to May); during summer and autumn months, Beaufort Island, Po Toi Island and Waglan Island recorded relatively higher usage (AFCD, 2010c) (**Figure 7b.11**). In other words, within and around the proposed reclamation and submarine cable laying sites, winter and spring months (December to May) had the highest distribution of Finless Porpoise sightings, whereas summer and autumn months (June to November) had the lowest Finless Porpoise sightings.

SPSE and DPSE

7b.4.10.6 Based upon the data from the AFCD dolphin surveys, among the 134 grids in Southeast and Southwest Lantau survey areas, 76 grids recorded on-effort porpoise sightings from December to May in 2004-2009 (AFCD, 2010c). The SPSE (number of on-effort porpoise sightings per 100 units of survey effort) and DPSE (number of porpoises per 100 units of survey effort) among the 134 grids ranged from 0->20 and 0-80 respectively. A number of grids recorded high porpoise densities, and most of them were located to the south of Tai A Chau, the offshore waters between Tai A Chau and Shek Kwu Chau, and at the southwest and west sides of Shek Kwu Chau (**Figure 7b.12**). These clusters of high porpoise density grids can be viewed as important porpoise habitats in winter and spring months.

7b.4.10.7 Between 2002 and 2009, the averaged SPSE and DPSE at south Lantau waters were 4.3 and 11.6 respectively (AFCD, 2009a). Among the 8 grids that overlapped with the IWMF reclamation and submarine cables, all except 2 grids recorded porpoise sightings. The averaged SPSE and DPSE values of these 8 grids were 7.3 and 22.6 respectively, which were both higher than the averages recorded in south Lantau waters (4.3 and 11.6) (*ibid.*).

7b.4.10.8 In particular, the 3 grids overlapped with the IWMF reclamation site and part of the submarine cable alignment (Grids Q30-31, R31) recorded high porpoise densities, with averaged SPSE and DPSE values of 14.93 and 44.09 respectively, which were 3 to 4 times higher than the averages recorded in south Lantau waters (4.3 and 11.65) (*ibid.*). The high porpoise densities at the IWMF reclamation site and along the route of submarine cables suggested that these areas were important porpoise habitats with frequent occurrence of porpoises in winter and spring months.

Survey Results for this Study

7b.4.10.9 From December 2008 to May 2009, a total of 7 systematic line-transect surveys had been completed in the Southeast Lantau survey area for the present study. From these line-transect surveys, 373.1 km of survey effort was conducted (**Appendix 7b.9**). A majority of survey effort was conducted under acceptable weather condition, with 94.9% at sea state Beaufort 3 or below, and 65.7% at sea state Beaufort 2 or below.

7b.4.10.10 From these surveys, 29 groups of Finless Porpoise of 49 individuals were sighted (**Appendix 7b.10**). Among them, 25 groups were sighted during on-effort search. No Chinese White Dolphin was sighted in the Southeast Lantau survey area during the 6-month study period.

7b.4.10.11 A notable concentration of porpoise sightings were observed at the southwest of Shek Kwu Chau, as well as the offshore waters at the southwest portion of the survey area (**Figure 7b.13**). In which, a few sightings were noted within the proposed reclamation and breakwater area, as well as in proximity to the proposed submarine cable alignment. Such sightings indicate that the proposed works areas are within the range of Finless Porpoise.

7b.4.10.12 Combining the results for the present study and AFCD monitoring surveys in December 2008 to May 2009, group sizes of Finless Porpoise at the Southeast Lantau waters ranged from 1 to 7 individuals, with a mean of 2.1 ± 1.45, which is lower than the average recorded from the same area from 2002-2008 (3.2) (AFCD, 2009a).

7b.4.10.13 Although no Chinese White Dolphin was sighted in the Southeast Lantau waters during the six-month study period, however, they have been sighted in this survey area during the past decade of marine mammal monitoring programme. Since 1996, 24 groups of Chinese white dolphins were observed in Southeast Lantau, but only 7 of them were sighted there since 2002. Notably, 50% of the 24 dolphin sightings were made in association with pair-trawlers, which may have attracted the dolphins to follow from Southwest Lantau to Southeast Lantau waters (Hung, 2009).

7b.4.10.14 While very few of these dolphin sightings were made near the IWMF and the proposed submarine cables since 1996, their occurrence within the study area is considered to be rare.

7b.5 Ecological Value

7b.5.1.1 With reference to EIAO-TM Annex 8 criteria, the ecological importance of recorded habitats has been evaluated in **Tables 7b.23 – 7b.31** for Shek Kwu Chau, **Tables 7b.32 – 7b.38** for Cheung Sha, and **Tables 7b.39-7b.40** for the submarine cable alignment.

Shek Kwu Chau

Table 7b.23 Ecological Value of Shrubland Habitat at Shek Kwu Chau

Criteria	**Shrubland**
Naturalness	Habitat is secondary in nature and is dominated by native species.
Size	Large (38.2 ha)
Diversity	Floral diversity: High (114 species) Faunal diversity: Moderate (34 avifaunal species, 1 amphibian species, 2 reptile species, 32 butterfly species, and 6 damselfly / dragonfly species)
Rarity	3 avifaunal species of conservation interest were recorded under this study: White-bellied Sea Eagle, Emerald Dove, and White-throated Kingfisher. While Black Kite and Pacific Swift were recorded at flight. 1 uncommon butterfly species of conservation interest was recorded under this study: Small Grass Yellow. Japanese Pipistrelle of conservation interest was recorded at flight under this study. An active nest of White-bellied Sea Eagle was previously recorded at coastal hillside shrubland outside the study area, 300 m and 550 m away from the nearest breakwater and reclamation works. Bogadek's burrowing lizard was previously recorded at Shek Kwu Chau.
Re-creatability	Moderate.
Fragmentation	Low
Ecological linkage	Not functionally or structurally linked to any habitat of high ecological value
Potential value	Moderate
Nursery ground	Nest of White-bellied Sea Eagle was previously recorded outside the study area
Age	Young
Abundance/richness of wildlife	Moderate
Ecological value	**Moderate**

Table 7b.24 Ecological Value of Plantation Habitat at Shek Kwu Chau

Criteria	Plantation
Naturalness	Man-made habitat, dominated by exotic species.
Size	Very small (0.7 ha)
Diversity	Floral diversity: Low (30 species) Faunal diversity: Low to moderate (14 avifauna species, 2 amphibian species, 4 reptile species, 11 butterfly species, and 3 damselfly / dragonfly species)
Rarity	1 reptile species of conservation interest was recorded under this study: Tree Gecko
Re-creatability	High
Fragmentation	Low
Ecological linkage	Linked to the rest of shrubland habitat around Shek Kwu Chau
Potential value	Low
Nursery ground	None was recorded
Age	Young
Abundance/richness of wildlife	Low to moderate
Ecological value	**Low**

Table 7b.25 Ecological Value of Developed Habitat at Shek Kwu Chau

Criteria	Developed Area
Naturalness	Man-made habitat
Size	Small (2.7 ha)
Diversity	Floral diversity: Low (14 species) Faunal diversity: Moderate (20 avifaunal species, 1 amphibian species, 3 reptile species, 20 butterfly species, and 5 damselfly / dragonfly species)
Rarity	1 avifaunal species of conservation interest was recorded under this study: Japanese Paradise Flycatcher, with Pacific Swift recorded at flight.
Re-creatability	High
Fragmentation	Moderate
Ecological linkage	Not functionally or structurally linked to any habitat of high ecological value
Potential value	Low
Nursery ground	None was recorded
Age	Not applicable
Abundance/richness of wildlife	Low
Ecological value	**Low**

Table 7b.26 Ecological Value of Pond Habitat at Shek Kwu Chau

Criteria	Pond
Naturalness	Man-made habitat used as a reservoir
Size	Small (0.3 ha)
Diversity	Floral diversity: Low (22 species) Faunal diversity: Low to moderate (9 avifaunal species, 1 mammal, 4 amphibian species, 5 butterfly species, and 13 damselfly / dragonfly species)

Criteria	Pond
Rarity	1 avifaunal species of conservation interest was recorded under this study: White-throated Kingfisher 1 uncommon damselfly species under this study: Eastern Lilysquatter 1 mammal species of conservation interest was recorded under this study: Japanese Pipistrelle (at flight). In previous study, 1 additional uncommon damselfly species of conservation interest was recorded: Dusky Lilysquatter
Re-creatability	High
Fragmentation	Low
Ecological linkage	The pond receives water from the watercourse W2; and the pond discharges into the watercourse W1 through a pond dam.
Potential value	Low to moderate
Nursery ground	Breeding ground for Eastern Lilysquatter and Dusky Lilysquatter
Age	Not applicable
Abundance/richness of wildlife	Low
Ecological value	**Low to Moderate**

Table 7b.27 Ecological Value of Watercourse Habitat at Shek Kwu Chau

Criteria	Watercourse
Naturalness	Both watercourses (W1 and W2) are natural
Size	Small Watercourse W1: 51 m Watercourse W2: 110 m
Diversity	Floral diversity: Low (29 species) Faunal diversity: Low to moderate (7 avifaunal species, 1 amphibian species, 4 butterfly species, and 8 damselfly / dragonfly species, and 21 freshwater species)
Rarity	No rare species or species of conservation interest was recorded under this study.
Re-creatability	Low
Fragmentation	W1: Low to moderate. A dam is present at both ends of this watercourse. W2: Low
Ecological linkage	W1 receives discharge from pond through a pond dam. W2 feeds water into the pond.
Potential value	Low to moderate
Nursery ground	None was recorded
Age	Not applicable
Abundance/richness of wildlife	Low to moderate
Ecological value	**Low to moderate**

Table 7b.28 Ecological Value of Rocky Shore Habitat at Shek Kwu Chau

Criteria	**Rocky Shore**
Naturalness	Natural
Size	Small (2.3 ha)
Diversity	Low (34 taxa of intertidal species, and 1 avifauna species)
Rarity	1 avifauna species of conservation interest was recorded under this study: Pacific Reef Egret
Re-creatability	Moderate
Fragmentation	Low
Ecological linkage	Not functionally or structurally linked to any habitat of high ecological value
Potential value	Low
Nursery ground	None was recorded
Age	Not applicable
Abundance/richness of wildlife	Low to moderate
Ecological value	**Low to moderate**

Table 7b.29 Ecological Value of Subtidal Hard Bottom Habitat at Shek Kwu Chau

Criteria	**Subtidal Hard Bottom Habitat**
Naturalness	Natural. Typical substratum near rocky shore.
Size	Not applicable
Diversity	Low: (15 coral species: 8 hard corals and 7 octocorals) Coral communities were dominated by hard coral species *Oulastrea crispata* at shallow hard bottom substratum, and by octocorals *Echinomuricea* sp. and *Echinogorgia* sp. at the offshore muddy substratum.
Rarity	8 hard coral species were recorded under this study: 1 uncommon species: *Coscinaraea* n sp.; 7 common species: *Psammocora superficialis, Oulastrea crispata, Goniopora stutchburyi, Turbinaria peltata, Tubastrea* sp., *Tubastrea diaphana,* and *Dendrophyllia* sp.
Re-creatability	Low
Fragmentation	Low
Ecological linkage	Structurally and functionally linked to the preferred habitats of marine mammal in South Lantau.
Potential value	Moderate
Nursery ground	No significant records.
Age	Not applicable
Abundance/richness of wildlife	Low
Ecological value	**Low to Moderate**

Table 7b.30 Ecological Value of Subtidal Soft Bottom Habitat at Shek Kwu Chau

Criteria	**Subtidal Soft Bottom Habitat**
Naturalness	Natural. Typical substratum nearby a natural rocky shore.
Size	Large
Diversity	Moderate (98 benthos species). The community was strongly dominated by 2-3 opportunistic polychaete species (>40% of total abundance).
Rarity	No rare species or species of conservation interest was recorded under this study.
Re-creatability	N/A
Fragmentation	N/A
Ecological linkage	Structurally and functionally linked to the preferred habitats of marine mammal in South Lantau.
Potential value	Moderate.
Nursery ground	None was recorded
Age	Not applicable
Abundance/richness of wildlife	Moderate
Ecological value	**Low to Moderate**

Table 7b.31 Ecological Value of Coastal / Marine Waters at Shek Kwu Chau

Criteria	**Coastal / Marine Waters**
Naturalness	Natural. The waters at the northeast, north, and northwest of Shek Kwu Chau are in proximity to one of the busiest marine traffic route in Hong Kong. The waters are subject to pollution discharge from the Pearl River.
Size	Large
Diversity	N/A
Rarity	1 marine mammal species of conservation interest was recorded under this study: Finless Porpoise Chinese White Dolphin of conservation interest was also previously recorded around the waters of Shek Kwu Chau, however, only very few observations were made. Horseshoe crab (*Tachypleus tridentatus*), a species of conservation interest, was previously recorded 600 m away from the northwest of Shek Kwu Chau.
Re-creatability	Not re-creatable
Fragmentation	Not applicable
Ecological linkage	Structurally linked to the subtidal hard bottom habitat with the observations of coral colonies along the Shek Kwu Chau shore; also linked to the preferred habitats of marine mammal in South Lantau waters
Potential value	High
Nursery ground	None was recorded
Age	Not applicable

Criteria	Coastal / Marine Waters
Abundance/richness of wildlife	Under the long term marine mammal monitoring survey, the 3 grids that overlapped with the IWMF reclamation site and part of the submarine cable alignment (Grids Q30-31, R31) recorded high porpoise densities (with averaged SPSE/DPSE values of 14.93 and 44.09 respectively), which were 3 to 4 times higher than the averages recorded in South Lantau waters (4.3 and 11.65).
Ecological value	**High**

Cheung Sha

Table 7b.32 Ecological Value of Shrubland Habitat at Cheung Sha

Criteria	Shrubland
Naturalness	Habitat is secondary in nature and is dominated by native species.
Size	Moderate (18.2 ha)
Diversity	Floral diversity: High (99 species) Faunal diversity: Moderate (11 avifaunal species, 4 amphibian species, 3 reptile species, 14 butterfly species, and 3 damselfly / dragonfly species)
Rarity	Avifauna of conservation interest, Black Kite, was recorded at flight under this Study. 1 protected plant species was recorded under this Study: *Aquilaria sinensis* 1 amphibian species of conservation interest was recorded under this Study: Lesser Spiny Frog In previous study, 2 amphibian species of conservation interest were recorded: Short-legged Toad and Romer's Tree Frog
Re-creatability	Moderate
Fragmentation	Moderate
Ecological linkage	Linked to the extensive wooded area to the northwest of the study area.
Potential value	Moderate
Nursery ground	None was recorded
Age	Young
Abundance/richness of wildlife	Moderate
Ecological value	**Moderate**

Table 7b.33 Ecological Value of Developed Habitat at Cheung Sha

Criteria	**Developed area**
Naturalness	Man-made habitat
Size	Small (8.2 ha)
Diversity	Floral diversity: Moderate (62 species) Faunal diversity: Moderate (12 avifaunal species, 1 mammal species, 1 amphibian species, 3 reptile species, 15 butterfly species, and 1 dragonfly species)
Rarity	1 reptile species of conservation interest was recorded under this Study: *Chinese Cobra* A potential nest of Black Kite was recorded under this Study
Re-creatability	High
Fragmentation	Moderate
Ecological linkage	Not functionally or structurally linked to any habitat of high ecological value
Potential value	Low
Nursery ground	None was recorded
Age	Not applicable
Abundance/richness of wildlife	Low
Ecological value	**Low**

Table 7b.34 Ecological Value of Watercourse Habitat at Cheung Sha

Criteria	**Watercourse**
Naturalness	Both watercourses (W1 and W2) are natural
Size	Small Watercourse W1: 499 m Watercourse W2: 103 m
Diversity	Floral diversity: Low (30 species) Faunal diversity: Low to moderate (5 avifaunal species, 1 amphibian species, 12 butterfly species, and 2 damselfly species, and 27 freshwater species)
Rarity	W1: 2 avifauna of conservation interest, Little Egret and White-throated Kingfisher, and 1 amphibian of conservation interest: Short-legged Toad, were recorded under this Study. W2: 1 rare plant species, *Ceratopteris thalictroides*, was recorded near W2 under this Study. In previous study: 1 reptile species of conservation interest was recorded at W1 - Chinese Cobra; 2 butterfly species of conservation interest were recorded at W1 – Large branded Swift and Common Rose; a damselfly species of conservation interest was recorded at W1 – Short-winged Shadowdamsel; and 2 fish species of conservation interest were recorded at W1 – *Stiphodon atropurpureus* and *Awaous melanocephalus*.
Re-creatability	Low
Fragmentation	W1: Low W2: Low

Criteria	Watercourse
Ecological linkage	W1: Not functionally or structurally linked to any habitat of high ecological value W2: Not functionally or structurally linked to any habitat of high ecological value
Potential value	Low
Nursery ground	None was recorded
Age	Not applicable
Abundance/richness of wildlife	Low to moderate
Ecological value	**Moderate**

Table 7b.35 Ecological Value of Rocky Shore Habitat at Cheung Sha

Criteria	Rocky Shore
Naturalness	Natural
Size	Very small (0.8 ha)
Diversity	Low to Moderate (53 taxa of intertidal species, and 3 avifauna species)
Rarity	2 avifauna species of conservation interest were recorded under this Study: Pacific Reef Egret and Black Kite, with Little Egret recorded at flight.
Re-creatability	Moderate
Fragmentation	Low
Ecological linkage	Not functionally or structurally linked to any nearby valuable habitat
Potential value	Low
Nursery ground	None was recorded
Age	Not applicable
Abundance/richness of wildlife	Low
Ecological value	**Low to moderate**

Table 7b.36 Ecological Value of Subtidal Hard Bottom Habitat at Cheung Sha

Criteria	Subtidal Hard Bottom Habitat
Naturalness	Natural. Typical substratum near rocky shore.
Size	Not applicable
Diversity	Low, dominated by common subtidal fauna
Rarity	No corals or other species of conservation interest was recorded.
Re-creatability	Low
Fragmentation	Low
Ecological linkage	Structurally linked to the preferred habitats of marine mammal in South Lantau.
Potential value	Low
Nursery ground	None was recorded
Age	Not applicable
Abundance/richness of wildlife	Low
Ecological value	**Low**

Table 7b.37 Ecological Value of Subtidal Soft Bottom Habitat at Cheung Sha

Criteria	**Subtidal Soft Bottom Habitat**
Naturalness	Natural. Typical substratum in southern waters.
Size	Large
Diversity	Low
Rarity	No species of conservation interest was recorded
Re-creatability	Low
Fragmentation	Low
Ecological linkage	Structurally linked to the preferred habitats of marine mammal in South Lantau.
Potential value	Low
Nursery ground	None was recorded
Age	Not applicable
Abundance/richness of wildlife	Low
Ecological value	**Low**

Table 7b.38 Ecological Value of Coastal / Marine Waters at Cheung Sha

Criteria	**Coastal / Marine Waters**
Naturalness	Natural
Size	Large
Diversity	N/A
Rarity	No rare species or species of conservation interest was recorded under this study.
Re-creatability	Not re-creatable
Fragmentation	Not applicable
Ecological linkage	Structurally linked to the preferred habitats of Finless Porpoise in South Lantau.
Potential value	Low
Nursery ground	None was recorded
Age	Not applicable
Abundance/richness of wildlife	Under the long term marine mammal monitoring survey, the 2 grids that cover the submarine cable's landing portal at Cheung Sha (Grids O26, P26) recorded no porpoise density.
Ecological value	**Low**

Along the Cable Alignment

Table 7b.39 Ecological Value of Subtidal Soft Bottom Habitat along the Submarine Cable Alignment

Criteria	**Subtidal Soft Bottom Habitat**
Naturalness	Natural.
Size	Large
Diversity	Moderate (80 benthos species).
Rarity	No rare species or species of conservation interest was recorded during this Study.
Re-creatability	N/A
Fragmentation	N/A
Ecological linkage	Structurally and functionally linked to the preferred habitats of marine mammal in South Lantau waters.

Criteria	Subtidal Soft Bottom Habitat
Potential value	Moderate. The water quality was fair despite of the major pollution source from runoff from Pearl River during wet season. The potential value of conservation is limited.
Nursery ground	None was recorded
Age	Not applicable
Abundance/richness of wildlife	Moderate
Ecological value	**Low to Moderate**

Table 7b.40 Ecological Value of Coastal / Marine Waters along the Submarine Cable Alignment

Criteria	Coastal / Marine Waters
Naturalness	Natural. The waters between Shek Kwu Chau and Cheung Sha have busy marine traffic.
Size	Large
Diversity	N/A
Rarity	1 marine mammal species of conservation interest was recorded under this Study: Finless Porpoise Very few sightings of Chinese White Dolphin of conservation interest were previously made within southern waters (including waters around Shek Kwu Chau).
Re-creatability	Not re-creatable
Fragmentation	Not applicable
Ecological linkage	Structurally linked to the preferred habitats of Finless Porpoise in South Lantau.
Potential value	Moderate
Nursery ground	None was recorded
Age	Not applicable
Abundance/richness of wildlife	Under the long term marine mammal monitoring survey, among the 8 grids that overlapped with the IWMF footprint and submarine cables, all except 2 grids recorded porpoise sightings. The average SPSE and DPSE values of these 8 grids were 7.3 and 22.6 respectively, which were both higher than the averages recorded in South Lantau waters (4.3 and 11.65).
Ecological value	**Moderate**

Shek Kwu Chau

7b.5.1.2 Habitats identified to have low ecological value in the study area include plantation and developed area. Pond, watercourse, rocky shore, subtidal hard bottom habitat, and subtidal soft bottom habitat are of low to moderate ecological value. Shrubland is of moderate ecological value, whereas costal/marine waters are considered to be of high ecological value.

7b.5.1.3 Shrubland habitat is considered to be of moderate ecological value, supporting high flora and moderate fauna diversity. This habitat dominates the terrestrial study area in Shek Sku Chau, mainly in the form of hillside shrubland due to the topography of Shek Kwu Chau. Fauna species of conservation interest were recorded in this habitat, including the

Bogadek's burrowing lizard (previously recorded), and an active breeding pair of White-bellied Sea Eagle within hillside shrubland near shore.

7b.5.1.4 Coastal/marine waters is considered to be of high ecological value. Although it is subject to pollution discharge from the Pearl River, nevertheless it is an important habitat for Finless Porpoise due to the record of high occurrence between December and May. It is also linked to habitats of marine mammals in South Lantau waters. This habitat is found within the Project footprint.

7b.5.1.5 In accordance with EIAO-TM Annex 8 criteria, species of conservation interest recorded in the study area of at Shek Kwu Chau are listed in **Table 7b.41**. Results from literature review are also included in the table where applicable.

Table 7b.41 Species of Conservation Interest Recorded in the Study Area of Shek Kwu Chau during the Current and Previous Studies

Common name	Scientific name	Locations	Protection status	Distribution	Rarity
FAUNA					
Marine Mammal					
Finless Porpoise	*Neophocaena phocaenoides*	South Lantau waters	Cap. 170, Cap. 586, Class II Protected Animal of PRC, IUCN Red List of Threatened Species (Category Vulnerable), CITES Appendix I	Found in the southern and eastern waters of Hong Kong	-
* Chinese White Dolphin	*Sousa chinensis*	West and South Lantau waters	Cap. 170, Cap. 586, Class I Protected Animal of PRC, IUCN Red List of Threatened Species (Category NT), CITES Appendix I	Locally found in western waters, especially the North and West Lantau waters.	-
Corals					
Hard Corals:					
	Psammocora superficialis	Subtidal hard bottom habitat at shore of Shek Kwu Chau	Cap. 586	Widely distributed in Hong Kong	Locally abundant
	Oulastrea crispata	Subtidal hard bottom habitat at shore of Shek Kwu Chau	Cap. 586	Widely distributed in Hong Kong	Locally common
	Goniopora stutchburyi	Subtidal hard bottom habitat at shore of Shek Kwu Chau	Cap. 586	Widely distributed in Hong Kong	Locally common
	Turbinaria peltata	Subtidal hard bottom habitat at shore of Shek Kwu Chau	Cap. 586	Mostly found in northeastern and eastern waters, and occasionally found in the southern and western waters	Locally common
	Coscinaraea n sp.	Subtidal hard bottom habitat at shore of Shek Kwu Chau	Cap. 586	-	Locally uncommon
	Tubastrea sp.	Subtidal hard bottom habitat at shore of Shek Kwu Chau	Cap. 586	-	Locally common
	Tubastrea diaphana	Subtidal hard bottom habitat at shore of Shek Kwu Chau	Cap. 586	Found at southern waters	Locally common
	Dendrophyllia sp.	Subtidal hard bottom habitat at shore of Shek Kwu Chau	Cap. 586	-	Locally common

Common name	Scientific name	Locations	Protection status	Distribution	Rarity
Octocorals:					
	Dendronephthya sp.	Subtidal hard bottom habitat at shore of Shek Kwu Chau	Not applicable	-	Locally common
	Menella sp.	Subtidal hard bottom habitat at shore of Shek Kwu Chau	Not applicable	-	Locally common
	Euplexaura sp.	Subtidal hard bottom habitat at shore of Shek Kwu Chau	Not applicable	-	Locally common
	Echinomuricea sp.	Subtidal hard bottom habitat at shore of Shek Kwu Chau	Not applicable	Widely distributed in Hong Kong	Locally common
	Echinogorgia sp. A	Subtidal hard bottom habitat at shore of Shek Kwu Chau	Not applicable	-	Locally common
	Echinogorgia sp. B	Subtidal hard bottom habitat at shore of Shek Kwu Chau	Not applicable	-	Locally common
	Paraplexaura sp.	Subtidal hard bottom habitat at shore of Shek Kwu Chau	Not applicable	-	Locally common
Horseshoe Crab					
	* *Tachypleus tridentatus*	Offshore subtidal soft bottom habitat at the northwest of Shek Kwu Chau	China Red Data Book(Vulnerable)	Found in a few localities in northern western New Territories and Lantau Island	-
Avifauna					
Pacific Reef Egret	*Egretta sacra*	Rocky shore at southern Shek Kwu Chau	Cap. 170, China Red Data Book(Rare)	Widely distributed in coastal area in Hong Kong	Locally uncommon
White-bellied Sea Eagle	*Haliaeetus leucogaster*	Hillside shrubland, and at flight over waters and Shek Kwu Chau	Cap. 170, Cap. 586, China Red Data Book(Indeterminate)	Widely distributed in coastal area in Hong Kong	Locally uncommon
Emerald Dove	*Chalcophaps indica*	Shrubland	Cap. 170, China Red Data Book(Vulnerable)	Widely distributed in woodland in Hong Kong	Locally scarce
White-throated Kingfisher	*Halcyon smyrnensis*	Shrubland, pond	Cap. 170	Widely distributed in coastal area in Hong Kong	Locally common

Common name	Scientific name	Locations	Protection status	Distribution	Rarity
Black Kite	*Milvus migrans*	At flight over shrubland	Cap. 170; Class II Protected Animal of PRC; CITES Appendix II	Widely distributed in Hong Kong	Locally common
Pacific Swift	*Apus pacificus*	At flight over shrubland and developed area	Cap. 170	Widely distributed in Hong Kong	Locally common
Japanese Paradise Flycatcher	*Terpsiphone atrocaudata*	Developed area	Cap. 170, IUCN Red List of Threatened Species (Category LR/NT),	Found in Tai Po Kau, Mai Po, Pok Fu Lam, Victoria Peak	Locally scarce
* Eurasian Eagle Owl	*Bubo bubo*	Open hillsides and offshore islands	Cap. 170, Cap. 586, China Red Data Book(Rare)	Widely distributed in Hong Kong	Locally scarce
Butterfly					
Small Grass Yellow	*Eurema brigitta rubella*	Shrubland	Not applicable	Found in Ping Shan Tsai, Yung Shue O and Pat Sin Leng	Locally uncommon
Damselfly					
Eastern Lilysquatter	*Cercion melanotum*	Pond	Not applicable	Found in Hong Kong Wetland Park, Lai Chi Wo, Luk Keng and Shek Kwu Chau	Locally uncommon
* Dusky Lilysquatter	*Cercion calamorum dyeri*	Pond	Not applicable	Found in Kai Kuk Sheu Ha, Kang Mun Tsui, Kwan Tei River, Lung Tsai Ng Yuen, River Jhelum, Tai Tong and Wu Kau Tang	Locally uncommon
Reptile					
Tree Gecko	*Hemiphyllodactylus* sp.	Plantation near the developed area	Not applicable	Found in Po Toi, Aberdeen and Shek Kwu Chau	Locally very rare
* Bogadek's Burrowing Lizard	*Dibamus bogadeki*	Live in soil, or under sheltered microhabitats such as rotting wood lying on the forest floor.	Not applicable	Found in Hei Ling Chau, Shek Kwu Chau and Sunshine Island	Locally rare
Mammal					
Japanese Pipistrelle	*Pipistrellus abramus*	At flight over pond and shrubland	Cap. 170	Widely distributed in Hong Kong	Locally very common
Marine Fish					
Fish spawning and nursery area		Southern waters	Not applicable	-	-

Note: * = Previously recorded at Shek Kwu Chau

Cheung Sha

7b.5.1.6 Habitats identified to have low ecological value in the study area at Cheung Sha include developed area, subtidal hard bottom habitat, subtidal soft bottom habitat, and costal/marine waters. Rocky shore is identified to have low to moderate ecological value, whereas shrubland and watercourse is considered to be of moderate ecological value.

