

10 Ecological Impact Assessment

10.1 Introduction

10.1.1 Requirements of Environmental Impact Assessment (EIA) Study Brief

10.1.1.1 The EIA Study Brief No.: ESB-303/2017 for the Project issued in October 2017 has stipulated the technical requirements for ecological impact assessment (EcoIA), i.e. Section 3.4.11 and Appendix I of EIA Study Brief. The aim of the ecological impact assessment is to protect, maintain or rehabilitate the natural environment, in particular, to avoid or minimise impacts on recognised sites of conservation importance and other ecologically sensitive areas. The assessment is intended to identify and quantify as far as possible the potential ecological impacts arising from the construction and operational phases of the Project on the natural environment and its associated wildlife and habitats or species.

10.1.2 Assessment Area

10.1.2.1 As stated in Section 3.4.11.2 of ESB-303/2017, the Assessment Area for the purpose of the terrestrial ecological impact assessment shall include areas within 500 metres of the boundary of the Project and the works of the Project as well as any other areas likely to be impacted by the Project. For aquatic ecological impact assessment, the Assessment Area shall be the same as for Water Quality Impact Assessment (**Figure 6.1**).

10.1.3 Key Ecological Issues stipulated in EIA Study Brief

10.1.3.1 Key ecological issues stated in the EIA Study Brief included but were not limited to the following:

Wildlife groups/habitats of conservation interest

- pre-roosting site and/or roosting site of Collared Crow (*Corvus torquatus*) and Black Kite (*Milvus migrans*);
- vertebrates;
- macroinvertebrates; and
- coral communities.

Recognized Site of Conservation Importance in the Assessment Area and its vicinity

- Fung Yuen Valley Site of Special Scientific Interest (SSSI);

- Shuen Wan Egrettry SSSI; and
- Ting Kok SSSI.

10.2 Legislation, Standards and Guidelines

10.2.1 General

10.2.1.1 Ordinances and regulations that are relevant to this Ecological Impact Assessment (EcoIA) include the followings:

- Forests and Countryside Ordinance (Cap. 96) and its subsidiary legislation, the Forestry Regulations;
- Wild Animals Protection Ordinance (Cap. 170);
- Country Parks Ordinance (Cap. 208) and its subsidiary legislation;
- The Marine Parks Ordinance (Cap. 476);
- The Environmental Impact Assessment Ordinance (Cap. 499) and the associated Technical Memorandum (TM-EIAO); and
- The Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586) and its subsidiary legislation.

10.2.1.2 This EcoIA makes reference to the following guidelines and standards:

- Hong Kong Planning Standards and Guidelines (HKPSG) Chapter 10, "Conservation";
- PELB Technical Circular 1/97 / Works Branch Technical Circular 4/97, "Guidelines for Implementing the Policy on Off-site Ecological Mitigation Measures";
- EIAO Guidance Note No. 3/2010 – Flexibility and Enforceability of Mitigation Measures Proposed in an EIA Report;
- EIAO Guidance Note No. 6/2010 - Some Observations on Ecological Assessment from the Environmental Impact Assessment Ordinance Perspective;
- EIAO Guidance Note No. 7/2010 – Ecological Baseline Survey for Ecological Assessment;
- EIAO Guidance Note No. 10/2010 – Methodologies for Terrestrial and Freshwater Ecological Baseline Surveys; and
- EIAO Guidance Note No. 11/2010 – Methodologies for Marine Ecological Baseline Surveys.

10.2.1.3 This EcoIA makes reference to the following Mainland legislation:

- List of State Protected Wild Animals, promulgated by the State Council 國家重點保護野生動物名錄; and
- List of Wild Plants under State Protection 國家重點保護野生植物名錄(第一批).

10.2.1.4 Other international conventions and guidelines that are relevant to this EcoIA include the following:

- Convention on International Trade in Endangered Species of Wild Fauna and Flora ("CITES"). This Convention regulates international trade in animal and plant species considered to be at risk from such trade. Depending on the degree of threat posed by international trade, CITES classifies endangered species of animals and plants into three Appendices. Appendix I includes highly endangered species threatened with extinction. Commercial trade in these species is prohibited. Appendix II includes species which are not presently threatened with extinction but may become so unless trade is controlled. Trade of these species is allowed but is subject to licensing controls. Appendix III species are species identified by any Party to CITES as requiring cooperation in controlling their trade. Their trade is subject to permits or certificates of origin. Hong Kong's obligations under this Convention are enforced via the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586). The CITES authority for Hong Kong SAR is the Department of Agriculture, Fisheries and Conservation (AFCD).
- IUCN. The World Conservation Union maintains, through its Species Survival Commission, a "Red List" of globally threatened species of wild plants and animals (see <http://www.iucnredlist.org>). The Red List is considered the authoritative publication to classify species into nine groups as Extinct (EX) - No individuals remaining; Extinct in the Wild (EW) - Known only to survive in captivity, or as a naturalized population outside its historic range; Critically Endangered (CR) - Extremely high risk of extinction in the wild; Endangered (EN) - Very high risk of extinction in the wild; Vulnerable (VU) - High risk of extinction in the wild; Near Threatened (NT) - Likely to become endangered in the near future; Least Concern (LC) - Lowest risk. Does not qualify for a higher risk category. Widespread and abundant taxa are included in these two categories: Data Deficient (DD) – Knowledge of the species is inadequate to enable assessment its risk of extinction; and Not Evaluated (NE) – Species not yet evaluated against the criteria.
- United Nations Convention on Biological Diversity. This convention requires parties to regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use. It also requires parties to promote the protection of ecosystems, natural habitats and the

maintenance of viable populations of species in natural surroundings. The People's Republic of China (PRC) ratified the Convention on Biological Diversity on 5th January 1993. The HKSAR Government has stated that it is "committed to meeting the environmental objectives" of the Convention (PELB 1996).

- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (the "Ramsar Convention"), which requires parties to conserve and make wise use of wetlands, particularly those supporting waterfowl populations. The PRC ratified the Ramsar Convention on 31st July 1992, and various wetlands have since been listed as wetlands of international importance (i.e. Ramsar sites). One of these, Mai Po Marshes and Inner Deep Bay Ramsar site in Hong Kong SAR, was listed on 4 September 1995.
- Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention), which requires parties to protect listed threatened or endangered migratory species occurring within their boundaries.

10.2.2 Criteria of Evaluating Species of conservation importance

10.2.2.1 Species of flora and fauna with conservation importance were given special attention. In accordance with Table 3, Annex 8 of the TM-EIAO, the ecological value of species was assessed in terms of protection status, distribution, and rarity. For faunal species, the protection status (e.g. fauna protected under Cap. 170 (except birds as all wild birds are protected under the ordinance but their conservation importance is not equal), Cap. 586, and/or regional/global laws/conventions), the species distribution (e.g. endemic), and the rarity (e.g. rare or restricted, or level of concern highlighted in Fellowes *et al.* (2002)) were considered. Similarly, floral species of conservation importance are considered from protection status (e.g. listed under Forestry Regulations and Cap.586 in Hong Kong, listed by IUCN or CITES, or listed as Category I or II protected species in mainland China); species distribution (e.g. endemic); and rarity (e.g. considered rare by AFCD (2003, 2007), Xing *et al.* (2000), Wu and Lee (2000), or Siu (2000)). However, exotic invasive species, escaped cultivars or captive species, vagrants and introduced species are excluded.

10.2.2.2 The following laws/regulations and conventions for conservation were relevant with evaluation of the conservation importance of flora and fauna species.

- Forestry Regulations (Cap. 96A) which are subsidiary legislation of the Forests and Countryside Ordinance (Cap. 96) ;
- Considered 'Rare' or 'Very Rare' plant species listed in in AFCD (2003, 2007), Xing *et al.* (2000), Wu and Lee (2000), or Siu (2000);
- Category I or II protected species in mainland China;

- Wild Animals Protection Ordinance (Cap 170);
- Protection of Endangered Species of Animals and Plants Ordinance (Cap 586);
- PRC Wild Animal Protection Law;
- China Red Data Book of Endangered Animals;
- China Plant Red Data Book;
- China Species Red List;
- The International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species (*Species which are classified by IUCN as Least Concern (LC), Data Deficient (DD), or Not Evaluated (NE), and not covered by any other laws/regulations/conventions are not considered of conservation importance in the present EcoIA.*);
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); and
- Fauna species considered of concern in Fellowes *et al.* (2002).

10.2.2.3 The species identified as having conservation importance are further categorised in accordance with their relevance to potential impacts, which were assessed in accordance with the TM-EIAO criteria.

10.3 Methodology for Baseline Establishment

10.3.1 Literature Review Methodology

10.3.1.1 A baseline review for ecology was conducted. The relevant literature was reviewed and information was extracted to establish a preliminary ecological baseline for the Assessment Area.

10.3.2 Ecological Field Survey Methodology

10.3.2.1 Ecological field surveys were carried out to verify the ecological profile established from literature review, update baseline information, and fill identified information gaps. Information generated by these surveys facilitated the ecological characterisation of the Assessment Area and informed the ecological assessment presented here.

10.3.2.2 According to 2(iii) of Appendix I of the EIA Study Brief, ecological field surveys should be carried out with a duration of at least 6 months covering both wet and dry seasons. Investigations should be carried out to verify the information collected and to fill in the information gaps as identified during literature review. The ecological survey programme covered terrestrial, aquatic, intertidal and marine habitats. It originally spanned nine-months (from May 2017 to January 2018) and covered both wet and dry seasons (**Table 10.3.1**). The programme was then extended till July 2018 to collect additional data on bird roosting usage,

and thus a total of 15 months was covered by the ecological survey programme.

10.3.2.3 The methodology of the ecological surveys made reference to the relevant government Guidance Notes (GN 7/2010, GN 10/2010 and GN 11/2010). Sampling locations for terrestrial, aquatic and marine fauna are shown in **Figure 10.1a**.

10.3.3 Terrestrial Survey

Habitat and Vegetation Survey

10.3.3.1 Habitats within the Assessment Area were mapped based on the latest government aerial photos combined with field ground-truthing. Representative areas of each habitat type were surveyed on foot. Plant species of each habitat type encountered and their relative abundance were recorded with special attention to rare or protected species. Nomenclature and conservation status of plant species follows Xing *et al.* (2000), Wu and Lee (2000) and Siu (2000).

Mammals

10.3.3.2 Mammal surveys (including day and night-time surveys) were carried out with the survey transects covered representative habitats within the Assessment Area. Surveyors searched for and recorded sightings, tracks, and signs of mammals (including droppings) along the survey transects. Night surveys were conducted to survey nocturnal mammal species (e.g., bats). Nomenclature for mammals followed Shek (2006).

Avifauna

10.3.3.3 The avifauna of representative habitats within the Assessment Area was surveyed using transect count method. The presence and abundance of avifauna species at various habitats observed from survey transects were recorded visually and aurally. Bird species encountered outside survey transects but within the Assessment Area were also recorded. Behaviours related to breeding (e.g., nest building) observed during the surveys were also recorded. Night surveys were conducted to record nocturnal avifauna (e.g., owls). The location(s) of any encountered avifauna species of conservation importance were recorded, along with any notable behaviours. Ornithological nomenclature in this study follows Hong Kong Bird Watching Society List of Hong Kong Birds 2017.

10.3.3.4 Collared Crow Pre-Roost/Roost Survey: Besides the regular avifauna survey, specific surveys to record the pre-roost and roost locations as well as the abundance of Collared Crow were conducted for this ecological impact assessment. Surveys of pre-roost and roost locations of Collared Crow were conducted at least twice per month between August 2017 and July 2018 (i.e. 12 months). Surveys of both pre-roost and final roost sites were carried out before sunset of that day (reference made to the Hong Kong Observatory), and continued after sunset until the light condition was not sufficient for counting birds. Observations

were made from the selected vantage points which could cover the Project Site as well as most areas within the 500m Assessment Area (**Figure 10.1b**). Compared with other possible survey points such as the existing driving range, the selected vantage points at higher level of Lo Fai Road provided wider view for the surveyors and facilitated simultaneous observations on areas both outside and inside the Project Site. Observations were made with binoculars and spotting scope, and photos were taken where possible. Number of Collared Crows at both pre-roost location(s) and final roost(s) were counted and recorded. Locations of pre-roost(s) and final roost(s) were determined by their relative locations with existing land features such as the flood light poles and then marked on maps.

10.3.3.5 Black Kite Pre-Roost/Roost Survey: Surveys of pre-roost/roost of Black Kite were conducted at least twice per month between October 2017 and April 2018 (i.e. 7 months). Surveys of both pre-roost and final roost were carried out before sunset of that day (reference made to the Hong Kong Observatory), and continued after sunset until the light condition was not sufficient for counting birds. Observations were made from vantage points, survey point at Tai Po Waterfront Park pier and vessel near the eastern boundary of the Project Site (**Figure 10.1c**). Observations were made with binoculars and spotting scope at the vantage points and with binoculars at the pier and vessel observation points. Photos were taken where possible. Numbers of Black Kite at both pre-roost location(s) and final roost(s) were counted and recorded. Locations of pre-roost(s) and final roost(s) were determined by their relative locations with existing land features and then marked on maps.

Herpetofauna

10.3.3.6 Herpetofauna surveys (including day and night surveys) were carried out using transect count method. The survey transects covered representative habitats within the Assessment Area. Particular attention was given to streams/watercourses. Herpetofauna surveys were conducted through direct observation and active searching in all potential hiding places such as among leaf litter, inside holes, under stones and logs along the survey transects within the Assessment Area. During the surveys, all reptiles and amphibians sighted and heard were recorded. Auditory detection of species-specific calls was used to survey frogs and toads during night surveys. The nomenclature and conservation status followed Karen *et al.* (1998) and Chan *et al.* (2005, 2006a, 2006b).

Dragonfly and Butterfly

10.3.3.7 Dragonfly and butterfly surveys were conducted by transect survey. All encountered dragonflies and butterflies were recorded by species by direct observation with binoculars and their abundance was recorded. The nomenclature and conservation status for butterflies and odonates in this report follows Chan *et al.* (2011) and Tam *et al.* (2010) respectively.

Freshwater Communities

10.3.3.8 No natural watercourse is located within the Project Site. Surveys of freshwater communities were undertaken at selected streams/watercourses (either natural or man-made) within the 500 m Assessment Area by means of one or a combination of the following techniques: bank side observation; active searching with fish hand nets; and fish capturing using fish cages. All freshwater fauna found were identified to the lowest possible taxonomic level and their abundance was recorded. The nomenclature used for fish in this assessment follows Lee *et al.* (2004).

10.3.4 Marine and Intertidal Survey

Intertidal Communities

10.3.4.1 Intertidal surveys consisted of qualitative walk-through surveys along the coastlines where accessible (both natural and artificial), and quantitative transect surveys at selected locations (see **Figure 10.1a**). The objective was to produce comprehensive species lists for the survey areas. The conservation status at local, regional and international scales was listed for all recorded biota.

10.3.4.2 Intertidal surveys covered both wet and dry seasons. Local tide tables were checked to assess tidal height at the site and to schedule timing of surveys.

10.3.4.3 For qualitative walk-through surveys, organisms encountered were recorded and their relative abundance was noted.

10.3.4.4 For quantitative transect surveys, at each survey location, one 50 m horizontal transect along the coastline was surveyed at each of the three tidal levels: 2.0 m (high), 1.5 m (middle) and 1.0 m (low) above Chart Datum (CD). On each transect, five quadrats (50 cm × 50 cm) were placed randomly to assess the abundance and diversity of flora and fauna. All organisms found in each quadrat were identified and recorded to the lowest possible taxonomic level to allow density to be calculated. Sessile species, such as algae (encrusting, foliose and filamentous), barnacles and oysters, in each quadrat were identified to the lowest possible taxonomic level and estimated as percentage cover on the substrate surface. In addition, where transect locations were on soft shore, all organisms found in the top 50 cm × 50 cm × 5 cm layer (length x width x depth) of the substrate were identified to the lowest possible taxonomic level and recorded.

Benthic Communities

10.3.4.5 Benthic sediment samples were collected from sampling sites in the subtidal soft-bottom habitats near the Project Site. At each survey site, three grab samples were collected. Survey sites were sampled using a grab sampler of 0.1 m² and 15 cm biting depth. Each grab sample collected was photographed and its conditions and physical characteristics were documented. Sediments from the grab samples

were sieved on board the survey vessel, washed onto a sieve stack (comprising 1 mm and 500 µm meshes) and gently rinsed with seawater to remove all fine material. Following rinsing, any materials remaining on the two sieves were combined and carefully rinsed using a minimal volume of seawater into pre-labelled thick triple-bagged zip-lock plastic bags. A 5% solution formalin containing Rose Bengal in seawater was added to the bag to ensure tissue preservation. Care was taken to ensure the concentration of solution was not adversely diluted through rinsing into the bags. Samples were sealed in plastic containers for transfer to the laboratory for sorting and identification.

10.3.4.6 Before sorting, the samples were held in formalin for a minimum of 24 hours to ensure adequate fixation of the organisms. Individual samples were gently rinsed with fresh water into a 250 µm sieve to remove the formalin from the sediments. Sieves were partially filled while rinsing a specific sample to maximize washing efficiency and prevent loss of material. All materials retained on the sieve were placed in labelled plastic jars, covered with 70% ethanol, and lightly agitated to ensure complete mixing of the alcohol with the sediments. Original labels were retained with the rescreened sample material.

10.3.4.7 Standard and accepted techniques were used for sorting organisms from the sediments. Small fractions of a sample were placed in a petri dish under a 10-power magnification dissecting microscope and scanned systematically with all animals and fragments removed using forceps. Each petri dish was sorted at least twice to ensure removal of all animals. Organisms were kept into separated, labelled vials containing 70% ethanol.

10.3.4.8 Taxonomic identification was performed using stereo dissecting and high-power compound microscopes. Taxa, were identified to the lowest practicable level. The careful sampling procedure minimized fragmentation of organisms. If breakage of soft-bodied organisms occurred, only the anterior portions or parts of individuals were counted, although all fragments were retained and weighed for biomass determinations (wet weight).

10.3.4.9 Species and abundance of biota in the samples were reported. Diversity and evenness indices were calculated for evaluation and ranking of ecological values.

Coral Communities

10.3.4.10 Dive surveys were conducted for corals and other hard substrate marine organisms. Two types of subtidal dive survey were carried out, including: Spot dive checks; and Rapid Ecological Assessment (REA) survey.

10.3.4.11 Locations for spot dive checks covered areas along the shoreline within and in close proximity to the Project Site. At each survey location, a spot dive reconnaissance check was conducted. The substrate type, associated sessile benthos, particularly the presence of coral

communities (including all hard corals, octocorals and black corals) was recorded. Representative photographs of the seabed and associated fauna were taken, where visibility was adequate. Photographs were taken using a suitable camera.

10.3.4.12 When corals were found in the spot dive checks, Rapid Ecological Assessment was conducted. At each REA survey location, a dive was conducted along a 50 to 100 m transect (subject to underwater visibility), and the substrate type, associated sessile benthos, particularly the presence of coral communities (including all hard corals, octocorals and black corals) as well as their locations and abundance were recorded. This standardized REA survey technique was also used to obtain semi-quantitative data on benthic communities. Representative photographs of the seabed and associated fauna were taken where visibility was adequate.

