# 10 ECOLOGICAL IMPACT

## 10.1 Legislation and Standards

**10.1.1** The relevant legislation and associated guidelines to the present study for the assessment of ecological impact include:

(1) Forests and Countryside Ordinance (Cap. 96) and its subsidiary legislation, the Forestry Regulations;

(2) Wild Animals Protection Ordinance (Cap. 170)

(3) Environmental Impact Assessment Ordinance (Cap. 499) and relevant Annexes 8, 11, 16, 20 and 21 of the associated Technical Memorandum;

(4) EIA Study Brief No. ESB-247/2012;

(5) Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586) and its subsidiary legislation;

(6) Hong Kong Planning Standards and Guidelines (HKPSG) Chapter 10, "Conversation";

(7) Planning, Environment and Lands Bureau Technical Circular 1/97/ works Branch Technical Circular 4/97, "Guidelines for Implementing the Policy on Off-site Ecological Mitigation Measures";

(8) EIAO Guidance Note No. 6/2002 – Some Observations on Ecological Assessment from the Environmental Impact Assessment Ordinance Perspective;

(9) EIAO Guidance Note No. 7/2002 – Ecological Baseline Survey for Ecological Assessment;

(10) EIAO Guidance Note No. 10/2004 – Methodologies for Terrestrial and Freshwater Ecological Baseline Survey

(11) Revised versions of EIAO Guidance Notes 6/2010, 7/2010 and 10/2010 (issued December 2010).

**10.1.2** International conventions and guidelines potentially relevant include:

(1) Convention on International Trade in Endangered Species of Wild Fauna and Flora ("CITES"). This Convention regulates international trade in certain animal and plant species. 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).

(2) 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).

(3) 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 5$^{th}$ January 1993. The

HKSAR Government has stated that it is "committed to meeting the environmental objectives" of the Convention.

## 10.2 Description of Existing Environment

**10.2.1** Baseline ecological conditions presented in this report are derived from the results of ecological field surveys conducted within the Study Area and Assessment Area of the proposed development. Surveys were conducted between April and July 2013.

### *Study Area and Assessment Area*

**10.2.2** In accordance with Section 3.4.10.2 of the Study Brief No. ESB-247/2012, the Assessment Area for the purpose of the terrestrial ecological impact assessment includes all areas within 500m of the boundary of the Study Area (**Figure 227724/E/6101**) and the areas likely to be impacted by the Project. In this context, **"**Study Area**"** in this section refers to the areas within the boundary of the proposed developmental design, whereas **"**Assessment Area**"** refers to the whole area within the 500 m radius from the boundary of the **"**Study Area**"**.

**10.2.3** The Study Area involves an existing quarry site at Anderson Road. It is located on the southwestern slope of Tai Sheung Tok Hill at the far northeastern edge of urban East Kowloon, overlooking the densely populated areas of Sau Mau Ping, Lam Tin and Tsui Lam. The existing quarry site is excavated into the southwest facing slope of Tai Sheung Tok Hill, and forms a series of rock faces, slopes and benches of approximately 60 degrees. With a total area of approximately 86 ha, the quarry operation will not cease until 2015, and the associated rehabilitation works will be completed by mid-2016. According to the approved Kwun Tong (North) Outline Zoning Plan No. S/K14N/13, the Study Area falls within Other Specified Uses (Mining and Quarrying), in which the planning intention is primarily for the implementation of quarry operations and rehabilitation works.

**10.2.4** The Assessment Area comprises a mix of urbanised habitats such as public housing estates (Shun Lee Estate, Shun On Estate, Shun Tin Estate, Sau Mau Ping Estate and Po Tat Estate), the existing construction site for the development at Anderson Road (i.e. the ex-quarry site to the southwest of Anderson Road), associated infrastructure and villages, as well as secondary woodland, shrubby grassland and natural watercourses (including Tseng Lan Shue Stream) mainly situated to the northeast, east and south of the Assessment Area.

**10.2.5** According to the latest RODP (details refer to Chapter 3) for the Project, the proposed development in the Study Area will include residential development (including public housing) and other associated commercial and recreational uses to meet territory, district and local needs. A population of approximately 25,000 is targeted for the residential development, with plot ratios for subsidised housing and private housing at 6.3 and 4.2 respectively. In identifying ecological resources and habitats/areas of ecological significance, the ecological impact assessment will examine the flora, fauna and other components of the Study Area and Assessment Area, identify the potential ecological impacts associated with the Project and recommend any mitigation measures for the identified ecological impacts predicted from the Project.

### *Recognized Sites of Conservation Importance*

**10.2.6** There are a number of recognized sites of conservation importance surrounding the Study Area. Any development within the Study Area should define and address

potential impacts to these sites. Locations of these recognized sites of conservation importance are shown in **Figure 227724/E/6106**.

*Conservation Area*

**10.2.7** A Conservation Area covering an area of about 33 ha is located to the northeast and east of the Study Area. The planning intention of this area is to protect and retain the existing natural landscape, ecological or topographical features of the area for conservation, educational and research purposes, and to separate sensitive natural environment such as Country Park (i.e. Ma On Sha Country Park in this Project) from the adverse effects of development. This Conservation Area is a natural hill slope vegetated with a mosaic of mature secondary woodland and shrubby grassland. Foraging and roosting habitats for wildlife within this Conservation Area are present, but the existing knowledge is limited. The Conservation Area does not fall within any part of the Study Area, though almost all lies within the Assessment Area.

*Tseng Lan Shue Stream*

**10.2.8** Tseng Lan Shue Stream is a 3km long stream flowing through Tseng Lan Shue Tsuen and Pak Shek Wo Tsuen and finally entering the inner part of Junk Bay. Tributaries of this stream pass through various natural vegetated hillside areas as well as modified, disturbed areas until they reach the concrete channels in urbanised areas. Ecological information on Tseng Lan Shue Stream is limited. CED (1998) reveals that the tributaries are either quite polluted with a heavy load of fine suspended sediment, or possess little water flow. No aquatic fauna were recorded in CED (1998). However, the recent Water Quality Index measured at the upstream monitoring station near Tseng Lan Shue Tsuen has improved from "Very Bad" (in 1991) to "Fair" (in 2011) (EPD 2011). Improvement in water quality and implementation of Sewerage Master Plans may benefit fauna recolonization in the stream.

*Ma On Shan Country Park*

**10.2.9** Ma On Shan Country Park is located in the eastern New Territories and covers inland upland areas between Sai Sha Road and Hebe Haven, which lies between Pak Sha Wan and Port Shelter. The area was first designated as Country Park in 1979, with subsequent revision made in 1998, and covers an area of approximately 2,880 ha. Ecologically, the less disturbed ravines and valleys of the eastern slopes support rare flora, and, to preserve the natural resources in these lowland areas (55ha), the eastern lowlands were designed as a Special Area in 1980. Rare and protected plants such as shrubs *Rhododendron* spp., ferns (*Hymenophyllum austrosinicum*) and orchids are found in hilly areas, while the relatively undisturbed Country Park is also inhabited by common mammal species. The proposed development of Anderson Road Quarry is highly unlikely to impose significant impacts on species or habitats in Ma On Shan Country Park, as the nearest points of the Country Park and the Study Area are separated by urbanized habitats (i.e. roads, villages and public housing) and the Country Park lies at least 0.75km from the Study Area. It is also located outside the Assessment Area.

*Ho Chung Valley SSSI*

**10.2.10** Ho Chung Valley SSSI is a valley area located above Ho Chung Village. This area includes vegetated ravines and hillsides running west and northwest from Ho Chung Village into the mountain mass of Fei Ngo Shan and Buffalo Hill. This SSSI covers approximately 395 ha and was designated in 1979 for the presence of rich floristic resources, including rare orchids, ferns and herbs. Due to its location, this SSSI is

protected within Ma On Shan Country Park and situated approximately 1 km from the Study Area. It is also located outside the Assessment Area.