7b.5.1.7 Shrubland habitat at Cheung Sha has moderate ecological value with high flora and moderate fauna diversity. Shrubland habitat dominates the majority of the study area, providing habitat for the protected plant species *Aquilaria sinensis*, and amphibian species including Lesser Spiny Frog, Short-legged Toad and Romer's Tree Frog.

7b.5.1.8 Watercourse at Cheung Sha are natural and generally undisturbed with riparian vegetation. Low flora and low to moderate fauna diversity was recorded. Utilisation by fauna species of conservation interest including Little Egret, White-throated Kingfisher, Short-legged Toad, Chinese Cobra, Large Branded Swift, Common Rose, Short-winged Shadowdamsel, as well as fish species Stiphodon atropurpureus and *Awaous melanocephalus*, and rare plant species *Ceratopteris thalictroides*.

7b.5.1.9 In accordance with EIAO-TM Annex 8 criteria, species of conservation interest recorded in the study area of at Cheung Sha are listed in **Table 7b.42**. Results from literature review are also included in the table where applicable.

Along the Submarine Cable Alignment

7b.5.1.10 Habitats identified along the submarine cable alignment include subtidal soft bottom habitat of low to moderate ecological value, and coastal / marine waters of moderate ecological value.

7b.5.1.11 Coastal/marine waters is considered to be of moderate ecological value. Although it is subject to pollution discharge from the Pearl River, nevertheless occasional sightings of Finless Porpoise has been made. It is part of habitats of marine mammals in South Lantau waters.

7b.5.1.12 In accordance with EIAO-TM Annex 8 criteria, species of conservation interest recorded in the study area along the submarine cable alignment are listed in **Table 7b.42**. Results from literature review are also included in the table where applicable.

Table 7b.42 Species of Conservation Interest Recorded in the Study Area of at Cheung Sha and Along the Submarine Cable Alignment during the Current and Previous Studies

Common name	Scientific name	Locations	Protection status	Distribution	Rarity
FLORA					
Incense Tree	*Aquilaria sinensis*	Shrubland	Cap. 586, Category III nationally protected species in China	Lowland forests and fung shui woods	Locally common
Water Fern	*Ceratopteris thalictroides*	Watercourse	-	Found in Sam A Tsuen, Lai Chi Chong, Kam Tin, Po Toi Island and Tung Ping Chau	Locally rare
FAUNA					
Marine Mammal					
Finless Porpoise	*Neophocaena phocaenoides*	Off shore marine waters	Cap. 170, Cap. 586, Class II Protected Animal of PRC, IUCN Red List of Threatened Species (Category Vulnerable), CITES Appendix I	Found in the southern and eastern waters of Hong Kong	-
* Chinese White Dolphin	*Sousa chinensis*	Off shore marine waters	Cap. 170, Cap. 586, Class I Protected Animal of PRC, IUCN Red List of Threatened Species (Category NT), CITES Appendix I	Locally found in western waters, especially the North and West Lantau waters.	-
Avifauna					
Black Kite	*Milvus migrans*	Potential nest at developed area, rocky shore	Cap. 170; Class II Protected Animal of PRC; CITES Appendix II	Widely distributed in Hong Kong	Locally common
Pacific Reef Egret	*Egretta sacra*	Rocky shore	Cap. 170, China Red Data Book(Rare)	Widely distributed in coastal area in Hong Kong	Locally uncommon
Little Egret	*Egretta garzetta*	Watercourse, at flight over rocky shore	Cap. 170	Widely distributed in Hong Kong	Locally common
White-throated Kingfisher	*Halcyon smyrnensis*	Watercourse	Cap. 170	Widely distributed in coastal area in Hong Kong	Locally common
Butterfly					
* Large Branded Swift	*Pelopidas subochraceus*	Watercourse	Not applicable	Found in Clear Water Bay Country Park	Locally rare
* Common Rose	*Pachliopta aristolochiae*	Watercourse	Not applicable	Widely distributed in Hong Kong	Locally uncommon

Common name	Scientific name	Locations	Protection status	Distribution	Rarity
Damselfly					
* Short-winged Shadowdamsel	*Drepanosticta hongkongensis*	Watercourse	Not applicable	Found in Aberdeen Upper Reservoir, Big Wave Bay, Keung Shan, Lantau Peak, Ngau Kwo Tin, Shek Pik Reservoir, Sunset Peak and Tei Tong Tsai	Locally uncommon
Reptile					
Chinese Cobra	*Naja atra*	Developed area, watercourse	Cap. 586, China Red Data Book(Vulnerable)	Widely distributed in Hong Kong	-
Amphibian					
Lesser Spiny Frog	*Paa exilispinosa*	Shrubland	IUCN Red List of Threatened Species (Category Vulnerable)	Widely distributed in mountain streams in Hong Kong	Locally common
Short-legged Toad	*Xenophrys brachykolos*	Shrubland	IUCN Red List of Threatened Species (Category Endangered)	Widely distributed in upland forest streams throughout Hong Kong	Locally common
* Romer's Tree Frog	*Philautus romeri*	Shrubland	Cap. 170, IUCN Red List of Threatened Species (Category Endangered)	Found in woodlands on Lantau Island, Po Toi Island, Lamma Island, Hong Kong Island and New Territories.	Common in various localities
Fish					
* Philippine Neon Goby	*Stiphodon atropurpureus*	Watercourse	Not applicable	Found in a few streams in North-East of New Territories and on Lantau Island	Locally uncommon
* Black-headed Thick-lipped Goby	*Awaous melanocephalus*	Watercourse	Not applicable	Found in a few streams on Hong Kong Island and Lantau Island	Locally rare

Note:
*Previously recorded under another study within the study area of this Project

7b.6 Identification and Evaluation of Environmental Impacts

7b.6.1 Introduction

7b.6.1.1 The construction of the proposed Project is scheduled to commence in 2013 and complete in 2018. The proposed marine construction works would involve reclamation, and construction of breakwater, cofferdam and berth at Shek Kwu Chau (**Figure 2.8**); laying of submarine cable between Shek Kwu Chau and Cheung Sha (**Figure 7b.3**); and construction of a landing portal at Cheung Sha (**Figure 7b.3**).

Reclamation, and Cofferdam and Breakwater Construction at Shek Kwu Chau

7b.6.1.2 Marine works, including filling, reclamation, and dredging would cause the stirring up of seabed sediment, resulting in sediment suspension and release of contaminants (if any), and hence degradation in water quality in the marine habitat. Non-percussive bore piling method would be adopted for the installation of tubular piles for the berth construction; and the installation of circular cells for cellular cofferdam and circular cell breakwater would involve driving of sheet piles in place using vibratory hammer or hydraulic impact hammer (details are presented under **Section 2**).

7b.6.1.3 As species/habitats of conservation importance, including corals, Finless Porpoise and Chinese White Dolphin, have been identified within and in the vicinity of the marine works, it is anticipated that significant ecological impact would be resulted if no mitigation measures are implemented.

7b.6.1.4 Noting the ecological importance of the Project site, the Project Proponent has made alteration to the phasing of works, construction method, and layout plan of the IWMF, in order to minimise its ecological impacts (details are included in **Section 7b.8**).

Submarine Cable Laying between the IWMF at the artificial island near SKC and Cheung Sha

7b.6.1.5 The submarine cable alignment would connect the IWMF at the artificial island near SKC with Cheung Sha. The installation of submarine cables would employ subsea burying machine to form narrow cable trench at sea bed up to 5 m deep by water jetting and lay the submarine cable spontaneously. A short length of cable trench would be formed by open cut method using dredger for closing sections near the shore end at Cheung Sha.

Construction of Landing Portal at Cheung Sha

7b.6.1.6 Proposed works mainly comprise of small-scaled construction and excavation works, the constructional runoff may result in sediment suspension and release of contaminants, and hence degradation in water quality in the nearby intertidal habitat and marine waters.

7b.6.2 Construction Phase

Direct Impact

Habitat and Fauna loss

7b.6.2.1 While the proposed Project Site at Shek Kwu Chau has been identified as a hotspot for Finless Porpoise, in order to minimise the loss of Finless Porpoise habitat, the primary design of the seawall and breakwater has been revised to this current design. The following table summarizes the habitats to be directly affected under the Project:

Table 7b.43 Area of Habitat to be Directly Affected under the Project

Shek Kwu Chau		
Reclamation	7.9 ha	
Cofferdam	2 ha	
Breakwater	4.1 ha	
Berth	1.9 ha	
Embayment	15.1 ha	
Anti-scouring layer	1.5 ha	
Cheung Sha		
Landing portal	20 m^2	
Along submarine cable alignment		
Submarine cable trench	5.8 km long, 17,400 m^2	
Habitat to be Directly Affected	**Measurement before Amendment of Layout Plan**	**Measurement after Amendment of Layout Plan (Current Design)**
Shek Kwu Chau		
Marine mammal habitat	50 ha	31 ha
Subtidal soft bottom habitat	24.3 ha	17.2 ha
Subtidal hard bottom habitat	0.2 ha	0.2 ha
Fish spawning and nursery grounds	23 ha	15.9 ha
Cheung Sha		
Intertidal and subtidal habitat	20 m^2	20 m^2
Along submarine cable alignment		
Subtidal soft bottom habitat	5.8 km long, 17,400 m^2	5.8 km long, 17,400 m^2

7b.6.2.2 The impact assessment for this study is based on the current design and construction method.

Shek Kwu Chau

7b.6.2.3 The proposed reclamation and breakwater construction would be located away from the rocky shore, in order to avoid / minimize direct loss of intertidal habitat, as well as the hard bottom subtidal habitat near shore. No direct impact on the terrestrial habitat, intertidal habitat and its associated communities are expected to arise due to the works.

Marine mammal habitat loss during construction

7b.6.2.4 With a conservative evaluation approach, this study assumes the whole embayment enclosed within the proposed works would become inaccessible to marine mammals due to avoidance of construction works and working vessels. Although the opening of the breakwater would allow water circulation between the waters outside and within the breakwater, nevertheless, the physical structure of breakwater would restrict the accessibility of marine mammals, and that boats and vessels within the breakwater would lead to disturbance, which may in turn limit the foraging range and communication of marine mammals with each other.

7b.6.2.5 As previously discussed, in order to minimise the loss of Finless Porpoise habitat, the original design of Project has been revised to the current design, where the total size of habitat loss for marine mammals had significantly reduced from 50 ha down to 31 ha.

7b.6.2.6 While marine mammals utilize a large range of area, where frequent sightings of Finless Porpoise have been made at the southwest waters further offshore of Shek Kwu Chau during this current study (**Figure 7b.13**); these results indicate that suitable habitat of similar quality are available in the surrounding waters of Shek Kwu Chau. Finless Porpoise may utilise these waters when the works areas are not available during construction phase.

7b.6.2.7 Nevertheless, while the south and southwest waters of Shek Kwu Chau have been identified as important habitat for Finless Porpoise, due to the high utilization rate during the current study and the long term marine mammal monitoring survey by the AFCD, the potential impact on Finless Porpoise due to the loss of the remaining 31 ha of habitat is still considered to be high. Mitigation measures are required.

Subtidal hard bottom habitat loss (and the associated corals) during construction

7b.6.2.8 The large majority of subtidal habitat within the works area composed of soft bottom substrate. The term 'subtidal hard bottom habitat' used under this discussion refers to the rocks and boulders that are scattered along and near the shore of Shek Kwu Chau.

7b.6.2.9 An estimated loss of subtidal hard bottom habitat can be quantified by: length of reclamation area along shore x extent of recorded locations of corals (which are attached to hard surfaces) from boundary of reclamation area near shore to the recorded coral location furthest away from shore, which is approximately 400 m x 25 m = 10,000 m^2 = 1 ha. During the REA survey, it was recorded that scattered boulders had a percentage cover of approximately 20% (conservative approach) along REA transects T10-T13. Therefore the estimated size of 1 ha can be refined as: 1 ha x 20% = 0.2 ha. The estimated loss of subtidal hard bottom habitat is approximately 0.2 ha.

7b.6.2.10 Coral communities found attached to hard bottom surfaces within the works area, along the REA transects T10-T13, comprise approximately 198 colonies. Only one hard coral species, *Tubastrea* sp., and 7 species of octocorals were recorded within the directly affected area. **Table 7b.44** presents a summary of REA results for the REA T10-T13. **Table 7b.45** presents the corals species recorded within the directly affected area.

Table 7b.44 Brief Summary of REA Survey Results within the Reclamation Area at Shek Kwu Chau

	REA Transects			
	T10	**T11**	**T12**	**T13**
Coral Coverage	<1%	<1%	<1%	<1%
Total No. of Coral Colonies	36	40	73	49
Total No. of Coral Species	6	5	7	6
Size	Small	Small	Small	Small
Health Condition	Fair	Fair	Fair	Fair
Total No. of Movable Coral Colonies (Rock size <50cm diameter)	36	40	73	49
Dominant Coral Species	*Tubastrea* sp., *Menella* sp.	*Tubastrea* sp.	*Echinomuricea* sp.	*Echinomuricea* sp.

Table 7b.45 Potentially Affected Coral Species Recorded within the Reclamation Area at Shek Kwu Chau

Species	Rarity in Hong Kong
Hard Corals [(1)]	
Tubastrea sp.	Common
Soft Corals / Gorgonian	
Dendronephthya sp.	Common
Menella sp.	Common
Euplexaura sp.	Common
Echinomuricea sp.	Common
Echinogorgia sp. A	Common
Echinogorgia sp. B	Common
Paraplexaura sp.	Common

Note:
1. All hard coral species are protected under Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586)

7b.6.2.11 Within the subtidal hard bottom habitat to be directly affected by the proposed works, a total of 8 coral species (1 hard coral species, 7 soft coral species – **Table 7b.44-45**) of 198 colonies of small sizes and low coverage (<1%) were recorded. The coral species recorded were all common in Hong Kong waters. Considering the species composition, the ecological value of the potentially affected subtidal hard bottom habitat is considered to have a comparatively lower ecological value than the subtidal hard bottom habitat nearer to shore.

7b.6.2.12 Nevertheless, as permanent loss of a small area of subtidal hard bottom habitat (approximately 0.2 ha) and the associated corals would be directly affected, potential impact on corals within the works area is considered to have moderate impact and therefore mitigation measure would be required.

7b.6.2.13 According to the results of the coral REA surveys, all directly affected coral colonies were attached on movable boulders with diameter of <50 cm. In order to mitigate the direct impact to corals, translocation of directly affected coral colonies attached to movable rocks should be recommended.

7b.6.2.14 Previous experience on successful coral translocation includes the *EIA-112/2005 – Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung* (HKJC, 2005). A total of 89 coral colonies were transplanted to a nearby site in late November 2006 due to construction works. The recipient site is 80 m to the south of a ferry pier where corals were already present on the bedrocks. Monitoring surveys for transplanted corals were conducted quarterly for one year (4 surveys in total: from December 2006 to September 2007).

7b.6.2.15 According to the Environmental Monitoring and Audit (EM&A) reports during the coral monitoring period between December 2006 and September 2007, by the end of the monitoring period, 86 out of 89 transplanted corals were recovered and their condition remained similar with the baseline condition before transplantation (HKJC, 2007a-d). Only a total of 3 colonies went missing; and within the 86 remaining colonies, only 3 colonies showed some degree of mortality (30-80%) (*ibid.*). No signs of mortality nor bleaching were noted in the rest of the 83 transplanted coral colonies (*ibid.*). With over 93% of transplanted corals remained in the same condition before transplantation, and no trigger of Event and Action Level, coral translocation is considered to be an effective measure to avoid direct loss of corals under this Project.

Subtidal soft bottom habitat loss during construction

7b.6.2.16 With the original design, the total size of subtidal soft bottom habitat loss would be 24.3 ha. As previously discussed, in order to minimise the intensity of impacts on marine ecological resources, the design of the Project has been revised. The total size of subtidal soft bottom habitat loss had reduced from 24.3 ha down to 17.2 ha.

7b.6.2.17 The potentially affected subtidal soft bottom habitat of approximately 17.2 ha is composed of sandy and muddy substrate. Benthic communities recorded during the grab sampling surveys were dominated by common typical surface deposit feeders and opportunistic species, and no rare species or species of conservation interested was recorded in the recent surveys. Considering the low to moderate ecological value of the habitat, potential impact of the loss of subtidal soft bottom habitat and the associated benthic communities is considered to be low.

Loss of fish spawning and nursery ground during construction

7b.6.2.18 The footprint of works overlaps with the previously identified fish spawning and nursery ground (AFD, 1998). Fish spawning and nursery grounds are important habitats, as they are essential to the regeneration and long-term survival of various organisms, adverse impact on existing grounds should be mitigated.

7b.6.2.19 As previously discussed, in order to minimise the intensity of impacts on marine ecological resources, the design of the Project has been revised. With the revised design for the Project, the area of fish spawning and nursery ground to be lost has reduced from 23 ha down to 15.9 ha (current design), hence minimizing the adverse impact on the regeneration of marine fisheries.

7b.6.2.20 Considering that the 15.9 ha of loss would only account for an insignificant amount of the total fish spawning and nursery ground in the southern waters, the predicted loss of 15.9 ha is considered to be insignificant.

7b.6.2.21 Moreover, it should be noted that during a more updated fisheries baseline surveys (ichthyoplankton and post-larvae) conducted under *EIA-125/2006 Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities: Part 2 South Soko* (CLP, 2006), the survey results concluded that the densities for fish larva and eggs at all sampling stations at South and West Lantau waters (including 2 stations at Shek Kwu Chau) were generally low; the degree of difference in densities between stations were small; and therefore it was concluded that there was no observable difference in fish larvae and egg densities between the identified spawning and nursery grounds at southern waters of Hong Kong, and the waters at Western Lantau, which was not identified to be important spawning and nursery grounds (*ibid.*).

Cheung Sha

7b.6.2.22 The proposed landing portal at Cheung Sha would permanently occupy a small area of intertidal and subtidal habitat (total = 20 m^2). Slight encroachment into the backshore vegetated area of 750 m^2 may also be resulted during construction for siting of construction plants.

Intertidal habitat loss during construction

7b.6.2.23 The potentially affected intertidal rocky shore habitat is composed of large boulders in various forms and is a typical exposed rocky shore in Hong Kong. While the intertidal species recorded were common across other natural rocky shores in Hong Kong, and the area to be lost is small, potential loss of intertidal habitat and the associated rocky shore communities due to the Project is considered to be insignificant.

Subtidal habitat loss during construction

7b.6.2.24 Towards the end of the proposed submarine cable near the shore of Cheung Sha, a short length of cable trench would be formed by open cut method using dredger for closing sections near shore ends. The potentially affected subtidal habitat is composed of muddy substrate with scattered boulders. Considering that no rare species or species of conservation interest were recorded during dive and benthos surveys, the potential loss of subtidal habitat of low ecological value and of small size is considered to be insignificant.

Backshore vegetated area loss during construction

7b.6.2.25 Although the proposed landing portal would be situated at an intertidal rocky shore, slight encroachment into the backshore shrubland habitat may arise (750 m^2) during construction phase due to siting of construction plants. Potential vegetation loss would be limited to the backshore area and temporary in nature. Common backshore species such as *Ipomoea pes-caprae, Cerbera manghas, Hibiscus tiliaceus,* and *Pandanus tectorius* may be directly affected. Considering that no rare nor protected floral species were recorded at the backshore vegetated area within the works area at intertidal habitat, the potential loss of backshore vegetated area of very small size is considered to be insignificant.

Submarine Cable Alignment (between Shek Kwu Chau and Cheung Sha)

Subtidal soft bottom habitat loss during construction

7b.6.2.26 During the submarine cable laying process (for details please refer to **Section 2**: Project Description), the subsea burying machine would create a trench of about 5 m deep, 3 m wide and about 5.8 km long by performing water jetting. The cable would be laid into the trench spontaneously. Minor disturbance to about 17,400 m^2 of subtidal soft bottom habitat is therefore expected, and its associated benthic communities would be temporarily affected.

7b.6.2.27 The potentially affected subtidal habitat is composed of muddy substrate with scattered boulders. No coral species was recorded at the coastal subtidal hard bottom habitat during the coral spot-check surveys. The benthos recorded during grab sampling surveys was dominated by common typical surface deposit feeders and opportunistic species, no rare nor species of conservation importance were recorded.

7b.6.2.28 Moreover, it should be noted that benthos community of the temporarily affected areas are expected to recolonise the seabed areas after the short period of submarine cable laying operation (about 20 working days). In view of the low to moderate ecological value of the subtidal habitats and temporary nature of the impact, the potential impact on subtidal habitat and the associated benthos communities due to submarine cable laying works is considered to be low.

Indirect Impact – Marine-based Construction

7b.6.2.29 Potential indirect impacts due to marine-based works include:

(i) Increase in Suspended Solids

7b.6.2.30 The disturbance on seabed during dredging increases the level of suspended solids (SS) in water. The effect of SS on marine organisms depends on several factors, such as species tolerance, life mode of organisms (sessile or free-swimming), growth form or orientation of sessile organisms and water movement. Sessile filter feeders are susceptible to deleterious impacts from elevated SS in the water column through smothering and clogging of their respiratory and feeding apparatus. Increased turbidity

due to elevation in SS may reduce the amount of light reaching beneath the water surface. Lethal (e.g. mortality) and sub-lethal (e.g. slow growth rate and low in reproductive success rate) impacts on marine life may occur. All these impacts may eventually cause the reduction in population size of marine communities/populations.

7b.6.2.31 Considering the presence of coral communities along the coast of Shek Kwu Chau, and the sensitivity of marine organisms to SS, revision has been made to the original construction method for breakwater and the surrounding structure of reclamation area, with the objective to minimise SS elevation during construction phase.

7b.6.2.32 With the adoption of the current cellular cofferdam to surround the reclamation area, and circular cell breakwater to protect the reclamation area, the dredging volume has significantly reduced from 79,141 m^3 (original seawall structure) to 26,200 m^3 (currently proposed circular cells).

7b.6.2.33 In addition, for filling activities for circular cells and reclamation area, phasing of works has been adopted to minimise cumulative impacts from SS elevation. All filling works would be conducted within enclosed environment. More details on phasing of works are presented in **Section 7b.8**.

7b.6.2.34 To assess the potential water quality impacts on marine organisms, the existing ambient environmental conditions would be taken into account, where a certain level of SS is received from Pearl River. The general water quality objective of a 30% increase from the ambient condition would be adopted as the assessment criteria, as adopted in the *EIA-174/2009 Tuen Mun - Chek Lap Kok Link* (HyD, 2009c). The existing ambient value for SS concentration at the Project Site is 10.7 mg/L during dry season, and 8.4 mg/L during wet season.

7b.6.2.35 As covered in the **Water Quality Impact Assessment** (**Section 5b**), the following table presents the calculated elevation of SS levels assuming the worst case scenario:

Table 7b.46 Calculated Suspended Solids (SS) Concentrations at Shek Kwu Chau under Unmitigated Dredging Scenario (Dredging Rate 4000 m^3/day, without silt curtain)

Distance from Source (m)	Suspended Sediment Elevation (mg/L)
15	697
50	209
100	105
200	52.2
300	34.8
400	26.1
500	20.9
600	17.4
700	14.9
800	13.1
900	11.6

7b.6.2.36 As shown in **Table 7b.46**, without mitigation, the level of SS elevation due to the dredging operation at the nearest works area would reach 697 mg/L (minimum distance from the originally proposed dredging boundary to Shek Kwu Chau coast is 15 m), which is far above the relevant assessment criteria, indicating potential adverse impact on the existing marine organisms.

7b.6.2.37 In order to mitigate the potential impact on marine species, especially corals, and habitat due to SS elevation, silt curtain would be adopted (reduction of SS dispersion by 75%), and no dredging operation for anti-scouring protection layer would be carried out within 100 m from the nearest coral communities (**Figure 5b.4**). The anti-scouring protection layer would be constructed without dredging within 100 m from the coral communities.

7b.6.2.38 To further mitigate the potential impacts from SS elevation, it is proposed to reduce the maximum allowable production rate from 4000 m^3/day to 380 m^3/day, with no more than 15 grabs per hour using grab size of approximately 2 m^3 for anti-scouring protection layer construction. Details are discussed in **Section 5b**, and **Table 5b.11-5b.12** under **Water Quality Impact Assessment** (**Section 5b**).

7b.6.2.39 After the adoption of silt curtain, limitation on extent of dredging works for anti-scouring protection layer, reduction of dredging rate, and limitation on number of grabs per hour and grab size, the predicted maximum SS elevation at the nearest coral communities to dredging works (100 m away) would significantly reduce to 2.5 mg/L, which complies with the SS criterion of elevation from 30% of the ambient SS (i.e. 10.7 mg/L during dry season and 8.4 mg/L during wet season).

Intertidal communities

7b.6.2.40 Elevation of SS level due to reclamation, circular cells installation and dredging may result in degradation in water quality in the vicinity of the natural rocky shore along the coasts of Shek Kwu Chau; while construction works for the landing portal and submarine cable would also affect the water quality of the adjacent rocky shores at Cheung Sha. Elevated SS may reduce the amount of light reaching algae in rocky shores, inhibiting their growth, and settlement of elevated SS may cause the smothering of intertidal organisms.

7b.6.2.41 As previously discussed, and as shown in **Table 5b.11**, with the adoption of silt curtain, limitation on extent of dredging works, and reduction of dredging rate, the predicted maximum SS elevation from works to the nearest intertidal communities (over 100 m away) would greatly reduce to 2.5 mg/L, which complies with the SS criterion of elevation from 30% of the ambient SS (i.e. 10.7 mg/L during dry season and 8.4 mg/L during wet season). It is therefore considered that significant adverse impact on intertidal communities due to SS elevation from the dredging operation would not be anticipated.

Coral communities

7b.6.2.42 Coral communities were recorded along the shoreline of the study area at Shek Kwu Chau. Of particular ecological concern, hard corals may be harmed by high SS level. The reduction in light availability due to elevation in SS may inhabit photosynthesis of symbiotic algae associated with hard corals, leading to bleaching and mortality of hard corals.

7b.6.2.43 As previously discussed, and as shown in **Table 5b.11** with the adoption of silt curtain, limitation on extent of dredging works, and reduction of dredging rate, the predicted maximum SS elevation from works to the nearest non-translocatable coral communities (approximately 100 m away) would greatly reduce to 2.5mg/L, which complies with the SS criterion of elevation from 30% of the ambient SS (i.e. 10.7 mg/L during dry season and 8.4 mg/L during wet season). It is therefore considered that significant adverse impact on coral communities due to SS elevation from the dredging operation would not be anticipated.

7b.6.2.44 A total of 2 colonies of an uncommon coral *Coscinaraea* n sp. was found in REA transect T9, approximately 250 m away from the breakwater construction. With the adoption of silt curtain and reduction in dredging rate, adverse impact on *Coscinaraea* n sp. due to SS elevation is expected to be insignificant.

7b.6.2.45 The construction of the seawall discharge for disposal of brine water generated from the desalination plant would be minimal. No disturbance on the seabed sediment should arise.

Soft bottom benthic communities

7b.6.2.46 Increase in SS level and sedimentation due to marine works may affect the benthic communities in the vicinity of the proposed works area. Considering that no rare nor species of conservation importance was recorded; benthic communities within and in the vicinity of the study area of Shek Kwu Chau, Cheung Sha and along the cable alignment was dominated by polychaetes (an opportunistic surface deposit feeders in disturbed environment); and that benthic communities have high tolerance of SS elevation, as it is a normal phenomenon for SS deposition at subtidal habitat; no significant indirect disturbance on benthic communities due to SS elevation is expected.

Marine mammals

7b.6.2.47 While Finless Porpoise and Chinese White Dolphin use echolocation and vision to forage, they are less vulnerable to SS impact than other filter feeders. Nevertheless, the potential increase in SS concentration may influence the prey of marine mammals, and affect marine mammals indirectly by the loss of supply due to disturbance of seafloor and increase in sedimentation (Jefferson *et al.*, 2009).