10.3.4.13 The ecological importance of the habitats was evaluated in accordance with the criteria stipulated in Annex 8 of TM-EIAO. In accordance with Table 3, Annex 8 of the TM-EIAO, the ecological value of recorded species was assessed in terms of protection status (e.g. fauna protected under WAPO (except birds), and flora and fauna protected under regional/global legislation/conventions), species distribution (e.g. endemic), and rarity (e.g. rare or restricted). The potential impacts arising from the proposed development were evaluated and mitigation measures were recommended

10.3.5 Survey Programme

10.3.5.1 The ecological survey programme is shown in **Table 10.3.1**.

Table 10.3.1 Ecological Survey Programme

Year	2017								2018						
	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Season	wet						dry			Wet					
Item															
Ecological Baseline Survey															
Literature Review															
<i>Habitat and Vegetation Survey</i>															
Habitat Mapping															
Vegetation survey															
<i>Terrestrial Fauna Survey</i>															
Bird survey															
Collared Crow Pre-Roost/Roost Survey															
Black Kite Pre-Roost/Roost Survey															
Mammal survey															

Year	2017								2018						
Month	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Season	wet							dry			Wet				
Item															
Herpetofauna (reptile and amphibian survey)															
Dragonfly and Butterfly survey															
Night Survey for terrestrial fauna															
Aquatic fauna survey															
Marine Fauna Survey															
Intertidal Survey															
Subtidal Coral Survey - Spot Dive survey															
Subtidal Coral Survey - REA survey															
Benthos Survey															

10.4 Ecological Baseline Conditions

10.4.1 General descriptions of the Project Site and Assessment Area

10.4.1.1 The Project Site is located at the Shuen Wan Restored Landfill with Tai Po Industrial Estate (TPIE) to the west, Ting Kok Road to the north, Fortune Garden to the northeast, and Tolo Harbour to the east and the south. The Project is land-based and there will not be any marine works. The Project will not encroach onto intertidal or marine habitats during both construction and operational phases.

10.4.1.2 The Project Site was previously a landfill (i.e. the Shuen Wan Landfill) which commenced and ceased its operation in 1973 and 1995 respectively. Subsequent to the closure of the landfill, restoration works were implemented and the restored landfill was converted to a golf driving range (i.e. the existing “Golf Park Golf Driving Range”) for public use since 1999. Currently, the Project Site is mainly composed of turf grass that is maintained for recreational purposes and restoration planting dominated by exotic species and landscape trees including *Acacia confusa*, *Casuarina equisetifolia*, *Ficus microcarpa*, and *Bauhinia* sp. of about 20 years in age.

10.4.1.3 According to Tai Po OZP S/TP/28, the Project Site is zoned as “Other Specified Uses (Golf Course)”. Hence, the primary objective of the

Project is to implement the prevailing land use zoning as stipulated in the relevant OZP.

10.4.1.4 The western part of Assessment Area is the Tai Po Industrial Estate which is a built-up area. The key ecological resources within or near the Assessment Area include a number of sites and species of conservation importance that were identified from the literature and are described below.

10.4.2 Recognised Sites of Conservation Importance

10.4.2.1 No recognised site of conservation importance was found within the 500m Assessment Area.

10.4.2.2 There are six SSSIs in Tai Po and Ting Kok areas including Fung Yuen SSSI, Shuen Wan Egretty SSSI, Ting Kok SSSI, Sha Lo Tung SSSI, Yim Tin Tsai and Ma Shi Chau SSSI, and Centre Island SSSI. The first two are located about 1km from the Project Site while others are at least 1.5 km from the Project Site.

10.4.2.3 Fung Yuen SSSI was designated in 1980 because the forested ravine of about 42.8 ha behind Fung Yuen Village supports rare and/or protected plants such as *Illigera Illigera celebica* and also provides an important breeding site for some uncommon butterflies such as White Dragontail *Lamproptera curius*, Common Birdwing *Troides helena* and Common Rose *Pachliopta aristolochiae*. A Fung Yuen Butterfly Reserve (2ha) has been managed by the Tai Po Environmental Association under the Management Agreement Scheme since November 2005.

10.4.2.4 Shuen Wan Egretty SSSI was designated in 1994. The site is a small *fung shui* wood behind the villages of Shuen Wan Tsim Uk and Shun Wan Lei Uk, covering an area about 2.1 ha. The site was once used for nesting by Little Egrets *Egretta garzetta*, Great Egrets *Ardea alba*, Eastern Cattle Egrets *Bubulcus coromandus*, Black-crowned Night Herons *Nycticorax nycticorax* and Chinese Pond Heron *Ardeola bacchus* (Young and Cha 1995). More than 300 nests were recorded in 1993 (*ibid.*). Nesting ceased after 1995, and resumed in 2005, but the nesting population (3 nests in 2007, 2 nests in 2008, 3 nests in 2009) (Anon. 2007, 2008) was much smaller than those recorded in the 1990's and the egretty was abandoned again since 2010.

10.4.2.5 Ting Kok SSSI covers an area of about 37.5 ha along the coastal area near Ting Kok Village, Tai Po and was designated in 1985. It is a mangrove habitat consisting of *Kandelia obovata*, *Aegiceras corniculatum*, *Lumnitzera racemosa*, *Avicennia marina* and *Bruguiera gymnorrhiza* and is typical example of mangrove habitat suitable for field studies.

10.4.2.6 Sha Lo Tung SSSI was designated in January 1997 covering a total of about 22 hectares, to conserve the streamcourses and the freshwater marsh in the north-eastern portion of the Sha Lo Tung area, which are of special scientific interest. Under the draft Sha Lo Tung Outline

Zoning Plan (OZP) approved in 2002, the streamcourses and a 30m wide buffer area on both sides of the streamcourses are also zoned as "Site of Special Scientific Interest" ("SSSI").

10.4.2.7 The Yim Tin Tsai and Ma Shi Chau SSSI was designated since September 1982 mainly for geological interest with about 50 hectares in area size, and covering the eastern tip of Yim Tin Tsai, the whole island of Ma Shi Chau, and the tombolo connecting them. Yim Tin Tsai and its surrounding area contain the best exposed, densest swarm of dyke varied from 3 to 20m wide. Yim Tin Tsai also contains unconformable contact of Tolo Harbour Formation with volcanic tuff of the Yim Tin Tsai Formation.

10.4.2.8 The whole Centre Island was designated as SSSI in 1982. The island is also of geological interest. It contains land fossils of Permian Age, and geologically linked to Ma Shi Chau and contains the oldest rock formation known in Hong Kong.

10.4.2.9 Due to the nature of the Project and large separation distance of these recognised sites of conservation importance from the Project Site, adverse impacts are unlikely. Literature review and desktop assessment were considered adequate to assess whether these sites will be affected by the Project.

10.4.3 Habitats and Wildlife Groups of Conservation Interest

10.4.3.1 No habitats of conservation importance are identified neither within the Project Site nor in the Assessment Area.

10.4.3.2 The Project Site is a restored landfill, and plantation for restoration purposes currently covers a large portion of the Project Site, other than the turf areas maintained as golf driving range. A tree survey conducted at the Project Site in 2011 identified 49 tree species (Earthasia 2013). Dominant species were *Acacia confusa*, *Casuarina equisetifolia*, *Ficus microcarpa*, *Leucaena leucocephala*, *Acacia auriculiformis*, and *Bauhinia* sp. Most are exotic plantation trees and landscape trees with some pioneer natives. Most of the trees recorded on the Project Site were in fair to poor condition. No species of conservation importance were recorded.

10.4.3.3 Collared Crow *Corvus torquatus* is an uncommon and localised resident in Hong Kong. It is ranked as vulnerable by IUCN Red List (IUCN 2019). This bird is seen on rocky and sandy shores, mudflats, *gei wais*, and fish ponds in Hong Kong, and seldom recorded away from coastal areas (Carey *et al.* 2001). Collared Crow occasionally concentrates at areas with scavenging opportunities provided by man (*ibid.*).

10.4.3.4 According to the previous population estimation made by BirdLife International in 2007, the population of this species in China declined greatly during the last few decades (Leader *et al.* 2016). It was postulated that the major change in agricultural practices, including loss

of food supply owing to agricultural intensification and the associated over-use of pesticides in the 1950s was the major factor leading to the decline. Hong Kong supported the second greatest proportion (20%) of the population in China (*ibid.*). There are two major areas of this species in Hong Kong, which are Deep Bay and Tolo Harbour (Stanton 2017). Observations of Collared Crow outside Deep Bay and Tolo Harbour seldom exceeded five individuals of birds (*ibid.*).

10.4.3.5 Communal roosting behavior of corvids is well known. Birds usually congregate during early evening hours at locations known as pre-roosting sites that are located near final roost sites. Communal roost sites were identified in two locations in Hong Kong, including Mai Po Nature Reserve and Shuen Wan (Stanton *et al.* 2014). The roosting behaviour at Mai Po Nature Reserve was studied between 2004 and 2013. The final roost was located in dense stands of mangrove trees, probably *Kandelia obovata*, outside the immigration fence. Number of roosting birds ranged from 31 (Feb 2005) to 167 birds (Jul 2013), and was higher in summer than in winter.

10.4.3.6 Shuen Wan is known to be a pre-roosting and roost site of this species. Different from the study at Mai Po Nature Reserve, counts of roosting birds at Shuen Wan were mainly based on anecdotal observations (**Table 10.4.1**). The population of Collared Crow roosted in Shuen Wan seems to have only regularly used the Project Site for about a decade as records at “Shuen Wan Landfill” were mostly reported after 2010. Roosting was also observed in locations near the “Shuen Wan Landfill”, including Sha Lan (77 birds in Aug 2006), Yim Tin Tsai (18 birds in Oct 2006 and 42 birds in Oct 2008).

Table 10.4.1. Counts of Collared Crow at “Shuen Wan” (data source: Hong Kong Bird Report)

Year	Peak Count
1997	36 (Jul), 25(Oct)
1998	28 (Jul), 20 (Sep)
1999	62 (Jul)*
2000	Regularly recorded
2001	17 (May), 19 (Sep)
2002	16 (Oct), 13 (Dec)
2003	Small numbers
2004	Small numbers (< 6 birds)
2005	18 (Nov)
2006	nil
2007	Present
2008	Present
2009	nil
2010	nil
2011	71 (April)*
2012	nil
2013	nil
2014	117 (June)*
2015	94 (June)*

* specified as “Shuen Wan Landfill”

- 10.4.3.7** The local population of Collared Crow seems to be largely comprised of floating non-breeding birds (Carey *et al.* 2001, Leader *et al.* 2016). The breeding population of Collared Crow is largely restricted to the Deep Bay area (Carey *et al.* 2001). According to the anecdotal records, courtship and nest-building of Collared Crow mainly take place from mid-November to December, with young in the nest during February and young fledgings sighted in late March. Nests are usually well hidden in dense woody vegetation, including *fung shui* woodland, intertidal mangal or plantation woodland (Stanton 2017).
- 10.4.3.8** Black Kite *Milvus migrans* is the commonest raptor species in Hong Kong. This species occurs in many types of habitats (including urban areas) in Hong Kong and is far more numerous in winter (Carey *et al.* 2001). Numbers of Black Kite in Hong Kong usually peak in December and January (*ibid.*). Birds observed in Hong Kong during autumn, winter, and spring seasons probably include migrants (*ibid.*).
- 10.4.3.9** Black Kite has been known for many decades to roost colonially (Hutson 1930). No mention of Black Kite utilisation of pre-roosting sites was, however, discovered in reviewed literature (Hutson 1930, Humphreys 1960, Bovey 1972, Webb 1972, Melville 1976, Carey 1996). According to the survey observations reported in Carey (1996), Black Kites mainly roosted in Magazine Gap and on what was in 1996 Stonecutters Island. Night roosts were also identified in other areas, including Tai O, Ma Wan and Ma Lam Wat (*ibid.*). Large numbers are known to roost regularly in Magazine Gap, Stonecutters and Yeung Chau in Sai Kung in recent years. The tree species used as roosts at Yeung Chau included *Hibiscus tiliaceus* and *Acacia auriculiformis*. Though mentioned in Section 2(v)(a) of the Appendix I of the EIA Study Brief, there was no record from the reviewed literature that Shuen Wan is a night roosting site for Black Kite. Only day roost in Shuen Wan was mentioned in the reviewed literature (Carey *et al.* 2001). A roosting population was recorded at Yim Tin Tsai Island near Shuen Wan infrequently (23 birds on 1 Oct 2005; 70 birds on 18 Sep 2007 and 74-78 birds on 16 Feb 2008).
- 10.4.3.10** Scattered coral colonies were reported within Tolo Harbour and Tolo Channel, while one species of hard coral *Oulastrea crispata* was previously recorded on the coastline of the current Project Site and the adjacent Tai Po Industrial Estate (AECOM 2009). This species is commonly found in Hong Kong waters especially in turbid water.
- 10.4.3.11** Five seahorses *Hippocampus kuda* were recorded at the coasts of Tai Po Industrial Estate (AECOM 2009). *H. kuda* is still found in reasonable numbers in Hong Kong's eastern waters. It is categorized as "Vulnerable" in the IUCN Red List due to a globally declining population trend (IUCN 2019). All *Hippocampus* species are listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and hence are protected under Cap. 586.

10.4.4 Terrestrial Ecological Survey Results

Habitat Survey

10.4.4.1 Habitats within the Assessment Area were secondary woodland, plantation, grassland, turfgrass, cultivated land, developed areas, watercourse, rocky shore, sandy shore, seawall, and marine waters (**Figure 10.3, Table 10.4.2**). Photos of habitats and plant species of conservation importance are presented in **Figure 10.4**)

10.4.4.2 A total of 299 plant species were recorded within the Assessment Area, 165 of which were natives (**Appendix 10.1**). Two species of conservation importance, *Aquilaria sinensis* and *Cleisostoma simondii* var. *guangdongense* were recorded. *A. sinensis* was recorded in plantation on the Project Site while *C. simondii* var. *guangdongense* was recorded in secondary woodland outside the Project Site (**Figure 10.3**).

10.4.4.3 The Project Site is a restored landfill mainly comprised of man-made habitats including restoration planting dominated by exotic species and landscape trees including *Acacia confusa*, *Casuarina equisetifolia*, *Ficus microcarpa*, and *Bauhinia* sp. about 20 years of age and turfgrass that is maintained for recreational purposes.

Table 10.4.2 Habitats recorded within the Assessment Area

Habitat	Size (ha)	Percentage (%)	Size (ha)
	Assessment Area		Project Site
Secondary woodland	19.20	6.59	-
Plantation	65.78	22.57	31.38
Grassland	3.77	1.29	2.99
Turfgrass	14.36	4.93	14.36
Cultivated Land	6.30	2.16	-
Developed Area	89.91	30.86	4.15
Watercourse	0.12 (0.62 km)	0.04	-
Rocky Shore	0.12 (0.18 km)	0.04	-
Sandy Shore	0.37 (0.39 km)	0.13	-
Seawall	1.00 (1.6 km)	0.34	0.49 (0.9km)
Marine Waters	90.46	31.04	-
Total	291.39	100	53.37

(A) Secondary Woodland

10.4.4.4 Secondary woodland was located on hillsides outside the Project Site, succeeded from shrubland/grassland which survived hillfire from grave sites. Most of the secondary woodland stands were young with canopy heights ranging from 6 to 10 m and some trees were heavily covered with climbers. More mature trees were recorded in secondary woodlands near villages and on foothills. Secondary woodland was composed of a mixture of both exotic and native plant species. Species commonly recorded included *Alangium chinense*, *Ficus hispida*,

Mallotus paniculatus, *Schefflera heptaphylla*, *Aporosa dioica*, *Rhus succedanea*, *Bauhinia championii*, *Mikania micrantha* and *Alocasia macrorrhizos*. A plant species of conservation importance, *Cleisostoma simondii* var. *guangdongense* was recorded at the woodland edge near Ha Hang Village. It is an epiphytic orchid commonly found in Hong Kong. The family Orchidaceae is protected under both Forestry Regulations (Cap. 96A) and Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586).

(B) Plantation

10.4.4.5 Plantation was one of the dominant terrestrial habitats within the Assessment Area. It was recorded on slopes of the Project Site and also on hillsides along Ting Kok Road, Lo Fai Road and at the fringes of residential areas further uphill. Exotic trees including *Acacia* spp., *Eucalyptus* spp., *Casuarina equisetifolia*, and *Lophostemon confertus* of 8-15m heights were commonly recorded in the canopy. Other species recorded in the canopy and understorey included *Ficus microcarpa*, *Mallotus paniculatus*, *Bauhinia* spp., *Wedelia trilobata*, *Ligustrum sinensis*, and *Dicranopteris pedata*. Two young trees of *Aquilaria sinensis* were recorded in this habitat within the Project Site during the tree surveys for the present study.

10.4.4.6 *Aquilaria sinensis* is protected under Cap. 586 in Hong Kong and is rather common in lowland forest and fung shui woods, although many mature trees were felled or damaged illegally for collection of resin. It is also a Category II nationally protected species in China and is listed as vulnerable in the China Plant Red Data Book and by IUCN (2019).

(C) Grassland

10.4.4.7 Scattered patches of grassland were recorded mainly along roads of the driving range and on engineered slopes in the Assessment Area. Grasslands were mainly composed of ruderal species including *Bidens alba*, *Wedelia trilobata*, *Imperata cylindrica*, and *Kyllinga polyphylla* with scattered exotic trees including *Leucaena leucocephala*, *Livistona chinensis*, and *Acacia auriculiformis*.

(D) Turfgrass

10.4.4.8 Turfgrass was recorded on the driving range within the Project Site. Grass species including *Axonopus compressus* and *Paspalum* spp. were commonly recorded. The fringe of turfgrass was colonised by a variety of herb and weedy species including *Bidens alba*, *Mimosa pudica*, *Kyllinga polyphylla* and *Imperata cylindrica*.

(E) Cultivated Land

10.4.4.9 Both active and abandoned cultivated lands were recorded near Ha Hang Village and in the valley between Ha Hang Village and Lo Fai Road, all beyond the Project Site. Abandoned fields were covered with grasses and weedy species including *Brachiaria mutica*, *Microstegium*

ciliatum and *Pueraria lobata* var. *thomsonii*. Fruit trees, including *Musa x paradisiaca*, *Carica papaya*, and *Dimocarpus longan*, and landscape trees *Osmanthus fragrans* and *Michelia x alba* were recorded. Vegetables such as *Brassica* spp. were recorded in active cultivated lands.

(F) Developed Area

10.4.4.10 TPIE, villages, residential area, roads and build-up area within the existing driving range constituted Developed Area. Plant species recorded were mainly common landscape and roadside trees as well as ruderal species.

(G) Watercourses

10.4.4.11 There was no watercourse inside the Project Site. Two minor watercourses were recorded north of Ting Kok Road near Ha Hang Village. The upper sections of the watercourses were modified for irrigation where weirs and concrete and grassy banks were observed. Plant species included *Brachiaria mutica*, *Panicum maximum*, *Microstegium ciliatum* and *Ludwigia perennis*. The lower sections of the watercourses were channelled along footpaths/village houses and modified to flow into underground culverts below Ting Kok Road before discharging into Tolo Harbour.

(H) Rocky Shore

10.4.4.12 A small portion of coastline immediately to the east of the Project Site was covered by rocky shore. A few common native trees and shrubs including *Rhus succedanea*, *Scolopia chinensis* and *Clerodendrum inerme* were recorded.

(I) Sandy Shore

10.4.4.13 A small sandy beach was recorded in front of Fortune Garden. A few plant species including both exotic and native trees such as *Casuarina equisetifolia*, *Lantana camara*, *Panicum maximum* and *Hibiscus tiliaceus* were recorded at the backshore.