### *Literature Review*

**10.2.11** Existing knowledge regarding the ecology of the Assessment Area, especially for the natural terrestrial habitats at the north and northeast of the Area, is very limited. The Final Ecological Impact Assessment Report on Planning *and Engineering Feasibility Study for Development at Anderson Road* (CED 1998) and Final Environmental Review Report on *Agreement No. CE 55/2005 (CE) Development at Anderson Road – Design and Construction* (Arup 2009), in which the ecological review was mostly based on CED (1998), are the major relevant studies to the Study Area.

**10.2.12** CED (1998) identified the terrestrial habitats, flora and fauna (including avifauna, breeding birds, mammals and aquatic fauna) in the development site of Anderson Road, and determined that woodlands at the northern and southern ends of the site supported higher floral and faunal diversity and were of higher ecological value than other natural and human-disturbed habitats. However, as the site was studied in 1997-1998 and habitat changes have arisen from concurrent site formation and associated infrastructural works in recent years, data collected in this earlier study is considered out of date.

**10.2.13** In the feasibility study on future land use at Anderson Road Quarry, Arup (2012) identified woodland/shrubland and developed area as the two major habitat types within the current 500m Assessment Area, with natural streams scattered among the hillside habitats. In particular, Tseng Lan Shue Stream was identified as of potential ecological significance, a few tributaries of which lie within the Assessment Area. A Conservation Area located to the north and northeast of the Study Area comprises hill slope naturally vegetated with mature woodland, and it was also identified as of significant landscape value. Ma On Shan Country Park is located in the northwestern side and separated from the Study Area by Clear Water Bay Road. The Country Park lies at least 0.75km from the Study Area as well as outside the Assessment Area.

**10.2.14** Botanically, the Master Landscape Plan Report, and its associated Milestone Reports for rehabilitation of Anderson Road Quarry provide the planting schemes and landscape plan implemented on the slopes and benches along the northeastern and eastern sides of the quarry. These reports provides the general species composition of plantation mix, tall shrub mix, climbers and ground cover planted on the slopes and benches throughout the period from 1999 to 2013.

**10.2.15** A review of Arup (2001) and CEDD (2008) on the feasibility study for South East Kowloon Development and Kai Tak Development respectively did not provide any data related to habitats, vegetation or wildlife relevant to the current Study. Ecological impact assessment areas and scope of works studied by these two approved EIAs were located some way to the south of the current Study Area, and hence are considered to be irrelevant.

## 10.3 Survey Methodology

**10.3.1** In view of the lack of updated ecological data from the Project Area and its vicinity, ecological surveys of all flora and fauna were conducted within the Study Area and its 500m Assessment Area. Surveys were conducted from April to July 2013. **Table 10.1** outlines the survey schedule of all flora and fauna groups during the four-month survey

period. All methodologies followed the ecological survey methodologies recommended in EIAO Guidance Notes No. 7/2010 and 10/2010. Methodologies for each group are detailed below. Transects of fauna surveys are shown in **Figures 227724/E/6201**.

**Table 10.1:** Ecological survey programme during the four-month survey period (April to July 2013)

| Surveys | April 2013 | May 2013 | June 2013 | July 2013 |
|---|---|---|---|---|
| Habitat and Vegetation[1] | | | √ | √ |
| Mammal | √ | √ | √ | √ |
| Mammal (night-time)[2] | | | √ | √ |
| Avifauna | √ | √ | √ | √ |
| Avifauna (night-time) | | √ | √ | |
| Herpetofauna (day-time) | √ | √ | √ | √ |
| Herpetofauna (night-time) | | √ | √ | |
| Dragonfly and Butterfly | √ | √ | √ | √ |
| Stream Fauna | √ | | | √ |

Notes:

[1] Surveys on habitats and vegetation were conducted on two survey days in June and July 2013 so as to cover the entire Study Area and Assessment Area.

[2] Night-time surveys on mammal were adjusted from the tentative survey programme in May and June 2013 to June and July 2013 due to the rainy weather in May 2013.

## *Habitat/ Vegetation Survey*

**10.3.2** Habitat mapping of the Assessment Area was initially conducted by reference to the latest available aerial photographs and verified through ground-truthing of the area, in order to confirm habitat types and condition. Vegetation survey was conducted in accessible areas and along paths on 19 June and 9 July 2013 to characterise vegetation in the Assessment Area. All plant species observed were recorded and their relative abundance in each habitat was noted. General characteristics of the flora community present in each habitat type were noted for use in habitat description and evaluation. All recognized sites of conservation importance, locations of habitats and species of conservation importance recorded within the Assessment Area were mapped. Representative colour photographic records of each habitat type and identified ecological features were taken and presented in **Appendix 10.1**.

## *Mammal and Bat Roost Survey*

**10.3.3** Daytime mammal surveys were undertaken on a monthly basis during the survey period from April to July 2013. Signs of mammals, such as droppings, diggings, burrows, scats, paw prints and tracks were photographed and identified as far as possible if found. Special attention was paid to identifying the potential presence of bat roosts and specific surveys for bats using detectors were conducted in suitable habitats within the Assessment Area in June and July 2013. During all other diurnal and nocturnal surveys, any direct observations of mammals were recorded. Nomenclature follows Shek (2006).

### *Bird Survey*

**10.3.4** Monthly bird surveys were undertaken from April to July 2013. Survey effort was greatest in habitats that offer most opportunities for birds, e.g. patches of woodland and streams. During the bird survey, all birds seen or heard were identified and recorded according to the habitat in which they were observed. All bird species of conservation importance were enumerated. Special attention was paid to areas which may provide suitable habitats for raptors and woodland-dependent migratory bird species. Observations of any nocturnal bird species were conducted on two occasions in May and June 2013. Nomenclature follows the latest official Hong Kong Bird List available, whereas conservation status follows Carey *et al.* (2001) and Fellowes *et al.* (2002).

### *Herpetofauna Survey*

**10.3.5** Monthly daytime herpetofauna surveys were carried out from April to July 2013 within the Assessment Area. Given the lack of wetland habitats suitable for breeding amphibians, two nocturnal surveys were conducted in May and June 2013. Stream habitats, along with other potential microhabitats and refuge areas for reptiles were also searched (e.g. leaf letter, inside holes, under stones and logs). All reptiles seen and all vocalizing amphibians were identified, enumerated and recorded according to the habitat in which there were observed. Nomenclature and status for reptiles follows Karsen *et al.* (1998), while that of amphibians follows Chan *et al.* (2005).

### *Dragonfly/ Butterfly Survey*

**10.3.6** Monthly dragonfly/ butterfly surveys were undertaken from April to July 2013. All dragonflies and butterflies observed were identified and enumerated. Attention was paid to those habitats which provide suitable habitat for these species groups. Nomenclatures for butterflies and dragonflies follow Lo and Hui (2010) and Tam *et al.* (2011) respectively.

### *Stream Survey*

**10.3.7** Stream fauna survey was conducted twice along the accessible, natural and unpolluted watercourses, and the surveyed streams are shown in **Figure 227724/E/6201**. The streams were surveyed primarily by direct observation, active searching, sweep sampling and kick sampling techniques.

## 10.4 Ecological Baseline Conditions

### *Physical Environment*

**10.4.1** The Study Area is an existing quarry site located to the northeast of Anderson Road. Situated at the far northeastern edge of East Kowloon areas, the majority of the Assessment Area comprises densely populated urban areas from northwest to south. These urban areas include various public housing estates and road infrastructure in Sau Mau Ping, as well as Tseung Kwan O Tunnel and approach roads, and an adjacent public housing development site immediately to the southwest of the Study Area. Low-rise residential buildings and village houses in Ma Yau Tong, Au Tau and Sam Long are also located to the southeast and northeast of the Assessment Area. Continuous vegetated hill slopes with secondary woodland, shrubby grassland and seasonal hillside streams on Tai Sheung Tok Hill are located from the northeastern to eastern parts of the Assessment Area. Remnant patches of secondary woodland and hillside plantation with native secondary growth are also found to the north and south, but are fragmented from

the main part of the Assessment Area by Clear Water Bay Road and Po Lam Road respectively.

**10.4.2** From an ecological perspective, the active quarry site largely occupies most of the Study Area, while the Assessment Area largely comprises of human-dominated developed areas in the western and southern sides. Both the quarry site and human-dominated developed area are of very low ecological value. Limited wildlife usage of the Study Area is anticipated in this active quarry site. However, the vegetated hillside environs in the vicinity are of higher ecological value, as they could provide suitable foraging and roosting habitats for wildlife.