7b.6.2.48 As previously discussed, with the implementation of mitigation measures recommended under **Water Quality Impact Assessment** (**Section 5b.8**), elevation of SS level is expected to be acceptable, hence the prey items of marine mammals are not expected to be adversely affected.

7b.6.2.49 In addition, elevation of SS level is considered to have limited impact on Finless Porpoise and Chinese White Dolphin, as they use lung to breath, they would not be exposed the risk of gill blockage due to high concentration of SS in water.

Horseshoe crabs

7b.6.2.50 During a previous study, adult horseshoe crab was recorded at the offshore subtidal soft bottom habitat at the northwestern waters of Shek Kwu Chau (Chiu & Morton, 1999). While juvenile horseshoe crabs are often found in intertidal soft shore areas, and buried under sediment during high tide and under low temperature; and adult horseshoe crabs that occur at the western waters of Hong Kong are exposed to pollution and SS transported from Pearl River; adult and juvenile horseshoe crabs are therefore considered to be tolerant of high SS level.

7b.6.2.51 Considering that the distance between the proposed works area and the previously identified recorded horseshoe crab location is over 600 m, and suitable habitat for juvenile horseshoe crabs was not found within or in the vicinity of the Project Site; with the adoption of water quality mitigation measures, SS elevation would comply with the assessment criteria. In addition, unlike sessile marine organisms, horseshoe crab could swim away from affected area; potential impact on Horseshoe Crab due to elevation in SS level is expected to be minor and acceptable.

Degradation in quality of important fish spawning and nursery ground in the southern waters

7b.6.2.52 The proposed dredging activities at Shek Kwu Chau would temporarily elevate the SS level and create sediment plumes. Effects on spawning and nursery fishes could be lethal or sublethal. Reduction in survivorship, growth rate, and reproductive potential would be resulted due to stress incurred by the constant need to flush out deposited material. High SS level may clog the gill structure of fish and cause physical damage and

hinder transfer of oxygen. Fish egg and larval fish (fry) are more susceptible to deleterious impacts from sedimentation through smothering and clogging of their respiratory systems. Adult fish are generally less sensitive to effects from SS.

7b.6.2.53 SS plume occurs naturally in the marine environment by wave action and vertical flux of water current. Fish has evolved behavioural adaptation to fluctuation in turbidity, such as clearing their gills by flushing water, or simply moving to less turbid waters.

7b.6.2.54 As previously discussed, after the adoption of silt curtain, limitation on extent of dredging works, and reduction of dredging rate, the resulted maximum SS elevation would be greatly reduced to 2.5 mg/L, which complies with the SS criterion of elevation from 30% of the ambient SS (10.7 mg/L during dry season and 8.4 mg/L during wet season). It is therefore considered that significant adverse impact on fish spawning and nursery ground due to SS elevation from the dredging operation would not be anticipated. Details on water quality are discussed in **Section 5b.7.3.22** to **5b.7.3.30**, and **Table 5b.10** to **5b.12** under **Water Quality Impact Assessment** (**Section 5b**).

7b.6.2.55 For the cable alignment works between Shek Kwu Chau and Cheung Sha, which overlaps with the previously identified potential fish spawning and nursery grounds, the modelling and calculation conducted under the **Water Quality Impact Assessment** (**Section 5b**) indicated that the sediments disturbed during the laying of submarine cable would remain within 1 m above the seabed (independent on the water depth), and settle onto the seabed within approximately 80 m from the cable alignment (**Section 5b.7.4.1** to **5b.7.4.7**). The whole submarine cable installation process would be about 20 working days. The suspended solids resulted from cable laying may have adverse impact on the potential fish spawning and nursery ground as previously discussed. Considering the localised nature of sediment plume and short term duration of works, as well as the natural adaption of fish, no significant impacts are expected on the potential fish spawning and nursery ground due to the submarine cable laying works. In addition, most of the influence zone of the cable laying works would be far away from the Shek Kwu Chau site. The cable laying works is not expected to cause cumulative water quality impact with the dredging for sheet piling at Shek Kwu Chau. For cable laying works close to Shek Kwu Chau, it is recommended that the construction program should be arranged so that the laying works and the dredging work would operate at least 80 m apart to avoid any cumulative impact on water quality (in case if such tight schedule is necessary).

7b.6.2.56 For the construction of Cheung Sha landing portal, surface runoff and disturbance on seabed may be resulted from cut and cover works, which may result in adverse impact on the important fish spawning and nursery grounds. Considering the small scale of landing portal works, existing turbid condition, and absence of ecological sensitive receiver along the shoreline, with the adoption of good site practise and water quality control measures, potential impact on ecological resources during construction of Cheung Sha portal is considered to be acceptable.

(ii) Changes in Sedimentation Rate

7b.6.2.57 As the extent of sediment plume from marine works is not expected to disperse to the coral sites, full compliance with the SS criterion (maximum elevation of ambient SS level by 30%) is predicted at all of the identified coral communities (**Section 5b**). As a result, the sedimentation rate at the coral sites is not expected to be significantly affected by the proposed works. This criterion for assessing SS impacts on corals (maximum elevation of ambient SS level by 30%) was adopted under the approved EIAs for Tuen Mun - Chek Lap Kok Link (HyD, 2009a), *Hong Kong - Zhuhai - Macao Bridge Hong Kong Boundary Crossing Facilities* (HyD, 2009b), Hong Kong - Zhuhai - Macao Bridge Hong Kong Link Road (HyD, 2009c), and *Tai Po Sewage Treatment Works Stage 5* (DSD, 2004). No significant adverse impact in terms of sedimentation is therefore expected at coral sites and on other marine fauna.

(iii) Decrease in Dissolved Oxygen

Suffocation of marine organisms and degradation of fish spawning and nursery area in the southern waters

7b.6.2.58 According to the **Water Quality Impact Assessment** (**Section 5b**), no significant DO depletion was predicted under this Project even under unmitigated scenario. The dredging activities would cause a maximum DO depletion of less than 0.1 mg/L at the nearest sensitive receiver (corals located 100 m away). Full compliance with the WQO for depth-averaged DO was predicted. Hence, no significant adverse impacts on marine fauna, including corals, benthic communities, as well as fish spawning and nursery ground, due to changes in DO level would be expected from the dredging works.

(iv) Release of Contaminants

7b.6.2.59 Dredging activities would disturb the sediments at seabed and cause water turbulence, which may result in release of pollutants and contaminants from the seabed sediment into the water column. Backfilling activities may also release pollutants and contaminants into the marine environment from the filling materials.

7b.6.2.60 Increase in pollutant or contaminant levels could cause lethal or sub-lethal toxic effects to marine fauna. Potential toxic effects on marine fauna would depend on several factors, such as species tolerance, contaminant levels, water flow rate, etc.

Bioaccumulation of heavy metals and organochlorines in marine mammals

7b.6.2.61 Contamination by organochlorine compounds and mercury is thought to threaten marine mammals in South China coastal waters (IUCN, 2009). Potential increase in contaminants may result in bioaccumulation in marine mammals through their intake of prey items, which have been contaminated by the released contaminants. Previous studies suggested that high concentrations of organochlorines and heavy metals in the tissue of Finless Porpoise may reduce their reproductive capacity and cause immunosuppression (Parsons *et al.*, 1998; Minh *et al.*, 1999; Jefferson *et al.*, 2002c; Ramu *et al.*, 2005).

7b.6.2.62 According to the sediment quality monitoring survey conducted by EPD in 2008 (EPD, 2009), the monitoring station closest to the Project Site, SS6, reflected no sediment contamination. Based on the laboratory test results conducted under this study (**Section 6b**), the assessment indicated that unacceptable elevation of contaminant levels due to the proposed marine works would be unlikely. Significant impact regarding bioaccumulation of heavy metals and organochlorines in marine mammals and other marine fauna is therefore not expected.

Bioaccumulation of heavy metals and organochlorines in fishes within the spawning and nursery area in the southern waters

7b.6.2.63 Dredging activities may result in the release of contaminants from marine sediments. Potential impacts on fisheries resources include the accumulation of contaminants in fish tissues, resulting in sub-lethal effects which may alter behaviour, reproduction and increase susceptibility to disease. Eggs, larvae and juveniles are particularly susceptible to the sub-lethal effects of contaminants, and elevated levels may lead to increased mortality.

7b.6.2.64 According to the sediment quality monitoring survey conducted by EPD in 2008 (EPD, 2009), the monitoring station closest to the Project Site, SS6, reflected no sediment contamination. Based on the laboratory test results conducted under this study (**Section 6b**), the assessment indicated that unacceptable elevation of contaminant levels due to the proposed marine works would be unlikely. Significant impact regarding

bioaccumulation of heavy metals and organochlorines in adult fish, as well as fish egg, larvae and juveniles are therefore not expected.

(v) Underwater Acoustic Disturbance on Marine Mammals

7b.6.2.65 Around the works area of the IWMF near Shek Kwu Chau, Cheung Sha landing portal and along the route of submarine cables, underwater noise generated from increased amount of vessel traffic, piling, dredging, backfilling, constructional works and cable trench forming works would cause acoustic disturbance on the marine mammals.

7b.6.2.66 Marine mammals are acoustically-sensitive animals, and sound is vital to their survival since they rely on the ability to echolocate in order to detect their surroundings, and to communicate with each other. Although no underwater blasting would be involved in this Project, however, noise from piling activities, as well as vessel traffic could be very loud, and can mask sounds porpoises use during foraging, either by affecting the return echo they emit to determine the location and shape of nearby items, or their echolocation capabilities. Therefore, noise from marine construction works and vessel traffic is a potential concern, and is likely to result in behavioural disturbance on porpoises.

7b.6.2.67 According to Goold and Jefferson (2002), Finless Porpoise uses narrowband and high-frequency ultrasonic pulses with peak energy of 142 kHz. While dredgers and large, slow-moving vessels generally produce very low frequency sounds (Richardson *et al.*, 1995), the expected acoustic disturbance from dredging and large, slow-moving vessels should be well below the acoustic range of porpoises.

7b.6.2.68 Nevertheless, noise generated during piling works may result in significant impact on marine mammals due to masking of sounds by construction noises if unmitigated. Potential impacts that may arise include threat to marine mammal's survival, due to loss of ability to echolocate for surrounding detection and to forage, as well as disturbance on the ability to communicate between individuals. Considering the potential consequences of underwater acoustic disturbance on marine mammals, unmitigated noise impact during piling works is considered to be of low to moderate severity and significant disturbance on marine mammals is predicted. Mitigation measures are considered necessary.

Underwater disturbance from bored piling

7b.6.2.69 A berth area would be constructed during Phase 3 (construction sequence is detailed in **Section 7b.8** and **Figure 2.8**) for the berthing of marine vessels for transportation of containers and staff / visitors, and for storage of MSW containers.

7b.6.2.70 Installation of tubular piles for the berth construction would involve piling activities, which may result in underwater acoustic disturbance on marine mammals. Potential impact from unmitigated piling activities on Finless Porpoise include threat to survival due to disturbance on echolocation and foraging ability, as well as disturbance on communication between individuals, as discussed in **Section 7b.6.2.68**. Mitigation measures are required to minimise impacts to acceptable levels.

Underwater disturbance from sheet piling

7b.6.2.71 The installation of cellular cofferdam and breakwater (Phase 1 and 3) would involve driving of sheet piles into the seabed using vibratory hammer or hydraulic impact hammer. Potential acoustic disturbance on Finless Porpoise due to unmitigated piling works may include threat to survival due to disturbance on echolocation and foraging ability, as well as disturbance on communication between individuals, as discussed in **Section 7b.6.2.68**. Mitigation measures are required to minimise impacts to acceptable levels.

(vi) Increase in Marine Traffic

Alteration of behavioural pattern of marine mammals

7b.6.2.72 Potential increase in number of vessels may disrupt marine mammal's behavioural pattern. Hung (2008) suggested that dolphin usage within shipping lanes was lower than the areas near the lanes, indicating that local dolphins may alter their diving and surfacing pattern, or reduce their time in vessel traffic lanes to avoid collision with marine vessels. The increased vessel traffic in the vicinity of the works area may result in short-term behavioural disturbance to marine mammals, which may avoid them from their preferred habitats.

7b.6.2.73 While the current proposed marine traffic route would go through the southern waters of Cheung Chau and Shek Kwu Chau with high utilisation rate of Finless Porpoise, the utilisation of the sea area by Finless Porpoise may be affected due to increase in marine traffic. The diving and surfacing pattern of Finless Porpoise may be disturbed due to attempts to avoid collision with marine vessels. The change in usual behavioural pattern may affect their health and survivorship due to limitation on forage range, alteration of breathing pattern, as well as interaction between individuals. The potential impacts are considered to have low to moderate severity and therefore mitigation measures are required.

Injury and mortality of marine mammals due to collision with vessels

7b.6.2.74 Collision with vessels, especially involving high-speed ferries, is a particular threat to marine mammals in Hong Kong (Parsons *et al.*, 2000). The increased traffic of working vessels during construction may increase the chance of injury and mortality of marine mammals due to collision with vessels (Parsons *et al.*, 2000; Jefferson *et al*., 2002b). The increased amount of marine traffic and vessel speed are considered to have low to moderate severity and therefore mitigation measures should be implemented.

(vii) Entering of Marine Mammals into the Works Area

7b.6.2.75 Silt curtains would be installed during construction works that may result in degradation of water quality. Enclosure of works area with silt curtain would minimise the dispersion of sediment plume from the works area. Details of silt curtain installation methods are presented in **Appendix 5b.5**.

7b.6.2.76 Works with full enclosure of silt curtain include:

- Sheet piling and filling for circular cells for cofferdam and breakwater construction – floating type silt curtain around the circular cell (Phase 1 and Phase 3);
- Filling for reclamation area – floating type silt curtain across the 50 m wide opening of the reclamation area for marine access (Phase 2);
- Anti-scouring dredging – frame-type silt curtain around grab (upon completion of Phase 3); and
- Maintenance dredging (if required during operation phase) - frame-type silt curtain around grab.

7b.6.2.77 During the installation/re-installation/relocation process of floating type silt curtains, marine mammals may accidentally enter the works area, and be entrapped within. Nevertheless, upon the completion of installation/re-installation/relocation process of silt curtains, the works area would be fully enclosed by silt curtain and the risk of entrapment of Finless Propose no longer exist.

7b.6.2.78 During reclamation works at Phase 2, a 50 m wide opening at the reclamation peripheral for marine assess would adopt a floating type silt curtain to minimise dispersion of sediment plume. As the silt curtain would be opened occasionally for marine access, marine mammals may accidently enter the works area, and be entrapped within.

7b.6.2.79 The potential trapping of marine mammal within the works area may result in increase in stress level due to proximity to working vessels and underwater noise during construction. In addition, higher chance of collision with vessel may also be resulted due to confined environment with presence of working vessels. Considering the potential impacts due to deployment of silt curtains on marine mammals, low to moderate level of impact is predicted. Mitigation measures would be required to minimise the risk of accidental entrance of marine mammals into the works area.

(viii) Release of Contaminants during Transportation and Disposal of Dredged Sediments

7b.6.2.80 Apart from dredging operations, potential spillage of sediments may also be resulted during transportation of dredged sediment due to overloading of barges or careless handling, and disposal of dredged sediments in improper areas.

7b.6.2.81 Such incidence may result in the release of pollutants and contaminants (if any) into the receiving waters, causing adverse impact on the well-being of ecologically sensitive receivers, i.e. marine mammals and corals.

7b.6.2.82 According to laboratory test results, the dredged material would have all contaminant levels not exceeding the Lower Chemical Exceedance Level (LCEL) (Category L: sediments with little or no contamination) (**Section 6b**). Currently, there are two sites for disposal of uncontaminated sediment: (1) South of Cheung Chau, and (2) East of Ninepin. The Marine Fill Committee shall decide which site to dispose the sediment at a later stage. Disposal of sediments would be restricted to designated disposal areas, in order to minimise any unacceptable impacts on the marine habitat and its associated fauna, including Finless Porpoise which has high occurrence in the Southern Lantau waters. No significant impact on marine fauna is expected to arise due to transportation and disposal of dredged sediments.

7b.6.2.83 Nevertheless, good practices for loading of barges and careful handling of dredged sediments are still considered necessary to minimize the potential increase in suspended solids level from spillage of dredged sediments. Measures recommended in the **Waste Management Implications** section (**Section 6b.5**) and **Water Quality** section (**Section 5b.8**) should be adopted.

(ix) Extraction and Placement of Fill Materials

7b.6.2.84 Fill materials for the circular cells and reclamation would be extracted from the CEDD Public Fills. Extracted fill materials would be transported to the required area and used immediately. During the transportation and disposal of extracted fill materials, potential adverse impact on water quality may arise due to accidental spillage of fill materials. Although the potential impact on water quality is considered to have low impact, however good practice for loading of barges and careful handling of extracted materials should be adopted to minimise impacts from accidental spillage.

(x) Disturbance on Avifauna

Shek Kwu Chau

Pacific Reef Egret, White-bellied Sea Eagle and Eurasian Eagle Owl

7b.6.2.85 During the current study, two species of avifauna species of conservation interest, Pacific Reef Egret and White-bellied Sea Eagle, were sighted at the rocky shore and the vicinity shrubland habitat at Shek Kwu Chau respectively. Both species are locally uncommon resident and is confined to coastal rocky areas (HKBWS, 2009; Viney *et al.*, 2005). The intertidal natural rocky shore is considered to be an important habitat for these two species. Another species of conservation interest, Eurasian Eagle Owl, was previously recorded at Shek Kwu Chau (HKU, 1998), which favours open hillsides and offshore islands (Viney *et al.*, 2005).

7b.6.2.86 Potential secondary impact due to degradation in water quality, including deteriorated quality at feeding ground and reduction of food availability, may affect avifauna which utilise the nearby areas. Although no direct loss of intertidal habitat and the associated shrubland habitat would be resulted, and habitat of the same quality is available around the whole of Shek Kwu Chau; nevertheless, implementation of water quality control measures are still considered necessary to minimise the impact of degradation in marine water quality to acceptable level.

7b.6.2.87 Increase in marine traffic, presence of human, and construction noise (including piling works) may cause disturbance on avifauna species present in the area, especially for White-bellied Sea Eagle, which is known to be sensitive to human disturbance. The increase in disturbance may cause the avoidance of works area and decrease in feeding opportunities, hence affecting the health and may be breeding success of avifauna which utilises the nearby areas. Considering the high mobility of avifauna, they can utilise the similar habitat in the vicinity; the temporary nature of construction works is therefore not expected to have significant adverse impact on avifauna in terms of habitat utilisation. Nevertheless, appropriate noise mitigation measures would still be required to minimise noise impact on avifauna to acceptable level.

7b.6.2.88 As artificial lighting may be provided at night during construction phase, the change in duration and intensity of lighting in the vicinity may disrupt the behavior of avifauna, including White-bellied Sea Eagle which has a nest 300 m away from the nearest works (breakwater). Impact of artificial lighting on avifauna species include disorientating birds by interfering with the magnetic compass of the birds (Poot *et al.*, 2008), disruption in behavioural patterns such as reproduction, fat storage (Rawson, 1963; Lack, 1965), and foraging pattern (Lebbin *et al.*, 2007).

7b.6.2.89 Although avifauna have already been exposed to artificial lighting from the existing settlement, however, the coastal shrubland habitat near the works area was less disturbed at present due to the difference in elevation from the settlement; hence avifauna within the coastal shrubland may be affected. Mitigation measures should be implemented to minimise impact from glare disturbance.

Nest of White-bellied Sea Eagle

7b.6.2.90 WBSE is known to be sensitive to human disturbance during breeding season, and may abandon a nest in some cases. For the active breeding nest of WBSE at Shek Kwu Chau, the aforementioned impacts (degradation in habitat and foraging ground quality, increase in marine traffic, presence of human, construction noise, and glare disturbance) may affect the breeding success of the existing pair.

7b.6.2.91 Major constructions works that may cause disturbance on the breeding nest include:

- sheet piling works for construction of cofferdam surrounding the reclamation area (Phase 1);
- sheet piling works for construction of the shorter section of breakwater (Phase 1);
- sheet piling works for construction of the remaining section of breakwater (Phase 3); and
- bored piling works for berth area (Phase 3).

7b.6.2.92 While the estimated distance from the nest to the nearest works from breakwater, berth and cofferdam are approximately 350 m, 500 m, and 550 m respectively, the breeding success of the WBSE pair may be affected. In extreme cases, nest abandonment may occur as the existing location may no longer consider being a suitable breeding location due to the disturbance during construction phase.

7b.6.2.93 Nevertheless, some previous studies have reported breeding success for nests near human settlement. The nest at Tai Ngam Hau had been recorded since 2002/2003; it is located about 500 m from a pier and settlement at Ma Lam Wat (AFCD, 2010). Breeding behaviour was noted every year and the pair had successfully produced fledglings in six of the seven survey years, which is regarded to be the most productive pair among the other pairs in Hong Kong (*ibid.*). The Tai Ngam Hau nest has demonstrated that WBSE has a certain level of tolerance from human disturbance and could achieve breeding success under human disturbance.

7b.6.2.94 Moreover, as WBSE is a highly mobile species, with a range and territory size from 3.8 km to as far as 18.7 km (AFCD, 2010); with the availability of similar habitat in the vicinity of the Project Site (i.e. the rest of hillside shrubland at Shek Kwu Chau, and other remote islands in the vicinity, e.g. Soko Island, Hei Ling Chau), WBSE could utilise other areas in the vicinity.

7b.6.2.95 Implementation of mitigation measures, including avoidance noisy works during the breeding season of WBSE, should be considered to minimise adverse impacts on the WBSE breeding nest due to construction noise disturbance.

Cheung Sha

Pacific Reef Egret

7b.6.2.96 During the current study, a total of 2 individuals of a species of conservation interest, Pacific Reef Egret, were recorded foraging at the isolated rocks off the shore of Cheung Sha (500 m away from works). Ecological status of this species has been described in **Table 7b.7**.

7b.6.2.97 Potential secondary impact on Pacific Reef Egret may be resulted from small-scaled habitat loss and deterioration of quality at feeding ground (at rocky shore at Cheung Sha), and reduction of food availability, due to degradation of marine water quality during works. Although the recorded individuals were located 500 m away from the proposed landing portal, however, considering the mobility of this species and its frequent utilisation of natural rocky shore, potential indirect impact may be resulted during construction phase.

7b.6.2.98 Considering that the area to be permanently lost is insignificant compare to the rest of the nearby rocky shore, and habitat of the same quality is available along the rest of the Cheung Sha rocky shore; Pacific Reef Egret is not expected to be significantly affected in terms of habitat utilisation. Nevertheless, implementation of water quality control measures is still considered necessary to minimise the impact from degradation in feeding ground / water quality to acceptable level during construction.

7b.6.2.99 During construction, increase in marine traffic and noise may cause disturbance on avifauna species which utilise the nearby areas. Considering the high mobility of avifauna, they can utilise habitat of similar habitat in the vicinity. The proposed noise mitigation measures in **Section 4b,** as well as adoption of good site practice, such as use of well maintained plants, should be implemented to minimise noise impact to acceptable level.

Black Kite

7b.6.2.100 An individual of Black Kite (*Milvus migrans*) was recorded foraging at the isolated rocks offshore at Cheung Sha. Black Kite, a species with Class II Protection Status in China, is considered to be locally common and is also a winter visitor (HKBWS, 2009; Viney *et al.* 2005). As discussed in the above 2 paragraphs, implementation of water quality control measures is considered necessary to minimise the impact from degradation in feeding ground / water quality to acceptable level during construction.

7b.6.2.101 The potential nest of Black Kite located inland within developed habitat at a metal tower, may be disturbed by construction noise. Considering the distance between the nest (in-land) and the coastal works (300 m), and difference in elevation between the two areas, no significant impact on Black Kite's nest is expected.

(xi) Disturbance on Terrestrial Habitats and their associated Flora and Fauna

Shek Kwu Chau

7b.6.2.102 Indirect impacts on terrestrial habitats of Shek Kwu Chau may also arise during marine-based construction of the IWMF.

Shrubland

7b.6.2.103 The coastal shrubland habitat facing the Project Site would be affected by increased human activities and noise disturbance from construction machinery and vessels. Potential consequences to wildlife include avoidance of areas in the vicinity of the works areas, and decline in density in areas close to the source of disturbance.

7b.6.2.104 White-bellied Sea Eagle, a species of conservation interest, has been recorded in the shrubland habitat facing the Project Site. Potential impact on such species has been previously discussed. Indirect impacts including increase in human activities and noise disturbance from construction works may arise.

7b.6.2.105 Although no direct loss of shrubland habitat would be resulted, and habitats of the same quality is available around the whole of Shek Kwu Chau; nevertheless, the adoption of mitigation measures such as noise reduction, and minimisation of glare disturbance (if any) should be recommended to minimise potential disturbance on White-bellied Sea Eagle and other inhabiting fauna due to indirect disturbance on shrubland habitat to acceptable level.

Other habitats

7b.6.2.106 Other habitats including plantation, developed area, pond, and watercourse are not expected to receive significant indirect impacts from the Project, due to the difference in elevation of the habitats and the works area, and their distance apart. Potential impacts on plantation, developed area, pond, and watercourse, and their associated fauna groups, are considered to be minimal.

Cheung Sha

7b.6.2.107 Indirect impacts on terrestrial habitats of Cheung Sha may arise during construction of landing portal:

Shrubland

7b.6.2.108 The coastal shrubland habitat facing the proposed landing portal would be affected by increased human activities and noise disturbance from construction plants and vessels. Potential consequences to wildlife include avoidance of areas in the vicinity of the works areas, and decline in density in areas close to the source of disturbance. Although no fauna species of conservation interest was recorded at shrubland habitat in the vicinity of the proposed works, nevertheless, implementation of measures such as adoption of quiet powered mechanical equipment, and full enclosure for static plant, as discussed under **Noise Impact** report (**Section 4b.8**), should be implemented to minimise disturbance on wildlife in the vicinity of the works area.

7b.6.2.109 One individual of a locally protected plant species, *Aquilaria sinensis*, was recorded at the coastal shrubland habitat, which was approximately 40 m away from the proposed landing portal at the rocky shore. Although the plant individual is not located within works area, nevertheless, considering the short distance from works (40 m), mitigation measures should still be recommended to avoid direct damage as well as indirect disturbance, i.e. dust impact.

Other habitats

7b.6.2.110 Other inland habitats including developed area and watercourse are not expected to receive significant indirect impacts from the Project, due to the difference in elevation of the habitats and the works area, and their distance apart. Potential impacts on the inland habitats are considered to be minimal.

Direct Impact – Terrestrial-based Construction

7b.6.2.111 The term 'terrestrial-based construction' at Shek Kwu Chau refers to works to be conducted on the newly reclaimed offshore land. During Phase 3, upon completion of surcharge loading of the reclaimed land, construction of Municipal Solid Waste (MSW) treatment facilities and the associated supporting facilities would commence on the newly reclaimed land.

7b.6.2.112 There is no physical connection of the reclaimed land to the Shek Kwu Chau island. Works would only be conducted within the newly reclaimed land, no direct loss of terrestrial habitats would occur at the Shek Kwu Chau island.

Indirect Impact – Terrestrial-based Construction

7b.6.2.113 Potential indirect impacts due to terrestrial-based works include:

(i) Disturbance on Pacific Reef Egret, White-bellied Sea Eagle, and Eurasian Eagle Owl

7b.6.2.114 As previously discussed, potential impacts on avifauna in the vicinity of works area during marine-based construction, including degradation of habitat quality and foraging ground due to runoff, increase in marine traffic, presence of human, construction noise, and glare disturbance, also applies to terrestrial-based construction works. Considering the mobility, range, territory size, and the availability of similar habitat in the vicinity (i.e. the rest of hillside shrubland at Shek Kwu Chau, and other remote islands in the vicinity, e.g. Soko Islands, Hei Ling Chau), avifauna could utilise other habitats in the vicinity during construction phase. Mitigation measures for water quality control, noise minimisation,

glare disturbance minimisation, and careful work scheduling to avoid noisy piling works during the breeding season of White-bellied Sea Eagle, would be recommended to minimise adverse disturbance on avifauna due to terrestrial works to acceptable levels.

(ii) Disturbance on Other Terrestrial Fauna and Flora

7b.6.2.115 Potential impacts on terrestrial fauna and flora during terrestrial-based construction works on the newly reclaimed land would be the same as the impacts on terrestrial fauna and flora as identified during marine-based construction works. Potential impacts identified include disturbance on the coastal shrubland habitat facing the Project Site due to increase in human activities and noise disturbance from construction machinery and vessels. Although no direct loss of shrubland habitat would be resulted, and habitats of the same quality is available around the whole of Shek Kwu Chau; nevertheless, mitigation measures for noise reduction, and glare minimisation (if any) would be recommended to minimise disturbance to acceptable levels. No significant indirect impacts are predicted on the coastal shrubland habitat.