(J) Seawall

10.4.4.14 The coastlines along Tai Po Waterfront Park within the Assessment Area and along the Project Site were modified to seawall, mostly in rip-rap from. Little vegetation was recorded on the rocky surface with the exception of weeds, herbs, climbers and some young trees in the crevices.

Terrestrial Survey

(A) Mammals

- 10.4.4.15** Two non-volant mammal species were recorded within the Project Site (**Appendix 10.2**) and none of them is considered of conservation importance. Due to isolation by marine waters, TPIE, and roadways, utilization of habitats within the Project Site by medium-sized mammal is expected to be low.
- 10.4.4.16** A few Leschenault's Rousette and Japanese Pipistrelle were observed in plantation within and outside the Project Site. All bats are protected under WAPO in Hong Kong.
- 10.4.4.17** Six species of mammal were recorded in the Assessment Area (excluding Project Site) (**Appendix 10.2**). All are common and widely distributed in Hong Kong. Apart from Leschenault's Rousette *Rousettus leschenaultii* and Japanese Pipistrelle, none of the recorded species is considered of conservation importance.

(B) Avifauna

- 10.4.4.18** Forty-three bird species were recorded within the Project Site (**Appendix 10.3a**). Most of the recorded species are common and widely distributed in Hong Kong. Both species richness and abundance of birds on the Project Site were ranked as low.
- 10.4.4.19** Fifty-seven bird species were recorded in the Assessment Area (excluding Project Site) (**Appendix 10.3a**). Both species richness and abundance of birds were low in plantation, and very low in other types of habitats in the Assessment Area.
- 10.4.4.20** Sixteen species recorded during the surveys are considered to be of conservation importance. These were Black-crowned Night Heron, Chinese Pond Heron, Eastern Cattle Egret, Great Egret, Little Egret, Grey Heron *Ardea cinerea*, Crested Goshawk *Accipiter trivirgatus*, Black Kite, Eastern Buzzard *Buteo japonicas*, Common Kestrel *Falco tinnunculus*, Eurasian Hobby *Falco Subbuteo*, Greater Coucal *Centropus sinensis*, Grey-chinned Minivet *Pericrocotus solaris*, Collared Crow, Rufous-capped Babbler *Stachyridopsis ruficeps* and Chinese Hwamei *Garrulax canorus*. Seven bird species of conservation importance were recorded on the Project Site. Apart from Collared Crow and Black Kite, the bird species of conservation importance were present in low abundance on the Project Site.

Pre-Roosting/Roosting Site of Collared Crow

- 10.4.4.21** A total of 28 night roost surveys for Collared Crow were conducted between August 2017 and July 2018 (see **Appendix 10.3b**). Pre-roost behavior was observed and the number of birds in pre-roost locations and final roost locations were recorded separately. There were a total of 1,057 individuals and 1,734 individuals recorded from all the surveys in the pre-roost locations and final roost locations respectively.

10.4.4.22 Pre-roost behaviour: Pre-roosts of Collared Crow were observed within and outside the Project Site. Collared Crow usually congregated at pre-roosts about 15-30 minutes before sunset (as recorded by Hong Kong Observatory). Roof tops of buildings in the Tai Po Sewage Treatment Works (TPSTW) (outside the Project Site) were the major pre-roost sites. Basically if there were pre-roost behaviour recorded in the surveys, TPSTW would be one of the locations (and sometimes the only location) used by Collared Crow individuals. Pre-roosting was recorded only once in plantation to the north of the Project Site. Within the Project Site, plantation at the southwest corner and the turfgrass area of the driving range were occasionally used as pre-roosts.

10.4.4.23 Abundance in Pre-roost: The number of Collared Crows in the pre-roosts was lower than that in the final roost on most occasions. Some Collared Crows were observed flying from locations outside the Assessment Area and landed directly on the final roosts. In some of the surveys (e.g. surveys in December 2017 and January 2018), the numbers of birds recorded at the pre-roost were much lower than the numbers recorded in other surveys. Besides, there were occasions from April 2018 to June 2018 that no pre-roost individual was observed but the final roost numbers were still similar with those in other survey dates. All these indicated that usually most birds would use a nearby pre-roost site before flying to the final roost, but occasionally a large portion of the birds would fly directly to the final roosts instead.

10.4.4.24 Final roost behaviour of Collared Crow: Collared Crows mainly utilised plantation in the Project Site as a night roost. The birds usually took off from pre-roosts and flew to final roosts around sunset. The locations of the pre-roost sites and final roost sites observed in each survey were presented on map shown in **Figure 10.5a-c**. Locations of Collared Crow final night roosts were found not fixed but shifting from day to day during the surveys. Collared Crows were observed roosting in different locations of the plantation, from the southern end of the Project Site, the southeast corner of the Project Site, to the eastern edge of the Project Site (**Figures 10.5a, b & c**). These observations showed that Collared Crows did not consistently roost in the exact same locations but rather, would change their final roost sites with time.

10.4.4.25 Roosting trees of Collared Crow: They roosted in groups in the final roosts, which were composed of several (mostly three to five) trees as recorded during most surveys. The trees used as final roosts were usually the taller tree species such as *Casuarina equisetifolia*, and also *Eucalyptus* sp. trees. It is apparent that the bird tends to choose to stay on the tallest tree individuals at the chosen final roost locations instead of any preference on tree species. These observations made on the vantage points were also verified during surveys on vessels to the south/southeast of the Project waterfront

10.4.4.26 Abundance in final roost of Collared Crow: The number of Collared Crows in final roosts ranged from 12 (19 Jan 2018) to 100 birds (18 Oct 2017) during the study (**Appendix 10.3b**). Fluctuations in numbers of

Collared Crows at final roosts were recorded throughout the study, without obvious patterns. These changes were thus not likely due to seasonal changes (e.g., recruitment from breeding or migration), but suggested that some birds did not roost in the Project Site every night, and the existence of alternative night roosts in nearby areas.

10.4.4.27 High use area for Final Roost of Collared Crow: Though changing the final roost sites with time, some areas of the plantation were used more frequently by the Collared Crow as night roost. To investigate the difference on the level of usage by Collared Crow as final roost, the demarcation grid adopted by Government Map Office to demarcate the coverage of the 1:1,000 basemaps (i.e. the area to be covered by one 1:1,000 basemap) was overlaid on the topographic basemap. Both breadth and height of each demarcation grid were then evenly divided into 8 equal parts (evenly divided in both the horizontal and vertical directions), and 64 grid cells (each of about 94m x about 75m) were produced in each demarcation grid. The rows covering the Project Site and its vicinity were assigned from A to P while the columns were numbered from 1 to 10 (As such, each grid cell has its own code number from A1 to P10, in a total of 160 grid cells). These grid cells were used for analysis of the final roost usage by Collared Crow (**Figure 10.7**). The locations of the final roost of CC recorded from all surveys were all overlaid on the grid. The frequency and abundance of CC choosing the trees inside each grid cell as roost sites were calculated and the cumulative numbers were presented. The frequency of the trees within the grid cells to be used as final roost and the total abundance of roosting CC individuals within the grid cells were indicated inside the corresponding cells. It was found that CC final roosts fell within 11 out of the 160 cells from A1 to P10, and grid cells N6 and O6 had the highest usage frequency by Collared Crow as final night roost. The frequency of N6 and O6 to be used as final roost (i.e. 10 number in both N6 and O6) was more than double of most other grid cells with final roost records (mostly ranging from 1 to 4, except M8 grid cell which had the record of 8 number). The cumulative abundance of roosting CC also showed a similar pattern. The grid cell with the highest cumulative abundance was N6, followed by M8, and O6.

10.4.4.28 Day time habitat use: During daytime surveys, crow numbers on the Project Site were usually very low (<5), while the numbers of Collared Crows observed in the TPIE were much higher. This might be related to the availability of food waste in the TPIE.

10.4.4.29 Breeding: No sign of breeding of Collared Crow was observed within the Project Site or in the rest of the Assessment Area.

Roosting Site of Black Kite

10.4.4.30 A total of 25 night roost surveys for Black Kite were conducted between October 2017 and April 2018. There was no obvious pre-roost behavior for Black Kite and the numbers of birds in night roost locations were

shown in **Appendix 10.3c**. There were cumulatively 893 individuals recorded in the night roost locations from all the surveys.

10.4.4.31 Roosting behaviour of Black Kite: Black Kites observed on the Project Site and Assessment Area during daytime surveys were mostly soaring. But some individuals of Black Kites also utilised the plantation in the Project Site as night roosting.

10.4.4.32 Prior to landing on the final roosts, most of the Black Kites were circling in the sky. Some individuals were observed roosting briefly on the poles and barrier nets along the driving range, turfgrass and plantation in the Project Site. No significant pre-roost location was identified.

10.4.4.33 Similar to Collared Crows, the night roosts of Black Kites were also scattered among the existing plantation strip along the eastern to southern boundary of the Project Site (**Figures 10.6 a, b & c**). The trees used as roosting sites were also the taller trees typically *Casuarina equisetifolia*.

10.4.4.34 Abundance of roosting Black Kite: The number of Black Kites at the night roost ranged from 5 (27 Dec 2017) to 147 (28 Nov 2017) during the study (**Appendix 10.3c**). Numbers of Black Kites dropped substantially after November 2017. The drop might be due to changes of roosting sites, or that Black Kites observed in November were mostly migrants. The use of roosting sites within the Project Site might be transient and irregular. This may also be the reason why no Black Kite roost in Project Site was reported in reviewed literature.

10.4.4.35 High use area for Night Roost by Black Kite: Similar with Collared Crow, some areas of the plantation were used more frequently by Black Kite as night roost. Similar approach as adopted for Collared Crow was applied to investigate the high use areas of Black Kite. It was found that Black Kite night roosts fell within 10 out of the 160 grid cells (**Figure 10.7**). Among the 10 grid cells, N7 has been the most frequently used (i.e. 18 number), which is double or more than other grid cells with Black Kite roosting records (i.e. between 6-9 in M8, I9, J9, K9 and L9; 4 in N8, H9 and M9; and 2 in N6).

Summary of Pre-roost/roost Survey Findings

10.4.4.36 It was found from the roosting surveys that TPSTW is the major pre-roost site for Collared Crow. While Collared Crow would often choose different locations within the restoration plantation (between the eastern end, the southeast end, and the southern end of the Project Site) as night roosts, they still show preference on some locations of the plantation over others. The plantation at the southern end of the Project Site was most often used by Collared Crow as night roost, about double the frequency in most other locations, and thus could be considered as the major roosting tree groups used by Collared Crow as night roost. The fluctuations of abundance among surveys suggested that there were alternative pre-roost and night roost sites outside the Assessment Area.

10.4.4.37 For Black Kite, there was no pre-roost behavior. The difference on the usage levels among different grid cells with Black Kite night roost records was generally smaller when compared with the case in Collared Crow, but the grid cell with the highest usage frequency in the southern end of the Project Site had a record of 18 number, which was even higher than the grid cell with the highest usage frequency of Collared Crow. Their abundance dropped to low level before December and January suggested that a large portion of the individuals recorded in the early stage of the survey were migrants using Hong Kong as a point of transit.

(C) Herpetofauna

10.4.4.38 Six species of reptile were recorded within the Project Site (**Appendix 10.4**). Most are widely distribution in Hong Kong. Apart from Common Rat Snake *Ptyas mucosus*, none of the recorded species is considered of conservation importance.

10.4.4.39 Eight species of reptile were recorded in the Assessment Area (excluding Project Site) (**Appendix 10.4**). Most are common and widely distribution in Hong Kong, and not considered of conservation importance.

10.4.4.40 Six species of amphibian were recorded within the Project Site (**Appendix 10.5**). Most are widely distribution in Hong Kong. None of the recorded species is considered of conservation importance. The low diversity of amphibians within the Project Site was due to the absence of natural freshwater habitats. The available aquatic habitats were ditches and culvert, both of which are concrete-lined and of low habitat structural complexity.

10.4.4.41 Six species of amphibian were recorded in the Assessment Area (excluding Project Site) (**Appendix 10.5**). Most are common and widely distribution in Hong Kong, and not considered of conservation importance.

(D) Dragonfly and Butterfly

10.4.4.42 Thirteen species of dragonfly were recorded within the Project Site (**Appendix 10.6**). The recorded species are mostly abundant/common and widely distributed in Hong Kong. Apart from Tiger Hawker *Polycanthagyna erythromelas*, none of the recorded species is considered of conservation importance.

10.4.4.43 Both species richness and abundance of dragonfly were low in the Project Site. This might be related to the absence of natural freshwater habitats. The available aquatic habitats were ditches and culvert, which are concrete-lined and of low habitat structural complexity.

10.4.4.44 Ten species of dragonfly were recorded in the Assessment Area (excluding Project Site) (**Appendix 10.6**). All are common and widely distribution in Hong Kong, and not considered of conservation

importance. Both species richness and abundance of dragonfly were low in all types of habitats within the Assessment Area.

10.4.4.45 Twenty-nine species of butterfly were recorded within the Project Site (**Appendix 10.7**). The recorded species are mostly very common/common and widely distributed in Hong Kong. None of the recorded species is considered of conservation importance. Species richness of butterfly in the Project Site was low, and abundance was considered low to moderate. This was due to the presence of high number of Common Grass Yellow *Eurema hecabe*. This species is very common in Hong Kong.

10.4.4.46 Forty-five species of butterfly were recorded in the Assessment Area (excluding Project Site) (**Appendix 10.7**). Most are common and widely distribution in Hong Kong, and not considered of conservation importance. Both species richness and abundance of butterfly were low in secondary woodland, plantation and cultivated Land, and very low in other habitat types within the Assessment Area.

(E) Freshwater Communities

10.4.4.47 While there are no significant freshwater habitats within the Project Site, a total of 5 and 7 freshwater fauna species were recorded within the Assessment Area during dry season and wet season, respectively (**Appendix 10.8** and **Appendix 10.9**). These included fishes, crustaceans and insects.

10.4.4.48 Diversity of freshwater fauna was low in the watercourse. Most species recorded in the surveys are common and widespread in Hong Kong. A fish species of conservation importance *Parazacco spilurus* Predaceous Chub was observed within the Assessment Area but outside Project Site from the wet season and dry season survey results.

10.4.4.49 Predaceous Chub, though common and widespread in Hong Kong and, occurring in most unpolluted hill streams in both upper and lower courses, its number is declining in Mainland China because of habitat loss and destructive fishing activities. This fish species is considered as “Vulnerable” in China (Lee *et al.* 2004). Its abundance was assessed as moderate in the watercourse outside the Project Site.

10.4.5 Marine and Intertidal Survey

Intertidal Communities

(A) Qualitative Walk-through Survey

10.4.5.1 Within the Assessment Area, qualitative walk-through survey was conducted along the accessible shorelines of the survey locations. The objective was to record organisms encountered and note their relative abundance (**Appendix 10.10** and **Appendix 10.11**).

- 10.4.5.2** Results of this qualitative survey showed that the shorelines along the survey locations were mainly comprised of artificial seawall, rocky shore, and sandy shore.
- 10.4.5.3** A total of 50 and 43 intertidal organisms were recorded at the survey locations during the qualitative surveys during wet and dry seasons, respectively. *Nodilittorina radiata* was abundant along the higher intertidal shores of artificial seawall and pebble shore. While *Saccostrea cucullata* and *Brachidontes variabilis* were the dominant species found in the middle intertidal and lower intertidal zones of artificial seawall and pebble shore, respectively. *Anomalocardia flexuosa*, *Donax* sp. and *Grafrarium pectinatum* were the dominant species recorded in the sandy shore.
- 10.4.5.4** Highly mobile fauna such as crabs were recorded in the qualitative surveys. A colony of hard coral *Leptastrea purpurea* was also observed in the subtidal part of the artificial seawall outside the Project Site.
- 10.4.5.5** No intertidal species of conservation importance was recorded (see sections below on coral communities for the conservation importance of hard coral *Leptastrea purpurea*). All species recorded were considered to be common and widespread as on other intertidal shores in Hong Kong.

(B) Quantitative Survey

- 10.4.5.6** Transects were sampled along the shorelines of the survey locations, to cover the major habitats of the intertidal areas. The transects covered three shore heights: 2.0 m (high-shore), 1.5m (mid-shore) and 1.0 m (low-shore) above Chart Datum (CD). Dominant species varied by shore height as reported by the qualitative survey described above. The results of each transect at each survey location are listed in **Appendix 10.12** and **Appendix 10.13**.
- 10.4.5.7** A total of 44 and 41 species were recorded during the quantitative surveys in the wet and dry seasons, respectively. Dominant species found were typical species for that particular shore as described in the qualitative survey.
- 10.4.5.8** **Table 10.4.3** shows the number of species (S), density (D i.e. individual/m²), evenness (J), and Shannon Diversity (H') of intertidal organisms recorded in the survey locations during wet and dry seasons (both qualitative and quantitative surveys are presented). Generally, density, evenness and Shannon diversity were higher along artificial seawall and rocky shore than on sandy shore. Density was generally higher during wet season than during dry season.
- 10.4.5.9** Overall, no species of conservation importance were recorded in the intertidal quantitative surveys in the survey locations. All species recorded are common and widespread as in other intertidal shores in Hong Kong.

Table 10.4.3 Number of species (S), density (D individual/m²), evenness (J) and Shannon Diversity (H') of intertidal organisms recorded at survey locations during wet and dry seasons (both qualitative and quantitative surveys are presented)

Site (type of shore)	Qualitative						Quantitative			
	S		S		D		J		H'	
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Artificial seawall	28	26	22	22	410	172	0.64	0.74	1.99	2.30
Rocky shore	24	23	23	23	444	287	0.64	0.67	1.99	2.09
Sandy shore	23	21	23	20	128	105	0.57	0.57	1.78	1.71

Benthic Infauna

10.4.5.10 Subtidal benthic surveys at 3 sampling locations (3 replicates in each location) in the Assessment Area recorded 34 individuals of organisms from 4 species, in 4 families and in 2 phyla during wet season, and 44 individuals of organisms from 10 species, in 9 families and in 4 phyla during dry season.

10.4.5.11 In terms of infaunal abundance, the majority of the organisms recorded in the subtidal soft bottom habitat were from the phylum mollusca in wet season (76%) and annelida in dry season (89%) (calculated from **Table 10.4.4**). Generally, the subtidal soft-bottom habitat was dominant by bivalvia *Moerella culter* during wet season; while in dry season, polychaeta *Sigambra habaokai* was the dominant species (**Appendices 10.14 - 10.17**). Most of the species recorded are common and widespread in Hong Kong, except for one individual of *Metapenaeus* sp., which was a species considered of conservation importance. This species was recorded at sampling location A during dry season.

10.4.5.12 Shrimps of the genus *Metapenaeus* are commercially important and were extensively cultured in the Gei Wai at Mai Po in the past. They are common in mangrove and estuarine areas in Hong Kong (Leung 1999, Vance 1999). Due to over-exploitation, all four *Metapenaeus* species found in Hong Kong are considered to be Vulnerable in China (CSIS 2008). Shallow estuarine areas in Hong Kong have potential to provide nursery habitats for these species.

10.4.5.13 In terms of infaunal biomass, organisms of the Phylum mollusca contributed about 97% (wet season) and 80% (dry season) of the total recorded biomass (calculated from **Table 10.4.5**). Benthic Shannon Diversity (*H'*) ranged from 0 to 1.02 during wet season and from 0 to 1.58 during dry season. Pielou's Evenness (*J*) ranged from 0.73 to 1 during wet season and from 0.87 to 0.98 during dry season.