## *Habitats and Flora*

**10.4.3** The areas of habitats present within the Study Area and the Assessment Area are listed in **Table 10.2**, while a habitat map is provided in **Figures 227724/E/6101 – 227724/E/6105**. A full list of flora species recorded and the relative abundance within each habitat is provided in **Appendix 10.2**. The identified floral species of conservation importance are summarised in **Table 10.3** and their locations are shown in **Figures 227724/E/6301 – 227724/E/6303**.

*Watercourses*

**10.4.4** Two watercourses are located in the secondary woodland in the southeast part of the Study Area. The uppermost sections of these watercourses within the Study Area were difficult to access due to the steep topography of Tai Sheung Tok Hill. Their lower sections run underneath the southeastern part of Anderson Road and Po Lam Road within the Assessment Area and finally merge in Ma Yau Tong area. Of these two watercourses, one is a permanent stream with natural bottom and riparian vegetation along the banks; it is believed its upper section within the Study Area is natural, though access to this section was not possible.

**10.4.5** Access to the watercourse to the west was not possible between the survey period (i.e. April to July 2013) due to the lack of access path within the dense woodland in the southeast. Access to this watercourse was available in August 2013 with the provision of temporary access path by the ground investigation works of the current Study. The watercourse to the west is a steep seasonal stream only fully in water after periods of heavy rain, though three semi-permanent pools exist at the base of short waterfalls towards Anderson Road. Below Anderson Road, but above Po Lam Road, this stream has been disturbed by on-going construction works and site clearance. It is piped underneath Po Lam Road into a semi-natural stream. Its upper section within the Study Area is natural and passes through closed canopy hillside secondary woodland.

**10.4.6** Several watercourses within the Assessment Area are located in the northeast and east, and are either tributaries of Tseng Lan Shue Stream or dry/ seasonal watercourses flowing from ravines. These tributaries of Tseng Lan Shue Stream are largely semi-natural, permanent watercourses, and some sections have partly concrete banks. These streams are generally clean, but localized domestic discharge from village houses was still observed during surveys. The watercourses running from the ravines are mostly narrow, with dry or seasonal water flow providing opportunistic foraging grounds for herpetofauna and dragonflies. Common herbaceous vegetation were recorded along the banks of the watercourses in the Assessment Area, including the grasses *Brachiaria mutica* and *Microstegium ciliatum*, other herbs such as *Alocasia macrorrhizos*, *Commelina diffusa* and *Alternanthera philoxeroides*, and woody shrubs and trees. One seedling of the protected tree species *Aquilaria sinensis* was recorded in woodland close

to a dry watercourse near Wilson Trail Stage 3 in the east side of the Assessment Area (**Figure 227724/E/6302**).

**10.4.7** Channelized watercourses to the north and south of the Assessment Area are highly modified, with concrete sides and bottom. It is connected with the channelized drainage system in the urban area, and is of very low ecological significance.

*Agricultural Land*

**10.4.8** Two very small pieces of dry agricultural land are located to the west of Ma Yau Tong and in the southeast of the Assessment Area. These are small and isolated, and lie under a dense canopy of secondary woodland in the area of Ma Yau Tong village. This habitat is subject to high levels of disturbance (such as weeding practice and farming activity) and supports simple floristic diversity and structure. Common crops are present in this farmland; however, access was not possible.

*Grassland*

**10.4.9** Four pieces of grassland are located in the northeast (i.e. in Sam Long area), east (i.e. to the west of Au Tau) and southwest (i.e. along Wilson Trail Stage 3) of the Assessment Area. These grassland patches are either evolved from abandoned farmland in village environs or constitute hillside grassland along the hiking trail. Grassland developed from abandoned farmland was extensively covered by grasses (such as native *Neyraudia reynaudiana* and *Microstegium ciliatum* and the exotic *Pennisetum purpureum* and *Paspalum conjugatum*) and other herbs (such as the exotic *Bidens alba* and *Praxelis clematidea,* and the exotic climbers *Ipomoea cairica* and *Mikania micrantha*). A few self-sown shrubs and trees were also recorded. The hillside grassland was mainly covered by native grass species such as *Neyraudia reynaudiana*, *Miscanthus floridulus* and *Microstegium ciliatum*. With regard to the landform of the lowland grassland in the village environs, these grassland patches appear to be seasonally flooded after heavy rain and may provide temporary habitat for amphibian and dragonfly in wet season. However, recent human disturbance (such as dumping of domestic waste and construction materials) was noted on these patches in the surveys.

*Grassland/ Shrubland*

**10.4.10** A small piece of shrubby grassland was identified in the east of the Study Area. It covers the peak of Tai Sheung Tok Hill and distributes further east towards the Wilson Trail Stage 3 within the Assessment Area. This hillside habitat is located between two continuous patches of secondary woodland to the north and south, and graves are present in this shrubby grassland, indicating this habitat may have been subject to infrequent hill fire in the last decade. Two relatively small patches of shrubby grassland were found in the hillside between Sam Long and Au Tau, and are located in the northeast of the Assessment Area.

**10.4.11** At least 10 individuals of the protected herb Chinese Lily *Lilium brownii* were identified in the shrubby grassland within the Study Area (**Table 10.3** and **Figure 227724/E/6303**). Chinese Lily can be found in restricted localities only and is distributed in hillside areas among grasses (AFCD 2011). It is protected under the Forestry and Countryside Ordinance (Cap. 96).

**10.4.12** Apart from Chinese Lily, this habitat in the rest of the Study Area and Assessment Area supports moderate floristic diversity and typical plant species, such as the grass *Miscanthus floridulus*, the fern *Dicranopteris pedata*, the herb *Aster baccharoides* and

the shrubs *Clerodendrum fortunatum*, *Melastoma malabathricum*, *Rhaphiolepis indica* and *Rhodomyrtus tomentosa*, were recorded.

*Secondary Woodland*

**10.4.13** Secondary Woodland is located at the edges of the Study Area, from northeast to east and in the southeast of the Study Area. Woodland at the northern and eastern edges is continuous with the mature woodland of Tan Shan and Tai Sheung Tok Hill. These woodlands support higher structural complexity, with more continuous canopy than the woodland in the southeast. The woodland edge facing the plantations on quarry benches was planted with some plantation species (such as exotic *Acacia confusa* and native *Castanopsis fissa*), but the major woodland canopy is dominated by mature native trees (such as *Celtis sinensis*, *Machilus chekiangensis* and *Schefflera heptaphylla*). Common woodland plants, including shrubs *Eurya nitida*, *Litsea rotundifolia* var. *oblongifolia* and *Psychotria asiatica*, and trees *Diospyros morrisiana* and *Litsea glutinosa*, were also recorded. The southeastern woodland supports similar floristic diversity, but with simpler structural complexity and dominated by younger canopy tree species. Thirteen seedlings/saplings of the shrub *Diospyros vaccinioides* were identified at the edges of secondary woodlands within the Study Area. About 30 seedlings, two young saplings and one young tree of *Ormosia pachycarpa*, as well as a woody climber *Gnetum luofuense* were recorded in the young woodland patch located in the southeast part of the Study Area (**Figure 227724/E/6303** and summarized in **Table 10.3**).

**10.4.14** Secondary woodlands in the Assessment Area include relatively natural and complex woodland to the north, northeast and southeast, as well as younger woodland with native self-sown growth on man-made slopes in the northwest and south. Woodland in the north and northeast supports higher floristic diversity and structural complexity than other woodland within the Assessment Area. The former woodland is characterised by a closed canopy dominated by common overstorey trees such as *Cinnamomum camphora*, *Machilus chekiangensis*, *Microcos nervosa*, *Schima superba* and *Syzygium hancei*. The understorey is dominated by woody climbers, shrubs and small trees, including *Desmos chinensis*, *Elaeocarpus chinensis*, *Litsea cubeba* and *Sarcandra glabra*. In addition, as shown in **Figures 227724/E/6301 – 227724/E/6303** and summarized in **Table 10.3**, five floral species of conservation importance, namely the woody climber *Gnetum luofuense*, the shrubs *Diospyros vaccinioides* and *Rhododendron* spp., and the trees *Aquilaria sinensis* and *Artocarpus hypargyreus* were recorded. These woodland patches are of higher ecological significance due to greater maturity and structural complexity; they also provide higher habitat diversity to wildlife.