7b.6.2.116 Other habitats including plantation, developed area, pond, and watercourse are not expected to receive significant indirect impacts during terrestrial-based construction works, due to the difference in elevation of the habitats and the works area, and their distance apart. Potential impacts on plantation, developed area, pond, and watercourse, and their associated fauna groups, are considered to be minimal.

(iii) Drainage and Construction Site Runoff

7b.6.2.117 Runoff from the construction works area may contain increased sediment load, other SS and contaminants, and may subsequently affect the receiving water bodies (e.g. marine environment for Shek Kwu Chau). Entrance of runoff with high SS loading from works area into the sea may lead to elevation in SS level in water quality, and subsequently affect the associated marine life, i.e. bleaching of corals, decrease in prey abundance for Finless Porpoise, and degradation in habitat quality for potential fisheries resources. Potential impacts from drainage and site runoff is considered to have low to moderate impacts. Mitigation measures should be implemented to control construction site runoff and drainage from the works areas, and to prevent runoff and drainage water with high levels of SS and contaminants from entering the nearby water bodies.

(iv) Accidental Spillage

7b.6.2.118 Accidental spillages of chemicals in the works area may contaminate the ground surface. The contaminated ground particles may get washed away via site drainage into the marine environment, causing degradation in water quality, hence adverse impact on the associated fauna, i.e. intertidal communities, marine mammals and corals. Species that are intolerant to the change in water composition may result in decrease in survival rate. Although the potential impacts from accidental spillage is considered to have low severity, nevertheless, adoption of good site practise should be adopted to minimise the potential impacts.

(v) Sewage Effluent

7b.6.2.119 Domestic sewage would be generated from the workforce during construction phase. Unmitigated discharge may degrade the quality of the receiving water body, hence adversely affecting its associated organisms and resulting in low to moderate impacts. Good site practise should be adopted to avoid the discharge of untreated sewage.

7b.6.3 Operation Phase

Direct Impact

Shek Kwu Chau

Permanent loss of habitat for marine mammals

7b.6.3.1 With a conservative evaluation approach, this study assumes the whole area enclosed within the breakwater and reclamation, which is 31 ha in size, would become permanently inaccessible to marine mammals due to avoidance of regular operation phase disturbance, including entrance and exit of container vessels and staff vessels. As already discussed under the "Construction Phase" direct impact assessment, where the original design of Project has been revised to the current design in order to minimise the loss of Finless Porpoise habitat, the total size of permanent habitat loss for marine mammals had significantly reduced from 50 ha down to 31 ha.

7b.6.3.2 While marine mammals utilize a large range of area, where frequent sightings of Finless Porpoise have been made at the southwest waters further offshore of Shek Kwu Chau during this current study (**Figure 7b.13**), these results indicate that suitable habitat of similar quality are available in the surrounding waters of Shek Kwu Chau. Finless Porpoise may utilise these waters when the waters to be permanently occupied by the IWMF is no longer available.

7b.6.3.3 Nevertheless, while the south and southwest waters of Shek Kwu Chau have been identified as important habitat for Finless Porpoise, due to the high utilization rate during the current study and the long term marine mammal monitoring survey by the AFCD, the potential impact on Finless Porpoise due to the permanently loss of 31 ha of habitat is still considered to be high.

7b.6.3.4 To mitigate such impact, adequate measure, i.e. setting up of a marine park at an area with high density of Finless Porpoise, should be recommended to minimise the impact to acceptable level. More details for the mitigation of habitat loss for Finless Porpoise are presented in **Section 7b.8**.

Permanent loss of subtidal hard bottom habitat

7b.6.3.5 As previously discussed, the term 'subtidal hard bottom habitat' refers to the rocks and boulders that are scattered along and near the shore of Shek Kwu Chau. An estimated loss of subtidal hard bottom area is approximately 0.2 ha. During dive survey, it was recorded that the habitat to be affected supported a total of 8 coral species of 198 colonies of small sizes and low coverage (<1%) (1 hard coral species, 7 soft coral species – **Table 7b.44-45**). All species recorded are common in Hong Kong waters. Although permanent loss of habitat would be resulted, but as the area to be lost is small in size, new hard surfaces of the reclaimed land, cofferdam and breakwater would be available for the recolonisation of corals, potential impact due to the permanent loss of subtidal hard bottom habitat is considered to be low to moderate.

Permanent loss of subtidal soft bottom habitat

7b.6.3.6 As discussed under the "Construction Phase" direct impact assessment, the original design of Project has been revised to the current design in order to minimise the intensity of impacts on marine ecological resources. The total size of subtidal soft bottom habitat to be permanently occupied by the footprint of the IWMF during operation phase had been reduced from 24.3 ha down to 17.2 ha.

7b.6.3.7 The 17.2 ha of subtidal soft bottom habitat to be permanently lost is composed of muddy and sandy substrate, and is physically connected to, or forms part of the important habitat

for Finless Porpoise. As previously mentioned in this chapter, the benthic communities recorded within the reclamation area (benthos survey sampling points P1 and P2) showed dominance of opportunistic deposit-feeding polychaetes; whereas the benthic communities recorded outside the reclamation area (benthos survey sampling point P3, P4 and P5) showed higher averaged diversity index, species evenness and lower abundance of opportunistic species. Given the above, the subtidal soft bottom habitat within the works area is considered to have lower ecological value than the surrounding areas. In addition, as no rare species or species of conservation importance were recorded during the recent benthos surveys, potential impact due to the permanent loss of subtidal soft bottom habitat is considered to be low.

Permanent loss of fish spawning and nursery ground

7b.6.3.8 As already discussed under the "Construction Phase" direct impact assessment, in order to minimise the potential adverse impacts from permanent loss of fish spawning and nursery ground on the regeneration and long-term survival of various organisms, the design of the Project has been revised and the permanent lost has been reduced from 23 ha down to 15.9 ha (current design). Considering that the 15.9 ha of loss would only account for an insignificant amount of the total fish spawning and nursery ground in the southern waters, the predicted permanent loss is therefore considered to be insignificant.

7b.6.3.9 Moreover, a more updated study as mentioned in **Section 7b.6.2.21** had concluded that there was no observable difference in fish larvae and egg densities between the previously identified spawning and nursery grounds at southern waters of Hong Kong, and the waters at Western Lantau, which was not identified to be important spawning and nursery grounds (CLP, 2006), the prediction of insignificant impact due to the permanent loss of the previously identified fish spawning and nursery ground is further supported.

Indirect Impact

Shek Kwu Chau

(i) Alteration in Flow Regime

7b.6.3.10 According to the **Water Quality Impact Assessment** (**Section 5b**), based on the reclamation layout plan, as well as the water depths and current velocity immediately around the southwest coastline of Shek Kwu Chau, it was calculated that the proposed reclamation near Shek Kwu Chau would block no more than 1% of the tidal flow discharge. Hence, no significant change in the generalized flow patterns in the southern waters would be expected from the proposed Project.

7b.6.3.11 The breakwaters around the IWMF would reduce the water current within the sheltered water for the safety of the vessels in the Project Site. The change in local flow regime may affect the coral sites along the shore by changes in flushing of sediments, and exchange of gas and nutrients between corals and the surrounding waters, hence resulting in threat on coral's health and survival in long run due to change in sedimentation pattern and depletion in gas and nutrient in the surrounding waters due to stagnant waters within the channel.

7b.6.3.12 According to the **Water Quality Impact Assessment** (**Section 5b.7.9.1**), the chance of the waters within the embayment, and the channel between the reclaimed land and shore, from turning into a piece of stagnant water after reclamation is minimal. The proposed breakwaters only partially enclose the embayment area, leaving a huge void for water to exchange with the surrounding. The width of the opening of breakwater at the narrowest location is about 210 m.

7b.6.3.13 During the current flow from northwest to southeast and vice versa during flood and ebb tide in the Project Site, the 210 m opening of the breakwater, which opens at the

northwest direction, would allow effective water exchange in either tide condition. A conservative approach was adopted during water quality assessment. With the assumption that a humble current velocity of 0.05 m/s (which is approximate the 10th percentile flow velocity as shown in **Table 5b.16**) would present across the opening during an ebb or flood tide, the water within the 15.1 ha of embayment area would be completely replaced within 3 hours. It is therefore expected that the exchange of water in the embayment with the surrounding waters would be sufficient.

7b.6.3.14 The proposed siting of the IWMF at an artificial island near SKC would create a channel between the IWMF structure and the Shek Kwu Chau shoreline. The channel would be around 10 – 40 m wide and 400 m long. The depth of water may vary greatly at different locations as the channel is located at coastal area. For the deeper side of the channel (near the reclaimed land), the water depth would be about 8.9 m. As previously discussed, the current flows from northwest to southeast direction and vice versa during flood and ebb tide, which is similar to that of the direction of the channel. The flow direction would allow the flood and ebb current to pass through the channel easily. As constant water flow would be maintained in the channel during operation phase, the chance of the channel becoming stagnant after reclamation is unlikely. In addition, the constriction at the opening of the channel may increase the overall flow speed within the channel when compared to the existing situation. Previous studies have documented that enhanced water flow stimulates photosynthesis within a coral colony (Hoogenboom *et al*., 2009; Finelli *et al*., 2006; Sebens *et al*., 2003; Shashar *et al*., 1996; Patterson *et al*., 1991; Dennison *et al.*, 1988)

7b.6.3.15 As the subtidal habitat within the channel was observed to mainly comprise bed rock and boulders during dive survey, the risk of SS elevation within the channel and the associated change in water quality (reduction in light penetration) due to potential enhanced flow and subsequently erosion is not anticipated. Considering that the coral species within the channel have widespread distribution and are regarded as common within Hong Kong, and that the current flow would be maintained between the channel and the surrounding waters, the creation of channel between the IWMF structure and Shek Kwu Chau shoreline is therefore not predicted to have significant adverse impact on the exiting coral communities.

7b.6.3.16 Potential impact on coral communities due to alteration in flow regime is therefore predicted to be acceptable during operation phase. Monitoring surveys for coral during construction and operation phases would be recommended to verify the predicted impacts.

(ii) Alteration in Sedimentation Pattern

7b.6.3.17 Ecological sensitive receivers including coral communities are sensitive to sediment deposition. The marine embayment formed by the proposed breakwaters would reduce the local currents and enhance sediment deposition within the embayment area, which may have an effect on the existing coral communities.

7b.6.3.18 According to the **Water Quality Impact Assessment** (**Section 5b.7.11.2**), the key pollution / sediment source within the Study Area would be the Pearl River in the far field. The exiting baseline sedimentation rates simulated by the Update Model (Hyder *et al.*, 1999) which took account of the cumulative effect from all the coastal pollution discharges including the Pearl River are given in **Appendix 5.1**. The sedimentation rate criterion adopted under the approved EIA for *Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities* for protection of marine ecological sensitive receivers was 200 g/m^2/day. As shown in **Appendix 5.1**, the existing maximum baseline sedimentation rates predicted in the Study Area are lower than 6 g/m^2/day, which are well below the assessment criterion of 200 g/m^2/day. Based on the proposed Project layout at Shek Kwu Chau, reduction in the local tidal currents is expected within or near the new breakwaters. As there is a great safety margin of over 97% between the baseline

sedimentation rates (6 g/m^2/day) and the criterion value (200 g/m^2/day), and considering that there would be no existing / planned sediment source within the new breakwaters, it is not expected that the presence of the proposed breakwaters and reclaimed land would cause significant adverse impact on corals due to alteration in sediment pattern during the operation phase.

(iii) Maintenance Dredging

7b.6.3.19 Currently, there is no plan for regular maintenance dredging. Depend on the actual sedimentation and scouring condition, maintenance dredging within the embayment area may be required to provide safe marine access route for the daily marine transportation. The need for maintenance dredging would be determined by onsite survey after the completion of this Project.

7b.6.3.20 If maintenance dredging is considered necessary during operation phase, potential impact on marine habitat and associated marine ecological resources may arise if unmitigated. As previously discussed under 'Indirect Impact- Marine-based Construction' under this chapter, most of the identified potential impacts from marine-based construction works also apply to maintenance dredging works during operation phase, including increase in suspended solids, degradation in quality of important fish spawning and nursery ground in the southern waters, changes in sedimentation pattern, decrease in dissolved oxygen, release of contaminants, underwater acoustic disturbance on marine mammals, increase in marine traffic, entering of marine mammals into the works area, and release of contaminants during transportation and disposal of dredged sediments.

7b.6.3.21 If unmitigated, significant adverse impacts on health, reproduction and survival may be resulted on intertidal, coral and soft bottom benthic communities, marine mammals, and the previously identified potential important spawning and nursery area in the southern waters. Although the duration of maintenance dredging would be short term and small in scale, nevertheless, considering the presence of marine species of conservation interest in the vicinity, including corals, marine mammals, and the potential important spawning and nursery area, moderate level of impact is anticipated and mitigation measures would be required to minimize potential adverse impacts to acceptable levels.

(iv) Wastewater from Incineration Plant and Mechanical Treatment Plant

7b.6.3.22 The IWMF would have zero discharge of wastewater during operation. A wastewater treatment plant would be provided on-site to treat the wastewater generated from the IWMF (mainly human sewage). The treated effluent would be reused on-site (e.g. landscape irrigation).

(v) Discharge of Saline Water from Desalination Plant at Seawall Outfall

7b.6.3.23 Approximately 1,520 m^3/day of saline water would be generated from the proposed desalination plant and discharged to the sea at the southern boundary of the proposed reclamation site (**Figure 5b.6** under **Water Quality Impact Assessment**). The discharge of concentrated saline water at ambient temperature at the proposed seawall outfall may affect the nearby ecological resources, including corals and marine mammal's prey distribution in the immediate waters. The brine water drained from the desalination plant would be concentrated seawater (about 1.7-1.8 time more concentrated than the raw seawater). There would be no temperature elevation in the brine water discharge as compared to the ambient water temperature. No other biocides / anti-fouling chemicals (such as chlorine and C-treat-6) would be used for the proposed desalination plant. Instead, membrane would be backwashed frequently to prevent fouling problem. The backwash water, which contains chemical for cleansing the membrane filter, would be diverted to the onsite sewage treatment works.

7b.6.3.24 According to the detailed discussion in the **Water Quality Impact Assessment** (**Section 5b.7.6.8 – 5b.7.6.14**), the saline water to be discharged from the desalination plant would comply with effluent discharge standard (**Table 5b.14**). With the adoption of a conservative approach during quantitative assessment, the maximum predicted downstream influence distance of the saline water discharge is about 72 m away from the outfall (**Table 5b.19**). According to **Section 5b.7.6.10**, the required dilution rate is about 8 times, which is far less than the predicted minimum dilution rate of 90 times from the near field modelling results (**Section 5b.7.6.14**). Considering that the identified corals are located more than 200 m away from the saline water discharge outfall, which is outside the influence zone (72 m) from the saline water discharge; prey items of marine mammals are not expected to be significantly affected by the discharge due to their capacity in salinity tolerance; and the discharge would only include saline water with no biocides / anti-fouling agents; no significant adverse impacts on marine fauna are anticipated.

(vi) Degradation in water quality at fish spawning and nursery area in the southern waters

7b.6.3.25 Under unmitigated scenario, the discharge of untreated sewage during operation may deteriorate the water quality of the marine habitat, hence causing adverse impact on the associated organisms.

7b.6.3.26 While the IWMF would adopt a “zero-discharge” scheme, no untreated sewage would be discharged into the marine environment during operation phase, no significant impact from discharge of untreated sewage is expected to arise.

7b.6.3.27 The brine water to be discharged from the desalination plant during operation phase would be concentrated seawater (about 1.7-1.8 time more concentrated than the raw seawater). The design flow of the desalination plant would be up to about 1,520 m^3 per day.

7b.6.3.28 There would be no temperature elevations in the brine water discharge as compared to the ambient water temperature. No other biocides / anti-fouling chemicals (such as chlorine and C-treat-6) would be used for the proposed desalination plant.

7b.6.3.29 According to the detailed discussion in the **Water Quality Impact Assessment** (**Section 5b.7.6.14**), the influence zone of saline discharge be negligible at 72 m downstream from the outfall (**Table 5b.19**). As marine fishes usually have a higher salt tolerance than freshwater fish, no significant adverse impact on fishes due to discharge of concentrated saline water is expected.

7b.6.3.30 Besides, the discharged saline water would comply with the standards for effluents discharged into the marine waters of Southern WCZ. No wastewater effluent, heavy metals and other contaminants would be released during operation phase of the Project. No significant adverse impact on fish spawning and nursery area is anticipated.

(vii) Entrainment and impingement of fish eggs and juvenile fishes

7b.6.3.31 At the proposed water intake point for water supply at the desalination plant, the pulling force at the intake point may damage the local fish, due to impingement (physical collision with the screen at intake point) and entrainment (uptake of fish along with seawater).

7b.6.3.32 Although the rate of the water intake is slow (2,460 m^3/day), however, for the adult and juvenile fish species that could not resist the pulling force at the water intake point, impingement may occur at the intake screen, due to their larger body size. For the smaller sized fish, larvae and eggs, entrainment may occur due to the pulling force from water intake.

7b.6.3.33 Considering that the results presented in the fisheries baseline surveys (ichthyoplankton and post-larvae) (CLP, 2006) revealed that the densities for fish larvae and eggs at all

sampling stations in South and West Lantau waters of Hong Kong were generally low; and there was no observable difference in fish larvae and egg densities between the identified spawning and nursery grounds at southern waters of Hong Kong, and that at Western Lantau, which was not identified to be important spawning and nursery grounds (*ibid.*); potential impact on fisheries due to entrainment and impingement is considered to be low. Nevertheless, adoption of a protective screen at the seawater intake point to minimise uptake of fish should be considered.

(viii) Increased Marine Traffic

7b.6.3.34 The proposed MSW barge frequency during operation phase would be 4 round trips/day. The visitor/staff shuttle ferry frequency was originally proposed to be 16 round trips/day; but revision was made to the frequency considering the potential disturbance impacts on marine mammals between Cheung Chau and Shek Kwu Chau (to be discussed later). The revised visitor/staff shuttle ferry frequency has reduced to 12 round trips/day (adopted frequency for this study).

7b.6.3.35 The proposed marine traffic route would go through the southern waters of Cheung Chau and Shek Kwu Chau, which has high occurrence of Finless Porpoise. The additional marine traffic due to this Project may increase underwater acoustic disturbance on Finless Porpoise, as well as increased risk of collision with vessel and change in behavioural pattern.

7b.6.3.36 According to Goold and Jefferson (2002), Finless Porpoise uses narrowband and high-frequency ultrasonic pulses with peak energy of 142 kHz. While the MSW barges are large, slow-moving vessels, which produce very low frequency sounds (Richardson *et al.*, 1995), the expected acoustic disturbance from the MSW barges should be well below the acoustic range of porpoise; hence no significant adverse impacts from underwater noise from marine traffic is expected.

7b.6.3.37 Nevertheless, the increased traffic of visitors/staff shuttle ferry during operation may increase the chance of injury and mortality of marine mammals due to collision with vessels (Parsons *et al.*, 2000; Jefferson *et al*., 2002b), as well as disruption of marine mammal's behavioural pattern. Hung (2008) suggested that dolphin usage within shipping lanes was lower than the areas near the lanes, indicating that local dolphins may alter their diving and surfacing pattern, or reduce their time in vessel traffic lanes to avoid collision with marine vessels.

7b.6.3.38 While the current proposed marine traffic route would go through the southern waters of Cheung Chau and Shek Kwu Chau with high utilisation rate of Finless Porpoise, the utilisation of the sea area by Finless Porpoise may be affected. The diving and surfacing pattern of Finless Porpoise may be disturbed due to attempts to avoid collision with marine vessels. The change in usual behavioural pattern may affect their health and survivorship due to limitation on forage range, alteration of breathing pattern, as well as interaction between individuals.

7b.6.3.39 Considering the increased marine traffic and marine traffic route to be adopted at waters with high utilisation rate of Finless Porpoise, potential impact level on Finless Porpoise is considered to be low to moderate. Adoption of appropriate mitigation measures would be required to minimise potential impacts to acceptable levels.

(ix) Trapping of Marine Mammal within the Channel behind the IWMF

7b.6.3.40 The proposed layout would create a coastal channel of about 10-40 m in width, and 400 m in length between the existing southwest coast of Shek Kwu Chau and the proposed reclamation. Considering that the subject area is identified as an important habitat for the Finless Porpoise, creation of such a channel may potentially increase the risk of trapping of marine mammal.

7b.6.3.41 Considering the physical dimension of the channel, Finless Porpoise is not expected to be prevented from going into and out of the channel. However, the physical existence of the IWMF structure and regular marine traffic during operation phase may reduce the utilisation of habitat by marine mammals. It is therefore expected that the potential of trapping of marine mammals within the channel behind the IWMF is insignificant. Nevertheless, monitoring survey should be adopted to verify the impact predication.

(x) Ecological Light Pollution by Artificial Lighting

7b.6.3.42 Artificial lighting would be provided at the facilities at night during operation. The change in duration and intensity of lighting may disrupt the behavior of fauna, including the nest of White-bellied Sea Eagle at the hillside shrubland habitat about 550 m away from the IWMF.

7b.6.3.43 Impact of artificial lighting on avifauna species include disorientating birds by interfering with the magnetic compass of the birds (Poot *et al.*, 2008), disruption in behavioural patterns such as reproduction, fat storage (Rawson, 1963; Lack, 1965), and foraging pattern (Lebbin *et al.*, 2007).

7b.6.3.44 Although research on impact of artificial lighting on herpetofauna is very scarce, a recent study suggested that some species may react differently to lighting at various stages in life; moreover, species which is better adapted to the altered lighting intensity and duration may receive beneficial effect and become more dominant in the community (Perry *et al.*, 2008).

7b.6.3.45 Although fauna groups, including White-bellied Sea Eagle, have already been exposed to artificial lighting from the existing settlement, and that the IWMF is not directly connected to Shek Kwu Chau; however, the coastal shrubland habitat near the IWMF was less disturbed at present due to the difference in elevation from the settlement; hence fauna groups, including the nest of WBSE, within the coastal shrubland may be affected by glare disturbance. Mitigation measures to minimise glare disturbance on ecological resources should be recommended.

(xi) Disturbance on the nest of White-bellied Sea Eagle

7b.6.3.46 For the active breeding nest of WBSE at Shek Kwu Chau, the aforementioned 'Increase in Marine Traffic', 'Operation Noise' and 'Ecological Light Pollution by Artificial Lighting' impacts may also have adverse impacts on the breeding success of the WBSE pair.

7b.6.3.47 In the worst case, WBSE may abandon the existing nest at Shek Kwu Chau due to operation disturbances from the IWMF. Although WBSE is a highly mobile species, with a range and territory size from 3.8 km to as far as 18.7 km (AFCD, 2010), and that similar habitat is available in the vicinity (i.e. the rest of hillside shrubland at Shek Kwu Chau, and other remote islands e.g. Soko Island, Hei Ling Chau); nevertheless, mitigation measures are still considered necessary to minimise potential impacts on WBSE during operation phase to acceptable level.

(xii) Physical Barrier for Avifauna

7b.6.3.48 The building envelope of the IWMF structure would mainly comprise non-reflective and non-transparent material, and therefore bird collision would be unlikely. Nevertheless, the IWMF structure may still act as a physical barrier for birds flying near the shore of Shek Kwu Chau. The birds may need to fly around or above the structure, resulting in alteration in their usual flying pattern. Such barrier may disrupt the ecological linkage between the feeding, breeding and roosting sites.

7b.6.3.49 The height of buildings on the reclaimed land would range from 5-50 m above ground, and the stack height would be 150 m. Bird species recorded along the shore of Shek

Kwu Chau during the survey include White-bellied Sea Eagle, Pacific Reef Egret, and Black-naped Tern. White-bellied Sea Eagle is reported to have flight height between 14 to 136 m above sea level (HKE, 2010; Smales, 2005); Black-naped Tern has flight height below 14 m above sea level near shore (HKE, 2010); and the majority of egrets and herons have flight heights below 14 m (*ibid.*).

7b.6.3.50 Although the physical existence of the IWMF may disrupt the ecological linkage along the shore, however, as the buildings within the IWMF would be at various heights (5-50 m), birds could still fly through the site. Moreover, while the size of the physical structure above water surface is considered to be insignificant (15.9 ha) when compared to the rest of the open sea; and that similar marine habitats are present around the Project Site; the avifauna which utilises the nearby areas are expected to be able to fly over and around the IWMF. The ecological linkage along the shore of Shek Kwu Chau is therefore not expected to be significantly affected.

(xiii) Operation Noise Disturbance

7b.6.3.51 While the IWMF would be situated on an artificial island near Shek Kwu Chau, the major source of noise generated during operation would be traffic and machines, which may result in the avoidance of the area by avifauna. Considering that the facilities would be located away from the main island of Shek Kwu Chau, and that the predicted noise level during daytime, evening time and night time would meet the noise criterion (for details please refer to **Section 4b**), potential operation noise impact on avifauna, as well as and other terrestrial fauna species is therefore considered to be minimal.

(xiv) Air and Dust Emission

7b.6.3.52 The air and dust emission during the operation of the IWMF may have adverse impact on the terrestrial ecology and avifauna of Shek Kwu Chau. The major sources of air quality impacts on ecological resources would be the air emission from the stacks of incineration process, and the dust released from the waste reception halls.

7b.6.3.53 Air pollution control and stack monitoring system would be incorporated during the operation of the IWMF, in order to ensure that the emissions from the IWMF stacks would meet the stringent target emission limits equivalent to those stipulated in Hong Kong and the European Commission for waste incineration. Besides, all the other potential air quality impacts would be mitigated through good operation practise and mitigation measures, as presented in **Section 3b.8**.

7b.6.3.54 Moreover, as the IWMF would be located at the prevailing downwind direction of the terrestrial portion of the Study Area at Shek Kwu Chau, indirect impact on terrestrial ecology and avifauna due to air and dust emission is expected to be acceptable. More detailed assessment on potential impact from air and dust emission on terrestrial habitat of Shek Kwu Chau is presented in the **Air Quality Impact Assessment** (**Section 3b**).

(xv) Heat and Fume Exhaust

7b.6.3.55 The proposed stack at the IWMF would be approximately 150 m in height, which is considered to allow effective dispersion of heat and fume, hence minimizing disturbance on the nearby ecological resources at lower height.

7b.6.3.56 Nevertheless, the high temperature of the fume exhausted from the stack may cause the avoidance of the area in the vicinity of the stack exhaust by avifauna, which otherwise utilises the space above the IWMF. Considering that immediate dispersion of heat and cooling down of fume is expected to occur at the exhaust, due to the openness of the surrounding environment, the avoidance of area by avifauna is expected to be small scale and acceptable.

(xvi) Introduction of Pest during Transportation of Waste

7b.6.3.57 During operation, the IWMF would receive wastes transported from other areas in Hong Kong. Pest may be introduced to the island and may result in negative impacts on flora and fauna at Shek Kwu Chau. The Project Site may encourage the growth of pests if the waste storage area is not well maintained and cleaned regularly. Disposal of refuse at sites other than approved waste transfer or disposal facilities can also result in similar impacts.

(xvii) Chemical Spillages arising from Vehicle / Vessel Accident

7b.6.3.58 Accidental spillages of chemicals from vehicles and vessels may contaminate the ground surface and marine environment. The contaminated ground surface particles may get washed away via site drainage, and would eventually enter into the marine environment, causing degradation in water quality and subsequently adverse impact on the associated fauna in the marine environment, i.e. intertidal communities, marine mammals and corals. Species that are intolerant to the change in water quality may result in decrease in survival rate, and eventually change in species composition of the affected habitats, favouring species that have higher tolerance level. Considering the potential consequences on marine habitats, accidental spillage of chemicals is therefore considered to have low to moderate impacts. Adoption of good site practices would be required to mitigate potential adverse impact to acceptable levels.

Cheung Sha

7b.6.3.59 No indirect impact is expected during operation phase.

7b.6.4 Overall Impact

7b.6.4.1 Potential ecological impacts on habitats arising from the proposed Project are evaluated according to Table 1 of Annex 8 of the *EIAO-TM*, and are summarized below.