10.4.5.14 The benthic assemblages within the Assessment Area are less diverse than are other sites in Hong Kong waters. Previous studies of benthic surveys showed that diversity varied from 2.21 – 3.50 in the eastern waters, which is higher than that in Victoria Harbour (1.10 to 2.49), Tolo Harbour and Channel (1.51 – 1.85), the western waters at outer Deep Bay (2.14 – 2.86), and the southern waters (2.53 – 2.98) (CityU Professional Services Limited 2002).

10.4.5.15 To conclude, except the only individual of *Metapenaeus* sp., the subtidal benthos survey showed that the infaunal assemblages of the surveyed locations mostly consisted of common and widespread species without special conservation importance.

Table 10.4.4 Benthic fauna composition of the grab samples

Phylum / season	No. of families		No. of species		No. of individuals		% of abundance		Biomass (g)		% of biomass	
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Annelida	1	5	1	6	8	39	24	89	0.03	0.25	3	20
Arthropoda	0	1	0	1	0	1	0	2	0	0.001	0	0.1
Chordata	0	1	0	1	0	1	0	2	0	0.001	0	0.1
Mollusca	3	2	3	2	26	3	76	7	0.90	0.99	97	80
Total	4	9	4	10	34	44	100	100	0.93	1.24	100	100

Table 10.4.5 Summary Information from Subtidal Benthic Survey in Dry and Wet Seasons (replicates of sub-stations are pooled together)

Location / season	No. of species		Abundance		Wet weight (g)		Pielou's Evenness		Shannon diversity	
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
A (Northern)	0	4	0	6	0	0.96	N/A	0.96	0	1.33
B (Southeast)	2	1	2	1	0.04	0.04	1	N/A	0.69	0
C (Southern)	1	2	1	3	0.001	0.004	N/A	0.92	0	0.64

Subtidal Hard Substrate Communities

10.4.5.16 The seawall just outside the Project Site and the nearby rocky shore were surveyed for coral communities.

10.4.5.17 Only two species of hard corals *Oulastrea crispata* and *Leptastrea purpurea* were recorded during the survey. *O. crispata* is commonly found in Hong Kong, as this species is tolerant of extreme environments; while *L. purpurea* is abundant in Hong Kong.

10.4.5.18 *O. crispata* was distributed in patches along the artificial and nearby rocky shore at less than 5% coverage. Sizes ranged from 2 cm to 15 cm in diameter. Only one colony (about 15 cm in diameter) of *L. purpurea* was found on the artificial seawall. All hard corals are protected under Cap. 586 Protection of Endangered Species of Animals and Plants Ordinance. A selection of some of the photos taken during the dive survey are shown in **Figure 10.3**.

10.4.6 Evaluation of Ecological Values

10.4.6.1 The ecological importance of the habitats within the Assessment Area was evaluated in accordance with the criteria stipulated in Annex 8 of TM-EIAO (**Tables 10.4.6 to 10.4.16**).

Table 10.4.6 Evaluation of secondary woodland within the Assessment Area

Criterion	Description
Naturalness	Semi-natural habitat, consisting of a mixture of native tree species, exotic and/or orchard species.
Size	19.20 ha
Diversity	Low to moderate for plants. Low diversity of dragonfly and butterfly, very low diversity of bird
Rarity	One protected plant species <i>Cleisostoma simondii</i> var. <i>guangdongense</i> recorded outside Project Site. Fauna species of conservation importance included Grey-chinned Minivet.
Re-creatability	Feasible, but the more mature the woodland, the longer time required for compensation/re-creation.
Fragmentation	Small linear and/or isolated stands along ravine and foothills.
Ecological linkage	Isolated, or linked to nearby shrubland/grassland or mature woodland
Potential value	Moderate to high under natural succession to develop into mature woodland if protected from anthropogenic disturbance or destruction
Nursery/breeding ground	No significant record
Age	At least 20-30 years.
Abundance/richness of wildlife	Very low abundance of bird; low abundance of butterfly and dragonfly
Overall ecological value	Low to moderate (NB: No secondary woodland within Project Site)

Table 10.4.7 Evaluation of plantation within the Assessment Area

Criterion	Description
Naturalness	Man-made habitat mainly on engineered slopes
Size	65.78 ha
Diversity	Low to moderate flora diversity; Low diversity of bird, dragonfly and butterfly
Rarity	Fauna species of conservation importance included Japanese Pipistrelle, Leschenault's Rousette, Eastern Cattle Egret, Black Kite, Eurasian Hobby, Greater Coucal, Collared Crow, Grey-chinned Minivet, Rufous-capped Babbler and Chinese Hwamei.

Criterion	Description
Re-creatability	Readily re-creatable
Fragmentation	Formed thin belts on filled slopes at restored landfill and hillsides above roads
Ecological linkage	Not functionally linked to habitats of conservation importance
Potential value	Moderate with protection from fire and active management including thinning and interplanting with native species
Nursery/breeding ground	No significant observation
Age	Young, about 20-30 years
Abundance/richness of wildlife	Low abundance of bird, dragonfly and butterfly
Overall ecological value	Low (except night roosts for Collared Crow and Black Kite) Moderate for those used as night roost

Table 10.4.8 Evaluation of grassland within the Assessment Area

Criterion	Description
Naturalness	Man-made on road side or on engineered slopes
Size	3.77 ha
Diversity	Low flora diversity; Low diversity of dragonfly, very low diversity of bird and butterfly
Rarity	No fauna species of conservation importance recorded.
Re-creatability	Readily re-creatable
Fragmentation	isolated small stands along roads and on hills
Ecological linkage	Not functionally linked to habitats of conservation importance
Potential value	Limited
Nursery/breeding ground	No significant observation.
Age	N/A
Abundance/richness of wildlife	Low abundance of dragonfly, very low abundance of bird and butterfly
Overall ecological value	Low

Table 10.4.9 Evaluation of turfgrass within the Assessment Area

Criterion	Description
Naturalness	Man-made, managed by mowing.
Size	14.36 ha
Diversity	Low flora diversity; Very low diversity of bird; low diversity of dragonfly and butterfly
Rarity	Fauna species of conservation importance included Collared Crow and Black Kite
Re-creatability	Readily re-creatable
Fragmentation	Large stands on existing driving range
Ecological linkage	Not functionally linked to habitats of conservation importance, but occasionally used by Collared Crow as pre-roost
Potential value	Limited
Nursery/breeding ground	No significant observation.
Age	N/A
Abundance/richness of wildlife	Abundance of bird is very low; abundance of dragonfly and butterfly are low
Overall ecological value	Low, but occasionally used by Collared Crow as pre-roost

Table 10.4.10 Evaluation of cultivated land within the Assessment Area

Criterion	Description
Naturalness	Man-made
Size	6.30 ha
Diversity	Low flora diversity, formed of common species; Low diversity of dragonfly and butterfly, very low diversity of bird
Rarity	Fauna species of conservation importance included Crested Goshawk.
Re-creatability	Readily re-creatable
Fragmentation	Subject to abandonment and conversion to village houses.
Ecological linkage	Not functionally linked to habitats of conservation importance.
Potential value	Might develop into semi-natural habitats if given enough time, but limited by small size, fragmentation and disturbance
Nursery/breeding ground	No significant observation. Limited as breeding habitat for birds or butterflies due to high level disturbance and low vegetation cover.
Age	N/A
Abundance/richness of wildlife	Very low abundance of bird; low abundance of butterfly and dragonfly
Overall ecological value	Low (NB: No cultivated land within Project Site)

Table 10.4.11 Evaluation of developed area within the Assessment Area

Criterion	Description
Naturalness	Man-made habitat
Size	89.91 ha
Diversity	Low flora diversity, mainly composed of landscape and ornamental species. Low diversity of dragonfly, very low diversity of bird and butterfly.
Rarity	Fauna species of conservation importance included J Black-crowned Night Heron, Black Kite, Eastern Buzzard, Common Kestrel and Collared Crow.
Re-creatability	Readily re-creatable
Fragmentation	N/A
Ecological linkage	Not functionally linked to habitats of conservation importance
Potential value	Low
Nursery/breeding ground	No significant breeding record. Limited as breeding habitats for fauna due to high level disturbance.
Age	N/A
Abundance/richness of wildlife	Low abundance of dragonfly, very low abundance of bird and butterfly
Overall ecological value	Very Low, but TPSTW is used by Collared Crow as pre-roost

Table 10.4.12 Evaluation of watercourse within the Assessment Area

Criterion	Description
Naturalness	Lower sections of the watercourses connected to underground culvert and connected to Tolo Harbour, while upper sections are partly natural and partly channelized.
Size	0.12 ha (0.62km)
Diversity	Low diversity of plant, dragonfly, butterfly, and aquatic fauna
Rarity	Species of conservation importance included <i>Parazacco spilurus</i>

Criterion	Description
Re-creatability	Natural section difficult to re-create, channelized sections easy to recreate
Fragmentation	Stream habitat fragmented by the channelised section and the underground culvert, but the stream flow is still maintained
Ecological linkage	Connected to Tolo Harbour
Potential value	Low
Nursery/breeding ground	May provide breeding habitat to <i>Parazacco spilurus</i>
Age	N/A
Abundance/richness of wildlife	Moderate abundance for aquatic fauna. Low abundance of dragonfly, very low abundance of bird and butterfly.
Overall ecological value	Low (NB: No watercourse within Project Site)

Table 10.4.13 Evaluation of rocky shore (intertidal and subtidal parts) and sandy shore within the Assessment Area

Criterion	Description	
	Rocky Shore	Sandy Shore
Naturalness	Natural	Natural, but backshore modified/developed
Size	0.12 ha (0.18km)	0.37 ha (0.39 km)
Diversity	Low for flora. Moderate diversity of intertidal organisms. Very low diversity of bird.	Low for flora. Low diversity of intertidal organisms. Very low diversity of bird
Rarity	Scattered <i>Oulastrea crispata</i> (coverage <5%)	None
Re-creatability	Difficult to recreate	Difficult to recreate
Fragmentation	Fragmented, only small sections remained	Fragmented, only small sections remained. Backshore modified.
Ecological linkage	Connected to Tolo Harbour	Connected to Tolo Harbour
Potential value	Moderate, natural rocky shores provide substrate for intertidal organisms	Low. Unlikely to become an area of conservation value
Nursery/breeding ground	Breeding and nursery ground for limited intertidal and/or subtidal organisms	Breeding and nursery ground for limited intertidal organisms
Age	N/A	N/A
Abundance/richness of wildlife	Moderate for intertidal organisms. Very low abundance of bird and subtidal fauna	Low for intertidal organisms. Very low abundance of bird
Overall ecological value	Low to Moderate	Low

Table 10.4.14 Evaluation of Seawall (intertidal and subtidal parts) within the Assessment Area

Criterion	Description
Naturalness	Man-made habitat
Size	1.00 ha (1.6 km)
Diversity	Low diversity for intertidal and subtidal organisms; very low diversity of bird
Rarity	Fauna species of conservation importance included <i>Oulastrea crispata</i> (coverage <5%) and a colony of <i>Leptastrea purpurea</i>
Re-creatability	Readily re-creatable
Fragmentation	N/A

Criterion	Description
Ecological linkage	Connected to Tolo Harbour
Potential value	Low
Nursery/breeding ground	Provide substrate for intertidal and marine organisms
Age	N/A
Abundance/richness of wildlife	Low for intertidal and subtidal organisms; very low abundance of bird
Overall ecological value	Low for both intertidal and subtidal parts

Table 10.4.15 Evaluation of Marine Waters (including subtidal seabed) within Assessment Area

Criterion	Description
Naturalness	Natural
Size	90.46 ha
Diversity	Low for benthic organisms
Rarity	Species of conservation importance included <i>Hippocampus kuda</i> (from literature)
Re-creatability	Difficult to recreate
Fragmentation	Not fragmented
Ecological linkage	Connected to other marine waters and intertidal habitats
Potential value	Low
Nursery/breeding ground	Nursery grounds for fishes and invertebrates
Age	N/A
Abundance/richness of wildlife	Low for subtidal benthic organisms
Overall ecological value	Low

Table 10.4.16 Evaluation of the Project Site

Criterion	Description
Naturalness	Entirely man-made habitat (former landfill, converted to golf practice range)
Size	53.37 ha
Diversity	Low to moderate diversity for plants. Low diversity of bird, dragonfly and butterfly
Rarity	Fauna of conservation importance included Chinese Pond Heron, Eastern Cattle Egret, Little Egret, Black Kite, Greater Coucal, Collared Crow, Grey-chinned Minivet, Common Rat Snake and Tiger Hawker. Night roosts for Collared Crow and Black Kite
Re-creatability	Readily re-creatable
Fragmentation	Not fragmented
Ecological linkage	Roosting site for Black Kite and Collared Crow possibly linked to availability of waste human food at Tai Po Industrial Estate.
Potential value	Low
Nursery/breeding ground	No significant observation.
Age	About 20 years after completion of landfill operation and restoration
Abundance/richness of wildlife	Low to moderate abundance of butterfly, low abundance of bird and dragonfly
Overall ecological value	Generally Low, but moderate for the plantation used as night roosts.

10.4.6.2 In accordance with Table 3, Annex 8 of the TM-EIAO, the ecological value of species recorded was assessed in terms of protection status (e.g. fauna protected under Cap. 170 (except birds), and flora and fauna protected under regional/global legislation/conventions), species distribution (e.g. endemic), and rarity (e.g. rare or restricted).

10.4.6.3 The list and evaluation of flora and fauna species of conservation importance recorded within the Assessment Area, according to the TM-EIAO, are given in **Table 10.4.17** and **Table 10.4.18** respectively. The locations of those (except Collared Crow, Black Kite and *Oulastrea crispata*) recorded during the field survey are shown in **Figure 10.2**.

Table 10.4.17 Evaluation of Flora Species of Conservation Importance

Scientific Name	Common Name	Protection status	Locations / Habitats recorded	Rarity
<i>Aquilaria sinensis</i>	Incense Tree	Cap. 586 CITES: Appendix 2 Category II Nationally Protected Species in the PRC China Plant Red Data Book: Vulnerable Near Threatened (NT) in China (AFCD 2015) Listed in Rare and Precious Plants in Hong Kong (AFCD 2015) Vulnerable in IUCN (2019).	Plantation within Project Site	Common (Xing <i>et al.</i> 2000)
<i>Cleisostoma simondii var. guangdongense</i>	Terete Cleisostoma	Cap. 586. Cap. 96A	Secondary woodland edge at Ha Hang Village outside Project Site	Very common (Xing <i>et al.</i> 2000)

Table 10.4.18 Evaluation of Fauna Species of Conservation Importance

Common names	Locations	Conservation status ^{1, 2}	Distribution ¹	Rarity ¹
Mammal				
Japanese Pipistrelle	Individuals observed in Plantation inside and outside the Project Site	WAPO; Fellowes <i>et al.</i> (2002): (LC)	Widely distributed throughout Hong Kong	Very common
Leschenault's Rousette	Individuals observed in Plantation inside and outside the Project Site	WAPO; Fellowes <i>et al.</i> (2002): (LC)	Fairly widely distributed in countryside areas throughout Hong Kong	Common
Bird				

Common names	Locations	Conservation status ^{1, 2}	Distribution ¹	Rarity ¹
Black-crowned Night Heron	One bird observed in Developed Area outside the Project Site	Fellowes <i>et al.</i> (2002): (LC)	Mainly found in low lying wetlands and coastal areas with mangroves	Common resident and winter visitor
Chinese Pond Heron	Single birds observed in Plantation in the Project Site and Seawall outside the Project Site	Fellowes <i>et al.</i> (2002): PRC, (RC)	Widely distributed in Hong Kong, but particularly common in the Deep Bay area. Found in almost any low lying damp areas	Common resident
Eastern Cattle Egret	Small flocks observed in Grassland in the Project Site and Plantation outside the Project Site	Fellowes <i>et al.</i> (2002): (LC)	Widely distributed in Hong Kong.	Resident and common passage migrant.
Great Egret	Individuals observed in Sandy Shore outside the Project Site	Fellowes <i>et al.</i> (2002): PRC, (RC)	Mainly found in wetlands in the Deep Bay areas	Common resident and winter visitor
Little Egret	Individuals observed in Plantation in the Project Site and Sandy Shore and Seawall outside the Project Site	Fellowes <i>et al.</i> (2002): PRC, (RC)	Widely distributed in low lying wet or coastal areas in Hong Kong	Common resident
Grey Heron	One bird observed in Seawall outside the Project Site	Fellowes <i>et al.</i> (2002): PRC	Mainly found in intertidal habitats, fishpond and gei wais in the Deep Bay Area	Common winter visitor
Crested Goshawk	One bird observed in cultivated land outside the Project Site	Cap. 586; CITES: Appendix II; Class 2 Protected Animal of China; China Red Data Book: Rare	Mainly found in areas of forest and mature woodland	Uncommon resident
Black Kite	Flocks Birds observed soaring above Developed Area, Plantation and Marine Waters outside the Project Site, and Turfgrass and Plantation inside the Project Sites Final roosts were located in Plantation in the Project Site	Cap. 586; Class 2 Protected Animal of China; CITES: Appendix II; Fellowes <i>et al.</i> (2002): (RC)	Widely distributed in Hong Kong and occurs in many types of habitats	Common resident and winter visitor

Common names	Locations	Conservation status ^{1, 2}	Distribution ¹	Rarity ¹
Eastern Buzzard	One bird observed soaring above Developed Area outside the Project Site	Cap. 586; Class 2 Protected Animal of China; CITES: Appendix II	Widely distributed in Hong Kong and occurs in many types of habitats	Common winter visitor
Common Kestrel	One bird observed in Developed Area outside the Project Site	Cap. 586; CITES: Appendix II; Class 2 Protected Animal of China	Widely distributed in Hong Kong and occurs in mainly in open areas	Common winter visitor
Eurasian Hobby	One bird observed in Plantation outside the Project Site	Cap. 586 CITES: Appendix II; Class 2 Protected Animal of China; Fellowes <i>et al.</i> (2002): (LC)	Mainly recorded from marshes, agricultural land and light wooded hills in northern, eastern and central parts of the New Territories	Uncommon passage migrant
Greater Coucal	Individuals observed in Plantation within and outside the Project Site	Class 2 Protected Animal of China; China Red Data Book: Vulnerable	Widely distributed in Hong Kong and occurs in many types of habitats	Common resident
Grey-chinned Minivet	Small flocks observed in Plantation inside and outside the Project Site and secondary woodland outside the Project Site	Fellowes <i>et al.</i> (2002): LC	Found in Tai Po Kau, Shing Mun, Ho Chung, Kadoorie Farm and Botanic Garden, Tung Ping Chau	Common in winter, scarce in summer.
Collared Crow	Individuals / small flocks were observed in Developed Area outside the Project Site and Plantation inside the Project Site. Pre-roosting sites were identified in Developed Area outside the Project Site and Plantation inside the Project Site. Final roosts were identified in Plantation inside the Project Site.	IUCN (2019): Vulnerable; Fellowes <i>et al.</i> (2002): LC	Usually found near coastal areas	Uncommon resident

Common names	Locations	Conservation status ^{1, 2}	Distribution ¹	Rarity ¹
Rufous-capped Babbler	Individuals observed in Plantation outside the Project Site	Fellowes <i>et al.</i> (2002): LC	Found in scattered wooded locations, e.g., Shing Mun, Tai Po Kau, Ng Tung Chai	Uncommon resident
Chinese Hwamei	One bird observed in Plantation outside the Project Site	Cap. 586; CITES: Appendix II	Mainly found in open and closed-canopy shrubland	Common resident
Herpetofauna				
Common Rat Snake	One individual in ditch within plantation in Project Site	Cap. 586; Appendix 2 of CITES; China Red Data Book: Endangered; Fellowes <i>et al.</i> (2002): PRC	Widely distributed throughout Hong Kong	Common in many open habitats throughout Hong Kong
Dragonfly				
Tiger Hawker	One individual in ditch within plantation in Project Site	Fellowes <i>et al.</i> (2002): LC	Found in Hok Tau Reservoir, Keung Shan, Ng Tung Chai, Pottinger Gap (Shek O Country Park), Sha Lo Tung, Shing Mun Country Park, Sunset Peak, Tai Po Kau and Wu Kau Tang	Common
Fish				
<i>Parazacco spilurus</i>	Watercourse outside Project Site	China Red Data Book: Vulnerable	Occurs in most unpolluted hill streams in both upper and lower courses	Common in Hong Kong
<i>Hippocampus kuda</i> (from literature)	Previously recorded off the Tai Po industrial estate	Cap 586; CITES: Appendix II; IUCN (2019): Vulnerable	Occasionally found in shallow, sheltered areas of corals and boulders, primarily in eastern waters but also around man-made structures such as abandoned nets, pipes and shark nets	Moderately abundant
Coral				

Common names	Locations	Conservation status ^{1, 2}	Distribution ¹	Rarity ¹
<i>Oulastrea crispata</i>	Found in artificial seawall and natural rocky shore	Cap 586; CITES: Appendix II	Found in many places in Hong Kong	Common
<i>Leptastrea purpurea</i>	Found in artificial seawall	Cap 586; CITES: Appendix II	Predominant in the eastern and northeastern waters of Hong Kong	Abundant

Note: 1: AFCD Hong Kong Biodiversity on Line, 2: Wang (1998).