**10.4.15** The woodland in the southeast is continuous with patches in the Study Area. It supports lower floristic diversity than the mature woodland in the north and northeast, and is characterised by younger floristic structure of more open canopy. Ecological value of this woodland in the southeast is relatively low. The remaining woodland within the Assessment Area derives from native spontaneous growth on man-made slopes in the northwest and south. This woodland is formed either with the retention of the original native composition or with natural establishment in exotic plantation stands (such as stands of *Acacia confusa* and *Lophostemon confertus*). Their understoreys support lower plant diversity and some are colonized by more weedy species such as the herbs *Bidens alba*, the climber *Mikania micrantha* and the shrub *Lantana camara.* Ecological value of this woodland type is lower than the mature woodland in the north and northeast, and younger woodland in the southeast.

*Plantation*

**10.4.16** Plantations within the Study Area occupy much of the north and east outside the quarry itself, and comprise primarily exotic species on the vertical benches. They have been established for rehabilitation under the operation of the Anderson Road Quarry and are relatively young, possibly less than a decade old. Plantations of this type are generally low in ecological value due to the predominance of exotic species such as *Acacia* spp., *Eucalyptus* spp. and *Casuarina equisetifolia*. The exotic climber *Parthenocissus dalzielii* was planted for vertical greening on the benches. Limited natural colonization by herbs (such as *Bidens alba*, *Commelina diffusa*, *Mimosa pudica* and *Praxelis clematidea*), shrubs (such as *Lantana camara*, *Melastoma* spp. *Ligustrum sinense*) and trees (such as *Celtis sinensis*, *Leucaena leucocephala* and *Mallotus paniculatus*) was also recorded.

**10.4.17** Small areas of plantation are located within the Assessment Area in the southwest, west and southwest. They are established on man-made slopes, along roads or on hill slopes above infrastructure. These plantations were established for screening and aesthetic reasons, or sometimes for soil erosion control if on a hill slope. They support low floristic diversity and structure, with an overstorey dominated by exotic plantation species including *Acacia confusa, Casuarina equisetifolia* and *Melaleuca cajuputi* subsp. *cumingiana*. Limited natural colonization by plants was recorded in their understorey.

*Developed Area*

**10.4.18** The only Developed Areas within the Study Area comprise the existing construction site to the west of Anderson Road, Anderson Road and southern section of Po Lam Road. These are either construction site or paved areas heavily used for traffic and quarry works.

**10.4.19** Developed Area within the Assessment Area is composed of low-rise residential buildings and village houses in the northeast and southeast, public housing estates and infrastructure from north to south, as well as an extensive site formation area for a public housing development project under construction and located immediately to the southwest of the Study Area. This habitat is heavily modified and suffers from high levels of disturbance by anthropogenic factors. It often supports low faunal and floral diversity, in which the dominant plant species are heavily-managed species, such as ornamental shrubs and trees in landscaped areas or urban parks.

*Quarry*

**10.4.20** The quarry site within the Study Area refers has been operating since 1956 and is excavated into the southwest facing slope of Tai Sheung Tok Hill. The vertical face is over 200m high, with a length of more than 1.5km from north to south. This active quarry site comprises plantation for rehabilitation, a quarry pond and an excavated platform with access roads and built offices. The quarry pond exists as a service reservoir and is of various sizes over time. The water quality of this pond is poor in ecological perspective. This habitat has been heavily modified and suffers from a high level of human disturbance. This quarry site is largely covered in bare ground, with scattered colonization primarily by grasses (such as *Neyraudia reynaudiana* and *Melinis repens*) and a few self-sown trees (such as *Leucaena leucocephala*, *Macaranga tanarius* var. *tomentosa* and *Ficus hispida*).

**Table 10.2:** Habitats present within the Study Area and Assessment Area

| Habitat | Study Area | | Assessment area (500m from the boundary of Study Area) | | Total Area under the Study | |
|---|---|---|---|---|---|---|
| | ha | % | ha | % | ha | % |
| Watercourses[1] | / (1.48km) | / | 0.3 (4.31km) | 0.1 | 0.3 (5.79km) | 0.1 |
| Agricultural Land | / | / | 0.2 | 0.1 | 0.2 | 0.1 |
| Grassland | / | / | 2.1 | 0.7 | 2.1 | 0.5 |
| Grassland/ Shrubland | 3.6 | 3.7 | 11.7 | 4.0 | 15.3 | 3.9 |
| Secondary Woodland | 15.4 | 15.6 | 113.0 | 38.5 | 128.4 | 32.8 |
| Plantation | 21.8 | 22.1 | 13.0 | 4.4 | 34.8 | 8.9 |
| Developed Area | 11.2 | 11.4 | 152.9 | 52.1 | 164.0 | 41.9 |
| Quarry | 46.5 | 47.2 | / | / | 46.5 | 11.9 |
| ***Total*** [2] | **98.5** | **100** | **293.2** | **100** | **391.6** | **100** |

Notes:

[1] Habitat area includes channelized watercourses only; narrow natural watercourses are presented in length (approximate length measured in km shown in brackets) in **Table 10.2** and in evaluations in the report.

[2] Figures above are rounded to the nearest decimal place. Hence, figures may not add to the total value.

**Table 10.3:** Floral species of conservation importance recorded in the Study Area and Assessment Area.

| Species | Conservation/ Protection Status | Distribution in Hong Kong[1]-[5] | Habitat Recorded | Recorded abundance in the Survey |
|---|---|---|---|---|
| Small Persimmon *Diospyros vaccinioides* | Critically Endangered[6] | Very common in shrubland, thin forest and thickets in ravines or hillslope habitats | Secondary Woodland | - 13 seedlings (Study Area)<br>- >50 seedlings and larger individuals (Assessment Area) |
| Chinese Lily *Lilium brownii* | Cap. 96A | Restricted to grassy hillside habitat at restricted locations | Grassland/ Shrubland | - >10 individuals (Study Area) |
| Incense Tree *Aquilaria sinensis* | Cap. 586; State Protection (Category II)[7]; Near Threatened[7]* ; Vulnerable[6] | Commonly found in lowland forest and *fung shui* wood | Secondary Woodland | - 13 seedlings and two trees (Assessment Area) |
| | | | Natural Watercourse (Dry watercourse) | - One seedling (Assessment Area) |
| *Rhododendron* spp. (Wild population) | Cap. 96 | Found in shrubland and forest | Secondary Woodland | - Two individuals (Assessment Area) |
| Luofushan Joint-fir | Near Threatened[6] | Commonly found in forest and shrubland | Secondary Woodland | - At least one individual (Study |

| Species | Conservation/ Protection Status | Distribution in Hong Kong[1]-[5] | Habitat Recorded | Recorded abundance in the Survey |
|---|---|---|---|---|
| *Gnetum luofuense* | | | | Area)<br>- Approx. 0.15 ha (Assessment Area) |
| Silver-back Artocarpus<br>*Artocarpus hypargyreus* | Vulnerable[6] ;<br>Near Threatened[7]* | Commonly found in lowland forest | Secondary Woodland | - Three trees (Assessment Area) |
| Hairy-fruited Ormosia<br>*Ormosia pachycarpa* | Endangered[7] | Restricted, found in several localities | Secondary Woodland | - About 30 seedlings, two saplings and one young tree (Study Area) |

Notes:

[1] Xing *et al.* (2000) [2] AFCD (2007) [3] AFCD (2008)

[4] AFCD (2009) [5] AFCD (2011) [6] IUCN (2013)

[7] AFCD (2003)

* Conservation/ Protection Status is stated in *China Plant Red Data Book* and *Illustration of Rare & Endangered Plant in Guangdong Province* as stipulated in AFCD (2003).