Shek Kwu Chau

Table 7b.47 Overall Impact Evaluation at Shek Kwu Chau: Shrubland

Evaluation criteria	Shrubland
Habitat quality	Moderate. Habitat is secondary in nature and is dominated by native species.
Species	3 avifauna species of conservation interest were recorded: White-bellied Sea Eagle, Emerald Dove, and White-throated Kingfisher. While Black Kite and Pacific Swift were recorded at flight. 1 uncommon butterfly species of conservation interest was recorded: Small Grass Yellow. Japanese Pipstrelle of conservation interest was recorded at flight. An active nest of White-bellied Sea Eagle was previously recorded at coastal shrubland outside the study area, 300 m away from the nearest breakwater construction works, and 550 m from the proposed reclaimed land. Bogadek's burrowing lizard was previously recorded at Shek Kwu Chau.
Size/abundance	This habitat would not be directly affected.

Evaluation criteria	Shrubland
Duration	*Construction phase* Indirect disturbance impact on wildlife resulting from construction activities would be temporary. *Operation Phase* Indirect impact on wildlife resulting from increased marine traffic, noise, human disturbance, and artificial lighting would be permanent.
Reversibility	*Construction phase* Indirect disturbance impact on wildlife resulting from construction activities would be reversible. *Operation Phase* Indirect impact on wildlife resulting from increased marine traffic, noise, human disturbance, and artificial lighting would be irreversible.
Magnitude	*Construction Phase* Low. No direct impact is anticipated. The magnitude of indirect impact is insignificant for majority of shrubland, but moderate for coastal shrubland. *Operation Phase* Low. No direct impact is anticipated. The magnitude of indirect impact is insignificant for majority of shrubland, but moderate for coastal shrubland.
Overall impact conclusion	**Low**

Table 7b.48 Overall Impact Evaluation at Shek Kwu Chau: Plantation

Evaluation criteria	Plantation
Habitat quality	Low. Man-made habitat, dominated by exotic species.
Species	1 reptile species of conservation interest was recorded: Tree Gecko (*Hemiphyllodactylus* sp.)
Size/abundance	This habitat would not be directly affected.
Duration	*Construction phase* Indirect disturbance impact on wildlife resulting from construction activities would be temporary. *Operation Phase* Indirect impact on wildlife is not expected.
Reversibility	*Construction phase* Indirect disturbance impact on wildlife resulting from construction activities would be reversible. *Operation Phase* Indirect impact on wildlife is not expected.
Magnitude	*Construction Phase* Low. No direct impact is anticipated. The magnitude of indirect impact is insignificant. *Operation Phase* Low. No significant direct and indirect impact is anticipated.
Overall impact conclusion	**Very low**

Table 7b.49 Overall Impact Evaluation at Shek Kwu Chau: Developed Area

Evaluation criteria	Developed Area
Habitat quality	Low. Man-made habitat
Species	1 avifauna species of conservation interest was recorded: Japanese Paradise Flycatcher, with Pacific Swift recorded at flight.
Size/abundance	The habitat would not be directly affected.
Duration	*Construction phase* Indirect disturbance impact on wildlife resulting from construction activities would be temporary. *Operation Phase* Indirect impact on wildlife is not expected.
Reversibility	*Construction phase* Indirect disturbance impact on wildlife resulting from construction activities would be reversible. *Operation Phase* Indirect impact on wildlife is not expected.
Magnitude	*Construction Phase* Low. No direct impact is anticipated. The magnitude of the indirect impact is insignificant. *Operation Phase* Low. No significant direct and indirect impact is anticipated.
Overall impact conclusion	**Very low**

Table 7b.50 Overall Impact Evaluation at Shek Kwu Chau: Pond

Evaluation criteria	Pond
Habitat quality	Low to moderate. Man-made habitat used as a reservoir
Species	1 avifauna species of conservation interest was recorded: White-throated Kingfisher 1 uncommon damselfly species: Eastern Lilysquatter Japanese Pipistrelle of conservation interest was recorded at flight. In previous study, 1 additional uncommon damselfly species of conservation interest was recorded: Dusky Lilysquatter
Size/abundance	The habitat would not be directly affected.
Duration	*Construction phase* Indirect impact on wildlife is not expected. *Operation Phase* Indirect impact on wildlife is not expected.
Reversibility	*Construction phase* Indirect impact on wildlife is not expected. *Operation Phase* Indirect impact on wildlife is not expected.

Evaluation criteria	Pond
Magnitude	*Construction Phase* Low. No significant direct and indirect impact is anticipated. *Operation Phase* Low. No significant direct and indirect impact is anticipated.
Overall impact conclusion	**Very low**

Table 7b.51 Overall Impact Evaluation at Shek Kwu Chau: Watercourse

Evaluation criteria	Watercourse
Habitat quality	Low to moderate. Both watercourses (W1 and W2) are natural.
Species	No rare species or species of conservation interest was recorded.
Size/abundance	The habitat would not be directly affected.
Duration	*Construction phase* No significant direct and indirect impact is anticipated. *Operation Phase* Indirect impact on wildlife is not expected.
Reversibility	*Construction phase* No significant direct and indirect impact is anticipated. *Operation Phase* Indirect impact on wildlife is not expected.
Magnitude	*Construction Phase* Low. No direct impact is anticipated. The magnitude of the indirect impact is insignificant. *Operation Phase* Low. No significant direct and indirect impact is anticipated.
Overall impact conclusion	**Very low**

Table 7b.52 Overall Impact Evaluation at Shek Kwu Chau: Rocky Shore

Evaluation criteria	Rocky Shore
Habitat quality	Low to moderate. Natural rocky shore.
Species	1 avifauna species of conservation interest was recorded: Pacific Reef Egret
Size/abundance	The habitat would not be directly affected.
Duration	*Construction phase* Indirect impact on wildlife resulting from marine habitat degradation due to increased SS would be temporary. *Operation Phase* Indirect impact on wildlife resulting from human disturbance and artificial lighting would be permanent.
Reversibility	*Construction phase* Indirect impact on wildlife resulting from water quality deterioration due to increase in SS would be reversible. *Operation Phase* Indirect impact on wildlife resulting from human disturbance and artificial lighting would be irreversible.

Evaluation criteria	Rocky Shore
Magnitude	*Construction Phase* Low. No direct impact is anticipated. The magnitude of the indirect impact is considered to be minor. *Operation Phase* Low. No direct impact is anticipated. The magnitude of the indirect impact is insignificant.
Overall impact conclusion	**Low**

Table 7b.53 Overall Impact Evaluation at Shek Kwu Chau: Subtidal Hard and Soft Bottom Habitats

Evaluation criteria	Subtidal Hard and Soft Bottom Habitat
Habitat quality	Low to moderate for subtidal hard bottom habitat: with recorded coral colonies close to shore. Low to moderate for subtidal soft bottom habitat: typical natural substratum in Southern WCZ.
Species	For subtidal hard bottom habitat, 8 protected hard coral species were recorded, including: 1 uncommon species: *Coscinaraea n* sp.; 7 common species: *Psammocora superficialis, Oulastrea crispata, Goniopora stutchburyi, Turbinaria peltata, Tubastrea* sp., *Tubastrea diaphana,* and *Dendrophyllia* sp. For subtidal soft bottom habitat, no rare species or species of conservation interest was recorded.
Size/abundance	*Construction phase* A total of 17.2 ha of subtidal soft bottom habitat, and 0.2 ha of subtidal hard bottom habitat would be lost. At subtidal hard bottom habitat: One hard coral species (and 7 octocoral species) of <1% coverage would be directly affected in the construction phase. 8 hard coral species (and 7 octocoral species) of <1% coverage would be indirectly affected due to the water quality deterioration. *Operation Phase* A total of 17.2 ha of subtidal soft bottom habitat, and 0.2 ha of subtidal hard bottom habitat would be permanently lost. Indirect impacts due to change in flow regime would be acceptable. Potential alteration in water quality and sedimentation pattern would satisfy the criteria for local coral protection. Continuous water flow into and out of at the embayment and channel would be maintained, water exchange and diffusion of gas and nutrient of the existing corals with the surrounding waters would still be allowed.

Evaluation criteria	Subtidal Hard and Soft Bottom Habitat
Duration	*Construction phase* Loss of 17.2 ha of subtidal soft bottom habitat, and 0.2 ha of subtidal hard bottom habitat would become permanent upon completion of Project. Indirect impact on marine fauna due to marine works would be temporary and last for approximately 3 years (2013 to 2015). *Operation Phase* Loss of 17.2 ha of subtidal soft bottom habitat, and 0.2 ha of subtidal hard bottom habitat would be permanent. Indirect impacts due to change in flow regime, water quality and sedimentation pattern would be permanent.
Reversibility	*Construction phase* Loss of 17.2 ha of subtidal soft bottom habitat, and 0.2 ha of subtidal hard bottom habitat, and habitat disturbance would be irreversible. Indirect impact on wildlife resulting from water quality deterioration due to increase in SS would be reversible. *Operation Phase* Permanent loss of 17.2 ha of subtidal soft bottom habitat, and 0.2 ha of subtidal hard bottom habitat would be irreversible. Indirect impacts due to change in flow regime, water quality and sedimentation pattern would be irreversible.
Magnitude	*Construction Phase* Low to moderate for loss of 17.2 ha of subtidal soft bottom habitat; and low for loss of 0.2 ha of subtidal hard bottom habitat. Translocation of all directly affected corals should be recommended. Low to moderate on wildlife resulting from water quality deterioration due to increase in SS. *Operation Phase* Low to moderate for permanent loss 17.2 ha of subtidal soft bottom habitat, and low for permanent loss of 0.2 ha of subtidal hard bottom habitat. Low to moderate on wildlife resulting from water quality deterioration. Low for change in flow regime. Alteration in water quality and sedimentation pattern would be insignificant.
Overall impact conclusion	**Low to Moderate**

Table 7b.54 Overall Impact Evaluation at Shek Kwu Chau: Coastal / Marine Waters

Evaluation criteria	Coastal / Marine Waters
Habitat quality	High
Species	1 marine mammal species of conservation interest was recorded in the recent study: Finless Porpoise. In previous study, 1 marine mammal species of conservation interest, Chinese White Dolphin, was rarely recorded around the waters of Shek Kwu Chau. Horseshoe crab, a species of conservation interest, was previously recorded 600 m away from the northwest of Shek Kwu Chau. Fish spawning and nursery ground was previously identified in southern waters, covering the Project Site.
Size/abundance	*Construction phase* A total of 15.9 ha of coastal / marine waters and fish spawning and nursery grounds would be lost. About 31 ha of marine mammal habitat would be lost. *Operation Phase* A total of 15.9 ha of coastal / marine waters and fish spawning and nursery grounds would be permanently lost. About 31 ha of marine mammal habitat would be permanently lost.
Duration	*Construction phase* Loss of 15.9 ha of coastal / marine waters and fish spawning and nursery ground would become permanent upon completion of Project. Loss of 31 ha of marine mammal habitat would become permanent upon completion of Project. Indirect impact resulting from water quality deterioration due to increase in SS and increase in vessel traffic would be temporary and last for approximately 6 years (2013-2018). *Operation Phase* A total of 15.9 ha of coastal / marine waters and fish spawning and nursery ground would be permanently lost. A total of 31 ha of marine mammal habitat would be permanently lost.

Evaluation criteria	Coastal / Marine Waters
Reversibility	*Construction phase* Loss of 15.9 ha of coastal / marine waters and fish spawning and nursery grounds would be irreversible. Loss of 31 ha of marine mammal habitat would be irreversible. Indirect impact resulting from water quality deterioration due to increase in SS and increase in vessel traffic would be reversible, and would last for approximately 6 years (2013-2018). Indirect impact resulting from unmitigated underwater acoustic disturbance would be reversible. *Operation Phase* Permanent loss of 15.9 ha of coastal / marine waters and fish spawning and nursery grounds would be irreversible. Permanent loss of 31 ha of marine mammal habitat would be irreversible. Indirect impact on marine mammal habitat resulting from increase in marine traffic during operation would be irreversible.
Magnitude	*Construction Phase* Low for loss of 15.9 ha of coastal / marine waters and fish spawning and nursery grounds. High for loss of 31 ha of marine mammal habitat. Low to moderate for unmitigated water quality deterioration. Low to moderate for unmitigated underwater acoustic disturbance on marine mammals. *Operation Phase* Low to moderate for permanent loss of 15.9 ha of coastal / marine waters and fish spawning and nursery grounds. High for permanent loss of 31 ha of marine mammal habitat. Low to moderate for increase in marine traffic leading to acoustic disturbance and vessel collision on marine mammals.
Overall impact conclusion	**High**

Cheung Sha

Table 7b.55 Overall Impact Evaluation at Cheung Sha: Shrubland

Evaluation criteria	Shrubland
Habitat quality	Moderate. Habitat is secondary in nature and is connected to the rest of the extensive shrubland at the northwest of the study area.
Species	1 amphibian species of conservation interest was recorded: Lesser Spiny Frog, outside the works area 1 protected plant species*: Aquilaria sinensis* recorded outside the works area In previous study, 2 amphibian species of conservation interest was recorded: Romer's Tree Frog and Short-legged Toad, outside the works area
Size/abundance	The habitat would not be directly affected.
Duration	*Construction phase* Indirect disturbance impact on wildlife resulting from construction activities would be temporary. *Operation Phase* Operation phase impact on wildlife is not expected.

Evaluation criteria	Shrubland
Reversibility	*Construction phase* Indirect disturbance impact on wildlife resulting from construction activities would be reversible. *Operation Phase* Operation phase impact on wildlife is not expected.
Magnitude	*Construction Phase* Low. The magnitude of indirect impact is insignificant. *Operation Phase* Operation phase impact on wildlife is not expected.
Overall impact conclusion	**Low**

Table 7b.56 Overall Impact Evaluation at Cheung Sha: Developed Area

Evaluation criteria	Developed Area
Habitat quality	Low. Man-made habitat
Species	1 reptile species of conservation interest was recorded: Chinese Cobra A potential nest of Black Kite
Size/abundance	The habitat would not be directly affected.
Duration	*Construction phase* Indirect disturbance impact on wildlife resulting from construction activities would be temporary. *Operation Phase* Operation phase impact on wildlife is not expected.
Reversibility	*Construction phase* Indirect disturbance impact on wildlife resulting from construction activities would be reversible. *Operation Phase* Operation phase impact on wildlife is not expected.
Magnitude	*Construction Phase* Low. No direct impact is anticipated. The magnitude of the indirect impact is insignificant. *Operation Phase* Operation phase impact on wildlife is not expected.
Overall impact conclusion	**Very low**

Table 7b.57 Overall Impact Evaluation at Cheung Sha: Watercourse

Evaluation criteria	Watercourse
Habitat quality	Moderate. Both watercourses (W1 and W2) are natural.
Species	W1: 2 avifauna species of conservation interest were recorded: Little Egret and White-throated Kingfisher. W2: 1 rare plant species was recorded, *Ceratopteris thalictroides*. In previous study: 1 reptile species of conservation interest was recorded at W1 - Chinese Cobra; 2 butterfly species of conservation interest were recorded at W1 – Large Branded Swift and Common Rose; a damselfly species of conservation interest was recorded at W1 – Short-winged Shadowdamsel; and 2 fish species of conservation interest were recorded at W2 – *Stiphodon atropurpureus* and *Awaous melanocephalus*.
Size/abundance	The habitat would not be directly affected.
Duration	*Construction phase* Construction phase impact on wildlife is not expected. *Operation Phase* Operation phase impact on wildlife is not expected.
Reversibility	*Construction phase* Construction phase impact on wildlife is not expected. *Operation Phase* Operation phase impact on wildlife is not expected.
Magnitude	*Construction Phase* Construction phase impact on wildlife is not expected. *Operation Phase* Operation phase impact on wildlife is not expected.
Overall impact conclusion	**Very low**

Table 7b.58 Overall Impact Evaluation at Cheung Sha: Rocky Shore

Evaluation criteria	Rocky Shore
Habitat quality	Low to moderate. Natural rocky shore.
Species	2 avifauna species of conservation interest was recorded: Pacific Reef Egret and Black Kite, with Little Egret recorded at flight.
Size/abundance	*Construction phase* Less than 20 m^2 of rocky shore and its associated intertidal communities would be lost. A total of 0.075 ha of backshore vegetation would be lost. *Operation Phase* Less than 20 m^2 of rocky shore would be permanently lost.

Evaluation criteria	Rocky Shore
Duration	*Construction phase* Loss of less than 20 m^2 of rocky shore and its associated intertidal communities would become permanent upon completion of construction. Loss of 0.075 ha of backshore vegetation would be temporary. Indirect impact on wildlife resulting from marine habitat degradation due to increased SS would be temporary. *Operation Phase* Loss of less than 20 m^2 of rocky shore would be permanent. Operation phase impact on wildlife is not expected.
Reversibility	*Construction phase* Loss of less than 20 m^2 of rocky shore and its associated intertidal communities would be irreversible. Loss of 0.075 ha of backshore vegetation would be reversible. Indirect impact on wildlife resulting from marine habitat degradation due to increased SS would be reversible. *Operation Phase* Operation phase impact on wildlife is not expected.
Magnitude	*Construction Phase* Low. The magnitude of the direct and indirect impacts is considered to be minor. *Operation Phase* Operation phase impact on wildlife is not expected.
Overall impact conclusion	**Low**

Table 7b.59 Overall Impact Evaluation at Cheung Sha: Subtidal Hard and Soft Bottom Habitat

Evaluation criteria	Subtidal Hard and Soft Bottom Habitat
Habitat quality	Low.
Species	No rare species or species of conservation interest was recorded.
Size/abundance	*Construction phase* A total of less than 20 m^2 of subtidal hard and soft bottom habitat would be lost due to trenching works at the shore end of the submarine cable at Cheung Sha. Nearby subtidal hard and soft bottom habitat may be indirectly affected due to water quality degradation. *Operation Phase* Operation phase impact on wildlife is not expected.
Duration	*Construction phase* Loss of less than 20 m^2 of subtidal hard and soft bottom habitat would be permanent. Indirect impact on wildlife resulting from water quality degradation due to increase in SS would be temporary. *Operation Phase* Operation phase impact on wildlife is not expected.

Evaluation criteria	Subtidal Hard and Soft Bottom Habitat
Reversibility	*Construction phase* Loss of less than 20 m^2 of subtidal hard and soft habitats would be irreversible. Indirect impact on wildlife resulting from water quality deterioration due to increase in SS would be reversible. *Operation Phase* Operation phase impact on wildlife is not expected.
Magnitude	*Construction Phase* Low. The magnitude of the direct and indirect impacts is considered to be low. *Operation Phase* No significant direct and indirect impact is expected.
Overall impact conclusion	**Low**

Table 7b.60 Overall Impact Evaluation at Cheung Sha: Coastal / Marine Waters

Evaluation criteria	Coastal / Marine Waters
Habitat quality	Low
Species	No rare species or species of conservation interest was recorded.
Size/abundance	*Construction phase* Indirect impact on wildlife resulting from water quality degradation due to surface runoff and increase in SS may arise. *Operation Phase* Operation phase impact on wildlife is not expected.
Duration	*Construction phase* Indirect impact on wildlife resulting from water quality degradation due to surface runoff and increase in SS would be temporary. *Operation Phase* Operation phase impact on wildlife is not expected.
Reversibility	*Construction phase* Indirect impact on wildlife resulting from water quality deterioration due to surface runoff and increase in SS would be reversible. *Operation Phase* Operation phase impact on wildlife is not expected.
Magnitude	*Construction Phase* Low. The magnitude of the indirect impacts is considered to be low. *Operation Phase* No significant direct nor indirect impact is expected.
Overall impact conclusion	**Low**

Along the Cable Alignment

Table 7b.61 Overall Impact Evaluation along the Submarine Cable Alignment: Subtidal Soft Bottom Habitat

Evaluation criteria	Subtidal Soft Bottom Habitat
Habitat quality	Low to moderate for subtidal soft bottom habitat: typical natural substratum in Southern WCZ.
Species	No rare species or species of conservation interest was recorded.
Size/abundance	*Construction phase* Jetting-blowing at soft bottom habitat (3 m wide x 5.8 km long) during cable laying would result in direct loss 17,400 m^2 of benthos habitat, and indirect impact on wildlife resulting from water quality degradation due to increase in SS may arise. *Operation Phase* Operation phase impact on wildlife is not expected.
Duration	*Construction phase* Direct and indirect impact on wildlife resulting from habitat loss and water quality degradation would be temporary. *Operation Phase* Operation phase impact on wildlife is not expected.
Reversibility	*Construction phase* Direct and indirect impact on wildlife resulting from habitat loss and water quality degradation would be reversible. *Operation Phase* Operation phase impact on wildlife is not expected.
Magnitude	*Construction Phase* Low. The magnitude of the direct and indirect impacts is considered to be low. *Operation Phase* No significant direct nor indirect impact is expected.
Overall impact conclusion	**Low**

Table 7b.62 Overall Impact Evaluation along the Cable Alignment: Coastal / Marine Waters

Evaluation criteria	Coastal / Marine Waters
Habitat quality	Moderate
Species	1 marine mammal species of conservation interest was recorded under this study: Finless Porpoise In previous study, 1 marine mammal species of conservation interest, Chinese White Dolphin, was rarely recorded around the waters of Shek Kwu Chau.
Size/abundance	*Construction phase* Jetting-blowing at sea bed during cable laying would result in indirect impact on wildlife due to water quality degradation. *Operation Phase* Operation phase impact on wildlife is not expected.

Evaluation criteria	**Coastal / Marine Waters**
Duration	*Construction phase* Indirect impact on wildlife due to water quality degradation would be temporary. *Operation Phase* Operation phase impact on wildlife is not expected.
Reversibility	*Construction phase* Indirect impact on wildlife due to water quality degradation would be reversible. *Operation Phase* Operation phase impact on wildlife is not expected.
Magnitude	*Construction Phase* Low. The magnitude indirect impact is considered to be low. *Operation Phase* No significant direct nor indirect impact is expected.
Overall impact conclusion	**Low**

7b.6.4.2 Major impacts on species of conservation importance recorded within the study area have been described. A summary of the potential impacts from construction and operation phases on all species of conservation importance recorded within the study area is presented in **Table 7b.63** for Shek Kwu Chau, and **Table 7b.64** for Cheung Sha and along the submarine cable alignment.

Table 7b.63 Overall Impacts on Species of Conservation Interest at Shek Kwu Chau

Species of Conservation Interest	Construction phase impacts		Operation phase impacts	
Common name /scientific name	**Description**	**Evaluation**	**Description**	**Evaluation**
FAUNA				
Marine Mammal				
Finless Porpoise *Neophocaena phocaenoides*	The location of the IWMF at an artificial island near SKC is frequently utilised by Finless Porpoise between December and May. The potential loss (31 ha) and disturbance of important habitat due to reclamation and breakwater construction would restrict the accessibility of Finless Porpoise, cause the avoidance of habitat, and limit the foraging range and communication of Finless Porpoise. Although porpoises are expected to be able to utilise the surrounding marine habitats of the similar quality, where high sighting frequency had also been frequently noted; nevertheless, due to the high utilization rate during the current study and the long term marine mammal monitoring survey by the AFCD, the potential impact on Finless Porpoise due to the loss of 31 ha of habitat is still considered to be high. As the loss of habitat would be carried forward to operation phase, such impact should be mitigated by compensatory measure. Increase in traffic of marine working vessels may result in collision of Finless Porpoise and vessel, causing injury and mortality of Finless Porpoise. The presence of vessels and underwater noise may also cause behavioural disturbance, affecting Finless Porpoise's resurfacing and diving pattern. Acoustic disturbance from vessels and construction works (e.g. piling) would affect their echolocation and communication ability, as well as increasing the background noise in their habitat. Water quality deterioration resulting from construction works (i.e. reclamation, dredging, filling, transportation	High	The permanent occupation of the IWMF at the important habitat of Finless Porpoise would result in permanent loss of important habitat for Finless Porpoise. The potential loss (31 ha) and disturbance of important habitat would be permanent and irreversible, which is considered to have high impact on Finless Porpoise. Frequent vessel traffic may result in collision of Finless Porpoise and vessel, causing injury and mortality of Finless Porpoise. The presence of vessels and underwater engine noise may also cause behavioural disturbance, affecting Finless Porpoise's resurfacing and diving pattern. Acoustic disturbance from vessels would affect Finless Porpoise's echolocation and communication ability, as well as increasing the background noise in their habitat. The narrow coastal channel between the existing southwest coast of Shek Kwu Chau and the proposed reclaimed land may increase the risk of trapping of Finless Porpoise. Considering the dimension of channel (10-40 m in width, 400 m in length), Finless Porpoise can go in and out. But the physical existing of the IWMF and breakwater structure, and the regular marine traffic near the IWMF is expected to cause the avoidance of habitat by Finless Porpoise. Trapping of Finless Porpoise within the channel behind the IWMF is therefore considered unlikely. The discharge of concentrated saline water at	High

Species of Conservation Interest	**Construction phase impacts**		**Operation phase impacts**	
Common name /scientific name	**Description**	**Evaluation**	**Description**	**Evaluation**
	and disposal of dredged sediment) would result in increase in suspended solid, and may lead to decrease in abundance of prey of Finless Porpoise. Finless Porpoise may enter the works area during the setting up of silt curtains around works area.		ambient temperature at the proposed seawall outfall may affect the distribution of prey for Finless Porpoise in the immediate waters. As the discharge would soon blend in with the surrounding waters due to mixing, prey items of marine mammals can tolerate a certain range of salinity, and the discharge would contain no anti-fouling agents; impact on Finless Porpoise should be minimal. Chemical spillages arised from vehicle and vessel accidents may affect the habitat quality.	
* Chinese White Dolphin *Sousa chinensis*	Rare sightings of Chinese White Dolphin have been made in the South Lantau waters. Shek Kwu Chau is not considered to be an important habitat for Chinese White Dolphin. Potential impacts on Chinese White Dolphin during construction are mostly the same as Finless Porpoise's, as described above, including potential collision with marine vessels, underwater acoustic disturbance, alteration in behavioural pattern, reduction in prey items, and entrapment within works area.	Low	Potential impacts on Chinese White Dolphin during operation are mostly the same as Finless Porpoise's, as described above (except permanent loss of important habitat), including potential collision with marine vessels, underwater acoustic disturbance, alteration in behavioural pattern, entrapment within the channel between the Shek Kwu Chau coast and the IWMF, discharge of concentrated saline water, and chemical spillages. Considering the area sightings of Chinese White Dolphin, potential impacts are considered to be low.	Low

Species of Conservation Interest	**Construction phase impacts**		**Operation phase impacts**	
Common name /scientific name	**Description**	**Evaluation**	**Description**	**Evaluation**
Corals				
Hard Corals: *Psammocora superficialis* *Oulastrea crispata* *Goniopora stutchburyi* *Turbinaria peltata* *Coscinaraea n* sp. *Tubastrea* sp. *Tubastrea diaphana* *Dendrophyllia* sp. Octocorals: *Dendronephthya* sp. *Menella* sp. *Euplexaura* sp. *Echinomuricea* sp. *Echinogorgia* sp. A *Echinogorgia* sp. B *Paraplexaura* sp.	Although the siting of the IWMF has been purposefully placed away from the shore of Shek Kwu Chau as a measure to minimise coral loss, however, unavoidable loss of coral communities within the works area would still be resulted. Direct loss of habitat for coral colonization would be permanent and irreversible. Disturbance on seabed during piling, dredging and filling works may result in increase in suspended solids, causing increase in SS level and sedimentation on the coral surface, inhibiting photosynthesis of symbiotic algae associated with corals, as well as increasing their energy expenditure on sediment removal, which may result in bleaching and mortality.	Moderate	The proposed breakwaters may reduce the water flow into the embayment area and channel behind the IWMF, threatening the health of coral communities along the coast and within the channel. As it is expected that exchange of waters between the embayment / channel and the surrounding waters would continue, diffusion of gas and nutrient between corals and the surrounding waters would be allowed. The discharge of concentrated saline water at ambient temperature at the proposed seawall outfall may affect the corals along the coast of Shek Kwu Chau. As it is quantified that the influence zone is about 72 m from the point of discharge, and the nearest coral community is located over 200 m away, impact on corals should be minimal.	Low
Horseshoe Crab				
* *Tachypleus tridentatus*	An individual of *Tachypleus tridentatus* was previously recorded at the northwestern waters offshore from Shek Kwu Chau, approximately 600 m away from the Project Site. The distance between the proposed works area and the previously identified recorded horseshoe crab location is over 600m, and suitable habitat for juvenile horseshoe crabs was not found within or in the vicinity of the Project Site; with the adoption of water quality mitigation measures, no unacceptable impact should arise.	Low	No impact	No impact