Level of concern: LC = local concern, PRC = potential regional concern, RC = regional concern, GC = global concern; Letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence (Fellowes *et al.*, 2002).

10.5 Impact Identification and Prediction

10.5.1 Proposed Layout Plan and Assessment Methodology

10.5.1.1 The proposed 18-hole golf course is a land-based project to be developed on a restored landfill site which currently contains a driving range. The layout plan of the Project is shown in **Figure 2.1**. Major project elements include:

- Construction of access road and underground water storage tank;
- Site formation (mostly by filling) for tees, greens, fairways and rough, practice range and related features;
- Construction of drain system to collect surface runoff;
- Construction of pond features for landscape purpose;
- Water extraction from existing open channel;
- Construction of ancillary facilities, carpark and associated utilities; and
- Landscape plantings.

10.5.1.2 No marine works (e.g. modification of seawall, marine dredging works, construction of barges, marine transport) will be involved.

10.5.1.3 The sewage generated from the Project will be conveyed to a neighbouring government sewer that connects back to TPSTW for treatment. No discharge to Tolo Harbour is needed.

10.5.1.4 The assessment below has identified and quantified as far as possible the potential terrestrial, aquatic, and marine ecological impacts associated with the Project for both construction phase and operational phase. Both direct (e.g. by physical disturbance) and indirect impacts (e.g. by change of water quality and hydrodynamic regime) on

recognised sites of conservation importance, important habitats, and the associated wildlife groups/species have been considered. Predicted impacts are quantified as far as possible and evaluated with reference to the criteria in Annexes 8 and 16 of the TM-EIAO. Impacts are generally ranked as "insignificant", "minor", "moderate" or "severe". Where significant negative impacts are predicted, the strategy follows the priority of "avoid, minimize, and compensate". The acceptability of residual impacts following mitigation was assessed. Finally, the assessment evaluated the need for ecological monitoring and audit, and prescribed in detail any required EM&A programme in accordance with the Study Brief. A summary of the potential impacts that may arise as a result of the construction and operation of present Project are presented below.

10.5.2 Predicted Impacts – Construction Phase

Direct Impacts

10.5.2.1 Terrestrial and Marine Recognized Sites of Conservation Importance. The Project will not directly affect any recognized sites of conservation importance, including Fung Yuen SSSI, Shuen Wan Egrettry SSSI, Ting Kok SSSI, Sha Lo Tung SSSI, Yim Tin Tsai and Ma Shi Chau SSSI, and Centre Island SSSI. These recognized sites of conservation importance are 1 km or more from the Project Site, and are not likely to be affected by the disturbance from the project elements during both construction and operational phases.

10.5.2.2 Estimated Habitat Loss - Loss of habitats and/or associated vegetation due to site re-profiling will constitute direct ecological impacts of the Project (**Figure 10.8**). All habitats to be converted to other habitat types are man-made (i.e. No habitat on the site is natural). Habitats anticipated to be affected include plantation, turfgrass, developed area, and grassland. As there will be no marine works, no natural or artificial aquatic, intertidal (including the seawall) or marine habitats would be directly impacted. Plantation tree groups of about 1.2 ha at the southern end which is the major roost site will be preserved. In addition, a number of plantation tree groups mainly along the eastern boundary, the western boundary, and the northern boundary will also be retained and will serve as alternative roost sites as well. The total area size of preserved plantation tree groups is about 6.1 ha. Estimated loss of area for each habitat type is summarised in **Table 10.5.1**.

Table 10.5.1 Estimated Habitat Loss

Habitat	Estimated Loss Size (ha)	Ecological Value
Developed Area	4.15	Very low
Grassland	2.99	Low
Turfgrass	14.36	Low (except occasionally used as pre roosts by Collared Crow)

Habitat	Estimated Loss Size (ha)	Ecological Value
Plantation	25.23 out of the 31.38 ha within the Project Site	Low (except night roosts for Collared Crow and Black Kite)

10.5.2.3 Temporary Habitat Loss. The works areas are mostly confined within the boundary of the Project, except the minor works for connecting government sewerage and drainage. Off-site site offices are not required. No significant temporary habitat loss is anticipated.

10.5.2.4 Loss of Roost Sites. While the major tree groups frequently used as roost sites together with other existing plantation tree groups will be preserved and new plantation will be reprovided for Collared Crow and Black Kite, the remaining plantation trees with roosting records of for Collared Crow and Black Kite would be cleared during the construction.

10.5.2.5 Species of Conservation Importance. Two individuals of one plant species of conservation importance, *Aquilaria sinensis*, were recorded within the Project Site but would not have direct conflict with the Project layout plan. Another species of conservation importance *Cleisostoma simondii* var. *guangdongense* was recorded outside the Project Site and will not be affected. Fauna of conservation importance recorded within Project Site include Chinese Pond Heron, Eastern Cattle Egret, Little Egret, Black Kite, Greater Coucal, Collared Crow, Grey-chinned Minivet, Common Rat Snake and Tiger Hawker. Apart from Black Kite and Collared Crow, all these species were present in low numbers within the Project Site.

Indirect Impacts

10.5.2.6 Indirect impacts are also caused by construction activities, usually disturbance due to noise, movement of workers and equipment, the associated changes to water quality. A summary of the potential indirect construction phase impacts on the habitats and species include the following:

- ***Disturbance impacts*** from construction activities on land;
- ***Construction light glare;***
- ***Disturbance from whip planting; and***
- ***Marine and Inland water quality impacts.***

10.5.3 Predicted Impacts – Operational Phase

Direct Impacts

10.5.3.1 Permanent Habitat Loss. The existing driving range will be replaced by an 18-hole golf course. Similar types of habitats will be reprovided, while more native species will be planted in the landscape area compared with the existing conditions.

Indirect Impacts

10.5.3.2 The following potential indirect impacts during operational phase are identified:

- *Noise, traffic and human activities in the Project;*
- *Artificial lighting from the driving range;*
- *Fragmentation;*
- *Barrier effect to bird flight; and*
- *Risk of agrochemicals to wildlife.*

10.6 Impact Evaluation for Terrestrial Ecology

10.6.1 Construction Phase – Terrestrial Direct Impacts

10.6.1.1 The potential terrestrial and aquatic ecological impacts arising from the construction works, including loss of habitats, removal of vegetation, and disturbance to wildlife, were assessed in accordance with Annexes 8 and 16 of the TM-EIAO.

Terrestrial Habitat Loss

10.6.1.2 The proposed golf course would fully utilize the restored landfill site (see **Figure 10.8**). Only terrestrial habitats would be impacted by the Project. There will be no loss of aquatic, intertidal, or marine habitats.

10.6.1.3 Among all the terrestrial habitat types to be lost, plantation contributes the largest portion, i.e. about 25.23 ha out of the 31.38 ha existing plantation within the Project Site. The overall ecological value of the plantation (except for the function as night roosts for Collared Crow and Black Kite) is low due to its man-made nature, young age, dominance by exotic species and simple structure. The potential impact due to loss of plantation habitat (excluding impact on roosting birds) is ranked as **minor to moderate**.

10.6.1.4 For the 14.36ha of turfgrass will be lost during construction, it is a man-made habitat with low species diversity and simple structure managed by the current driving range contractor. The potential impact due to loss of turf grass habitat is ranked as **minor**.

10.6.1.5 For the 3.48 ha of grassland will be lost during construction, it is a man-made habitat along existing roads, paths and engineered slopes that has low species diversity and simple structure. The potential impact due to loss of grassland habitat is ranked as **insignificant**.

10.6.1.6 For the 4.15 ha of developed area would be affected, it is mainly composed of the site office, car park and other paved area in the existing driving range with little ecological value. The potential impact due to loss of developed area is ranked as **insignificant**.

Direct impacts on Terrestrial Species of Conservation Importance

- 10.6.1.7** The two individuals of Incense Tree *Aquilaria sinensis* within the Project Site, one at the eastern side and the other one at the western boundary, would be preserved within the tree group in-situ, and thus would not be impacted. Should further individuals of Incense Trees be found and having direct conflict with the golf course layout, transplantation will be recommended to minimize the potential impact. Another plant species of conservation importance *Terete Cleisostoma* was recorded outside the Project Site and would not be impacted by the Project. No significant impact on plant species of conservation importance is anticipated.
- 10.6.1.8** Apart from Collared Crow and Black Kite, the Project will not cause severe adverse impact on the remaining fauna species of conservation importance recorded in the Project Site due to the low abundance of these species. Potential impact to the fauna species of conservation importance (excluding Collared Crow and Black Kite) is ranked as **minor**.
- 10.6.1.9** While Collared Crow occasionally pre-roosted at turf area within the existing driving range which would inevitably be affected, Collared Crow mainly pre-roosted at TPSTW which is outside the project boundary and their major pre-roost is therefore secured. Unlike Collared Crow, Black Kite were mainly soaring before roosting. Ecological surveys also revealed that they did not pre-roost within the project boundary. Hence, there will be no impact on its pre-roost site caused by the Project.
- 10.6.1.10** Both Collared Crow and Black Kite used the Project Site as night roosts. The potential impact to these two species will mainly be loss of roosting sites.
- 10.6.1.11** Being one of the two identified regular roost locations in Hong Kong, Shuen Wan is considered of local significance in terms of roosting population of Collared Crow, and the Project Site, in particular the plantation inside, would be an important component of this roosting location for Collared Crow. The survey results for this EIA study indicated that currently a number of Collared Crow (between 12 and 100 individuals) utilises some of the taller trees inside the Project Site as night roost, with variations on the usage frequencies. If these trees utilised by Collared Crow as roosts, in particular those to be used more frequently, are lost due to the Project, it might cause an impact on the species, in particular on individuals more regularly utilising the Project Site. The severity of the impact would be subject to a few factors, including the proportion of trees inside the Project Site to be lost, the availability of alternative roosting sites in Shuen Wan area, and the association of the individuals with the trees inside the Project Site.
- 10.6.1.12** Construction of golf course would involve change/modification of the topography throughout the layout and thus preservation of existing trees would be a challenge. It is anticipated that a large portion of the existing

plantation will be affected during the construction phase. Due to site constraints, site formation (e.g. construction of the access road and water tanks beneath at the eastern side of the Project Site, and the ancillary facilities) would inevitably cause loss of the plantations including those used as night roosts.

10.6.1.13 The survey results showed that there are variations on the utilisation of the trees inside the Project Site by Collared Crow as roosting sites. The variations included changes of roosting individual number on different dates, and changes in the exact locations of the roosts. This indicates Collared Crow had flexibility on using roosting sites, i.e. they are not using the same trees as roosting site every night, and there may be other locations outside the Project Site as alternative roosting sites. Given the above, the impact of loss of Collared Crow roosting site is therefore ranked as **moderate**.

10.6.1.14 Different from Collared Crow, regular utilisation of plantation in the Project Site by Black Kite as roosting sites was not identified in the reviewed literature. Also, the number of Black Kites roosting in the Project Site during the peak over-wintering season of Black Kite (December to January) was very low. The loss of roosting sites of Black Kite is therefore ranked as **minor to moderate**.

10.6.1.15 Mitigation measures are required for impacts on Collared Crow and Black Kite. In the present Project, effort has been made to preserve existing trees, and the tree group which is more frequently used will be preserved to minimise the impact during construction phase (see **Section 10.8.2** for details).

10.6.2 Construction Phase – Terrestrial Indirect Impacts

Disturbance Impacts

10.6.2.1 Noise, dust and human activities will increase during construction phase, and might temporarily reduce the abundance and distribution of fauna in particular, at the preserved tree groups for Collared Crow and Black Kite, and habitats adjacent to the development areas.

10.6.2.2 As most of the nearby areas are already highly developed (i.e. Tai Po Industrial Estate, Fortune Garden, and Ting Kok Road), utilisation of this type of habitat by fauna is currently very low due to the prevailing high level of disturbance. The potential impact due to these sources in construction phase is ranked as **insignificant**.

10.6.2.3 The proposed preserved tree groups, however, are located nearer the construction activities and included plantation currently frequently used by Collared Crow and Black Kite as night roost. They are preserved for the mitigation for the direct impact on the two concerned bird species. If without control, it is possible that the disturbance will impact on the usage by the two concerned bird species on these preserved tree groups, and the impact is ranked as **minor to moderate**. Mitigation is required and is discussed in **Section 10.9** below.

Construction light glare

10.6.2.4 Construction lightings might potentially produce light glare impacts to the surrounding habitats, and even to the preserved tree groups inside the Project Site if they are located closely. The majority of the Project Site will require re-profiling works. If there are any night time construction activities within the Project Site after sunset, light glare impacts might occur during the construction phase. As mentioned above, most of the nearby areas outside the Project Site are already highly developed and it is unlikely these areas are inhabited by light-sensitive nocturnal animals. It should also note that currently the driving range within the Project Site is open at night with the flood light on, and thus fauna in the Project Site including the roosting birds are used to a certain light level. Hence, adverse impact to night roosting Collared Crow and Black Kite due to lighting is not anticipated. Nevertheless, there will be no night time construction works for the present Project, and there will be only security lighting after construction works. The light glare impact is ranked as **insignificant** for the habitats inside and outside the Project Site, as well as the roosting Collared Crow and Black Kite.

10.6.2.5 As a good practice, lighting for security purposes would be directed away from the tree groups preserved as night roosts of Collared Crow and Black Kite, and will be kept to appropriate brightness level.

Inland Water Quality

10.6.2.6 Sections of the two watercourses near the Project Site within the Assessment Area are culverted downstream channels, while the upstream sections are separated from the Project Site by Ting Kok Road. Therefore, any potential risk of aquatic impacts of site runoff to the watercourses and resulting impacts on the species of conservation importance recorded (i.e. *Parazacco spilurus*) are not likely.

10.6.2.7 Detailed site practices for controlling site runoff have been detailed in the water quality assessment. Good site practice and site precautionary measures will be implemented to avoid the potential impact due to runoff. By adopting the best management practices, it is anticipated that the impacts of general site operation will be reduced to satisfactory levels before discharges.

10.6.2.8 Good site management as stipulated in ProPECC PN1/94 should be fully implemented to avoid polluted liquid or solid waste from falling into the river waters. The potential of these impacts will be reduced to acceptable levels.

Whip Planting inside Preserved Tree Groups

10.6.2.9 After the typhoon Mangkhut in September 2018, damaged/dead trees and collapsed trees were observed in some locations inside the tree groups proposed to be retained. In order to maintain the tree coverage in these thinned/exposed locations, supplementary whip planting is proposed in these locations. Approximately 4,818 whips will be planted

among retained trees, so that new planting could be more adaptive to shady and sloping site condition. Some of these supplementary whip planting locations are close to trees with night roost records of Collared Crow and Black Kite. The whip planting activity however would be conducted in day time only, and thus the potential on causing disturbance impacts to the roosting birds are remote and considered as **insignificant**.

10.6.3 Operational Phase – Terrestrial Direct Impacts

Permanent Habitat Loss

10.6.3.1 Operational phase direct impacts for terrestrial ecology would be the habitats lost permanently during the construction. In this project, only man-made habitat would be lost during the construction and would then be replaced by similar man-made habitats once the construction is completed. The habitat loss would thus mostly be temporary and short time periods. The proposed golf course would provide a total of approximately 37.9 ha of turf (in tees, greens, fairways, roughs, and driving range), about 1.93 ha of pond, and about 10 ha of plantation. The total greenery area would be similar while both habitat diversity and plant species diversity would be higher. More native plant species will be planted and these will be of greater ecological value compared to the existing exotic dominant tree plantation (to address the night roost behaviours of the Collared Crow and Black Kite, some existing *Casuarina equisetifolia* tree individuals are intentionally preserved and the proposed planting list for the new trees also includes *Casuarina equisetifolia* though it is an exotic species). Therefore, a positive terrestrial ecological influence is anticipated during the operational phase.

10.6.3.2 Reference is also made to the long-term ecological monitoring programme of Jockey Club Kau Sai Chau Public Golf Course (Black & Veatch 2005). The 10-year ecological monitoring during operation of the North Course recorded an increase in biodiversity while no evidence of adverse impact to wildlife due to the operation of golf course was observed (*ibid.*). Design elements including planting of native vegetation and lake features ensure that no adverse impact during operation phase will result from conversion of the driving range to golf course.

10.6.3.3 Part of the existing plantation lost to the development had records of night roost usage by Collared Crow and Black Kite which use the extent of plantation at the southern, southeastern and eastern sides of the Project Site as night roosts. The impact to Collared Crow and Black Kite due to loss of these plantations is addressed in the impacts to fauna of conservation importance below.

10.6.4 Operational Phase – Terrestrial Indirect Impacts

10.6.4.1 Potential operational phase impacts would mainly include noise, traffic, human disturbance, artificial lighting and surface runoff.

Noise, Traffic and Human Activities

10.6.4.2 Noise, traffic and human activities during operation phase might potentially affect the abundance and distribution of fauna in habitats inside and adjacent to the Project Site, in particular the night roosts for Collared Crow and Black Kite.

10.6.4.3 In accordance with the layout plan of the Project, only one vehicular access road would be provided along the eastern side of the Project Site. Electric golf carts would be provided to golfers. Under the proposed operation plan, the operation hour of the golf holes will be restricted to daytime only, and the driving range will be closed at 10 pm, which is similar to the operating hours of the existing driving range. The layout design also provides buffer planting for a pedestrian path between the ancillary facility building and the driving range, to separate the path from the preserved major tree group. As such the disturbance level over the Project Site would be low. Therefore, operational impacts to roosting Collared Crow and Black Kite are ranked as **minor**. As most of the nearby areas are already highly developed (i.e. TPIE, Fortune Garden, and Ting Kok Road), utilisation of this type of habitat by fauna is currently very low due to the prevailing high levels of disturbance. The potential impact due to these sources in operational phase is ranked as **insignificant**.