## *Mammals (Bats)*

*Literature review*

**10.4.21** The only mammal previously reported in the Assessment Area was Eurasian Wild Pig *Sus scrofa* in the woodland/shrubland in the north during Planning and Engineering Feasibility Study for Development at Anderson Road (CED 1998). This is a widely-distributed species in Hong Kong.

**10.4.22** Chan and Shek (2006) and Shek (2006) reported that small colonies (1-10 individuals) of Short-nosed Fruit Bat *Cynopterus sphinx* were found roosting in Chinese Fan-palm in the urban areas of Kwun Tong District. This fruit bat species is widely distributed in various habitats from woodlands, lowlands to urban areas (such as landscaped area and urban parks with suitable roosting palms) at lower elevations. The identified roosts in these two studies were located outside the 500m Assessment Area.

*Field surveys*

**10.4.23** No suitable sites for roosting bats were recorded from the Study Area. A single Japanese Pipistrelle *Pipistrellus abramus*, was recorded foraging in several locations in the secondary woodland and developed areas to the north, northeast and southeast of the Assessment Area in low densities during surveys, with no more than two individuals observed at a single time. Japanese Pipistrelle is protected under Cap. 170. However, it is widespread and frequently recorded in urbanised areas in Hong Kong (Chan & Shek 2006, Shek 2006).

## *Avifauna*

*Literature review*

**10.4.24** Twenty-seven bird species were recorded in the EIA study for the Development at Anderson Road (AEIAR-005/1999) (CED 1998), but none are of conservation interest. Of these 27, 16 were recorded as possible, probable or confirmed breeding species in the survey site (CED 1998). All these 16 species are common and widespread in Hong Kong, and of no conservation significance.

*Field surveys*

**10.4.25** Forty bird species were recorded in the surveys, 28 of which were recorded in the Study Area (see **Appendix 10.3**). Of the 40 species recorded, three are of conservation concern, (Black Kite, Crested Serpent Eagle and Grey-chinned Minivet), but only the first was recorded within the Study Area. A maximum of two Black Kites were observed flying overhead near the secondary woodland within the Study Area, while one Crested Serpent Eagle was seen over secondary woodland in the Assessment Area (**Figure 227724/E/6304**). These two species are listed as of conservation concern by Fellowes *et al.* (2002) based on the restrictedness in breeding and/or roosting sites rather than in general occurrence. Hence, these observations in this area are of no conservation significance. Grey-chinned Minivet is a species common in mature secondary woodlands in Hong Kong and a maximum count of one Grey-chinned Minivet was recorded in the secondary woodland in the northeast of the Assessment Area.

**10.4.26** Details of the bird species of conservation importance are shown in **Table 10.4**. A full list of species recorded, including scientific names, is shown in **Appendix 10.3.**

**Table 10.4:** Bird species of conservation importance recorded in the Study Area and Assessment Area.

| Species | Conservation Status (Fellowes *et al.* 2002)[1] | Max. count | Area/ Habitats Recorded |
|---|---|---|---|
| Black Kite *Milvus migrans* | (Regional Concern) | 2 | Study Area (Secondary Woodland) |
| Crested Serpent Eagle *Spilornis cheela* | (Local Concern) | 1 | Assessment Area (Secondary Woodland) |
| Grey-chinned Minivet *Pericrocotus solaris* | Local Concern | 1 | Assessment Area (Secondary Woodland) |

Notes:

[1] Conservation status in parentheses indicates that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.

## *Herpetofauna*

*Literature review*

**10.4.27** Eleven amphibian species are likely to occur in the Assessment Area according to the habitat types and the distribution in Hong Kong (scientific names are provided in **Appendix 10.4**). They are Asian Common Toad, Asiatic Painted Frog, Butler**'**s Pigmy Frog, Ornate Pigmy Frog, Paddy Frog, Gunther's Frog, Green Cascade Frog, and Brown Tree Frog, which are all common in Hong Kong and of no conservation concern (Karsen *et al.* 1998, Chan *et al.* 2005). Amphibian species of conservation concern that may occur in the Assessment Area include Hong Kong Newt *Paramesotriton hongkongensis*, Lesser Spiny Frog *Quasipaa exilispinosa*, and Short-legged Toad

*Xenophrys brachykolos* (Fellowes *et al.* 2002, Chan *et al*. 2005). However, no herpetofauna data relevant to the Assessment Area have been presented in the relevant literature (e.g. CED (1998)).

*Field surveys*

**10.4.28** A total of 12 amphibian species and four reptile species were recorded in the whole study, of which eight amphibians and three reptile species were recorded in the Study Area (see **Appendix 10.4**). Three of the amphibian species and one of the reptile species recorded are of conservation concern (see **Table 10.5**) and locations are shown in **Figure 227724/E/6305**.

**10.4.29** Hong Kong Newts were recorded in both the Study Area and Assessment Area. The species was found in the concrete U-channel in the Plantation in the Study Area in the May and June surveys; such channel habitat is not typical for this species, and these individuals were probably washed off nearby terrestrial habitat during their seasonal migration in their non-breeding period (Apr-Aug) (Chan *et al.*2005, Fu 2010). In addition, up to nine Hong Kong Newts were recorded in the natural watercourse (watercourse no. 1) at Tan Shan village. This species is of Potential Global Concern (Fellowes *et al.* 2002) and listed as Near Threatened in the IUCN Red List (IUCN 2013), despite it being common and widespread in unpolluted mountain streams in Hong Kong (Chan *et al*. 2005).

**10.4.30** Short-legged Toads were heard calling in three streams (watercourse no. 3, 5 and 6) in the Assessment Area in June and July. This species, which occurs in hill streams with wooded banks (Chan *et al.* 2005), is common and widespread on Hong Kong Island but restricted to a few localities in the New Territories and Lantau Island (Chan *et al.* 2005). Short-legged Toad is possibly endemic to Hong Kong (Chan *et al.* 2005), and is of Potential Global Concern (Fellowes *et al.* 2002) and listed as **'**Endangered**'** in the IUCN Red List (IUCN 2013).

**10.4.31** Two Lesser Spiny Frogs were heard in the natural watercourse (watercourse no. 2) in the Assessment Area in the night-time survey conducted in May. Tadpoles of this species were recorded in significant numbers from both streams (watercourse section no. 8a and 8c) in the southeast of the Study Area. This species can be found within or near streams at different altitudes throughout Hong Kong (Chan *et al.* 2005). It is listed as **'**Potential Global Concern**'** in Fellowes *et al.* (2002) and **'**Vulnerable**'** in the IUCN Red List (2013).

**10.4.32** All three amphibian species of conservation concern recorded inhabit streams with good riparian vegetative cover; streams in the wider Assessment Area are good quality habitat for amphibians.

**10.4.33** The only reptile species of conservation importance recorded was a Common Rat Snake *Ptyas mucosus* found in the plantation in the Study Area in the April survey. This species can be found in a range of habitats such as shrubland and grassland, but is much less common in wooded areas (Karsen *et al.* 1998). It is a **'**Potential Regional Concern**'** species in Fellowes *et al.* (2002) and **'**Endangered**'** in the China Red Data Book (Zhao 1998) although it is common in open habitats around Hong Kong (Karsen *et al.* 1998).

**Table 10.5:** Herpetofauna species of conservation importance recorded in the Assessment Area

| Species | Conservation Status (Fellowes *et al* 2002) | IUCN Red List Status | Max. count | Area/ Habitats |
|---|---|---|---|---|
| Hong Kong Newt *Paramesotriton hongkongensis* | Potential Global Concern | Near Threatened | 10 (1 at Study Area and 9 at Assessment Area) | Study Area (Concrete U-Channel in Plantation) Assessment Area (Watercourse no. 1) |
| Short-legged Toad *Xenophrys brachykolos* | Potential Global Concern | Endangered | 5 | Assessment Area (Watercourse no. 3, 5 and 6) |
| Lesser Spiny Frog *Quasipaa exilispinosa* | Potential Global Concern | Vulnerable | 2 | Study Area (Watercourse section no. 8a and 8c) Assessment Area (Watercourse no. 2) |
| Common Rat Snake *Ptyas mucosus* | Potential Regional Concern | - | 1 | Study Area (Plantation) |

## *Dragonflies*

*Literature review*

**10.4.34** No data directly relevant to the Assessment Area could be found in the literature.

*Field surveys*

**10.4.35** A total of 18 dragonfly species were recorded in the whole study, of which seven were recorded in the Study Area (see **Appendix 10.5**). Five dragonfly species recorded in the study are of conservation concern and two of these were found within the Study Area. Details of their conservation status are shown in **Table 10.6** and locations shown in **Figure 227724/E/6306**.