Species of Conservation Interest	**Construction phase impacts**		**Operation phase impacts**	
Common name /scientific name	**Description**	**Evaluation**	**Description**	**Evaluation**
Avifauna				
Pacific Reef Egret *Egretta sacra*	Two individuals were recorded at rocky shore within the study area. Works may result in deterioration in quality of foraging ground due to potential adverse impact on water quality. The construction noise and presence of vessels may cause avoidance of habitat. Nevertheless, Pacific Reef Egret could utilise the nearby habitat of similar quality (rocky shore), which is available around of the whole island. Artificial lighting may be provided during construction phase. The change in duration and intensity of lighting in the vicinity may disorientate birds and cause disruption in behavioural and foraging patterns. Avifauna within the coastal shrubland may be affected.	Low to moderate	The level of human disturbance, including marine traffic and noise, would increase due to operation of the proposed Project. Artificial lighting would be provided during operation phase. The change in duration and intensity of lighting in the vicinity may disorientate birds and cause disruption in behavioural and foraging patterns. Avifauna within the coastal shrubland may be affected. The air and dust emitted during operation may affect Pacific Reef Egret. Emissions from the IWMF stacks would be designed to ensure full compliance with relevant legislation. The heat and fume exhausted from the stack at the IWMF may cause the avoidance of the area in the vicinity of the stack by Pacific Reef Egret. As immediate dispersion and cooling down of fume is expected to occur at the exhaust, the avoidance of area by avifauna is expected to be small scale and acceptable.	Low to moderate
White-bellied Sea Eagle *Haliaeetus leucogaster*	One individual was recorded at shrubland habitat very near to rocky shore within the study area. Works may result in deterioration in quality of habitat and foraging ground due to degradation in water quality. Construction noise and increased marine traffic may cause avoidance of habitat. WBSE can utilise the nearby habitat of similar quality (rocky shore), which is available around of the whole island. Artificial lighting may be provided during construction phase. The change in duration and intensity of	Low to moderate	The level of human disturbance, including marine traffic and noise, would increase due to operation of the proposed Project. Artificial lighting would be provided at the IWMF during operation phase. The change in duration and intensity of lighting in the vicinity may disorientate birds and cause disruption in behavioural and foraging patterns. Avifauna within the coastal shrubland may be affected. The air and dust emitted during operation may	Low to moderate

Species of Conservation Interest	**Construction phase impacts**		**Operation phase impacts**	
Common name /scientific name	**Description**	**Evaluation**	**Description**	**Evaluation**
	lighting in the vicinity may disorientate birds, including WBSE which has a nest 300 m away from the nearest works (breakwater), and cause disruption in behavioural and foraging patterns. Avifauna within the coastal shrubland may be affected. For the active breeding nest of WBSE located 300m and 550m away from the proposed breakwater and reclamation, potential impacts including degradation in habitat and foraging ground quality, increase in marine traffic, noise, and glare disturbance, may affect the breeding success of the breeding pair. The WBSE nest at Tai Ngam Hau had demonstrated tolerance to a certain level of human disturbance, and can achieve breeding success under human disturbance. As WBSE is a highly mobile species, and suitable habitats are available in the vicinity, potential impact on the nesting WBSE is considered to be acceptable with the implementation of mitigation measures.		affect WBSE. With the implementation of air pollution control to ensure full compliance with relevant legislation, potential impact from air and dust emission is minimized. The heat and fume exhausted from the stack at the IWMF may cause the avoidance of the area in the vicinity of the stack by avifauna. As immediate dispersion and cooling down of fume is expected to occur at the exhaust, the avoidance of area by avifauna is expected to be small scale and acceptable. For the active breeding nest of WBSE, potential operation impacts including increase in marine traffic, operation noise, and glare disturbance, may affect the breeding success of the WBSE pair. In the worst case, WBSE may abandon the existing nest at Shek Kwu Chau. As WBSE is a highly mobile species; with the availability of similar habitat in the vicinity, as well as adoption the recommended measures, potential impacts on breeding WBSE during operation phase is considered to be acceptable.	
Emerald Dove *Chalcophaps indica*	No impact	No impact	No impact	No impact
White-throated Kingfisher *Halcyon smyrnensis*	No impact	No impact	No impact	No impact
Black Kite *Milvus migrans*	No impact	No impact	No impact	No impact
Pacific Swift *Apus pacificus*	No impact	No impact	No impact	No impact
Japanese Paradise Flycatcher	No impact	No impact	No impact	No impact

Species of Conservation Interest	**Construction phase impacts**		**Operation phase impacts**	
Common name /scientific name	**Description**	**Evaluation**	**Description**	**Evaluation**
Terpsiphone atrocaudata				
* Eurasian Eagle Owl *Bubo bubo*	No impact	No impact	No impact	No impact
Butterfly				
Small Grass Yellow *Eurema brigitta rubella*	No impact	No impact	No impact	No impact
Damselfly				
Eastern Lilysquatter *Cercion melanotum*	No impact	No impact	No impact	No impact
* Dusky Lilysquatter *Cercion calamorum dyeri*	No impact	No impact	No impact	No impact
Reptile				
Tree Gecko *Hemiphyllodactylus* sp.	No impact	No impact	No impact	No impact
* Bogadek's Burrowing Lizard *Dibamus bogadeki*	No impact	No impact	No impact	No impact
Mammal				
Japanese Pipistrelle *Pipistrellus abramus*	No impact	No impact	No impact	No impact

Species of Conservation Interest	**Construction phase impacts**		**Operation phase impacts**	
Common name /scientific name	**Description**	**Evaluation**	**Description**	**Evaluation**
Marine Fish				
Fish spawning and nursery area	The footprint of works would overlap with the previously identified fish spawning and nursery ground, a direct loss of 15.9 ha of fish spawning and nursery ground would be resulted. Nevertheless, as the loss would only account for an insignificant amount of the total spawning and nursery ground in the southern waters, the predicted loss of 15.9 ha is considered to be insignificant. Potential degradation in habitat quality due to increase in SS level may affect the survival of fish eggs, larvae and juveniles.	Low to moderate	The footprint of IWMF would result in the permanent loss of 15.9 ha of fish spawning and nursery ground. Nevertheless, as the loss would only account for an insignificant amount of the total spawning and nursery ground in the southern waters, the permanent loss of 15.9 ha of fish spawning and nursery ground is considered to be insignificant. Impingement and entrainment of fish eggs and juvenile fishes through the intake point may arise. Since a previous study revealed that the densities for fish larvae and eggs in southern waters of Hong Kong were generally low; and there was no observable difference in fish larvae and egg densities between the identified spawning and nursery grounds at southern waters of Hong Kong, and that at Western Lantau, which was not identified to be important spawning and nursery grounds, it is therefore considered that impacts on local fisheries resources due to impingement and entrainment is acceptable.	Low

Note: * = Previously recorded at Shek Kwu Chau

Table 7b.64 Overall Impacts on Species of Conservation Interest at Cheung Sha and Along the Submarine Cable Alignment

Species of Conservation Interest	**Construction phase impacts**		**Operation phase impacts**	
Common name /scientific name	**Description**	**Evaluation**	**Description**	**Evaluation**
FLORA				
Aquilaria sinensis *Ceratopteris thalictroides*	These species fall outside the works areas, no impact is predicted.	No impact	No impact	No impact
FAUNA				
Marine Mammal				
Finless Porpoise *Neophocaena phocaenoides*	The proposed alignment for submarine cable laying is frequently utilised by Finless Porpoise between December and May. The potential disturbance due to laying of submarine cable would be temporary. Increase in traffic of marine working vessels may result in collision of Finless Porpoise and vessel, causing injury and mortality of Finless Porpoise. The presence of vessels and underwater noise may also cause behavioural disturbance, affecting Finless Porpoise's resurfacing and diving pattern. Acoustic disturbance from vessels and construction works would affect their echolocation and communication ability, as well as increasing the background noise in their habitat. Degradation of habitat resulting from construction works would result in increase in suspended solids, and may lead to decrease in abundance of prey of Finless Porpoise.	Moderate	No impact	No impact

Species of Conservation Interest	**Construction phase impacts**		**Operation phase impacts**	
Common name /scientific name	**Description**	**Evaluation**	**Description**	**Evaluation**
* Chinese White Dolphin *Sousa chinensis*	Rare sightings of Chinese White Dolphin have been made in the South Lantau waters. South Lantau waters are not considered to be an important habitat for Chinese White Dolphin. Potential impacts on Chinese White Dolphin during construction are mostly the same as Finless Porpoise's, as described above, including potential collision with marine vessels, underwater acoustic disturbance, alteration in behavioural pattern, and reduction in prey items due to degradation in water quality.	Low	No impact	No impact
<u>Avifauna</u>				
Black Kite *Milvus migrans*	One individual was recorded resting on an isolated rock off the shore of Cheung Sha, and was foraging at the nearby waters 500 m away from the proposed landing portal. Works may result in deterioration in quality of foraging ground due to potential adverse impact on water quality. Construction noise and presence of vessels may cause avoidance of rocky shore habitat. Black Kite could utilise the nearby habitat of similar quality (rocky shore), which is available in the vicinity. The potential nest of Black Kite located inland within developed habitat at a metal tower, may be disturbed by construction noise. Considering the great distance between the nest (in-land) and the coastal works (300 m), and difference in elevation between the two sites, no significant impact on Black Kite's nest is expected.	Low	No impact.	No impact
Pacific Reef Egret *Egretta sacra*	Two individuals were recorded at rocky shore within the study area. Works may result in deterioration in quality of foraging ground due to potential adverse impact on water quality.	Low	No impact	No impact

Species of Conservation Interest	**Construction phase impacts**		**Operation phase impacts**	
Common name /scientific name	**Description**	**Evaluation**	**Description**	**Evaluation**
	The construction noise and presence of vessels may cause avoidance of rocky shore habitat. To minimize the noise impact, quieter construction methods and plants would be used. Pacific Reef Egret could utilise the nearby habitat of similar quality (rocky shore), which is available around of the whole island.			
Little Egret *Egretta garzetta*	An individual was recorded within a watercourse (W1). No impact should arise due to the great distance from works and the blockage from landscape.	No impact	No impact	No impact
White-throated Kingfisher *Halcyon smyrnensis*	No impact	No impact	No impact	No impact
Butterfly				
* Large Branded Swift *Pelopidas subochraceus*	No impact	No impact	No impact	No impact
* Common Rose *Pachliopta aristolochiae*	No impact	No impact	No impact	No impact
Damselfly				
* Short-winged Shadowdamsel *Drepanosticta hongkongensis*	No impact	No impact	No impact	No impact
Reptile				
Chinese Cobra *Naja atra*	No impact	No impact	No impact	No impact
Amphibian				
Lesser Spiny Frog *Paa exilispinosa*	No impact	No impact	No impact	No impact
Short-legged Toad *Xenophrys brachykolos*	No impact	No impact	No impact	No impact
* Romer's Tree Frog *Philautus romeri*	No impact	No impact	No impact	No impact

Species of Conservation Interest	**Construction phase impacts**		**Operation phase impacts**	
Common name /scientific name	**Description**	**Evaluation**	**Description**	**Evaluation**
Fish				
* Philippine Neon Goby *Stiphodon atropurpureus*	No impact	No impact	No impact	No impact
* Black-headed Thick-lipped Goby *Awaous melanocephalus*	No impact	No impact	No impact	No impact

Note:
*Previously recorded under another study within the study area of this Project

7b.7 Cumulative Impacts

7b.7.1.1 Two projects may be carried out concurrently with the IWMF at an artificial island near SKC:

ESB-209/2009 – Outlying Islands Sewerage Stage 2 - South Lantau Sewerage Works (2013 – 2017)

Marine works

7b.7.1.2 The concurrent project would involve the construction of a Sewage Treatment Works (STW) at San Shek Wan. Although the STW building would be located outside the study area of the IWMF at Cheung Sha, nevertheless, its associated submarine outfall, which is approximately 800 m in length and 300 mm in diameter, would extend from the shore of San Shek Wan into the Southern Water Control Zone. The proposed submarine outfall of the concurrent project would require dredging works.

7b.7.1.3 While the tentative construction schedule for the IWMF at an artificial island near SKC is 2013 to 2018, there may be an overlapping period for the two projects. As the water quality impacts generated from the proposed reclamation and submarine cable installation works are predicted to be localized in the **Water Quality Impact Assessment** section, no significant cumulative impact on marine ecology due to water quality would be anticipated.

ESB-187/2008 – Improvement of Fresh Water Supply to Cheung Chau (2010 – 2013)

Marine works

7b.7.1.4 This concurrent project would construct a submarine water main across Adamasta Channel, between Northern Channel of Cheung Chau and Chi Man Wan Peninsula, to replace the existing submarine water main. Works of the concurrent project that would overlap with the construction phase of the IWMF include the laying of submarine cable (1400 m in length and 500 mm in diameter) across Adamasta Channel within the Southern Water Control Zone.

7b.7.1.5 According to the tentative schedule of the concurrent project, which is 2010 to 2013, the submarine water main laying works may overlap with the construction phase of the IWMF (2013 to 2018). Considering that the overlapping time would be short, and that the water quality impacts generated from the IWMF marine works are predicted to be localized in the **Water Quality Impact Assessment** section, no significant cumulative impact on marine ecology due to water quality would be anticipated.

7b.7.1.6 No cumulative impact on terrestrial ecology is expected.

7b.8 Mitigation of Adverse Environmental Impacts

7b.8.1 Introduction

7b.8.1.1 According to EIAO-TM Annex 16 guidelines, mitigation measures are discussed in this section to avoid and minimize identified ecological impacts.

7b.8.2 Avoidance

Shek Kwu Chau

Intertidal habitat

7b.8.2.1 To avoid direct contact with the intertidal natural rocky shore of Shek Kwu Chau, the layout of Project has avoided direct encroachment of the existing natural rocky shore habitat, and subsequently avoiding the direct loss of intertidal communities. Some bird species of conservation interest such as Pacific Reef Egret and White-bellied Sea Eagle have also been recorded within and in the vicinity (within coastal shrubland) of the intertidal habitat.

Coastal Subtidal habitat

7b.8.2.2 According to the results of the recent dive surveys, extensive coral colonies were recorded on the non-movable bedrock and large boulders in the coastal hard bottom habitat at Shek Kwu Chau. To avoid and minimise the extensive direct impact on the coral colonies, the movable boulders with attached coral colonies within areas to be directly affected should be translocated to avoid direct loss.

Zero Discharge Scheme

7b.8.2.3 Considering the high ecological value of the marine habitats surrounding Shek Kwu Chau, the design scheme of the Project should avoid the addition of pollution loading into the marine environment. A zero discharge scheme should be adopted during the operation of the Project. An on-site wastewater treatment plant would be provided to treat the wastewater generated from the IWMF (mainly from human). The treated effluent should be re-used in the Incineration Plant and Mechanical Treatment Plant, or for onsite landscape. No significant adverse impact on the marine environment due to operation discharge is therefore expected.

Cheung Sha

Avoidance of plant species of conservation importance

7b.8.2.4 To avoid direct damage of the recorded individual of protected plant species, *Aquilaria sinensis*, at the coastal shrubland habitat at Cheung Sha, the proposed works for landing portal should avoid direct encroachment of, and provide fencing for the plant individual prior to works, in order to avoid any damage due to the Project. The siting of construction equipment and assess road (if any) should be located away from the plant species of conservation interest. Potential indirect disturbance, i.e. dust impact to shrubland and the associated flora species, should be minimised by mitigation measures as stated under the **Air Quality** section (**Section 3b**).

7b.8.3 Minimisation

Measures to Minimise Water Quality Impact

Careful phasing of construction works

7b.8.3.1 Considering the ecological importance of the proposed Project Site to Finless Porpoise, corals and fisheries, minimisation of adverse impacts from SS elevation on marine fauna would be achieved by phasing of constructions works (**Figure 2.8** under **Section 2 – Project Description**).

7b.8.3.2 In Phase 1, cofferdam would be constructed to enclose the reclamation area prior to the commencement of filling activities to minimize potential dispersion of sediment plume

during filling. In addition, the section of breakwater preventing the wave from striking the reclamation area directly from the northwest direction would also be constructed. Appropriate measures, such as silt curtain, would be also applied to reduce the potential impacts on water quality.

7b.8.3.3 In Phase 2, filling of the reclamation area would take place. Appropriate measures, such as silt curtain, would be applied to reduce the potential impacts on water quality.

7b.8.3.4 In Phase 3, the remaining breakwater and berth area would be constructed. At the same time, surcharge loading of the reclaimed area would be in progress. Upon the completion of surcharge loading, construction of Municipal Solid Waste (MSW) treatment facilities and the associated supporting facilities would commence.

7b.8.3.5 A more detailed construction programme is presented in **Table 2.5** under **Section 2 – Project Description**.

Low impact construction method

7b.8.3.6 In order to minimise the amount of dredging and filling works which may result in degradation in water quality, the originally proposed construction method for breakwater for the IWMF and the structure surrounding the perimeter of reclamation area has been revised to the current method.

7b.8.3.7 The currently proposed breakwater, and the structure surrounding the perimeter of reclamation area would be in the form circular cells connected together. Each circular cell would be formed by interlocking straight-web steel piles, which would then be filled with appropriate fill materials. Detailed on the circular cells are presented in **Section 2 – Project Description**.

7b.8.3.8 With the revised construction method, the projected dredging volume has significantly reduced from 79,141 m^3 (original construction method) to 26,200 m^3 (newly proposed construction method).

7b.8.3.9 During the dredging for anti-scouring protection layer, dredging operation would be shielded by frame-type silt curtain around grab to control sediment plume dispersion. The maximum extent of dredging required for the Project construction is shown in **Figure 5b.4**.

Adoption of silt curtains

7b.8.3.10 In order to minimise the dispersion of suspended solids which may have adverse impacts on marine habitats and their associated fauna, e.g. sedimentation on coral surface, reduction in light penetration in water etc., silt curtains should be installed to minimise potential water quality impacts during:

- Sheet piling and filling works for circular cells for cofferdam and breakwater construction – floating type silt curtain around the circular cell (Phase 1 and 3);
- Filling for reclamation area – floating type silt curtain closing the opening for marine access to the reclamation area (Phase 2);
- Anti-scouring dredging – frame-type silt curtain around grab (upon completion of Phase 3); and
- Maintenance dredging (if required during operation phase) - frame-type silt curtain around grab.

7b.8.3.11 Regular inspection of silt curtains should be implemented, in order to maintain their effectiveness and intactness. Details of installation of silt curtains are presented in **Appendix 5b.5**.

Limitation on dredging rate

7b.8.3.12 In order to maintain the maximum SS elevation under 2.5 mg/L, which is below the allowed margin of 30% increase of existing ambient SS level in WQO, and to meet the assessment criteria for marine ecological resources that are sensitive to changes in water quality, a dredging rate of no greater than 380 m^3/day, with no more than 15 grabs per hour using grab size of approximately 2 m^3 should be implemented.

Good site practice for water quality control

7b.8.3.13 Standard good site practice as proposed in the **Water Quality Impact Assessment** (**Section 5b.8**) should be adopted during the construction and operation stages to minimize impacts to the marine environment. Some of the recommendations are as follows:

- Barges should be loaded carefully to avoid splashing of material;
- All barges used for the transport of dredged/waste materials should be fitted with tight bottom seals in order to prevent leakage of material during loading and transporting;
- All barges should be filled to a level that would not spill over during loading and transporting to the disposal site; and
- Adequate freeboard at all barges should be maintained to ensure that the decks are not washed by wave action.

7b.8.3.14 The Project Proponent would also ensure no untreated effluent would be discharged from the Project; and that any discharge should contain no pollutants and meet the requirement of Water Quality Objective.

Proper transportation and disposal of dredged materials at designated areas

7b.8.3.15 Good practice for loading of barges and careful handling of dredged sediments should be adopted; and disposal of sediments should be restricted to designated disposal areas, in order to minimise any unacceptable impacts on the marine habitat and its associated fauna. More mitigation measures to handle dredged materials are listed in **Section 5b.8**.

Specific measures to minimise disturbance on Finless Porpoise

Minimisation of habitat loss for Finless Porpoise

7b.8.3.16 In order to minimise the potential loss of important habitat for Finless Porpoise, substantial revision has been made on the layout plan of the breakwater. The revised layout of the breakwater has greatly reduced the size of the embayment area. Moreover, the newly proposed breakwater form (circular cells) has also reduced the size of the footprint. As a result, the total habitat loss (including reclamation and embayment) for Finless Porpoise has reduced from 50 ha (original plan: **Figure 7b.14**), down to 31 ha (revised plan: **Figure 7b.1**).

Avoidance of peak season for Finless Porpoise occurrence

7b.8.3.17 In order to minimise potential acoustic disturbance from construction activities on Finless Porpoise, construction works that may produce underwater acoustic disturbance should be scheduled outside the months with peak Finless Porpoise occurrence (December to May) (**Table 2.5** under **Section 2**), including:

- sheet piling works for construction of cofferdam surrounding the reclamation area (Phase 1);
- sheet piling works for construction of the shorter section of breakwater (Phase 1);
- sheet piling works for construction of the remaining section of breakwater (Phase 3);
- bored piling works for berth area (Phase 3); and
- submarine cable installation works between Shek Kwu Chau and Cheung Sha.

7b.8.3.18 Such works should be restricted within June to November. This approach would not only avoid the peak season for Finless Porpoise occurrence, the magnitude of impacts arise from acoustic disturbance would also be minimised.

Opt for quieter construction methods and plants

7b.8.3.19 In order to minimise underwater acoustic disturbance on Finless Porpoise, quieter construction methods and plants should be adopted:

- Considering the sensitivity of marine mammals to underwater acoustic disturbance, instead of the previously proposed conventional breakwater and reclamation peripheral structure, which requires noisy piling works, the current circular cells structure for breakwater and reclamation peripheral structure is proposed. A quieter sheet piling method using vibratory hammer or hydraulic impact hammer, would be adopted for the installation of circular cells for cellular cofferdam and northern breakwater during Phase 1, and southern breakwater Phase 3;
- Non-percussive bore piling method would be adopted for the installation of tubular piles for the berth construction during Phase 3.

Monitored exclusion zones

7b.8.3.20 During the installation/re-installation/relocation process of floating type silt curtains, in order to avoid the accidental entrance and entrapment of marine mammals within the silt curtains, a monitored exclusion zone of 250 m radius from silt curtain should be implemented. The exclusion zone should be closely monitored by an experienced marine mammal observer at least 30 minutes before the start of installation/re-installation/relocation process. If a marine mammal is noted within the exclusion zone, all marine works should stop immediately and remain idle for 30 minutes, or until the exclusion zone is free from marine mammals.

7b.8.3.21 The experienced marine mammal observer should be well trained to detect marine mammals. Binoculars should be used to search the exclusion zone from an elevated platform with unobstructed visibility. The observer should also be independent from the project proponent and has the power to call-off construction activities.

7b.8.3.22 In addition, as marine mammals cannot be effectively monitored within the proposed monitored exclusion zone at night, or during adverse weather conditions (i.e. Beaufort 5 or above, visibility of 300 meters or below), marine works should be avoided under weather conditions with low visibility.

Marine mammal watching plan

7b.8.3.23 Upon the completion of the installation/re-installation/relocation of floating type silt curtain, all marine works would be conducted within a fully enclosed environment within the silt curtain (as shown in **Appendix 5b.5**), hence exclusion zone monitoring would no longer be required. Subsequently, a marine mammal watching plan should be implemented. The plan should include regular inspection of silt curtains, and visual inspection of the

waters surrounded by the curtains. Special attention should be paid to Phase 2 (reclamation) where the floating type still curtain would be opened occasionally for vessel access, leaving a temporary 50 m opening. An action plan should be devised to cope with any unpredicted incidents such as the case when marine mammals are found within the waters surrounded by the silt curtains.

Small openings at silt curtains

7b.8.3.24 In order to avoid the entrance of marine mammals into the works area through the opening at silt curtains for vessel access, and the subsequent potential impacts including increase in stress level in marine mammals due to underwater noise and chance of collision with working vessels, the openings for vessel access at the silt curtains should be as small as possible to minimise the risk of accidental entrance.

Adoption of regular travel route

7b.8.3.25 In order to minimize the disruption on marine mammal's behavioural pattern during construction and operation phases, captains of all vessels should adopt regular travel route, in order to minimize the chance of vessel collision with marine mammals, which may otherwise result in damage to health or mortality.

7b.8.3.26 The regular travel route should avoid areas with high sighting density of Finless Porpoise as much as possible (**Figure 7b.15**), as indicated in the latest *Monitoring of Marine Mammals in Hong Kong Waters* (AFCD, 2010c). With the adoption of regular travel route, potential alteration in behavioural pattern of marine mammals due to increase in marine traffic is considered to be acceptable.

Vessel speed limit

7b.8.3.27 In order to minimise potential injury and mortality of marine mammals due to collision with vessels during construction (working vessels) and operation phases (4 round trips/day for MSW vessel, and 12 round trips/day for visitor/staff shuttle ferry), a speed limit of ten knots should be strictly enforced within areas with high density of Finless Porpoise, as identified in the latest *Monitoring of Marine Mammals in Hong Kong Waters* (AFCD, 2010c). The recommend area where speed limit should be adopted include the grids Q30, Q31, and R31 (**Figure 7b.15**).

7b.8.3.28 The same speed limit has been enforced within the Sha Chau and Lung Kwu Chau marine park, and adopted under the *EIA-172/2009 Hong Kong - Zhuhai - Macao Bridge Hong Kong Link Road* (HyD, 2009c), where density of Chinese White Dolphin is high. Limitation on vessel speed limit has appeared to be effective in protecting dolphins from vessel collision, as well as minimising underwater acoustic disturbance. With the adoption of these mitigation measures, the potential impact marine mammals due to injury and mortality from vessel collision would be minimised to acceptable level.

7b.8.3.29 Passive acoustic monitoring and land-based theodolite monitoring surveys should be adopted to verify the predicted impacts and effectiveness of the proposed mitigation measures.

Training of staff

7b.8.3.30 In order to ensure that all staff, including captains of vessels, are aware of the guidelines for safe vessel operations in the presence of cetaceans during construction and operation phases, adequate trainings should be provided.

Specific measures to minimise impact on corals

Coral translocation

7b.8.3.31 According to the results of the existing REA surveys, all 198 coral colonies to be directly affected by the proposed Project were attached to movable rocks, which are less than 50 cm in diameter. Translocation of the potentially affected corals is technically feasible to avoid direct loss. With the implementation of coral translocation prior to the construction works, no loss of coral colonies would be expected. Coral translocation should be carried out during the winter season (November to March) in order to avoid the spawning season of corals (July to October) (Lam, 2000; Storlazzi, 2004). The health status of translocated corals should be regularly monitored after the translocation works.

7b.8.3.32 Prior to coral translocation, a more detailed baseline survey, including a coral mapping survey, is recommended to further confirm the exact number and location of coral colonies within the potentially affected area. A more detailed coral translocation plan, including selection of suitable recipient site, plan for coral translocation, and event / action plan for coral monitoring should be submitted upon approval of this Project, prior to commencement of construction works. Advice from relevant governmental departments (e.g. AFCD) and professionals would be sought after, in order to identify a desirable location for the relocation of coral communities. Post-translocation monitoring on the translocated corals should also be considered.

Coral monitoring programme

7b.8.3.33 A coral monitoring programme is recommended to assess any adverse and unacceptable impacts to the coral communities at the coasts of Shek Kwu Chau during construction of the Project. More details are provided in **Section 7b.10**.

Specific measures to minimise disturbance on breeding White-bellied Sea Eagle

Avoidance of noisy works during the breeding season of White-bellied Sea Eagle

7b.8.3.34 In order to minimise potential construction noise disturbance on WBSE to acceptable level, noisy construction works should be scheduled outside their breeding season (December to May) to minimise potential degradation in breeding ground quality and breeding activities. Works that are recommended to adopt such measure include:

- sheet piling works for construction of cofferdam surrounding the reclamation area (Phase 1);
- sheet piling works for construction of the shorter section of breakwater (Phase 1);
- sheet piling works for construction of the remaining section of breakwater (Phase 3); and
- bored piling works for berth area (Phase 3).

Opt for quieter construction methods and plants

7b.8.3.35 In order to minimise potential construction noise disturbance on WBSE, quieter construction methods and plants should be adopted. The recommended noise mitigation measures in **Section 4b.8** should be implemented to minimise potential noise disturbance to acceptable levels.

Restriction on vessel access near the nest of White-bellied Sea Eagle

7b.8.3.36 During construction and operation, in order to minimise disturbance on the existing WBSE nest, a pre-defined practical route to restrict vessel access near the nest should be adopted to keep vessels and boats as far away from the nest as possible.

White-bellied Sea Eagle monitoring programme

7b.8.3.37 A WBSE monitoring programme is recommended to assess any adverse and unacceptable impacts to the breeding activities of WBSE during construction and operation of the Project. Monitoring surveys for WBSE would include pre-construction phase (twice per month for duration of three months during their breeding season immediately before the commencement of works), construction phase, and operation phase (two year after the completion of construction works).