10.6.4.4 As discussed in **Section 2**, in order to allow for more flexible uses and development of the Project to suit contemporary circumstances and operational requirements, the provision for staff quarters and overnight accommodations have been duly considered (i.e. Scenario 2; Scenario 1 would be the original development scenario without these facilities). Both Scenario 1 and Scenario 2 would have the same building footprint while only internal uses would be slightly different. The current assessment has assumed the Scenario 2 with the occurrence of both staff quarters and overnight accommodations within the ancillary facilities, which would be the worst case development scenario as far as ecology is concerned.

10.6.4.5 These staff quarters and overnight accommodations are strategically located close to and overlooking onto the east and south seafront. Besides, all the staff quarters and overnight accommodations are 1-2 storeys only and the upper roof structures are built into the slope and form part of the golf course facing the sea. Hence, both the staff quarters and overnight accommodations would be substantially screened from the preserved tree groups by the future terrain. These overnight accommodations would not induce significant disturbance, nor night time activities. Considering the nature of the accommodation and the size involved, it would not constitute to a significant disturbance source in the future.

Artificial lighting

- 10.6.4.6** Artificial lighting during operation phase will potentially affect the behaviour and distribution of nocturnal animals, including bats, birds, reptiles and amphibians in the golf course and at adjacent habitats.
- 10.6.4.7** The intensity and duration of artificial lighting on the Project Site would be of similar conditions at the existing driving range. The vehicular access road would be shifted from the existing alignment (i.e. going through the centre of the existing driving range) to the eastern side of the Project Site. Street light will incorporate a special design to reduce glare including deflector, low intensity, and pointing downward, etc. The golf course will only be open during daytime, and no lighting would be installed for golf at night. Lighting however would be provided at the driving range to be used on a schedule similar to that of the existing driving range (the operation hours of the future driving range will be similar as the existing driving range), and the ancillary facilities building facing seafront. The light level in the adjacent TPIE is also expected to be similar with the current level. Therefore, no significant impact to nocturnal wildlife is predicted to result from artificial lighting.
- 10.6.4.8** Buffer planting will be provided between the preserved tree groups as bird night roost area and the driving range where possible under the future detailed landscape planting plan. The direction of golf shots at the driving range has also been duly considered from the ecological perspective. A typical arrangement is to have the golf shots directed to the south (i.e. facing the shoreline), so that the golf players can enjoy the sea view while playing. To further reduce the potential of disturbance, the current layout has strategically positioned the golf driving range in order to direct the golf shots and lighting towards the north. Due to the change in orientation of the driving range, all the lighting will be pointed toward the turfgrass and away from the preserved tree groups as night roost. This would minimise the potential disturbance on the preserved tree groups, in the cost of compromising the view enjoyed by the users at the golf driving range. It is expected that the light intensity at the roost area during the operational phase would be similar or even lower than the existing conditions (currently in the existing driving range the direction of golf shot is toward the plantation.). Therefore, the potential impact to night roosting Collared Crow and Black Kite from artificial lighting is ranked as **insignificant**.

Fragmentation

- 10.6.4.9** The Project Site is located at the fringe of a terrestrial area that is surrounded by developed area (e.g., TPIE, Ting Kok Road). It is isolated from other terrestrial habitats in its baseline condition. Hence, utilisation of the Project Site as an ecological corridor by non-volant fauna in baseline conditions is considered to be minimal. Thus the threat of fragmentation or of blocking a movement corridor is minimal.

10.6.4.10 There will be tree planting in the Project Site during operation phase. Landscape within the Project Site during operation phase will be similar to that in baseline condition. No habitat discontinuity will result during operation phase. Hence, the potential impact due to fragmentation is anticipated to be **insignificant**.

Barrier Effect to Bird Flight

10.6.4.11 There will be no high-rise buildings in the Project Site during operation phase. Barrier effects to birds due to the new poles and barrier nets to be installed at the driving range are not anticipated as there are similar poles and nets currently existing in the Project Site and the height of those future poles and future barrier nets would be similar to the tree individuals of the preserved tree group. The potential impact due to barrier to the flight of birds is considered **insignificant**.

Risk of Agrochemicals to Wildlife

10.6.4.12 The agrochemicals to be applied in the Project Site during operation phase will be essentially those already used for years in other local golf course such as the Jockey Club Kau Sai Chau Public Golf Course.

10.6.4.13 Wildlife monitoring survey in the North & South Courses in Kau Sai Chau commenced in 1995, and started in the East Course in 2008. The monitoring showed a progressive increase of bird diversity and abundance inside the golf courses since their operation. Except isolated cases of bird and wild boar carcasses likely the results of diseases or injuries, wildlife mortality is rarely recorded in the golf courses in Kau Sai Chau. As a similar collection of agrochemicals as those used on Kau Sai Chau golf courses is adopted to the Project during operational phase, no adverse impact to terrestrial wildlife due to the application of agrochemicals is anticipated.

10.7 Impact Evaluation for Marine Ecology

10.7.1 Construction Phase – Marine Direct Impacts

10.7.1.1 There will be neither marine works nor marine traffic for the Project and thus there will be no loss of marine habitats within the Assessment Area.

10.7.2 Construction Phase – Marine Indirect Impacts

Marine Water Quality

10.7.2.1 As the Project Site is located along the coastline, during the construction phase, inter-tidal and marine habitats (e.g., seawall, sandy and rocky shore and marine waters) in the vicinity of the Project Site would potentially be impacted by surface runoff, especially during rainstorm. The surface runoff might be polluted by:

- Wheel washing water;

- Wastewater from building construction, site facilities and road works;
- Acid cleaning, etching and pickling wastewater; and
- Accidental chemical spillage.

10.7.2.2 The site runoff if not properly managed would cause elevated levels of suspended solids and sedimentation rates, and depletion of oxygen due to presence of elevated suspended solids. A lower oxygen level would affect stationary species, whilst mobile species would tend to temporarily avoid the area. The result could be a temporary reduction in aquatic life abundance and/or change in distribution. If uncontrolled, potential impacts due to runoff to nearby coral colonies, seahorse and mangrove communities at Ting Kok SSSI might occur.

10.7.2.3 As mentioned in **Section 2.5**, water storage tanks with a total volume of 30,000 m³ will be constructed in phases along the seafront up to the ancillary facilities (with the future access road on top) during site reprofiling works. These water storage tanks are primarily designed for the operation phase storage of turf area surface runoff. Once any of these water tanks are constructed, they would serve to store site runoff during construction phase. A temporary drainage system would be installed around the site perimeter to intercept all construction runoff and divert it to the water storage tanks. Construction site surface runoff collected by the storage tanks will undergo sufficient sedimentation before discharged to Tolo Harbour.

10.7.2.4 If the water storage tanks are not available for sedimentation at the time of working due to site conditions, conventional sedimentation tank should be provided accordingly. Hence, together with the implementation of mitigation measures/precautionary measures stated in water quality chapter to prevent site run-off to Tolo Harbour, the chance of sediments from construction site runoff being released to marine habitats will be very low, and the potential impact due to construction site runoff to marine ecology is considered **Insignificant**.

10.7.2.5 As stormwater extraction from an existing open channel is one of the options to provide water for irrigation of the golf course, local modifications and excavation to the existing open channel will be required. If not properly controlled, the excavated materials, waste water, chemicals or other construction materials may enter the watercourses and give rise to water quality impact in the Tolo Harbour. To prevent adverse water quality impact, the open channel modification works should be scheduled in dry season as far as practicable, and the mitigation measures/precautionary measures stated in water quality chapter will be followed. Works sequence should be duly planned to minimise water quality impacts. Dewatering of the construction works area shall be conducted prior to the construction works if necessary. Silt removal facilities should be adopted to treat the wastewater from dewatering operation prior to discharge. After completion of the

construction works, the works area shall be cleaned up before receiving any water flow or connecting to any existing watercourses. The impacts would be transient, and the potential impact due to the runoff to marine ecology is considered **Minor**.

- 10.7.2.6** Temporary sanitary facilities will be provided on-site for the construction workers and hence, no adverse water quality impact from sewage is anticipated.

Impacts on Marine Habitats and Species of Conservation Importance

- 10.7.2.7** There will be no direct impacts on marine habitats and Species of Conservation Importance as the Project involves no marine works. For indirect impacts of water quality, given the water storage tanks will be constructed along the perimeter seawall which will help intercepting site runoff and desilting the collected runoff before discharge, water quality impact on marine habitats and Species of Conservation Importance is not anticipated.

10.7.3 Operational Phase – Marine Direct Impacts

- 10.7.3.1** There will be neither marine works such as maintenance dredging nor marine traffic for the Project during operational phase and thus no direct impacts on marine ecology are anticipated.

10.7.4 Operational Phase – Marine indirect Impacts

Residual Agrochemicals

- 10.7.4.1** According to the outline of Turfgrass Management Plan (TMP) in **Section 2.7**, agrochemicals including fertilizers, fungicides, insecticides and herbicides will be applied to the turf area during operational phase. Since not all agrochemicals will be totally absorbed, consumed or decayed during the course of application, there will be residual agrochemicals on the turfgrass area which may later potentially be carried away by the surface runoff, and may subsequently enter Tolo Harbour. As the presence of residual agrochemicals in particular fungicides and insecticides in marine water could be a threat to marine ecology, this may pose impacts to marine ecology in the vicinity.

- 10.7.4.2** To reduce the water quality and marine ecological impacts by the residual agrochemicals in turfgrass area runoff, special considerations have been taken on various aspects of the design and operations of the future golf course. These include the drainage collection system, water storage tanks and outfall location, the selection of agrochemicals, and the daily operation of the turfgrass management (including the practices on agrochemical application).

- 10.7.4.3** For the collection system, it is designed to minimize the chance of surface runoff overflow (i.e. directly overflowing from the turfgrass area to Tolo Harbour) by diverting all the turfgrass area runoff to the water storage tanks via drain system. Besides, u-channel along the

Project Site perimeter (the seaward side) will also be provided to further prevent surface overflow. The whole collection network is designed to withstand a one-in-50-year rainstorm event. This means that, for a return period of less than 50-year, there will be no surface runoff overflow from the Project Site to Tolo Harbour and all surface runoff will be conveyed under control to the water storage tanks.

10.7.4.4 For the water storage tanks, they have been optimized to retain as much runoff as practicable to avoid the discharge of residual agrochemicals and to minimize the potential of bypassing of runoff into Tolo Harbour. The concentration of residual agrochemicals would generally be higher during the first flush. With the collection system in place and the optimized water storage tanks, the first flush will be collected into the tanks whenever there are rainfalls. During heavy and prolonged rainfall events, sufficient amount of runoff has run through the turf area to bring residual agrochemicals into the tanks before the water storage tank is full. Once the water tanks are full, any further runoff would bypass the tanks and at that time significant residual agrochemicals are not expected in the runoff any more.

10.7.4.5 For the outfall location, it has been duly situated to allow an optimum distance from the adjacent WSRs. It is proposed to be located away from the adjacent ecologically related WSRs (see **Figure 6.2**). The location of outfall is proposed to be away from the WSD Seawater Intake (S1), seahorse (H1) and corals (C1, C2 and C3) which are located at the south of the Project Site.

10.7.4.6 During operational phase, the drainage system including the collection system, water storage tanks and outfall location has been duly designed to reduce the water quality impact from the surface runoff which contains residual agrochemicals. The surface runoff from the turf area, landscape area and proposed access road will be collected by the collection system which is able to withstand rainstorms of a 50-year return period without causing flooding/surface overflow. The collected stormwater will be conveyed to the proposed water storage tanks which, having regard to the constraint due to the ex-landfill waste bodies underneath, will be optimized to a total volume of 30,000 m³.

10.7.4.7 None of the fungicides and insecticides proposed for the present Project (Fungicides – Daconil and Bayleton; Insecticides – Chlorpyrifos and Fipronil; see **Section 2.7** and Turfgrass Management Plan) are Persistent Organic Pollutants set out in Schedule 1 of Pesticides Ordinance (Cap.133) and are commonly applied in other golf courses in Hong Kong including Kau Sai Chau public golf course. The fungicides and insecticides to be used will be selected from a list of pesticides approved for use in Hong Kong by AFCD. The criteria of residual fungicides and insecticides are determined in the Water Quality Assessment of the present EIA study with reference to the available ecotoxicity data in the corresponding Material Safety Data Sheet (MSDS) (see Water Quality Chapter).

- 10.7.4.8** The residual agrochemicals will be flushed into the water storage tanks during first flush from raining. The concentration of residual agrochemicals in the runoff would generally be higher during the first flush but would decline after raining for a period of time as most of the residual agrochemicals have been carried away by the first flush. Once entering the tanks via surface drains, the runoff together with agrochemicals would be stored in the tanks and pumped for irrigation of the golf course when needed. Excessive surface runoff will only occur during extreme situation of heavy and prolonged rainfall.
- 10.7.4.9** The concentration of residual agrochemicals in water storage tanks would also be gradually diluted as rainfall is being diverted into the tanks, or when water from other sources (e.g. the water from WSD and the off-site channel) enter the tanks. Detailed calculations are shown in water quality chapter. According to the calculation results, the concentration of residual fungicides and insecticides in water storage tanks will be very low and in compliance with the proposed criteria (see water quality chapter). Even if the stored turf area runoff would enter the surrounding coastal waters, adverse water impact from the residual fungicides and insecticides is still **not anticipated**.
- 10.7.4.10** Among the agrochemicals, as mechanical methods of removing turf grass weeds (hand weeding) will be the primary means of control of weeds, herbicides are only occasionally required. In other words, the application of herbicides will not be a regularly scheduled practise to the entire golf course, but will be spot spraying to selected areas. Therefore, the amount of residual herbicides in the runoff will be insignificant and that in the water storage tanks is also insignificant.
- 10.7.4.11** Fertilizers proposed for the golf course mainly contain inorganic nutrients including nitrogen and phosphorus. Increased nutrients in the water bodies induce growth of phytoplankton and may result in oxygen depletion of the water bodies. In marine environment, increased nutrients may cause harmful algal blooms which produce dangerous toxins that can kill marine organisms.
- 10.7.4.12** The residual concentration of nutrients in water storage tanks are calculated by using the nutrient absorption rate in Kau Sai Chau case. According to the results shown in the water quality chapter, the concentrations of total inorganic nitrogen (TIN) and total phosphorus (TP) fall within the ranges of TIN and TP recorded in the EPD water quality monitoring data at Station TM3 in the Tolo Harbour and Channel Water Control Zone (WCZ). These concentrations will comply with the criteria at sources even if the collected runoff would be bypassed. When the whole catchment area of Tolo Harbour is considered, the proportion of TIN and TP loading contributed from the proposed development during each bypass to the Tolo Harbour are about less than 0.1% of the annual loading discharged to the Tolo Harbour. Adverse water quality impact is **not anticipated** from the residual fertilizers in the bypass from water storage tanks.

Sewage

10.7.4.13 During operation, there will be sewage generated from the guests and staff using the proposed ancillary facilities and other associated facilities within the golf course. A new sewer will be provided to collect and convey the sewage flows generated from the golf course development to the existing sewer manhole. It is proposed that the sewage generated from the Project would be conveyed to TPSTW. With proper treatment in TPSTW, it is anticipated that the treated sewage would meet statutory requirements and thus there would be no adverse water quality impacts. As such, unacceptable impacts on marine ecology are **not anticipated**.

10.7.4.14 There will be one proposed Sewage Pumping Station (SPS) located within the Project Site collecting and conveying the sewage flows generated from the Project to the TPSTW for treatment. To prevent the occurrence of emergency bypass at the SPS, contingency measures would need to be considered in the planning and design of the SPS, including dual feed power supply, backup power supply, and standby pumps. Sewage tanker vehicles could also be considered to remove sewage from the SPS to existing public sewer manhole located in front of main entrance of golf development on Ting Kok Road during emergency case. These could prevent the emergency bypass from the SPS. Details of the mitigation measures are discussed in **Section 6.5.3.3**. Moreover, as the proposed SPS will only serve the Proposed Development, it would be feasible to stop the sewage flows to the SPS when malfunctions. During that period, the operation of some facilities of the proposed development could be temporarily suspended, and portable toilets could be considered for temporary services. With the above design and operation provision as contingency measures, the risk of failure of SPS is considered to be negligible. Therefore, no adverse impact on marine ecology arising from the emergency bypass from the SPS is anticipated.

10.8 Cumulative Impacts

10.8.1 Concurrent Projects

10.8.1.1 In order to assess cumulative impacts, a review of best available information at the time of preparing this EIA report has been conducted to identify a number of other projects that are undergoing planning, design, construction and/or operation within the construction and/or operational period for the proposed development. A list of the concurrent projects identified at this stage is provided in **Table 2.12 of Section 2** this EIA report. These include Shuen Wan Landfill Restoration Contract, Food Waste Pre-treatment Facilities for Food Waste / Sewage Sludge Anaerobic Co-Digestion Pilot Trial in Tai Po Sewage Treatment Works, Upgrading of Sewage Pumping Stations and Sewerage along Ting Kok Road, Columbarium Development at Shuen

Wan Landfill, Tai Po, and Development of a Bathing Beach at Lung Mei, Tai Po.

10.8.1.2 Among the concurrent projects, maintenance of the landfill inside the Project Site will continue under the Shuen Wan Landfill Restoration Contract until 2026. “Columbarium Development at Shuen Wan Landfill, Tai Po” is still under planning stage and the programme is yet to be confirmed, and thus cumulative impacts are not included neither in construction phase nor operational phase. The project “Development of a Bathing Beach at Lung Mei, Tai Po” is more than 3 km from the Project Site and will most likely be completed before the commencement of the Project. The remaining projects will likely involve modification of developed area, while the present Project would replace the existing habitats within the Project Site (mainly plantation tree and turfgrass) with similar habitats of higher ratio of native plant species and better ecological functions, and thus would not have any influence on the ecological carrying capacity of the Project Site or the area. Therefore, cumulative impacts on both marine ecology and terrestrial ecology are not likely.

10.9 Mitigation Measures

10.9.1 Considerations for Impact Avoidance

10.9.1.1 The Project avoids all recognised sites of conservation importance, as well as all marine and intertidal habitats.

10.9.1.2 Since Tolo Harbour contains marine ecological and fishery resources which are particularly sensitive to water quality, it is very important that the Project shall not cause any adverse water impacts on Tolo Harbour.

10.9.1.3 The current design has adopted the following approaches to avoid impacts to the marine water quality during the construction period.

- No modification of the existing seawall;
- No marine dredging works on existing seabed; and
- No need for construction barges.

10.9.1.4 By adopting the above approaches, all the marine works during the construction phase would be avoided, and thus water quality impacts are avoided.

10.9.2 Considerations for Impact Minimisation

Constraints for Minimization of Ecological Impacts

10.9.2.1 Ecological considerations have been among the priorities during the design and development of various golf course layout scheme options. As the ecological survey findings had revealed, night roosting

behaviours of bird species of conservation importance were confirmed and constituted a constraint for the layout design.

10.9.2.2 It is also aware that there are other inherent constraints of the site due to the nature and history of the site. It is important to understand those other constraints and review their implications for ecological constraint and ecological considerations. Those key inherent constraints identified include the following and would be further elaborated in the subsequent sections:

- Constraints due to bird species of conservation interest;
- Constraints due to small Project Site area size; and
- Constraints due to waste boundary and topography.

10.9.2.3 All these constraints have been duly identified and stipulated at the onset of the scheme development, and were taken into account during the scheme development. Among the above key constraints, due considerations have been given to address the constraints due to bird species of conservation interest as much as practicable. The constraints due to the small site size and waste boundary and topography would also impose practical limitations on the design of the golf course.