**10.4.36** A single Chinese Yellowface was recorded in the streams (watercourse no. 1 and 3) in or close to secondary woodlands in the April and June survey respectively. Habitats of this species are forest seepages and small streams in woodland (Tam *et al.* 2011). Although this species is of 'Local Concern' (Fellowes *et al.* 2002), it is abundant around Hong Kong (Tam *et al.* 2011).

**10.4.37** A Blue-tailed Shadowdamsel was recorded in the stream (watercourse no. 3) in secondary woodland in the Assessment Area in the survey conducted in June. This species can be found in small streams in mature forest (Tam *et al.* 2011). Blue-tailed Shadowdamsel is listed as 'Global Concern' in Fellowes *et al.* (2002); despite it being common and widespread in well forested areas around Hong Kong (Tam *et al.* 2011).

**10.4.38** A Hong Kong Clubtail was seen perching in plantation in the Study Area during the survey conducted in June. This is a species that lives in woodlands near streams (Tam *et al.* 2011); it is of Local Concern in Fellowes *et al.* (2002) and endemic to Hong Kong (Tam *et al.* 2011), although it is common and widespread here (Tam *et al.* 2011).

**10.4.39** A Ruby Darter was recorded in the grassland next to village environs in the Assessment Area in the May survey. This species can be found in marshes and densely vegetated ponds (Tam *et al.* 2011). It is of **'**Local Concern**'** (Fellowes *et al.* 2002) but this species is common and widespread in Hong Kong (Tam *et al.* 2011).

**10.4.40** Emerald Cascader was recorded in the Study Area in June and July. Emerald Cascaders were found soaring over the plantation, secondary woodland and grassland/ shrubland in the Study Area. This species can be found in fast-flowing section of streams and young adults of this species often soar over woodlands (Tam *et al.* 2011). Emerald Cascader is a species of Potential Global Concern in Fellowes *et al.* (2002) but it is abundant and widespread in woodland streams all over Hong Kong (Tam *et al.* 2011).

**10.4.41** All except one dragonfly species of conservation importance recorded in the surveys lives in streams in woodlands (Tam *et al.* 2011); this shows that streams in the Assessment Area are of some ecological importance to dragonflies, despite the fact that all species are either abundant or common throughout Hong Kong (Tam *et al*. 2011).

**Table 10.6:** Dragonfly species of conservation importance recorded in the Assessment Area

| Species | Conservation Status (Fellowes *et al.* 2002) | Status in Hong Kong (Tam *et al.* 2011) | Max. count | Area/ Habitats |
|---|---|---|---|---|
| Chinese Yellowface *Agriomorpha fusca* | Local Concern | Abundant | 1 | Assessment Area (Watercourse no. 1 and 3) |
| Blue-tailed Shadowdamsel *Drepanosticta hongkongensis* | Global Concern | Common | 1 | Assessment Area (Watercourse no. 3) |
| Hong Kong Clubtail *Leptogomphus hongkongensis* | Local Concern | Common | 1 | Study Area (Plantation) |
| Ruby Darter *Rhodothemis rufa* | Local Concern | Common | 1 | Assessment Area (Grassland) |
| Emerald Cascader *Zygonyx iris* | Potential Global Concern | Abundant | 14 | Study Area (Plantation, Secondary Woodland & Grassland/Shrubland) |

## *Butterflies*

*Literature review*

**10.4.42** No data directly relevant to the Assessment Area could be found in the literature.

*Field surveys*

**10.4.43** A total of 63 butterfly species were recorded in the surveys, of which 54 were recorded in the Study Area (see **Appendix 10.6**). A total of 16 butterfly species of conservation importance were recorded in the surveys, of which four are of **'**Local Concern**'** (Fellowes *et al.* 2002), three are **'**Very Rare**'**; four are **'**Rare**'** and seven are **'**Uncommon**'** (Chan *et al.* 2011). Among these 16 species of conservation importance, 11 and three butterflies were recorded in the plantation and secondary woodland respectively within the Study Area. These 16 species, including their scientific names, are listed in **Table 10.7** and their locations are shown in **Figure 227724/E/6307**.

**10.4.44** Orange Awlet and Bamboo Tree Brown are the only two butterfly species of conservation concern not recorded in the Study Area. A caterpillar of Orange Awlet was recorded in the secondary woodland in the Assessment Area in July. This species occurs in woodland and has been recorded in a few localities in Hong Kong (including Sai Kung West) only (Lo and Hui 2010). This is a 'Very Rare' species in Hong Kong (Chan *et al.* 2011).

**10.4.45** Except Orange Awlet, the other two 'Very Rare' species are Indian Awl King and Hainan Palm Dart. Only a single individual of each species was recorded in plantation in the Study Area (Chan *et al.* 2011). Both species are listed as 'Local Concern' in Fellowes *et al*. (2002). They have different habitat preferences, with Indian Awl King preferring shaded woodland while Hainan Palm Dart preferring abandoned exposed grasslands and shrublands (Lo and Hui 2010). The larval food plant of the former are native tree species found in mature secondary woodland (*Meliosma fordii* and *M. rigida*), while the food plant for the latter is a common perennial herb species (*Miscanthus sinensis*). Both species are found in most country parks in Hong Kong (Lo and Hui 2010).

**10.4.46** Four 'Rare' butterfly species were recorded in the study; they are Banded Awl, Common Dart, White-banded Flat and Constable (Chan *et al.* 2011); Of these, Common Dart and Constable are also listed as species of 'Local Concern' in Fellowes *et al*. (2002). Apart from Constable, which was recorded once in the survey period with a count of two individuals, only a single individual of the other species were recorded once in the survey period.

**10.4.47** Both Common Dart and Constable are listed as a species of 'Local Concern' in Fellowes *et al.* (2002) and regarded as a 'Rare' species in Chan *et al.* (2011). Lo & Hui (2010) noted that the former species is the rarest of the four *Potanthus* species in Hong Kong and is found in Sai Kung West. However, the larval food plant is a common perennial herb in Hong Kong (*Micanthus floridulus*) and is common in abandoned fields and grasslands. Constable can be found in most country parks in Hong Kong and has a habitat preference for well vegetated uplands (Lo & Hui 2010). Its larval food plant is *M. fordii* and *M. rigida* (HKLS 2010) which are found in mature secondary woodlands.

**10.4.48** The caterpillar of Banded Awl feeds on a common native coastal tree species *Pongamia pinnata* and is found mainly in woodlands near the coast, including Sai Kung (Lo & Hui 2010).White-banded Flat is known to occur in well-vegetated areas in most country parks (Lo & Hui 2010). Seven 'Uncommon' butterfly species were recorded in the study; they are Restricted Demon, Indian Palm Bob, Plains Cupid, Striped Blue Crow, Bamboo Tree Brown, Dark Evening Brown and Yellow Orange Tip. Of these, Bamboo Tree Brown was only recorded in the Assessment Area (single observation of one individual), and Restricted Demon and Dark Evening Brown were observed in both the Study Area and the Assessment Area. All other 'Uncommon' species were recorded only in the Study Area, and, with the exception of Indian Palm Bob, all records involved single observations of one individual. Two individuals of Indian Palm Bob were recorded once in the plantation area within the Study Area.

**10.4.49** Though considered 'Uncommon', Restricted Demon, Indian Palm Bob, Dark Evening Brown and Yellow Orange Tips are known to occur in most country parks and all, except Indian Palm Bob, prefer well wooded area such as forest, woodlands and shaded woodlands (Lo & Hui 2010), while Indian Palm Bob is noted to prefer urban areas (Lo & Hui 2010). The larval food plant for Plains Cupid is *Cycas revoluta* (HKLS 2010)

which is commonly planted as an ornamental species in Hong Kong. Striped Blue Crow and Bamboo Tree Brown prefer forest areas (and bamboo groves for the latter) and are known to occur in several locations with mature secondary woodlands in Hong Kong.