7b.8.3.38 Surveys would be conducted twice per month during their breeding season (from December to May); and once per month outside breeding season (June to November). More details on monitoring for WBSE are presented in the EM&A Manual.

Education of staff

7b.8.3.39 Staff, including captains of all vessels during construction and operation phases, should be aware of the ecological importance of WBSE. Awareness should be raised among staff to minimise any intentional or unintentional disturbance to the nest.

Minimisation of glare disturbance

7b.8.3.40 To minimise glare disturbance on WBSE, which may cause disorientation of birds by interfering with their magnetic compass, and disruption in behavioural patterns such as reproduction, fat storage and foraging pattern, any un-necessary outdoor lighting should be avoided, and in-ward and down-ward pointing of lights should be adopted.

Opt for Quieter Construction Methods and Plants

7b.8.3.41 Disturbance to the nearby terrestrial habitat and the associated fauna should be minimised by adoption of quieter construction methods and plants wherever possible.

Minimisation of Artificial Lighting

7b.8.3.42 Disturbance from light pollution on fauna groups should be mitigated by avoidance of unnecessary lighting, and shielding of lights to minimise glare disturbance to the nearby habitats.

Accidental Spillage

7b.8.3.43 Accidental spillage may eventually enter the marine environment, hence affecting the habitat quality and associated fauna groups. Regular maintenance of vessels, vehicles and equipments that may cause leakage and spillage should only be undertaken within pre-designated areas, which are appropriately equipped to control the associated discharges.

7b.8.3.44 Oils, fuels and chemicals should be contained in suitable containers, and only be used and stored in designated areas which have pollution prevention facilities. All fuel tanks and storage areas should be sited on sealed areas in order to prevent spillage of fuels and solvents to the nearby watercourses. All waste oils and fuels should be collected in designated tanks prior to disposal. More measures for the prevention of accidental spillage are recommended in **Section 5b.8**.

Sewage Effluent

7b.8.3.45 Temporary sanitary facilities, such as portable chemical toilets, should be employed on-site where necessary to handle sewage from the workforce.

Drainage and Construction Runoff

7b.8.3.46 Potential ecological impacts resulted from potential degradation of water quality due to unmitigated surface runoff could be minimised to acceptable level via the detailed mitigation measures in **Section 5b.8**. The following presents some of the mitigation measures:

- On-site drainage system with implemented sedimentation control facilities.
- Channels, earth bunds or sand bag barriers should be provided on site to direct storm water to silt removal facilities.
- Provision of embankment at boundaries of earthworks for flood protection.
- Water pumped out from foundation piles must be discharged into silt removal facilities.
- During rainstorms, exposed slope/soil surfaces should be covered by tarpaulin or other means, as far as practicable.
- Exposed soil surface should be minimized to reduce siltation and runoff.
- Earthwork final surfaces should be well compacted. Subsequent permanent surface protection should be immediately performed.
- Open stockpiles of construction materials, and construction wastes on-site should be covered with tarpaulin or similar fabric during rainstorms.

General Construction Activities

7b.8.3.47 In order to avoid the entering of construction solid waste into the nearby habitats, construction solid waste should be collected, handled and disposed of properly. It is recommended to clean the construction sites on a regular basis.

Pest Control

7b.8.3.48 Good waste management practices should be adopted at the IWMF in order to minimise the risk of introduction of pest to the island:

- Transportation of wastes in enclosed containers
- Waste storage area should be well maintained and cleaned
- Waste should only be disposed of at designated areas
- Timely removal of the newly arrived waste
- Removal of items that are capable of retaining water
- Rapid clean up of any waste spillages
- Maintenance of a tidy and clean site environment
- Regular application of pest control
- Education of staff the importance of site cleanliness

Minimisation of Habitat Degradation during Maintenance Dredging

7b.8.3.49 Depending on the seabed condition of the approach channel for marine vessels during operation phase of the IWMF, maintenance dredging may be required to ensure safe access. In order to avoid degradation in water quality due to elevation in SS and dispersion of sediment plume due to dredging works, it is recommended that any future maintenance dredging works should not be carried out within 100 m from the shore, similar to that of the dredging for anti-scouring protection layer during construction phase. All maintenance dredging works should also be carried out with the implementation of silt curtain to control the dispersion of SS. The recommended dredging rate should be no greater than 380 m^3/day. As shown in **Table 5b.8**, the maximum SS elevation for such dredging condition should be under 2.5 mg/L, which is below the allowed margin of 30% ambient level. No significant adverse impact on water quality and its associated ecological resources would be expected from the proposed maintenance dredging. The extent of the recommended dredging is shown in **Figure 5b.8**.

7b.8.4 Compensation

Designation of Marine Park

7b.8.4.1 Loss of 31 ha of marine habitat would be permanently resulted from the reclamation and breakwater construction at the southwestern waters of Shek Kwu Chau. The proposed works area is of high ecological value, as it is identified as an important habitat for Finless Porpoise; hence high level of adverse impact is predicted. As minimisation measures are exhausted, compensatory measure is therefore required.

7b.8.4.2 According to the Finless Porpoise data recorded between 2004 and 2009 (AFCD, 2010c), the waters between Shek Kwu Chau and Soko Islands is the nearest area to the proposed Project that has high sighting concentration of Finless Porpoise than the rest of the nearby waters. In addition, the extent of Finless Porpoise habitat is the most continuous and connected to other nearby important habitats of marine mammals, i.e. Soko Islands, which has records of both Finless Porpoise and Chinese White Dolphin.

7b.8.4.3 The Project Proponent has made a firm commitment to seek to designate a marine park of approximately 700 ha in the waters between Soko Islands and Shek Kwu Chau, in accordance with the statutory process stipulated in the Marine Parks Ordinance, as a compensation measure for the habitat loss arising from the construction of the IWMF at an artificial island near SKC.

7b.8.4.4 The firm commitment to seek to designate the marine park, where incompatible activities would be regulated and proper management regime imposed in accordance with the Marine Park Ordinance, would significantly help conserve Finless Porpoise, and hence serve as an effective compensation measure for the permanent loss of Finless Porpoise habitat arising from the project. The Project Proponent shall seek to complete the designation by 2018 to tie in with the operation of the IWMF at the artificial island near SKC.

7b.8.4.5 A further study should be carried out to review relevant previous studies and collate available information on the ecological characters of the proposed area for marine park designation; and review available survey data for Finless Porpoise, water quality, fisheries, marine traffic and planned development projects in the vicinity. Based on the findings, ecological profiles of the proposed area for marine park designation should be established, and the extent and location of the proposed marine park be determined. The adequacy of enhancement measures should also be reviewed.

7b.8.4.6 In addition, a management plan for the proposed marine park should be proposed, covering information on the responsible departments for operation and management (O&M) of the marine park, as well as the O&M duties of each of the departments

involved. Consultation with relevant government departments and stakeholders should be conducted under the study. The study should be submitted to Director of Environmental Protection (DEP) for approval before the commencement of construction works.

7b.8.4.7 The Project Proponent should provide assistance to AFCD during the process of the marine park designation.

7b.8.4.8 The firm commitment to designate the waters between Soko Islands and Shek Kwu Chau as a marine park, where the control and management of the marine park would be in accordance with the Marine Parks Ordinance, is considered to be adequate to effectively mitigate the permanent loss of important habitat of Finless Porpoise to acceptable level.

7b.8.5 Additional Enhancement or Precautionary Measures

Deployment of Artificial Reefs

7b.8.5.1 In addition to the habitat compensation measure for Finless Porpoise, deployment of artificial reefs (ARs) is considered as an enhancement measure for the marine habitats. The creation of hard surfaces increases the complexity of marine habitats by offering various micro-habitats, and provides opportunities for marine organisms to develop within the ARs. The development of such communities would subsequently attract small predators, i.e. fishes, which in turn bring positive impacts to Finless Porpoise by creating food sources. This enhancement feature would also bring positive impacts to the potential important spawning and nursery ground for fisheries resources.

7b.8.5.2 The enhancement functions of ARs had been confirmed by previous studies (Wilson, 2003b). It had been reported that juvenile fish were recorded after ARs were deployed. Biodiversity and abundance of fishes found around the deployed ARs were found to be higher than those observed in the nearby areas (*ibid.*). More than 220 fish species were recorded at the ARs, which provide feeding ground, shelter, spawning and nursing areas for their young (*ibid.*).

7b.8.5.3 ARs are proposed to be deployed within the proposed marine park under this Project. The exact location, dimension and type of ARs to be deployed are to be further investigated along with the further study of the proposed marine park under this Project. The proposed ARs would be deployed at the same time as the complete designation of marine park.

Release of Fish Fry at Artificial Reefs

7b.8.5.4 Release of fish fry at the proposed ARs, as well as the proposed marine park under this study, should be considered as an enhancement measure for the fish resources in the nearby waters, and subsequently food sources for Finless Porpoise. The proposed ARs with various micro-habitats would have the potential to provide shelter and nursery ground for the released fish fry. The frequency and quantity of fry to be released should be agreed by AFCD.

7b.8.6 Summaries of Ecological Impacts and Mitigation / Enhancement Measures

7b.8.6.1 Summaries of overall construction and operation impacts and mitigation / enhancement measures are presented in **Table 7b.65-66** for Shek Kwu Chau, **Table 7b.67-68** for Cheung Sha, and **Table 7b.69-70** for submarine cable alignment.

Table 7b.65 Overall Construction Stage Impact and Mitigation / Enhancement for Shek Kwu Chau

Potential Impact	Source	Receiver	Nature of Impact						Severity of Overall Impact	Further mitigation / enhancement required
			Habitat Quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
Loss of important habitat for Finless Porpoise	Footprint of the IWMF and the partially enclosed embayment	Marine waters	High	Finless Porpoise	Moderate	Permanent	Irreversible	Low to moderate	High	Designation of a marine park, deployment of ARs, release of fish fry
Loss of subtidal hard bottom habitat	Footprint of the IWMF	Subtidal hard bottom habitat	Low to moderate	1 common hard coral and 7 common soft coral species	0.2 ha of habitat loss. Corals are small sized and had low coverage (<1%)	Permanent	Irreversible	Low	Moderate	Translocation of all corals
Loss of subtidal soft bottom habitat	Footprint of the IWMF	Benthic habitat	Low to moderate	Common benthos	17.2 ha	Permanent	Irreversible	Low to moderate	Low	Not required
Loss of fish spawning and nursery ground	Footprint of the IWMF	Marine waters	High	Fisheries resources	An insignificant amount of the total fish spawning and nursery ground in the southern waters	Permanent	Irreversible	Low	Insignificant	Not required, but would benefit from deployment of ARs and release of fish fry
Disturbance on marine habitats due to degradation in water quality	Dredging and other seabed disturbing works	Marine habitats	Low to high	Corals, Finless Porpoise, intertidal communities, soft bottom benthic communities, horseshoe crab, fish spawning and nursery ground, avifauna that utilize the marine habitats as feeding ground	Localised	Temporary	Reversible	Low to moderate	Low to moderate	Water quality mitigation measures

Potential Impact	Source	Receiver	Nature of Impact						Severity of Overall Impact	Further mitigation / enhancement required
			Habitat Quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
Underwater acoustic disturbance from construction work	Sheet piling, bored piling	Marine waters	High	Finless Porpoise	High	Temporary	Reversible	Moderate	Low to moderate	Avoidance of piling works during the peak season for Finless Porpoise occurrence
Increase in vessel traffic	Working vessels	Marine waters	High	Finless Porpoise	High	Temporary	Reversible	Low to moderate	Low to moderate	Vessel speed restrictions and adoption of regular travel route
Trapping of marine mammals due to installation/re-installation/ relocation of silt curtains	Silt curtains	Marine waters	High	Finless Porpoise	High	Temporary	Reversible	Low to moderate	Low to moderate	Monitored exclusion zone, marine mammal watching plan
Release of contaminants during Transportation and disposal of dredged sediments	Dredged sediments	Marine waters	High	Finless Porpoise, corals, intertidal communities, soft bottom benthic communities, horseshoe crab, fish spawning and nursery ground	Localised	Temporary	Reversible	Low	Insignificant	Not required
Extraction and placement of fill materials	Fill sediments for circular cells	Marine waters	High	Finless Porpoise, corals, intertidal communities, soft bottom benthic communities, horseshoe crab, fish spawning and nursery ground	Localised	Temporary	Reversible	Low	Low	Water quality mitigation measures

Potential Impact	Source	Receiver	Nature of Impact						Severity of Overall Impact	Further mitigation / enhancement required
			Habitat Quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
Disturbance on intertidal habitat	Human disturbance, marine traffic, construction noise, artificial lighting	Intertidal habitat	Low	Avifauna	Localised	Temporary	Reversible	Low to moderate	Low to moderate	Noise mitigation measures
Disturbance on coastal shrubland habitat	Working vessels, construction noise, artificial lighting	Coastal shrubland habitat	Moderate	Wildlife that utilise the coastal shrubland	Localised	Temporary	Reversible	Low to moderate	Low to moderate	Noise mitigation measures, minimisation of glare disturbance
Disturbance on White-bellied Sea Eagle	Working vessels, construction noise, artificial lighting	Coastal shrubland habitat	Moderate	White-bellied Sea Eagle, nest of White-bellied Sea Eagle	1 active breeding nest	Temporary	Reversible	Low to moderate	Low to moderate	Avoidance of noisy works during the breeding season of WBSE, noise mitigation measures, minimisation of glare disturbance
Drainage and construction site runoff	Terrestrial construction works	Marine waters	High	Finless Porpoise, corals, intertidal communities, soft bottom benthic communities, horseshoe crab, fish spawning and nursery ground	Localised	Temporary	Reversible	Low	Low to moderate	Water quality mitigation measures
Accidental spillage of chemicals	Terrestrial construction works	Marine waters	High	Finless Porpoise, corals, intertidal communities, soft bottom benthic communities, horseshoe crab, fish spawning and nursery ground	Localised	Temporary	Reversible	Low	Low	Adoption of good site practise

Potential Impact	Source	Receiver	Nature of Impact						Severity of Overall Impact	Further mitigation / enhancement required
			Habitat Quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
Sewage effluent discharge	Workforce	Marine waters	High	Finless Porpoise, corals, intertidal communities, soft bottom benthic communities, horseshoe crab, fish spawning and nursery ground	Localised	Temporary	Reversible	Low	Low	Adoption of good site practise

Table 7b.66 Overall Operation Stage Impact and Mitigation / Enhancement for Shek Kwu Chau

Potential Impact	Source	Receiver	Nature of Impact						Severity of Overall Impact	Further mitigation / enhancement required
			Habitat Quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
Permanent loss of habitat for marine mammals	Footprint of the IWMF and the partially enclosed embayment	Marine waters	High	Finless Porpoise	Moderate	Permanent	Irreversible	High	High	Designation of a marine park, deployment of ARs, release of fish fry
Permanent loss of subtidal hard bottom habitat	Footprint of the IWMF	Subtidal hard bottom habitat	Low to moderate	1 common hard coral and 7 common soft coral species. Small sized and low coverage (<1%)	0.2 ha of habitat loss.	Permanent	Irreversible	Low to moderate	Low to moderate	Translocation of all corals within directly affected area
Permanent loss of subtidal soft bottom habitat	Footprint of the IWMF	Benthic habitat	Low to moderate	Common benthos	17.2 ha	Permanent	Irreversible	Low	Low	Not required
Permanent loss of fish spawning and nursery ground	Footprint of the IWMF	Marine waters	High	Fisheries resources	An insignificant amount of the total fish spawning and nursery grounds in the southern waters	Permanent	Irreversible	Low	Insignificant	No, but would benefit from deployment of ARs and release of fish fry

Potential Impact	Source	Receiver	Nature of Impact						Severity of Overall Impact	Further mitigation / enhancement required
			Habitat Quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
Alteration in flow regime	Footprint of the IWMF and the partially enclosed embayment	Marine waters	High	Corals	Localised	Permanent	Irreversible	Low	Insignificant	Not required
Alteration in sedimentation pattern	Embayment within breakwater	Marine waters	High	Corals	Localised	Permanent	Irreversible	Low	Insignificant	Not required
Maintenance dredging	Dredging works	Marine waters	High	Finless Porpoise, corals, intertidal communities, soft bottom benthic communities, horseshoe crab, fish spawning and nursery ground	Localised	Temporary	Reversible	Low to moderate	Moderate	Water quality mitigation measures
Discharge of saline water from desalination plant at seawall outfall	Desalination Plant	Marine waters	High	Marine fauna, especially corals	Localised	Permanent	Irreversible	Low	Insignificant	Not required
Degradation of water quality in fish spawning and nursery ground	Discharge of untreated sewage, brine water, biocides / anti-fouling chemicals; temperature rise in discharge	Marine waters	High	Fish eggs and juvenile fishes	Localised	Permanent	Irreversible	Low	Insignificant	Not required

Potential Impact	Source	Receiver	Nature of Impact						Severity of Overall Impact	Further mitigation / enhancement required
			Habitat Quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
Entrainment and impingement of fish eggs and juvenile fishes	Water intake point for water supply at the desalination plant	Marine waters	High	Fish eggs and juvenile fishes	Localised	Permanent	Irreversible	Low	Low	Not required
Increase in marine traffic	MSW barge, visitor/staff shuttle ferry	Marine waters	High	Finless Porpoise	4 round trips/day for MSW barge, and 12 round trips/day for visitor/staff shuttle ferry	Permanent	Irreversible	Low to moderate	Low to moderate	Vessel speed restrictions and adoption of regular travel route
Trapping of marine mammal within the channel behind the IWMF	Channel betwen the IWMF structure and Shek Kwu Chau shore	Coastal marine waters	High	Finless Porpoise	10-40 m in width, and 400 m in length	Permanent	Irreversible	Low	Insignificant	Land-based monitoring by site staff
Light Pollution by artificial Lighting	Artificial lights	Southwest facing hillside shrubland	Low to moderate	Residence fauna	Southwest facing hillside shrubland	Permanent	Irreversible	Low to moderate	Low to moderate	Avoidance of unnecessary lighting, shielding of lights
Disturbance on the nest of White-bellied Sea Eagle	Increase in marine traffic, operation noise, artificial light	Southwest facing hillside shrubland	Low to moderate	Nest of White-bellied Sea Eagle	Southwest facing hillside shrubland	Permanent	Irreversible	Low to moderate	Low to moderate	Avoidance of unnecessary lighting, shielding of lights, restriction on vessel access near the nest, education of staff, monitoring programme

Potential Impact	Source	Receiver	Nature of Impact						Severity of Overall Impact	Further mitigation / enhancement required
			Habitat Quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
Physical barrier for avifauna	The whole of the IWMF structure	Avifauna	N/A	Avifauna that utilises the shore of Shek Kwu Chau	Structure above water surface 15.9 ha, height of buildings range between 5-50 m, stack height 150 m	Permanent	Irreversible	Low	Low	Not required
Operation noise disturbance	Plants within the IWMF, vessels	Hillside shrubland, intertidal habitat	Moderate for shrubland, low to moderate for intertidal habitat	Avifauna	Habitats facing the IWMF	Permanent	Irreversible	Low	Low	Not required
Air and dust emission	Air emission from the stacks of incineration process, and the dust released from the waste reception halls	Terrestrial fauna	N/A	Terrestrial fauna, including avifauna that utilise the space above stack	N/A	Permanent	Irreversible	Low	Low	Air quality mitigation measures
Heat and fume exhaust	Stack of incineration plant	Avifauna	N/A	Avifauna that utilise the space above stack	Localised	Permanent	Irreversible	Low	Low	Not required
Introduction of pest during transportation of waste	Wastes transported from other areas in Hong Kong	Shek Kwu Chau	N/A	Flora and fauna at Shek Kwu Chau	N/A	Permanent	Irreversible	Low	Low	Waste management mitigation measures
Chemical spillages arising from vehicle / vessel accident	Vehicles and vessels	Marine waters	High	Marine fauna	N/A	Permanent	Irreversible	Low to moderate	Low to moderate	Good site practices

Table 7b.67 Overall Construction Stage Impact and Mitigation / Enhancement for Cheung Sha

Potential Impact	Source	Receiver	Nature of Impact						Severity of Overall Impact	Further mitigation / enhancement required
			Habitat Quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
Loss of intertidal habitat	Footprint of submarine cable landing portal	Rocky shore and benthic habitat	Low to moderate	Common intertidal and benthic species	Total:20 m^2	Permanent	Irreversible	Low	Insignificant	Not required
Loss of subtidal habitat	Footprint of submarine cable landing portal	Benthic habitat	Low	Common benthos		Permanent	Irreversible	Low	Insignificant	Not required
Loss of backshore vegetated area	Works area	Backshore shrubland	Low	Common backshore vegetation	750 m^2	Temporary	Reversible	Low	Low	Not required
Disturbance on marine habitats due to degradation in water quality	Open cut method using dredger	Coastal waters	Low	No species of conservation important	Localised	Temporary	Reversible	Low to moderate	Insignificant	Water quality mitigation measure
Disturbance on coastal shrubland habitat	Construction noise, human activities	Coastal shrubland habitat	Low	Avifauna	N/A	Temporary	Reversible	Low	Low	Not required

Table 7b.68 Overall Operation Stage Impact and Mitigation / Enhancement for Cheung Sha

Potential Impact	Source	Receiver	Nature of Impact						Severity of Overall Impact	Further mitigation / enhancement required
			Habitat Quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 7b.69 Overall Construction Stage Impact and Mitigation / Enhancement for Submarine Cable Alignment

Potential Impact	Source	Receiver	Nature of Impact						Severity of Overall Impact	Further mitigation / enhancement required
			Habitat Quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
Loss of subtidal soft bottom habitat	Submarine cable laying	Benthic habitat	Low to moderate	Common benthos	17,400 m^2	Temporary	Reversible	Low	Low	Not required
Increase in marine traffic and underwater acoustic	Submarine cable laying	Marine waters	High	Finless Porpoise	17,400 m^2	Temporary	Reversible	Low	Low to moderate	Scheduling of works outside the peak season for Finless Porpoise occurrence

Table 7b.70 Overall Operation Stage Impact and Mitigation / Enhancement for Submarine Cable Alignment

Potential Impact	Source	Receiver	Nature of Impact						Severity of Overall Impact	Further mitigation / enhancement required
			Habitat Quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

7b.9 Evaluation of Residual Impacts

7b.9.1 Shek Kwu Chau

Permanent Loss of Finless Porpoise Habitat

7b.9.1.1 A total loss of approximately 31 ha of important habitat for Finless Porpoise is predicted, as the whole area behind the proposed breakwater is assumed to become permanently inaccessible for Finless Porpoise upon completion of the Project.

7b.9.1.2 To mitigate the loss, the Project Proponent has made a firm commitment to seek to designate the waters between Soko Islands and Shek Kwu Chau and as a marine park, in accordance with the statutory process stipulated in the Marine Parks Ordinance. With such commitment implemented, the residual impact on Finless Porpoise due to permanent loss of important habitat is considered to be acceptable.

Permanent Loss of Subtidal Hard Bottom Habitat

7b.9.1.3 The reclamation footprint would result in a permanent loss of 0.2 ha of subtidal hard bottom habitat, where 1 common hard coral and 7 common soft coral species were recorded. With the translocation of corals, no direct loss of corals would be resulted. The residual impact of permanent loss of subtidal hard bottom habitat is considered acceptable.

Permanent Loss of Subtidal Soft Bottom Habitat

7b.9.1.4 The permanent loss of 17.2 ha of subtidal hard bottom habitat is considered acceptable as the habitat is considered to be of limited ecological concern, and that only common benthos species were recorded.

Permanent Loss of Fish Spawning and Nursery Grounds

7b.9.1.5 The permanent loss of 15.9 ha of fish spawning and nursery grounds is considered acceptable as the loss only constitute an insignificant portion of total fish spawning and nursery ground in the southern waters, and a recent study has suggested that there was no observable difference in fish larvae and egg densities between the identified spawning and nursery grounds at southern waters of Hong Kong, and the waters at Western Lantau, which was not identified to be important spawning and nursery grounds (CLP, 2006).

Abandonment of Nest of White-bellied Sea Eagle

7b.9.1.6 Noting the recordable breeding success of the WBSE nest at Shek Kwu Chau since 2006, and the current undisturbed nature of the location of the nest; with the implementation of the proposed mitigation measures during construction and operation phases, the possibility of WBSE nest abandonment still remains.

7b.9.1.7 Other than the external disturbances, it should also be taken into consideration that nest abandonment could also be caused by the innate behavioural pattern of White-bellied Sea Eagle. According to the long term monitoring surveys conducted by AFCD, breeding success of White-bellied Sea Eagle fluctuates naturally over time (AFCD, 2010a). The number of successful breeding pairs ranged from 14.3% to 87.5% between the survey period of 2007/2008 and 2008/2009 (*ibid.*). The low breeding success rate (14.3%) in 2007/2008 was considered to be caused by a prolonged exceptionally cold period in February 2008 during their core breeding season (*ibid.*). Such event indicates that other than human induced disturbances, natural occurring events may also have an effect on the behaviour of White-bellied Sea Eagle.

7b.9.1.8 Considering that WBSE is a highly mobile species with large territory size, and that similar habitat is available in the vicinity (i.e. the rest of hillside coastal shrubland at Shek Kwu Chau, and other remote islands e.g. Soko Island, Hei Ling Chau); WBSE could utilise other areas in the vicinity. Residual impact on the nest of WBSE is considered to be acceptable.

Degradation of Marine Habitat

7b.9.1.9 With the adoption of the proposed mitigation measures, no unacceptable residual impacts on marine habitats due to degradation in water quality, increase in underwater acoustic disturbance, and increase in vessel number during construction and operation phases are predicted.

Overall Residual Impacts

7b.9.1.10 With the implementation of the proposed mitigation measures, no unacceptable residual impacts on marine and terrestrial habitats and their associated flora and fauna groups are expected.

Additional Enhancement Measure

7b.9.1.11 Additional marine habitat enhancement measures, including deployment of artificial reefs and release of fish fry at artificial reefs, would be adopted. Such measures would bring additional positive long term impact to the marine habitats, further conserving marine fauna and their habitat.

7b.9.2 Cheung Sha

Permanent Loss of intertidal and subtidal habitats

7b.9.2.1 Permanent loss of a total of 20 m^2 of intertidal and subtidal habitats is considered acceptable as both habitats are considered to be of limited ecological concern and the loss is small.

Temporary Loss of backshore vegetated area

7b.9.2.2 A temporary loss of 750 m^2 of backshore vegetated area at Cheung Sha is considered acceptable as only common backshore vegetation was recorded in the directly affected area.

Overall Residual Impacts

7b.9.2.3 With the implementation of the proposed mitigation measures, no unacceptable residual impacts on marine and terrestrial habitats and their associated flora and fauna groups are expected.

7b.9.3 Along the Cable Alignment

Temporary Loss of subtidal soft bottom habitat

7b.9.3.1 The temporary loss of 17,400 m^2 of subtidal soft bottom habitat is considered acceptable as only common benthos species were recorded, the habitat is considered to be of limited ecological concern.

Overall Residual Impacts

7b.9.3.2 With the implementation of the proposed mitigation measures, no unacceptable residual impacts on marine habitats and their associated fauna groups are expected.

7b.10 Environmental Monitoring and Audit

7b.10.1 General

7b.10.1.1 Ecological monitoring and audit programmes for Finless Porpoise, corals and White-bellied Sea Eagle are recommended:

7b.10.2 Finless Porpoise Monitoring

Vessel-based Line Transect Survey

7b.10.2.1 The vessel-based line transect survey would focus on the monitoring of Finless Porpoise, as the study area has been identified as a hotspot for this species. The monitoring programme would cover the survey area as adopted during the EIA study, as well as the proposed marine park for the mitigation of loss of important habitat for Finless Porpoise. The monitoring would verify the predicted impacts, and examine whether the mitigation measures recommended in **Section 7b.8** have been effectively implemented to protect marine mammals from negative impacts from construction activities.

7b.10.2.2 The marine mammal monitoring programme should cover pre-construction phase, construction phase, and operation phase. The survey methodology should remain the same as that adopted during the EIA study, in order to allow fair comparison of marine mammal monitoring results.

7b.10.2.3 Regular line-transect surveys should be conducted to collect data for the analysis of distribution, encounter rate, density and habitat use of both porpoises and dolphins. After analysis of the data, the results would allow the detection of any changes of their usage of habitat, in response to the proposed construction works.