10.9.2.4 When constraints are identified conflicting with each other, efforts were made to resolve the conflicts. Measures were also proposed to overcome the constraints, refine the recommended scheme where practicable without adversely compromising the ecological considerations. When the conflicts could not be completely resolved, due to those inherent constraints, methods to minimize the conflicts were explored to retain as much those ecological considerations as possible. The intention is to make sure the proposed schemes are both ecologically conscious and also practicable during implementation.

Constraints due to bird species of conservation interest and Targets of Ecological Conservation

10.9.2.5 Extensive ecological surveys have been conducted as part of this EIA. All those survey findings have revealed and confirmed that the existing Shuen Wan Restored Landfill is night roost sites for two bird species of conservation interest, i.e. Collared Crow (CC) and Black Kite (BK).

10.9.2.6 While CC occasionally pre-roost at different turf areas within the existing driving range which would inevitably be affected, the major pre-roost location of CC is TPSTW which is outside the project boundary and thus their major pre-roost is therefore secured. Ecological surveys also revealed that, unlike CC, BK would mainly be soaring before night roosting, without pre-roost behaviour. Hence, there will not be a pre-roost site issue for BK.

10.9.2.7 Locations of CC and BK final night roosts were found not fixed but shifting from day to day during the surveys. CC and BK roosts were

both scattered among the existing plantation strip along the eastern to southern boundary of the Project Site.

10.9.2.8 According to the analysis of the survey results for both CC and BK, the key high use areas include the following:

- The Southern Area – Plantation used by both species; with the highest CC usage;
- The South-eastern Area - Plantation used by both species; with a relatively high BK usage; and
- The Eastern Area – Plantation used by both species; but the usage is rather scattered.

10.9.2.9 Based up on the survey findings and the nature of the proposed development, three targets of Ecological Conservation were formulated and the design of the Project should consider achieving these three targets. i.e.:

- Target 1 – Preservation of existing plantation used as night roosts of both bird species as much as practicable, in particular those to be used more frequently;
- Target 2 – Prevention of disturbance to the preserved night roost locations of CC and BK during both construction and operational phases; and
- Target 3 – Provision of new tree groups for the two bird species as part of the ecological enhancement package for the site which including other general ecological resource enhancements.

Constraints due to Small Area Size of the Site

10.9.2.10 The Project Site was previously the Shuen Wan Landfill which has a site area of about 53ha. The objective of the Project is to develop an 18-hole golf course to implement the previously planned land use. This site area is significantly smaller than other golf courses in HK and other neighbouring areas (see **Section 2.1**).

Constraints due to Waste Boundary and Topography

10.9.2.11 Review of available information such as aerial photos and drawings reveal that the waste boundary within which waste was dumped has occupied the majority of the entire site area. All the area within or very close to the waste boundary cannot accommodate excessive loading and hence cannot be considered for uses such as ancillary facilities, access roads, water tanks etc. Based on best available information, the only area where the ancillary facilities can be located is the south-eastern part of the site. **Section 2.4** has discussed the need for a 30,000m³ water tanks to recycle surface run-off as much as practicable. This water tank is a relatively heavy structure especially when fully loaded with water. Hence, it can only be located at area beyond the waste boundaries. However, most of those areas outside the waste boundaries are located

along the eastern edge of the site and the southeast end of the site (and the southeast end has been used for ancillary facilities), etc. Hence, the current design has placed the 30,000m³ water tanks along the eastern site boundary. To save the very limited space, the access road connecting the ancillary facilities is located on the top of the water tank. This would require a much higher construction cost but would have avoided the need for an extra area for the access road.

Resolving Conflicts between Ecological Targets and the Site Constraints

10.9.2.12 The following sections discuss how the golf design has evolved to optimize the opportunities for achieving the three ecological targets and the conservation of Collared Crow and Black Kite.

Conflicts with the target of Preservation of plantation used as Night Roost

10.9.2.13 Currently plantation inside the Project Site covered over 31 ha out of the about 53 ha Project Site (close to 60% of the Project Site). Due to the behaviours of shifting night roost locations by both bird species as observed during the survey for this EIA, the locations of plantations with records of night roost usage are quite scattered (including the eastern, south-eastern and southern sides of the plantation). It is neither feasible for the golf course design nor viable for the Project to fully preserve all plantations with night roost records, as it would mean the area size becomes infeasible for an 18-hole golf course layout.

10.9.2.14 Alternatively, it is proposed to preserve existing roosting location plantation as much as practicable, in particular those to be used more frequently. For those roosting locations which could not be avoided, similar habitats will be re-provided (planting new trees in groups) in the design of the golf course.

10.9.2.15 As mentioned above, according to the analysis of the use frequencies by both Collared Crow and Black Kite in terms of night roosting sites within the Project Site, the areas with the highest use frequencies include the southern area, the south-eastern area and the eastern area.

10.9.2.16 The following summarises the approaches adopted during the design of the golf course to avoid and minimize the impacts on Collared Crow and Black Kite.

10.9.2.17 Several measures will be implemented to minimise impacts due to loss/disturbance of night roosts of Collared Crow and Black Kite. These include:

- Preservation of existing tree groups to minimise the loss;
- Erection of fencing surrounding these tree groups to minimise the construction phase impact;
- Phasing of Construction Works and Works Areas to minimise duration of impact; and

- Restriction of construction works hours to minimise the construction phase impact.

10.9.2.18 In order to minimize the potential impact of loss of roosting sites, preservation of some existing tree groups which are within the area to be used by the two bird species (Collared Crow and Black Kite) as night roosts would be an effective approach.

10.9.2.19 Construction of golf course would involve change/modification of the topography throughout the layout and thus preservation of existing trees would be difficult. Preservation of existing trees would have implications on the golf course design and the available size for the fairway layout, and thus the viability of the proposed development. Currently the Project Site, of which the area size was dictated by the ex-landfill boundary, was very challenging for an 18-hole golf course. Preserving existing tree groups would place an additional and significant constraint on the golf course layout plan, alongside the engineering constraints for site formation on a previous landfill site such as the water tank issue mentioned in **Section 2**. A reduction of available plantation as roosting sites for Collared Crow and Black Kite during construction phase is thus inevitable due to site constraints.

10.9.2.20 After taking into account the conservation need, the engineering constraints, and the requirements of a viable golf course design, a package of mitigation measures for conserving Collared Crow and Black Kite has been derived.

(A) Minimising Impact on Night Roost Loss

(A-1) Preservation of Existing plantation including major Roosting Tree Groups

(A-1-i) The Southern Area

10.9.2.21 The plantation located at the southern end of the Project Site (immediately to the south of the existing driving range) is more frequently used by CC and BK as night roosting areas (used by both species and with the highest CC usage inside the Project Site). This area is adjacent to the south-eastern end which is the only location where the ancillary facilities could be accommodated. In most golf courses, the areas surrounding the ancillary facilities are often used for car parks, putting green and driving range. After the ecological survey results become available and the importance of roosting sites confirmed, the design and layout have been substantially amended, in order to preserve the plantation trees in this area. In contrary to typical golf course which would arrange these immediately next to their ancillary facilities, the current design has relocated these facilities. The current design has turned the usual open carpark into an underground carpark, and put it underneath the ancillary facilities. This would definitely escalate the construction cost for the ancillary facilities, similar to the case of the access road but would avoid the need for an extra area for the car park.

10.9.2.22 And the layout has also opted to locate the putting green and golf driving range further away from the ancillary facilities, by at least 250m in order to preserve this major tree group utilised as roosting site. The adjacent golf hole alignments have also been modified, and the size of the driving range has also been proactively reduced from 25,000m² to 20,000m² to maximise the area size of this major tree group to be preserved.

10.9.2.23 New trees will be proposed in the future detailed planting plans adjacent to the preserved trees, where possible, to expand the tree group sizes and also provide additional buffer.

(A-1-ii) The South-Eastern Area

10.9.2.24 The plantation trees in the south-eastern area are used by both bird species as night roosts, with a relatively higher usage by BK. As discussed in **Section 2.4.8**, the site area is considered as very small for an 18-hole golf course, and would probably be the smallest 18-hole golf course in HK. In addition, the waste boundaries underneath have imposed significant constraints for various essential elements for this golf course such as ancillary facilities and water storage tanks, etc. The south-eastern area is the only location feasible for the ancillary facilities. Due to the construction works and necessary re-profiling works for the ancillary facilities, plantations at and adjacent to the ancillary facilities would be impacted. Though preservation is not feasible, larger areas of new planting trees are proposed in and near this area (heavy standard trees, or mature-size trees will be used for planting where possible to provide suitable tree groups as fast as possible).

(A-1-iii) The Eastern Area

10.9.2.25 Plantation trees in the eastern area are also used by both species but the usage is rather scattered. The current design has put the 30,000m³ water tank along the eastern edge of the site, which is the only solid ground left available for facilities with loading. The access road was put on the top of the water tanks to save the space though this would definitely escalate the construction cost for the water tank. For the eastern area in particular, the need for the water tanks has inevitably to run along the eastern site boundary and hence would cause some impacts on the existing plantation habitat. Besides, some further areas would inevitably need to be used for fairway construction. Efforts were still made to preserve two groups of existing plantation trees close to the recorded night roost locations. Like in the case of the southern area, new trees (heavy standard, or mature size where possible) will be proposed to be planted adjacent to the preserved trees as much as possible to enlarge the tree group sizes.

(A-1-iv) Preservation of Plantation Achieved

10.9.2.26 As a result of the effort to resolve the conflict, several existing tree groups with a total area size of about 6.1 ha will be preserved to

minimise the impact of loss of roosting sites for the two concerned bird species (ie Collared Crow and Black Kites) (see **Figure 10.9**). These areas include a 1.2 ha at the southern side of the Project Site in which Collared Crow has been observed using the trees as pre-roosts and frequently as final roosts during baseline surveys, and also close to Black Kite night roost locations. To facilitate this preservation, the golf course layout has been substantially amended. The original design of the golf course would have putting green and fairway right at the location of the major preserved tree group. After the ecological survey results become available and the importance of roosting sites confirmed, the layout has been substantially amended to relocate the putting green, fairway with driving range which would involve less earth works. In contrary to typical golf courses which would arrange the golf driving range immediately next to their ancillary facilities, the current layout has opted to locate the golf driving range away from the ancillary facilities by at least 250m in order to preserve the major tree group utilised as night roost sites and allow buffer from human activities. The adjacent golf hole alignments has also been modified, and the size of the proposed driving range has been substantially reduced, from 25,000m² to 20,000m² to maximise the area size of this major tree group to be preserved. During the detailed design stage of the Project, opportunities for further improvement of the golf course layout will be explored, aiming at allowing preservation of more existing plantation trees.

10.9.2.27 The total area size of preserved existing tree groups is about 6.1 ha, and the major tree group at the south side as the night roost site is 1.2 ha. Considering that both species roost in groups on limited number of trees (the roosting individuals of Collared Crow usually roosts only on a few trees, mostly 3-5, trees, and Black Kite individuals as observed also utilized less than 20 number of trees) and the roosting birds do not display strong fidelity to particular spots along the plantation at the waterfront for roosting (see Figures on night roost survey results), the preserved trees are considered having the capacity for all birds roosting in the Project Site, and also providing enough buffer during both construction and operational phase..

(A-2) Modification of Golf Course Layout and Facilities

10.9.2.28 It is important to prevent disturbance to the preserved tree groups and the adjacent new planting trees to facilitate the continuous usage of these trees as night roosts by both bird species. However, there are potential disturbance during both construction and operational phases which might jeopardize the intention of the preservation of trees.

10.9.2.29 The potential disturbance during operational phase is also considered. For the major tree group at the southern end of the Project Site, the future driving range will be located to its west. This will be similar with the present conditions as the existing driving range is immediately to the north of the location of this tree groups. Besides, to maximize the benefits of preserving the major tree group, the direction of golf shots

at the driving range has been duly considered from the ecological perspective. A typical arrangement is to have the golf shots directed to the south (i.e. facing the shoreline), so that the golf players can enjoy the sea view while practicing (see **Figure 2.3**). However, this arrangement might have potential impacts on the neighbouring night roosts (e.g. physical disturbance and light glare). Hence, the current layout of has strategically positioned the golf driving range in order to direct the golf shots towards the north, and lighting will also be limited to the driving bay area. This would minimise the potential disturbance on the major preserved tree group, in the cost of compromising the view enjoyed by the users at the golf driving range.

(A-3) Protection and Enhancement of Preserved Major Tree Groups

10.9.2.30 Protective fencing without foundations will be erected surrounding the major preserved tree group to further protect from construction disturbance. Upon completion of construction works, these protective fencing will be removed at the end of the construction period. In addition, advance enhancement planting would be implemented at the major preserved tree group. Whip planting will be conducted to replace those in poor conditions/collapsed to secure the conditions of the trees at the preserved area for night roost. Additional tree planting would also be proposed in the future detailed planting plans adjacent to the preserved tree group to expand the plantation area size as roosting sites for Collared Crow and Black Kite.

(A-4) Preservation of Other Existing Tree Groups

10.9.2.31 Several patches of plantation tree groups along the eastern boundary of the Project Site, which also include trees used by Collar Crow and Black Kite as night roosts, will also be preserved as well. Other major preserved tree groups include plantations along the western boundary of the Project Site will also be preserved as alternative roost sites for Collared Crow and Black Kite and also to provide visual screening from the industrial estate. The heights of these trees are similar to those used by Collared Crow and Black Kite as night roosts, and the tree species used as roosts is also present in these preserved plantations.

10.9.2.32 Similar advance enhancement whip planting and fencing, as those for the major preserved tree group, would also be implemented in these other preserved tree groups to replace those in poor conditions/collapsed and as protection.

10.9.2.33 Besides preservation of existing tree groups, the proposed phasing of construction (see below sections) shall allow the planting of new tree groups, with the function of roosting site reprovision, to be conducted at early stage.

(A-5) Environmentally Sensitive Construction Programme

10.9.2.34 In addition to preservation of tree groups for roosting, the construction programme has also been designed to minimise potential disturbance to

bird roosting within the Project Site and to reprovide additional roosting sites.

10.9.2.35 Construction phasing is designed to minimise the duration of possible indirect disturbance to the major preserved tree group as roost sites. Construction activities in the Project Site will be implemented by phases. This will enable existing plantation trees to be lost gradually, and new planting will also be provided gradually during the construction, rather than after all construction is finished as in other projects. Upon completion of site formation at each phase, landscape planting will be implemented immediately before the beginning of next phase such that new tree groups aiming for roosting site provision will be planted before site clearance in the next phase (see **Figure 2.2** for indicative illustration). Extensive new tree planting is proposed under Landscape Impact Assessment of the present EIA and the new tree groups will cover about 10 ha. The new trees will be planted in patches or several rows (see inserts in **Figure 10.9**), to allow the future tree groups suitable for bird roosting. Heavy standard trees (or mature-size trees where possible) will be included in the planting list to facilitate the establishment of new tree groups as early as possible.

10.9.2.36 The construction site will be divided into three areas (i.e. northern, middle and southern in Area 1, 2 and 3 respectively, see **Appendix 10.18**) and the major earth works in each area will be conducted separately in three phases, starting from landward side. As such, the roosting habitats will not all be lost in one time, but by phases. As no roost site used by either Collared Crow or Black Kite was recorded in the works area of Area 1 during the surveys, so no impacts to the roosting colonies are anticipated during Area 1 construction, and the roosting habitats in Area 2 and Area 3 will not be impacted in one time, but by phases. Site re-profiling of the area near the major preserved tree group in the southern end would fall under the last phase (Area 3) of construction.

10.9.2.37 Restricted Working Hours: In addition, working hours will be restricted during construction phase to minimise potential disturbance to utilisation of the preserved plantations by Collared Crow and Black Kite as night roosts. Construction hours will also be restricted to daytime when Collared Crow and Black Kite mainly use areas outside the Project Site. While the normal works hours are 0700-1900, work hours of powered mechanical equipment in Area 3 of the Construction Programme (i.e. the southern part of the Project Site, near the major preserved tree group), the ancillary facilities (including part of the water storage tanks and traffic along the existing access road), and the eastern part of Area 2 (near another preserved tree groups) will be restricted to at least one hour before sunset (**Figure 10.10**), following the proposed restriction hours derived from the earliest sunset time in each month between 2018 and 2020 (source: Hong Kong Observatory) (see **Table 10.9.1** below). The proposed restriction of works hours would slightly extend the construction programme, but would provide sufficient time for powered mechanical equipment to halt before sunset when Collared

Crow and Black Kite might be in search of a roost site. Therefore, given these multiple protection measures, the potential construction disturbance to the preserved tree group for Collared Crow and Black Kite would be minimised.

Table 10.9.1 Proposed restriction time for operation of powered mechanical equipment in Area 3, the ancillary facilities, and the eastern part of Area 2.

Year Month	Earliest sunset time in each month between 2018 and 2020 from Hong Kong Observatory website			Proposed restriction hours for powered mechanical equipment to be stopped in different months
	2018	2019	2020	
Jan	17:51	17:51	17:50	16:30
Feb	18:12	18:12	18:11	17:00
Mar	18:27	18:27	18:27	17:30
Apr	18:38	18:38	18:39	17:30
May	18:50	18:50	18:50	17:30
Jun	19:03	19:03	19:04	18:00
Jul	19:05	19:05	19:04	18:00
Aug	18:41	18:42	18:41	17:30
Sep	18:12	18:12	18:12	17:00
Oct	17:47	17:47	17:47	16:30
Nov	17:38	17:38	17:38	16:30
Dec	17:38	17:38	17:38	16:30

(B) Minimising Impact on Protected Plant Species

10.9.2.38 The two individuals of *Aquilaria sinensis* recorded within the Project Site will be preserved in-situ inside the preserved tree groups.

(C) Minimising Aquatic/Marine Ecological Impact

10.9.2.39 To reduce the potential water quality impact due to construction site runoff, good site practices as described in Practice Note for Professional Persons on Construction Site Drainage, Environmental Protection Department, 1994 (ProPECC PN 1/94) should be implemented where applicable to avoid potential adverse water quality impacts.

(C-1) Retention of Construction Site Runoff

10.9.2.40 As mentioned in **Section 2.5** and **Section 6.5**, water storage tanks with a total volume of 30,000 m³ will be constructed in phases underneath the future access road (which runs along the seafront and leads to the ancillary facilities) during site formation works. Primarily designed for

the operational phase storage of surface runoff from the Project Site to minimize the discharge during raining, these water storage tanks, once any of them are constructed, would also serve to temporarily store site runoff during construction phase. During the construction phase, a temporary drainage system would be installed around the site perimeter as per the requirements stated in the water quality chapter, to intercept all construction runoff and divert it to the water storage tanks. Construction site surface runoff collected by the storage tanks will undergo sufficient sedimentation before discharged to Tolo Harbour.

10.9.2.41 Other mitigation measures stated in the water quality chapter such as dikes or embankments for flood protection, silt/sediment traps, oil interceptors will be implemented.

(C-2) Works Programme to Minimise Site Runoff

10.9.2.42 Construction works should be programmed to minimize surface excavation works during the rainy seasons. All exposed earth areas should be vegetated as soon as possible after earthworks have been completed. If excavation of soil cannot be avoided during the rainy season, or at any time of year when rainstorms are likely, exposed slope surfaces should be covered by tarpaulin or other means.

10.9.2.43 All construction materials at temporary storage areas should be covered with tarpaulins or similar fabric during rainstorms. Measures should be taken to prevent the washing away of construction materials, soil, silt or debris into any drainage system.