**Table 10.7:** Butterfly species of conservation importance recorded in the Assessment Area

| **Species** | **Conservation Status (Fellowes *et al.* 2002)** | **Status in Hong Kong (Chan *et al.* 2011)** | **Max. count** | **Area/ Habitats Recorded** |
|---|---|---|---|---|
| Orange Awlet *Bibasis oedipodea* | - | Very Rare | 1 (Caterpillar) | Assessment Area (Secondary Woodland) |
| Indian Awl King *Choaspes benjaminii* | Local Concern | Very Rare | 1 | Study Area (Plantation) |
| Banded Awl *Hasora chromus* | - | Rare | 1 | Study Area (Plantation) |
| Swift sp. - | [1] | [1] | 1 | Study Area (Plantation & Secondary Woodland) |
| Restricted Demon *Notocrypta curvifascia* | - | Uncommon | 1 (Study Area) and 1 (Assessment Area) | Study Area (Secondary Woodland) & Assessment Area (Secondary Woodland) |
| Common Dart *Potanthus pseudomaesa* | Local Concern | Rare | 1 | Study Area (Plantation) |
| Indian Palm Bob *Suastus gremius* | - | Uncommon | 2 | Study Area (Plantation) |
| *Telicota* sp. - | [2] | [2] | 1 | Study Area (Plantation) |
| Hainan Palm Dart *Telicota besta* | Local Concern | Very Rare | 1 | Study Area (Plantation) |
| White-banded Flat *Gerosis phisara* | - | Rare | 1 | Study Area (Grassland/ Shrubland) |
| Plains Cupid *Chilades pandava* | - | Uncommon | 1 | Study Area (Plantation) |
| Striped Blue Crow *Euploea mulciber* | - | Uncommon | 1 | Study Area (Plantation) |
| Constable *Dichorragia nesimachus* | Local Concern | Rare | 2 | Study Area (Secondary Woodland) |
| Bamboo Tree Brown *Lethe europa* | - | Uncommon | 1 | Assessment Area (Secondary Woodland) |
| Dark Evening Brown *Melanitis phedima* | - | Uncommon | 3 (Study Area) and 1 (Assessment Area) | Study Area (Plantation) & Assessment Area (Secondary Woodland) |
| Yellow Orange Tip *Ixias pyrene* | - | Uncommon | 1 | Study Area (Plantation) |

Notes:

[1] Paintbrush Swift (*Baoris farri*), Colon Swift (*Caltoris bromus*) and Dark Swift (*Caltoris cohira*) are indistinguishable in field. Paintbrush Swift and Dark Swift are 'Rare' species and Colon Swift is 'Very Rare in Hong Kong (Chan *et al.* 2011).

[2] There are four species of Dart in the Genus Telicota in Hong Kong. Of which *T. besta* and *T.colon* are species of Local Concern (Fellowes *et al.* 2002). In Chan *et al.* (2011), *T. ancilla* is listed as 'Uncommon', *T.colon* and *T. ohara* are listed as 'Rare' and *T. besta* is listed as 'Very Rare'.

### *Stream fauna*

*Literature review*

**10.4.50** No data directly relevant to the Assessment Area could be found in the literature.

*Field surveys*

**10.4.51** Surveys of aquatic invertebrates recorded nine taxa in the Study Area (see **Appendix 10.7**), including two crab species of conservation concern (see **Table 10.8** and **Figure 227724/E/6308**).

**10.4.52** The freshwater crab *Cryptopotamon anacoluthon* was recorded in the streams (watercourse section no. 8a) found within the young woodland to the north of Anderson Road and that to the south (watercourse section no. 8c) of Anderson Road in the Study Area. It is endemic to Hong Kong, of **'**Potential Global Concern**'** (Fellowes *et al*. 2002) and listed as **'**Vulnerable**'** in the IUCN Red List (IUCN 2013). *C. anacoluthon* occurs in unpolluted, shaded and fast-flowing streams (IUCN 2013) and is fairly common and widespread in local unpolluted streams.

**10.4.53** Another Freshwater Crab species *Nanhaipotamon hongkongense* was found in the stream (watercourse no. 3) in the Secondary Woodland in the northeast of the Assessment Area. This species is also endemic to Hong Kong (IUCN 2013) and of Potential Global Concern (Fellowes *et al.* 2002). It is usually found in Secondary Woodland and is a terrestrial crab species that lives in dry areas of the banks of the streams and is rarely found in water body (IUCN 2013).

**Table 10.8:** Stream fauna of conservation importance recorded in the Assessment Area.

| Scientific Name | Conservation Status (Fellowes *et al.* 2002) | IUCN Red list Status (IUCN 2013) | Max. count | Area/ Habitats |
|---|---|---|---|---|
| *Cryptopotamon anacoluthon* | Potential Global Concern | Vulnerable | 1 | Study Area (Watercourse section no. 8a and 8c) |
| *Nanhaipotamon hongkongense* | Potential Global Concern | - | 1 | Assessment Area (Watercourse no. 3) |

## 10.5 Evaluation of Ecological Importance of Habitats and Species

**10.5.1** Based on the above observations and the criteria set in Annex 8 of TM-EIAO, ecological values of the habitats recorded within the Study Area and Assessment Area are assessed below.

## *Habitat*

*Watercourses*

**10.5.2** Natural watercourses within the Study Area are located in secondary woodland in the southeast (i.e watercourse section no. 8a – 8f in **Figure 227724/E/6201**). Access to the upper sections of these watercourses (watercourse section no. 8b) were limited due to the steep topography and dense vegetation present. The lower sections of these streams (section no. 8c and 8e) run beneath Anderson Road and Po Lam Road to enter the southeast of the Assessment Area. Within the Assessment Area, the easternmost of the two watercourses (section no. 8c and 8d) is largely natural, with riparian vegetation and generally good water quality. One Lesser Spiny Frog and a freshwater crab *Crytopotamon anacoluthon* was recorded in each of the watercourse section no. 8a and 8c. However, the lower section of the stream to the west (section no. 8e) has been lost to an adjacent development. The upper section (above Anderson Road, section no. 8a) is highly seasonal, with flow only present after periods of heavy rain. Three semi-permanent pools are located at the base of three waterfalls in this steep watercourse (section no. 8a); high numbers of Lesser Spiny Frog tadpoles and a freshwater crab *Crytopotamon anacoluthon* were recorded from these pools. Watercourses present in the northeast and east of the Assessment Area are semi-natural to natural, usually with a retained natural bottom and sometimes partly concrete-lined (watercourse no. 1 – 7 in **Figure 227724/E/6201**). Several narrow hillside streams are dry or seasonally wet and could have water flow after heavy rainfall. One seedling of the protected tree species *Aquilaria sinensis* was recorded near a dry watercourse close to Wilson Trail Stage 3 in the east of the Assessment Area (watercourse no. 5) (**Figure 227724/E/6302**). Single individual of Lesser Spiny Frog was recorded in a dry stream (watercourse no. 2) (**Figure 227724/E/6305**), while low number of Short-legged Toad were recorded in other streams (watercourse no. 5 and 6) (**Figure 227724/E/6305**). Both amphibian species are regarded as of Potential Global Concern by Fellowes *et al.* (2002) but are widely distributed locally (Chan *et al.* 2005). A maximum of nine individuals (recorded in a single survey) of the locally-protected Hong Kong Newt, and a dragonfly Chinese Yellowface were recorded in a tributary (watercourse no. 1) (**Figure 227724/E/6306**) of Tseng Shue Stream in the Sam Long area. In addition, one Short-legged Toad, two dragonflies Chinese Yellowface and Blue-tailed Shadowdamsel, and a freshwater crab *Nanhaipotamon hongkongense* were recorded in the semi-natural stream (watercourse no. 3) (**Figure 227724/E/6306** and **6308)** connected with Tseng Lan Shue Stream. Given that these semi-natural streams are partly aligned with riparian vegetation and have reasonable water quality, streams connected with Tseng Lan Shue Stream are considered to provide potential breeding/ nursery ground for amphibians and Hong Kong Newt, and hence they are of higher ecological significance than other hillside dry/seasonal streams in the terrestrial habitats.