Active Acoustic Monitoring

7b.10.2.4 Active acoustic monitoring aims to study the acoustic behaviour of Finless Porpoise in relation to the presence and absence of vessels, and their associated underwater acoustic disturbance. Hydrophones should be deployed from stationary boat to record noise data from vessels and Finless Porpoise. Approximately 30 days of field work should be carried out during the peak occurrence period of Finless Porpoise (December to May). With the recorded data, analysis on whether presence of, and distance from vessel traffic would cause acoustic behavioural changes in Finless Porpoise, or changes in use of frequency range etc. could be determined. The monitoring results should be used to verify the predicted impacts and the effectiveness of the proposed mitigation measures.

7b.10.2.5 Details of the active acoustic monitoring methodology and frequency should be agreed with AFCD.

Passive Acoustic Monitoring

7b.10.2.6 Passive acoustic monitoring aims to study the utilisation of an area by Finless Porpoise. An array of automated static porpoise detectors (e.g. C-POD) should be deployed at different locations within and outside the Project Area to detect the unique ultra-high frequency sounds produced by Finless Porpoise during pre-construction, construction and operation phases. Porpoise detectors would be left on-site over the monitoring period, the utilisation of the area by Finless Porpoise would be monitored 24-hous a day and under any weather conditions. The monitoring results should be used to verify the predicted impacts and the effectiveness of the proposed mitigation measures.

7b.10.2.7 The number, position, and duration of the porpoise detectors deployment should be agreed with AFCD.

Land-based Theodolite Tracking

7b.10.2.8 The objective of the land-based theodolite tracking of Finless Porpoise is to study their movement and behavioural pattern in response to the presence of marine vessels and their associated underwater acoustic disturbance within and around the Project Area.

7b.10.2.9 With a well-positioned theodolite from vantage points at a height above the area to be monitored, the movement and behavioural patterns of marine mammals could be monitored. The survey should cover pre-construction phase to obtain baseline movement and behavioural pattern of Finless Porpoise within and near the Project Area, and construction and operation phases to verify the predicted marine traffic impacts on Finless Porpoise, as well as the effectiveness of the proposed mitigation measures.

7b.10.2.10 Details of the land-based theodolite tracking methodology and frequency should be agreed with AFCD.

Exclusion Zone Monitoring

7b.10.2.11 Results of the monitoring of exclusion zones during the installation/re-installation/relocation process of floating type silt curtains should be included in the EM&A report, in order to avoid the accidental entrapment of marine mammals within the silt curtains. An action plan for when marine mammals are found within the waters enclosed by the silt curtains should be included in the EM&A Manual.

Marine mammal watching plan

7b.10.2.12 Upon the completion of floating type silt curtain installation/re-installation/relocation, all marine works would be conducted within a fully enclosed environment within the silt curtain (as shown in **Appendix 5b.5**), hence exclusion zone monitoring would no longer be required. Subsequently, a marine mammal watching plan would be implemented. The plan would include regular inspection of silt curtains, and visual inspection of the waters surrounded by the curtains. Special attention would be paid to Phase 2 (reclamation) where the floating type still curtain would be opened occasionally for vessel access, leaving a temporary 50 m opening. An action plan should be devised to cope with any unpredicted incidents such as the case when marine mammals are found within the waters surrounded by the silt curtains.

Land-based Monitoring of Channel between the IWMF and Shek Kwu Chau

7b.10.2.13 Although the trapping of marine mammals within the channel is predicted to be unlikely; however in view of their conservation importance, precautionary land-based monitoring of channel for potential trapping of marine mammals by site staff during operation phase should be adopted to verify the impact predication.

7b.10.3 Coral Monitoring

7b.10.3.1 A coral monitoring programme is recommended to assess any adverse and unacceptable indirect impacts to the coral communities at the coasts of Shek Kwu Chau during construction of the Project. The coral monitoring programme should comprise 3 phases: pre-construction phase (or baseline phase), construction phase, and operation phase (one year after the completion of construction works).

7b.10.3.2 Corals located within areas likely to be affected by the Project, translocated corals, and corals at control sites (areas unlikely to be affected by SS elevation) should be chosen (including the location(s) where the uncommon *Coscinaraea n* sp. was found), in order to identity any adverse indirect impact from the marine works. The size, percentage cover and health condition of corals at representative transects should be recorded during each monitoring.

7b.10.3.3 A more detailed coral monitoring plan, including which coral species and colonies to be monitored, methodology, monitoring frequency, and event and action plan for coral monitoring should be submitted upon approval of this Project, prior to commencement of construction works. Advice from relevant government departments (e.g. AFCD) would be sought after, in order to identify an effective practice for coral monitoring.

7b.10.4 White-bellied Sea Eagle Monitoring

7b.10.4.1 A monitoring programme is recommended for WBSE, especially for the active breeding nest, located 60 m above ground within a hillside shrubland habitat, 130 m in-land from shore, and about 550 m away from the proposed reclaimed land. The monitoring programme should comprise pre-construction phase, construction phase, and post-construction phase.

7b.10.4.2 Information to be collected should include behaviour (e.g. foraging, territory fending), breeding activity, and any observable response to disturbances. Any observable responses to disturbances should be assessed, taking into account of the human induced activities occurring at the time, as well as other disturbances such as weather condition, or invasion by other fauna species.

7b.10.4.3 A more detailed White-bellied Sea Eagle monitoring programme, including pre-construction baseline survey, confirmation of location and status of breeding nest, commencement dates for monitoring, and detailed survey methodology in relation to the latest location of breeding nest, etc., should be submitted prior to commencement of construction works. Advice from relevant government departments (e.g. AFCD) would be sought after, in order to identify an effective practice for monitoring of nesting White-bellied Sea Eagle.

7b.10.5 Water Quality Monitoring and Audit

7b.10.5.1 To further monitor the potential water quality impact on the nearby marine ecological sensitive receivers, a water quality monitoring and audit programme has been recommended (**Section 5b**). Part of the monitoring stations would be located near coral sites (including where the uncommon *Coscinaraea n* sp. was recorded), in order to allow a close monitoring of relationship between water quality and corals. Details of water monitoring programme are discussed in the **EM&A Manual**.

7b.11 Conclusion

7b.11.1.1 The proposed Project Site is an important habitat for Finless Porpoise (*Neophocaena phocaenoides*), a species of conservation interest, due to their high occurrence in the area. A total of 15 species of corals, including one uncommon species, have been identified along the shore of Shek Kwu Chau within and in the vicinity of the Project Site. Breeding of White-bellied Sea Eagle (*Haliaeetus leucogaster*), an uncommon species with limited number of known breeding sites in Hong Kong, had been recorded near the proposed reclamation area.

7b.11.1.2 The key potential direct impact identified under the Project include permanent loss of 31 ha of important habitat for Finless Porpoise, covering the reclamation and the embayment area within breakwater. Mitigation measures proposed to mitigate the loss include firm commitment from the Project Proponent to seek to designate a marine park of approximately 700 ha in the waters between Soko Islands and Shek Kwu Chau, in accordance with the statutory process stipulated in the Marine Parks Ordinance by 2018, in order to tie in with the operation of the IWMF at the artificial island near SKC. Deployment of artificial reef and release of fish fry have also been proposed as additional enhancement measures for the loss of important habitat for Finless Porpoise and fisheries resources. For the indirect impacts on Finless Porpoise, such as acoustic disturbance, collision with vessels, and alteration of behavioural pattern during

construction and operation phases, mitigation measures proposed include avoidance of noisy works during peak Finless Porpoise season, monitoring of exclusion zone, marine mammal watching plan, adoption of regular traffic route, and limitation of vessel speed to ten knots at areas with high Finless Porpoise sighting density. With the implementation of the proposed mitigation measures, adverse impacts on Finless Porpoise would be mitigated to acceptable level.

7b.11.1.3 A total of 198 coral colonies of small sizes and low coverage (<1%), comprising 1 hard coral and 7 octocoral species, within the proposed reclamation area may be directly affected. While all the corals to be affected were recorded to be translocatable, coral translocation has been recommended to avoid any direct loss. Other corals that are located along the shore of Shek Kwu Chau may be indirectly affected by the potential elevation in suspended solid level during construction phase, which could be effectively mitigated through water quality measures. With the implementation of the proposed measures, unacceptable impacts on corals are not anticipated.

7b.11.1.4 The White-bellied Sea Eagle breeding pair and their nest may receive indirect disturbances during construction and operation phases of the IWMF. Such impacts could be mitigated through avoidance of noisy works during the breeding season of White-bellied Sea Eagle, restriction of vessel access near the nest of White-bellied Sea Eagle, and avoidance of unnecessary lighting and provision of shielding for lights to minimise glare disturbance from the IWMF. Potential impacts on White-bellied Sea Eagle are hence minimized to acceptable level.

7b.11.1.5 Besides the above marine works, the construction of the Project also involves laying of submarine cables between Shek Kwu Chau and Cheung Sha as well as the construction of a landing portal at Cheung Sha. The benthos communities of the temporarily affected areas are expected to recolonise the seabed areas after the short period of submarine cable laying operation (about 20 working days). In view of the low to moderate ecological value of the subtidal habitats and temporary nature of the impact, the potential impact on subtidal habitat and the associated benthos communities due to submarine cable laying works is considered to be low. Moreover, considering the localized nature of sediment plume and short term duration of the works, as well as the natural adaption of fish, no significant impacts are expected on the potential fish spawning and nursery ground due to the submarine cable laying works. For the construction of Cheung Sha landing portal, considering the small scale of landing portal works, existing turbid condition, and absence of ecological sensitive receiver along the shoreline, with the adoption of good site practice and water quality control measures, potential impact on ecological resources during construction of Cheung Sha portal is considered to be acceptable.

7b.11.1.6 Monitoring programmes for Finless Porpoise, coral colonies, and White-bellied Sea Eagle have also been recommended to assess the effectiveness of the proposed mitigation measures. With the implementation of the recommended mitigation measures and the EM&A programme, adverse ecological impacts due to the construction and operation of the proposed Project would be minimised to acceptable levels.

7b.12 Reference

AFCD (2010a). Breeding Ecology of White-bellied Sea Eagle (*Haliaeetus leucogaster*) in Hong Kong – A review and Update. *Hong Kong Biodiversity – Agriculture, Fisheries and Conservation Department Newsletter,* Issue No. 18, February 2010. Agriculture, Fisheries and Conservation Department, Hong Kong.

AFCD (2010b). Hong Kong Artificial Reef Project. http://www.artificial-reef.net/ (lasted visited on 7 June 2010). Agriculture, Fisheries and Conservation Department, Hong Kong.

AFCD (2010c). Monitoring of Marine Mammals in Hong Kong Waters – Data Collection (2009-2010), Final Report. Agriculture, Fisheries and Conservation Department, Hong Kong.

AFCD (2010d). AFCD's Biodiversity Survey at Shek Kwu Chau in 2010. Agriculture, Fisheries and Conservation Department, Hong Kong.

AFCD (2009a). Monitoring of Marine Mammals in Hong Kong Waters – Data Collection (2008-2009), Final Report. Agriculture, Fisheries and Conservation Department, Hong Kong.

AFCD (2009b). Fisheries: Capture Fisheries. http://www.afcd.gov.hk/english/fisheries/fish_cap/fish_cap_latest/fish_cap_latest.html (last visited on 6 January 2010). Agriculture, Fisheries and Conservation Department, Hong Kong.

AFCD (2009c). AFCD's Biodiversity Survey at Shek Kwu Chau from 2002 to 2009. Agriculture, Fisheries and Conservation Department, Hong Kong.

AFCD (2008). Monitoring of Marine Mammals in Hong Kong Waters – data collection: final report (2007-2008). Agriculture, Fisheries and Conservation Department of Hong Kong SAR Government.

AFCD (2007). *Monitoring of Chinese white dolphins (Sousa chinensis) in Hong Kong waters – data collection: final report (2006-07).* Agriculture, Fisheries and Conservation Department of Hong Kong SAR Government.

AFCD (2006a). The AFCD Biodiversity Database. Agriculture, Fisheries and Conservation Department, Hong Kong.

AFCD (2006). *Monitoring of Chinese white dolphins (Sousa chinensis) in Hong Kong waters – data collection: final report (2005-06).* Agriculture, Fisheries and Conservation Department of Hong Kong SAR Government.

AFCD (2005a). *Monitoring of Chinese white dolphins (Sousa chinensis) in Hong Kong waters – data collection: final report (2004-05*). Agriculture, Fisheries and Conservation Department of Hong Kong SAR Government.

AFCD (2005b). *Monitoring of finless porpoise (Neophocaena phocaenoides) in Hong Kong waters: final report (2003-05).* Agriculture, Fisheries and Conservation Department of Hong Kong SAR Government.

AFCD (2004) *Ecological Status and Revised Species Records of Hong Kong's Scleractinian Corals*. Agriculture, Fisheries and Conservation Department, Hong Kong.

AFCD (2003). *Rare and Precious Plants of Hong Kong*. Agriculture, Fisheries and Conservation Department, Hong Kong.

AFCD (2002a). *Underwater Survey in Coastal Waters of Hong Kong*. Agriculture, Fisheries and Conservation Department, Hong Kong.

AFCD (2002b). *Agreement No. CE 69/2000 Consultancy Study on Marine Benthic Communities in Hong Kong*. Agriculture, Fisheries and Conservation Department, Hong Kong.

AFD (1998). *Fisheries Resources and Fishing Operations in Hong Kong Waters*. Agriculture, Fisheries and Conservation Department, Hong Kong.

Barros, N. B., Jefferson, T. A., & Parsons, E. C. M. (2002). Food habits of finless porpoises (*Neophocaena phocaenoides*) in Hong Kong waters. *Raffles Bulletin of Zoology*, Supplement, 10**:**115-123.

Carey, G.J., Chalmers, M.L., Diskin, D.A., Kennerley, P.R., Leader, P.J., Leven, M.R., Lewthwaite, R.W., Melville, D.S., Turnbill, M. & Young, L. (2001). *The Avifauna of Hong Kong*. Hong Kong Bird Watching Society, Hong Kong.

CED (1998). *Seabed Ecology Studies, Composite Report*. Civil Engineering Department, Hong Kong.

Chan K.F., Cheung K.S., Ho C.Y., Lam F.N., & Tang W.S. (2006a)*. A Field Guide to the Venomous Land Snakes of Hong Kong.* Agriculture, Fisheries and Conservation Department, Hong Kong.

Chan K.F., Cheung K.S., Ho C.Y., Lam F.N., & Tang W.S. (2006b). The Geckos of Hong Kong. *Hong Kong Biodiversity – Agriculture, Fisheries and Conservation Department.* Newsletter, # 13. Agriculture, Fisheries and Conservation Department, Hong Kong.

Chan K.F., Cheung, K.S., Ho, C.Y., Lam, F.N., & Tang, W.S. (2005). *A Field Guide to the Amphibians of Hong Kong*. Agriculture, Fisheries and Conservation Department, Hong Kong.

Chen, D., Zhuang, X., Li, Z., and Lu, W. (1996). Vegetation and biodiversity of Shek Kwu Chau, Hong Kong. Journal of South China Normal University (Nat. Sci.) 1996(2): 68-73.

Chen, Y. (2007). The Ecology and Biology of Amphioxus in Hong Kong. PhD thesis, City University of Hong Kong.

Chiu, H.M.C. & Morton, B. (1999). The distribution of horseshoe crabs (*Tachypleus tridentatus* and *Carcinoscorpius rotundicauda*) in Hong Kong. *Asian Marine Biology* 16: 185 – 196.

CityU (2005). *Tender No. AFD/SQ/58/03 – Establishing threshold tolerance of local corals to sedimentation: Final Executive Summary*. Submitted to Agriculture, Fisheries and Conservation Department. City University of Hong Kong, Hong Kong.

CLP (2006). *EIA 125/2006 Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities, Environmental Impact Assessment Report*. Hong Kong.

CLP (2001). *EIA-065/2001 - 132 KV Supply Circuit from Pui O via Chi Ma Wan Peninsula via Sea Crossing towards Cheung Chau*. Hong Kong.

Dennison, W.C., Barnes, D.J. (1988). Effect of water motion on coral photosynthesis and calcification. *J Exp Mar Biol Ecol.* 115: 67–77.

DSD (2004). Tai Po Sewage Treatment Works Stage V – Final EIA Report. Drainage Services Department, Hong Kong.

DSD (2002). Agreement No. CE 25/2002 (DS) Hong Kong West Drainage Tunnel Drainage Improvement in Northern Hong Kong Island - Environmental Impact Assessment. Drainage Services Department, Hong Kong.

EPD (2009). *Marine Water Quality in Hong Kong in 2008*. Environmental Protection Department, Hong Kong.

EPD (2008). *Marine Water Quality in Hong Kong in 2007*. Environmental Protection Department, Hong Kong.

EPD (2007). *Marine Water Quality in Hong Kong in 2006*. Environmental Protection Department, Hong Kong.

EPD (2006). *Marine Water Quality in Hong Kong in 2005*. Environmental Protection Department, Hong Kong.

EPD (2005). *Marine Water Quality in Hong Kong in 2004*. Environmental Protection Department, Hong Kong.

EPD (2004). *Marine Water Quality in Hong Kong in 2003*. Environmental Protection Department, Hong Kong.

EPD (2006). *20 Years of Marine Water Quality Monitoring in Hong Kong 1986-2005*. Website: http://www.epd.gov.hk/epd/misc/marine_quality/1986-2005/index.html (visited in July 2009). Environmental Protection Department, Hong Kong.

Fellowes, J.R., Lau, M.W.N., Dudgeon, D., Reels, G.T., Ades, G.W.J., Carey, G.J., Chan, B.P.L., Kendrick, R.C., Lee, K.S., Leven, M.R., Wilson, K.D.P. & Yu, Y.T. (2002). Wild animals to watch: Terrestrial and freshwater fauna of conservation concern in Hong Kong. *Memoirs of Hong Kong Natural History Society*, 25: 123-159.

Finelli, C.M., Helmuth B.S.T., Pentcheff N.D., & Wethey D.S. (2006). Water flow influences oxygen transport and photosynthetic efficiency in corals. *Coral Reefs* 25:47–57.

Goold, J. C. & Jefferson, T. A. (2002). Acoustic signals from free-ranging finless porpoises (*Neophocaena phocaenoides*) in the waters around Hong Kong. *Raffles Bulletin of Zoology*, Supplement 10: 131-139.

HKDCS (2009). Finless Porpoise. Website: http://www.hkdcs.org/QnA/HKdolp_fp_en.htm#bm_fpdis (last visited on 6th January 2010). Hong Kong Dolphin Conservation Society, Hong Kong.

HKE (2009). *EIA-177/2009 Development of a 100MW Offshore Wind Farm in Hong Kong*. The Hong Kong Electric Co. Ltd., Hong Kong

HKJC (2007a). *EP-224/2005/A - Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung. Quarterly Environmental Monitoring & Audit (EM&A) Report for July to September 2007*. The Hong Kong Jockey Club, Hong Kong.

HKJC (2007b). *EP-224/2005/A - Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung. Quarterly Environmental Monitoring and Audit (EM&A) Report (Apr to Jun 2007)*. The Hong Kong Jockey Club, Hong Kong.

HKJC (2007c). *EP-224/2005/A - Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung. Quarterly Environmental Monitoring & Audit (EM&A) Report for January to March 2007*. The Hong Kong Jockey Club, Hong Kong.

HKJC (2007d). *EP-224/2005/A - Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung. Quarterly Environmental Monitoring & Audit (EM&A) Report for October to December 2006*. The Hong Kong Jockey Club, Hong Kong.

HKJC (2005). *EIA-112/2005 Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung*. The Hong Kong Jockey Club, Hong Kong.

HKU (1998). Wildlife Windows. *Porcupine*, University of Hong Kong, 17.

HKU (1997). Shek Kwu Chau strikes again. Porcupine, University of Hong Kong, 16: 6.

HKU (1993). Snakes of Shek Kwu Chau. Porcupine, University of Hong Kong , 4: 7.

Hoogenboom, M.O. & Connolly, S.R. (2009). Defining fundamental niche dimensions of corals: Synergistic effects of colony size, light, and flow. *Ecology* 90: 767–780.

Hung, S. K. (2008). *Habitat use of Indo-Pacific humpback dolphins (Sousa chinensis) in Hong Kong*. Ph.D. dissertation. University of Hong Kong, Hong Kong.

HyD (2009a). *EIA-174/2009 Tuen Mun - Chek Lap Kok Link*. Highways Department, Hong Kong.

HyD (2009c). *EIA-172/2009 Hong Kong - Zhuhai - Macao Bridge Hong Kong Link Road*. Highways Department, Hong Kong.

HyD (2009b). *EIA-173/2009 Hong Kong - Zhuhai - Macao Bridge Hong Kong Boundary Crossing Facilities*. Highways Department, Hong Kong.

HyD (2002). *EIA-075/2002 – Improvement to Tung Chung Road between Lung Tseng Tau and Cheung Sha*. Highways Department, Hong Kong.

Hyder Consulting and CES in association with Delft Hydraulics (1999). *Agreement No. CE 42/97, Update on Cumulative Water Quality and Hydrological Effect of Coastal Developments and Upgrading of Assessment Tool*. Report on Calibration and Verification of the Hydrodynamic Model.

IUCN (2009). IUCN Red List of Threatened Species. Version 2009.2. <www.iucnredlist.org>. Downloaded on 28 December 2009.

Jefferson, T. A., Hung, S. K. & Würsig, B. (2009). Protecting small cetaceans from coastal development: impact assessment and mitigation experience in Hong Kong. *Marine Policy*, 33: 305-311.

Jefferson, T. A., Hung, S. K., Law, L., Torey, M. & Tregenza, N. (2002a). Distribution and abundance of finless porpoises in waters of Hong Kong and adjacent areas of China. *Raffles Bulletin of Zoology, Supplement* 10: 43-55.

Jefferson, T. A., Curry, B. E. & Kinoshita, R. (2002b). Mortality and morbidity of Hong Kong finless porpoises, with emphasis on the role of environmental contaminants. *Raffles Bulletin of Zoology* 10: 161-171.

Jefferson, T. A., Robertson, K. M. & Wang, J. Y. (2002c). Growth and reproduction of the finless porpoise in southern China. *Raffles Bulletin of Zoology*, Supplement 10: 105-113.

Jefferson, T. A. (2000). Population biology of the Indo-Pacific hump-backed dolphin in Hong Kong waters. *Wildlife Monographs* 144:1-65.

Karsen, S.J., Lau, W.N., & Bogadek, A. (1998). *Hong Kong Amphibians and Reptiles*, 2nd Edition. The Provisional Urban Council, Hong Kong.

Konsulova, T. (1992). Seasonal Structure and Ecological Status of Varna Bay (Black Sea) Sandy and Muddy Macrozoobenthic Coenoses. *Rapp Com mint Mer Medit* 33: 42.

Lack, D (1965). The Life of the Robin. 4th Edition Collins.

Lam, K.K.Y. (2000). Sexual reproduction of a low-temperature tolerant coral Oulastrea crispate (Scleractinia, Faviidae) in Hong Kong, China. *Marine Ecology Progress Series* vol.205: 101-111.

Lazell, J. (2002) The herpetofauna of Shek Kwu Chau, South China Sea, with description of 2 new colubird snakes. *Memoirs of The Hong Kong Natural History Society*. 25:

Lebbin, D. J., Harvey, M. G., Lenz, T. C., Anderson, M. J., & Ellis, J. M. (2007). Nocturnal migrants foraging at night by artificial light. *Wilson Journal of Ornithology*.

Lo, Y.F. (2005). *Hong Kong Butterflies*, Friends of the Country Park and Cosmos Books Ltd.. Hong Kong.

Lutman, R. (2000). The butterflies of Shek Kwu Chau island, Hong Kong, China. *Lepidoptera News*, 2000(2): 1-11.

Minh, T. B., Watanabe, M., Nakata, H., Tanabe, S. & Jefferson, T. A. (1999). Contamination by persistent organochlorines in small cetaceans from Hong Kong coastal waters. *Marine Pollution Bulletin* 39: 383-392.

Parsons, E. C. M. & Jefferson, T. A. (2000). Post-mortem investigations on stranded dolphins and porpoises from Hong Kong waters. *Journal of Wildlife Disease.* 36: 342-356.

Parsons, E. C. M. & Chan, H. M. (1998). Organochlorines in Indo-Pacific hump-backed dolphins (*Sousa chinensis*) and finless porpoises (*Neophocaena phocaenoides*) from Hong Kong. The Marine Biology of the South China Sea. Proceedings of the Third International Conference on the Marine Biology of the South China Sea, Hong Kong. Page 423-437.

Patterson, M.R. (1991). The effects of flow on polyp-level capture in an octocoral, Alcyonium siderium. *Biological Bulletin* 180: 93–102.

Perry, G., Buchanan, B. W., Fisher, R. N., Salmon, M., & Wise. S. E. (2008). Effects of artificial night lighting on amphibians and reptiles in urban environments. Pages 239 – 256 in: Mitchell, J. C., Jung Brown, R. E., & Bartholomew, B. (editors) – *Urban Herpetology*. Society for the Study of Amphibians and Reptiles, Salt Lake City, UT. Herpetological Conservation Number Three.

Poot, H., B. J. Ens, H. de Vries, M. A. H. Donners, M. R. Wernand, & J. M. Marquenie (2008). Green light for nocturnally migrating birds. *Ecology and Society* 13(2):47. URL: http://www.ecologyandsociety.org/vol13/iss2/art47/

Ramu, K., Kajiwara, N., Lam, P. K. S., Jefferson, T. A., Zhou, K., & Tanabe, S. (2006). Temporal variation and biomagnification of organohalogen compounds in finless porpoises (*Neophocaena phocaenoides*) from the South China Sea. *Environmental Pollution* 144(2):516-523.

Rawson, H. E. A. (1932). Bird's Song in Relation to Light. Trans. Herts Natural History Society, 17.

Reeves, R. R., Smith, B. D., Crespo, E. A., & Notarbartolo di Sciara, G. (2003). *Dolphins, Whales and Porpoises: 2002-2010 Conservation Action Plan for the World's Cetaceans*. IUCN/SSC Cetacean Specialist Group, Gland, Switzerland and Cambridge, UK.

Richardson, W.J., Greene, C.R. Jr., Malme, C.I., & Thomson, D.H. (1995). Marine Mammals and Noise. *Academic Press*, San Diego, CA, USA. 576p.

Rogers, C.S. (1990). Responses of Coral Reefs and Reef Organisms to Sedimentation. *Marine Ecological Progress Series* 62:185-202.

Sebens, K. P., Helmuth B., Carrington E., & Agius B. (2003). Effects of water flow on growth and energetics of the scleractinian coral Agaricia tenuifolia in Belize. *Coral Reefs* 22, Number 1: 35-47.

Shashar, N., Kinane, S., Jokiel, P.L., & Patterson, M.R. (1996). Hydromechanical boundary layers over a coral reef. *Journal of Experimental Marine Biology and Ecology* 199: 17–28.

Shek, C.T. (2006). *A Field Guide to the Terrestrial Mammals of Hong Kong*. Agriculture, Fisheries and Conservation Department, Hong Kong.

Shin, P.K.S., Huang, Z.G., Wu, R.S.S., (2004). An updated baseline of subtropical macrobenthic communities in Hong Kong. *Marine Pollution Bulletin* 49:119-141.

Smale, I. (2005). *Modelled cumulative impacts on the White-bellied Sea-eagle of wind farms across the species' Australian range*. Report for Department of Environment and Heritage, Australia.

Storlazzi, Curt D. Michael E. Field, Andrea S. Ogston, Joshua B. Logan, M. Kathy Presto and Dave G. Gonzales 2004. Coastal Circulation and Sediment Dynamics Along West Maui, Hawaii Part III: Flow and Particulate Dynamics During the 2003 Summer Coral Spawning Season.

Viney C., Phillipps, K., & Lam, C.Y. (2005).*The Birds of Hong Kong and South China*. Information Services Department, Hong Kong.

Wang, W.Y., Chen, B.Z., Yao, L.T., Zhang, H.K., Zhang, Z.L., Qian, X.M., Wang, X.F., Lin, L.Y., Yang, G.L., Wu, Z.P. & Guo, J.H. (1989). A Report of the Amphioxus Resources in Qianpu bay of Xiamen. *Fujian Fisheries* 1: 17-22. (in Chinese).

Wilson, K.D.P., Tam, T.W., Kwan, S.P., Wu, K.Y., Wong, S.F., & Wong, K. (2003a). *Field Guide to the Dragonflies of Hong Kong*. Agriculture, Fisheries and Conservation Department, Hong Kong.

Wilson, K.D.P. (2003b). *Artificial Reefs and Reef Fish in Hong Kong*. Friends of the Country Parks.

Young, J.J. & Vor, Y. (2002). *Butterfly Watching in Hong Kong*. Wan Li Book Co. Ltd. Hong Kong.