10.9.2.44 During modification of open channels, precaution measures shall be implemented to prevent adverse water quality impact to the surrounding environment.

(C-3) Collection and Retention of Residual Agrochemicals and Runoff

10.9.2.45 During operational phase, a collection system, conveying the runoff to the water storage tanks, designed to withstand rainstorms of a 50-year return period will be installed. The surface runoff from turfgrass and landscaped areas will be collected by surface channels and diverted to the proposed water storage tanks (with a total volume of 30,000 m³), especially the first flush runoff from turf area after raining, to prevent the discharge of residual agrochemicals into Tolo Harbour and to minimize the bypass of runoff. Since the Project Site was once a landfill site, excavation or heavy loading is not allowed for most of the site due to the ex-landfill waste bodies underneath. The location of water storage tanks is thus limited to the area along the eastern side of the Project Site. Having considered the available space and site constraints, the volume of the proposed water storage tanks is optimized to 30,000m³. It is anticipated that adverse water quality impacts can be minimized with the proposed water storage tanks and collection system.

(C-4) Environmentally Conscious Turfgrass Management Plan

10.9.2.46 The future TMP will set out the management practices which could significantly reduce the amount of agrochemical application and thus the residual agrochemicals.

10.9.2.47 The amount of herbicides to be applied will be minimised through the implementation of the future TMP. Mechanical methods (hand weeding) of removing turfgrass weeds will be the primary means of weed control. Application of herbicides to the turf area will not be a regularly scheduled practise, and spot spraying will be adopted only when necessary.

10.9.2.48 Furthermore, the TMP will also take into account the weather conditions. When prolonged rainfall is forecasted, the application of agrochemicals in the golf course will cease.

(C-5) Utilisation of Runoff for Irrigation

10.9.2.49 As the water storage tanks have dual purposes on storage of surface runoff as well as storage of water from different water sources to cope with irrigation demand, an outline management plan for the water storage plan has been formulated. The Water Management Plan (as part of the TMP) will provide outline for daily management practices on the water storage and usage, so as to prepare the storage capacity in time to cope with rainfall events, including lowering the irrigation storage during rainy season, suspension of water extraction from off-site open channel, and fully consuming stored water when prolonged rainfall is forecasted. As stated in **Section 6.5.2**, with the optimised water storage tanks and those management practices in place, the number of days with bypass events have been significantly minimized. And the bypass events would mainly occur during extreme weather events (tropical cyclones and/or red/black rainstorm events) or prolonged rainfall. In both cases, there would be sufficient time or amount of runoff to carry the residual agrochemicals to the water tanks by the first flush. Furthermore, the concentrations of agrochemicals in the water storage tanks would be insignificant and would comply with the standards even inside the tanks as shown by Water Quality assessment. Even though, only additional runoff will be bypassed when the tanks are full.

10.9.2.50 For the location of outfall, it is proposed to be located away from the adjacent ecologically related WSRs and it is shown in **Figure 6.2**. The location of outfall is proposed to be away from the WSD Seawater Intake in Tai Po (S1), seahorse (H1) and corals (C1, C2 and C3) which are located at the south of the Project Site.

10.9.3 Impact Compensation

10.9.3.1 The construction phase and operational phase impacts and corresponding mitigation measures are summarised in **Table 10.9.2**. As the potential impact due to the habitat loss on Turf, Grassland and Developed Area is ranked as minor, no mitigation is required. The

proposed golf course will provide similar or more diverse habitats than does the existing driving range.

10.9.3.2 Extensive tree replanting plan: For the loss of plantation, the future golf course will include extensive plantation areas of about 10ha. Compared with the current restoration-orientated management, it is expected that the future vegetation management implemented under the golf course operation will result in better development of the plantation trees. Those new plantation areas will provide higher ecological functions (see below sections) and would be able to compensate the loss of the existing plantation which are of low diversity and will be lost by phases in accordance with the construction programme.

10.9.3.3 Plant species with higher ecological value: As potential impacts to fauna of conservation importance (except Collared Crow and Black Kite) are considered minor, no specific mitigation measures are required. The extensive tree planting (about 10 ha see the section above) and landscape planting for the future golf course, however, will still adopt a planting species list of higher diversity, including more native plant species, and providing more resources for wildlife (e.g. by selecting more bird-attracting and butterfly-attracting tree and shrub species which could provide berries and nectar). This will enhance the utilisation of the Project Site by wildlife, as well as enhance the ecological capacity of the Project Site. Mitigation measures for Collared Crow and Black Kite are described below.

10.9.3.4 To mitigate loss of roosting sites for Black Kites and Collared Crow, in addition to preserving existing tree groups including the major one in the southern end of the Project Site, tree planting during construction phase will provide new roosting sites in the Project Site. New tree, mainly native trees with large growth form will be planted to enhance the ecological value of the site. Heavy standard trees (or mature-size trees where possible) including *Hibiscus tiliaceus*, *Liquidambar formosana*, and *Schima superba* will be planted in patches/tree belts across the golf course as well as along the access road and near the waterfront to quickly provide established tree groups. *Casuarina equisetifolia* is the tree species most used for roosting on site. Besides intentional preservation of some existing *Casuarina equisetifolia* tree individuals inside the preserved tree groups, the proposed planting list for the new trees also includes *Casuarina equisetifolia* though it is an exotic species. Where possible, new trees will be proposed adjacent to the preserved trees, to expand the preserved tree groups and also provide additional buffer. It is expected that more potential roosting sites will be available as the new tree plantings mature over time.

10.9.3.5 Early implementation of replanting works: In addition to include a higher proportion of heavy standard trees (or mature-size trees where possible) in the planting mix, soft landscape works will also be implemented immediately following completion of site formation at each phase rather than at the end of all construction phases. This will ensure that they are available for wildlife use before commencement of

the next construction phase. Tree planting will be implemented on the Phase 1 works area before construction activities commence on the Phase 2 works area. Hence, alternative roosting sites will be provided in the Phase 1 works area prior to the loss of roosting sites of Collared Crow and Black Kite in the Project Site. Similarly, tree planting will be implemented on the Phase 2 works area before construction activities commence on the Phase 3 works area. There will be alternative roosting sites available in the Phase 1 and Phase 2 works areas prior to the loss of roosting sites of Collared Crow and Black Kite on the Phase 3 area, in addition to the preservation of the major tree group at the south side.

10.9.3.6 As no direct impact on marine ecology is anticipated, no specific mitigation measures other than good site practices to control water quality are required.

10.9.3.7 A summary of the impacts in construction and operational phases, with sources, receivers, nature, significance and mitigation required, was provided in **Table 10.9.2** below.

Table 10.9.2 Summary of construction phase and operational phase impacts

Impact	Sources	Receivers	Nature of impacts						Significance of an ecological impact	Mitigation required
			Habitat quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
Construction Phase – Direct impacts										
Terrestrial habitat loss	Site re-profiling	Developed Area	Very low	Low flora diversity, mainly composed of landscape and ornamental species. Low diversity of dragonfly, very low diversity of bird and butterfly	About 4.15 ha	Permanently replaced by golf course which provides a much higher vegetation cover	Recreation of habitat feasible	Small	Insignificant	No
		Grassland	Low	Low diversity of flora and fauna	About 2.99 ha	Permanently replaced by other vegetation	Recreation of habitat feasible	Small	Insignificant	No
		Turfgrass	Low (except occasionally used as pre-roosts by Collared Crow)	Low flora and fauna diversity and abundance, occasional include Collared Crow and Black Kite	About 14.36 ha	Permanently replaced by similar golf course turfgrass and more diverse vegetation, with better management	Recreation of habitat feasible	Moderate	Minor	No

Impact	Sources	Receivers	Nature of impacts						Significance of an ecological impact	Mitigation required
			Habitat quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
		Plantation	Low (except as night roosts for Collared Crow and Black Kite)	Dominated by exotic and landscape restoration trees. Low to moderate flora diversity. The diversity and abundance of other fauna were low.	About 25.23 ha (out of the existing 31.38 ha)	Permanently replaced by more diverse new planting trees and golf course turfgrass and other vegetation	Recreation of habitat feasible	Large	Minor to moderate (excluding impact to roosting birds)	Yes, planting of new tree groups will be proposed under Landscape Assessment
Loss of plantation trees used by birds as night roosts in the Project Site	Site re-profiling	CC and BK using the Project Site as night roost	Moderate	Collared Crow and Black Kite	Ranging from 12-100 individuals for Collared Crow, and from 5-147 for Black Kite.	Permanent	Not reversible, but new tree planting feasible	Minor for Black Kite, moderate for Collared Crow	Moderate for Collared Crow and Minor to moderate for Black Kite	Yes. Preservation of 6.1 ha tree groups which include locations more frequently used as roost, through changes of layout design. Planting about 10 ha new trees in patch, and/or in several rows. Phasing of construction programme to phasing the loss and speed up the new planting.

Impact	Sources	Receivers	Nature of impacts						Significance of an ecological impact	Mitigation required
			Habitat quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
Temporary habitat loss	Off-site works area	Habitats at off-site works area	Vary	Vary	Subject to construction needs	Temporary	Subject to reinstatement	Minor	Not anticipated	No
Direct impacts on floral species of conservation importance	Site re-profiling	Floral species of conservation importance	Very low to low	Incense Tree <i>Aquilaria sinensis</i> within the Project Site	Two individuals	Permanent	Planting / translocation feasible	Insignificant	In-situ preservation is provided, no significant impact	No
Direct loss of habitats for faunal species of conservation importance	Site re-profiling	Faunal species of conservation importance other than Collared Crow and Black Kite	Very low to low	Such as Leschenault's Rousette, Eastern Cattle Egret, Eurasian Hobby, Greater Coucal, Grey-chinned Minivet, Rufous-capped Babbler and Chinese Hwamei.	Very low to low	Permanent	Planting new trees and shrubs to provide habitats feasible	Insignificant	Minor	No. But future planting will include plant species which could provide food sources for wildlife.
Impacts on marine habitats and spp of conservation importance	Site formation	Marine habitats in the surrounding marine waters	Basically low	Mostly common species	Vary with locations	Permanent	Depend on habitat types	Avoided as no marine works	Avoided	No
Construction Phase –Indirect Impact										
Disturbance impacts - Noise, dust and human activities	Construction works	Fauna in and nearby	Vary with habitat types, mostly are of low ecological value	Mostly common species	Vary with locations	Temporary	Reversible	Minor	Insignificant	No But good site practices and phasing of construction programme will be implemented.

Impact	Sources	Receivers	Nature of impacts						Significance of an ecological impact	Mitigation required
			Habitat quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
	Construction works near the preserved tree groups	CC and BK using the preserved trees as night roost	Low for the plantation habitat, but moderate for its function as night roost.	Collared Crow and Black Kite using the tree groups as night roost	The key preserved tree groups are 1.2 ha.	Temporary	Reversible	Minor to Moderate	Minor to moderate	Yes. No night time works Suspension of powered mechanical equipment at least one hour before sunset at certain areas Protective fencing without foundation will be erected
Construction Light glare	Security lighting	Fauna inside and near the Project Site including CC and BK using the preserved and newly planted trees	Low for most habitats in the vicinity, but moderate for the major preserved tree group	Fauna in the surrounding habitats Collared Crow and Black Kite using the tree groups as night roost	Limited to areas required security lighting	Temporary	Reversible	Minor as no night time works	Insignificant for the habitats outside the Project Site Insignificant for both roosting Collared Crow and Black Kite	No. But precautionary, the light for security purposes will direct away from the preserved tree groups and the brightness level should be appropriate
Whip planting inside preserved tree groups	Planting works	CC and BK using the preserved trees as night roost	Moderate for the preserved plantation with function as night roost	Collared Crow and Black Kite using the tree groups as night roost	Limited to isolated areas with dead/ collapsed trees	Temporary	Reversible	Insignificant as planting will be conducted in day time only	Insignificant	No
Site Runoff	Re-profiling works	Inland water quality	Low	Aquatic fauna	Moderate abundance	Temporary	Reversible	Minor	Unlikely	No mitigation for ecology But good site practice as stipulated in ProPECC PN1/94

Impact	Sources	Receivers	Nature of impacts						Significance of an ecological impact	Mitigation required
			Habitat quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
	Re-profiling works	Adjacent marine waters	Low	Marine and intertidal fauna	Vary with locations	Temporary	Reversible	Moderate given the area size of the Project Site	Insignificant with the storage water tanks to store site runoff	and site precautionary measures will be implemented for inland waters and marine waters. Phasing of construction programme for inland waters and marine waters.
Pollutants and chemical spillage	From machinery inside the site	Coastal waters and sub-tidal soft bottom seabed offshore	Low	Marine and intertidal fauna	Vary with locations	Transient	Reversible	Minor	Insignificant	No specific mitigation is required other than water quality mitigation
Operation phase – Direct Impacts										
Habitat loss due to the footprint	The Golf course and associated facilities	Habitats inside the Project Site and associated Fauna	Basically low	Mostly common species except a few such as Collared Crow and Black Kite	Vary with locations	Permanent	Depend on habitat types	Moderate But both habitat diversity and plant species diversity would be higher.	Positive effects as more native plant species of higher ecological value compared to the existing exotic tree dominant plantation.	Mitigation has been provided in above. The proposed golf course would be mostly covered by vegetation with about 16 ha plantation.
Operation phase – Indirect impacts										
Noise, Traffic and Human Activities	Golf course and driving range operation	Fauna inside and near the golf course	Vary with habitat types, mostly are of low ecological value except the plantation used by birds as night roost	Mostly common species except CC and BK	Vary with locations	Long-term	Reversible	Minor	Insignificant for other fauna Minor for Collared Crow and Black Kite	No

Impact	Sources	Receivers	Nature of impacts						Significance of an ecological impact	Mitigation required
			Habitat quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
	Staff quarters and overnight accommodations	Fauna near the staff quarters and overnight accommodations	Vary with habitat types, mostly are of low ecological value except the plantation used by birds as night roost	Mostly common species except CC and BK	Vary with locations	Long-term	Reversible	Minor as facing the waterfront and mainly indoors use.	Insignificant	No
Artificial lighting	Lighting in the driving range	Nocturnal fauna and roosting birds inhabiting habitats adjacent to the light sources	Vary with habitat types, mostly are of low ecological value	Mostly common species except CC and BK	Vary with locations	Long-term	Reversible	Minor as the opening hours would be similar with the current driving range	Insignificant for the habitats outside the Project Site Insignificant for both roosting Collared Crow and Black Kite	No but potential impact of lightings could be further minimized by the design of lightings, to direct the light towards target areas only.
Habitat Fragmentation	The development	Fauna inhabiting natural habitats within the Assessment Area	Vary with habitat types, mostly are of low ecological value	Mostly common species	Vary with locations	Permanent	Non- reversible	Insignificant as the Project Site will be largely covered by vegetation	Insignificant	No specific measure required
Barrier Effect to bird flights	Ancillary facilities	Large sized birds	Vary with habitat types, mostly are of low ecological value	Mostly common species	Low	Permanent	Non- reversible	Insignificant as no high rise building	Insignificant	No.
Risk of Argochemicals to wildlife	Turfgrass maintenance	Wildlife inside Golf Course	Low	Mostly common species	Low	Occasional	Transient	Minor as minimal application under the Turfgrass Management Plan and proven experience in other golf courses	Insignificant	No specific measure required

Impact	Sources	Receivers	Nature of impacts						Significance of an ecological impact	Mitigation required
			Habitat quality	Species affected	Size / abundance	Duration	Reversibility	Magnitude		
Marine Water Quality changes due to residual argochemicals	Turfgrass maintenance	Coastal waters and sub-tidal soft bottom seabed	Vary within the assessment area	Marine organisms in the surrounding marine waters	Vary within the assessment area	Occasional	Transient	Minor as first flush will be intercepted by the water storage tanks	Not anticipated	No specific mitigation is required with the water storage tanks, drainage system, Turfgrass Management Plan, and WQ monitoring in place
Marine Water Quality changes due to sewage	Sewage generated within the Project and emergency bypass at SPS	Coastal waters and sub-tidal soft bottom seabed	Vary within the assessment area	Marine organisms in the surrounding marine waters	Vary within the assessment area	Not anticipated for sewage flows Unlikely for emergency bypass	Not anticipated for sewage flows Unlikely for emergency bypass	Not anticipated for sewage flows Negligible for emergency bypass	Not anticipated	No specific mitigation is required with the sewage conveyed to TPSTW and design provision of SPS to prevent emergency bypass

10.10 Residual Impacts

10.10.1 Residual Impacts for Terrestrial Ecology

10.10.1.1 The construction phase and operational phase impacts and corresponding mitigation measures are summarised in **Table 10.9.2**. About 25ha of plantation trees will be impacted due to the Project. With the planting of about 10 ha new trees which will include native trees with higher diversity, large growth form and higher ecological functions, there will be a net loss of about 15 ha of existing plantation, which will be replaced by other forms of vegetation (such as turfgrass and landscape vegetation) which will also have higher ecological value such as bird-attracting and butterfly-attracting functions. Though a temporary reduction of area sizes of plantation, the major tree groups frequently used as roosting sites will be preserved, which are of considerable sizes when compared with the numbers of trees used by roosting birds. With implementation of the mitigation measures, no adverse residual impacts to terrestrial ecology are anticipated.

10.10.2 Residual Impacts for Marine Ecology

10.10.2.1 No direct loss to marine ecology is anticipated from the Project during construction and operational phases. With the implementation of the mitigation measures, no adverse residual impacts to marine ecology are anticipated.

10.11 Environmental Monitoring and Audit (EM&A)

10.11.1 EM & A for Terrestrial Ecology

10.11.1.1 During construction phase, roost surveys should be conducted on the Project Site to monitor utilisation of the preserved tree groups by Collared Crow and Black Kite.

10.11.1.2 During operation phase, roost surveys should be conducted to monitor the utilisation by Collared Crow and Black Kite of both the preserved and new tree groups within the Project Site. The details of monitoring methodology programme have been included in the EM&A Manual.

10.11.2 EM & A for Marine Ecology

10.11.2.1 Site inspections and water quality monitoring during construction phase shall be carried out to monitor any malpractice leading to deterioration of water quality of the surrounding which may in turn affect marine ecology. Water monitoring are also required during operational phase to verify the prediction of no anticipated adverse impact.

10.12 Conclusions

- 10.12.1.1** Due consideration of avoidance and minimisation have been taken in the present Project. No marine works is proposed.
- 10.12.1.2** The Project Site is located in a restored landfill covered with man-made habitats of low ecological value including turfgrass in driving range and restored plantation, and away from recognised sites of conservation importance and other important habitats.
- 10.12.1.3** The impacts of habitat loss caused by the Project are thus of limited severity. The vegetation on the future golf course including newly planted tree groups, landscape areas, and also the turfgrass on golf playing areas will have a high ecological functions as native plant species with higher diversity and higher ecological value are included.
- 10.12.1.4** Part of the plantation trees to be used by Collared Crow and Black Kite as roosting sites will be lost during construction but tree groups with high use are preserved, and new trees of heavy standard (or mature-size where possible) will be planted.
- 10.12.1.5** During the operational phase, the surface runoff and residual agrochemicals are the key identified environmental impacts. Drainage system and water storage tanks with a total volume of 30,000m³, together with a proper location of outfall sited away from the ecologically related WSRs are designed to minimize the water quality impact. The sewage from the proposed development would be conveyed to TPSTW for treatment. Residual adverse ecological impacts are not anticipated.

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