**10.5.3** The channelised watercourses located to the northeast of Shun Chi Court and south of Po Tat Estate are highly modified and connected with the drainage system in the urban area. They are of very limited value to flora or fauna, and of very low ecological significance. The ecological evaluation of these watercourses within the Study Area and Assessment Area is summarised in **Tables 10.9** and **10.10** respectively.

**Table 10.9:** Ecological evaluation of watercourses within the Study Area

| Criteria | Watercourses within Study Area |
|---|---|
| Naturalness | Upper sections of the watercourses (watercourse section no. 8a and 8b) are semi-natural to natural, but the lower section of the watercourse to |

| Criteria | Watercourses within Study Area |
|---|---|
| | the west (section no. 8e) is a channelised one, while that of the easternmost watercourse within the Study Area (section no. 8c) is semi-natural to natural. |
| Size | Small in length (Length: approx. 1.5km) within the Study Area. |
| Diversity | Low fauna and floral diversity. |
| Rarity | A common habitat in Hong Kong. Tadpoles of Lesser Spiny Frog and a freshwater crab *Crytopotamon anacoluthon* recorded in watercourse section no. 8a; these two species were also recorded from watercourse located in the southeast of the Study Area (section no. 8c). |
| Re-creatability | Could be re-created in current form |
| Fragmentation | Individual watercourses within the Study Area are not fragmented. |
| Ecological Linkage | Minor ecological linkage with other adjacent hillside secondary woodland and grassland/ shrubland. |
| Potential Value | Value could be increased if protected and managed for wildlife. |
| Nursery/ Breeding Ground | High numbers of Lesser Spiny Frog tadpoles recorded from seasonal stream in the west (above Anderson Road) (section no. 8a) |
| Age | Unknown. |
| Abundance/ Richness of Wildlife | Low |
| **Ecological Value** | **Moderate** |

**Table 10.10:** Ecological evaluation of watercourses within the Assessment Area

| Criteria | Watercourses (watercourse section no. 8d and 8f) connected with streams in the Study Area | Watercourses (watercourse no. 1-7) to the northeast and east of Assessment Area | Channelized watercourse to the northeast of Shun Chi Court and south Po Tat Estate |
|---|---|---|---|
| Naturalness | Lower section of the watercourse on the west is partly channelised, semi-natural to natural lower reaches and that in the east is semi-natural to natural | Semi-natural to natural, some stream sections in developed area are partly concrete lined but with natural bottom | Highly modified with concrete lined and bottom. |
| Size | Small in length (Length: Approx. 0.8km). | Moderate in length (Length: Approx. 4.7km) | Small in length (Length: Approx. 0.5km) |
| Diversity | Low fauna and flora diversity. | | |
| Rarity | A common habitat type in Hong Kong.<br>Fauna common and widespread. | Dry/ seasonal hillside streams are common in Hong Kong, while lowland tributaries such as Tseng Lan Shue Stream in Sam Long area are not common. A seedling of *Aquilaria sinensis* was recorded in watercourse no. 5**;** Fauna | Channelized watercourse in developed areas is common habitat in Hong Kong.<br>Fauna common and widespread. |

| Criteria | Watercourses (watercourse section no. 8d and 8f) connected with streams in the Study Area | Watercourses (watercourse no. 1-7) to the northeast and east of Assessment Area | Channelized watercourse to the northeast of Shun Chi Court and south Po Tat Estate |
|---|---|---|---|
| | | of conservation concern are Hong Kong Newt, Lesser Spiny Frog, Short-legged Toad, dragonflies Chinese Yellowface and Blue-tailed Shadowdamsel, and the freshwater crab *Nanhaipotamon hongkongense*. | |
| Re-creatability | Could be re-created in current form | | |
| Fragmentation | Somewhat fragmented by roads. | Individual watercourses not fragmented. | Somewhat fragmented by developed areas and roads. |
| Ecological Linkage | Ecologically linked with other adjacent hillside secondary woodland, grassland/ shrubland and streams | | None of significance. |
| Potential Value | The watercourse to the east could increase value if protected and managed for wildlife, while scope of enhancement for the watercourse to the west is limited without re-engineering | Value would be increased if pollution source removed, and protected and managed for wildlife. | Very limited scope for enhancement. |
| Nursery/ Breeding Ground | Not known to support any significant nursery/ breeding ground for fauna. | Tributaries of Tseng Lan Shue Stream in Sam Long area could be potential nursery/ breeding ground of Hong Kong Newt and amphibians. | Not known to support any significant nursery/ breeding ground for fauna. |
| Age | Unknown. | | Unknown, but was built fairly recently. |
| Abundance/ Richness of Wildlife | Low abundance/ richness of wildlife | Low to Moderate abundance/ richness of wildlife | Low abundance/ richness of wildlife |
| **Ecological Value** | **Low to Moderate** due to the connection with the upper watercourses in which fauna of conservation importance were found, and potential value for stream enhancement | **Moderate to High** for lowland tributaries connected with Tseng Lan Shue Stream in Sam Long area due to the record of Hong Kong Newt, two dragonflies, two amphibians and one freshwater crab of | **Low** due to its highly modified habitat unsuitable for floral and faunal colonization. |

| Criteria | Watercourses (watercourse section no. 8d and 8f) connected with streams in the Study Area | Watercourses (watercourse no. 1-7) to the northeast and east of Assessment Area | Channelized watercourse to the northeast of Shun Chi Court and south Po Tat Estate |
|---|---|---|---|
| | | conservation concern. These streams are a potential nursery/ breeding ground for Hong Kong Newt and amphibians.<br>Low to Moderate for other dry/ seasonal hillside streams to the northeast and east due to the record of two amphibian species of conversation concern. | |

*Agricultural Land*

**10.5.4** Two very small pieces of dry agricultural land are located in Ma Yau Tong in the southeast of the Assessment Area. These are isolated areas of farmland, and do not support significant floristic or faunal diversity due to the high levels of human disturbance. The ecological evaluation of this habitat type within the Assessment Area is summarized in **Table 10.11**.

**Table 10.11:** Ecological evaluation of agricultural land

| Criteria | Agricultural Land within Assessment Area |
|---|---|
| Naturalness | Man-made habitat and heavily managed. |
| Size | Very small (0.2 ha) within the Assessment Area. |
| Diversity | Low faunal and floristic diversity. |
| Rarity | Common habitat type in village environs away from the main urban area in Hong Kong. |
| Re-creatability | Readily re-created. |
| Fragmentation | Fragmented by other abandoned farmland that have gradually developed into habitats with less disturbance and relatively higher ecological value. |
| Ecological Linkage | Some ecological linkage with the surrounding secondary woodland. |
| Potential Value | Limited scope under current intensive management regime and its small size. |
| Nursery/ Breeding Ground | Not known for any significant nursery/ breeding ground. |
| Age | Unknown. |
| Abundance/ Richness of Wildlife | Low abundance/ richness of wildlife. |
| **Ecological Value** | **Very Low** due to small size and current intensive management regime. |

*Grassland*

**10.5.5** Grassland habitats within the Assessment Area are located in the northeast (Sam Long area), east (west of Au Tau) and southwest (along Wilson Trail Stage 3). These habitats are generally young in age. Three patches identified in the village environs are developed from abandoned farmland, while another patch comprises hillside grassland. These habitats support very low floristic diversity (mainly grass species). Fauna species, such as amphibians, may occur in these habitats as some lowland grassland in village areas could be flooded after heavy rain. However, ecological importance of these habitats to fauna is less significant and the recorded fauna are common to very common species. Its ecological significance is further reduced due to human disturbance. The ecological evaluation of grassland within the Assessment Area is summarized in **Table 10.12**.

**Table 10.12:** Ecological evaluation of grassland

| **Criteria** | **Grassland to the northeast and east in village environs within Assessment Area** | **Hillside Grassland within Assessment Area** |
|---|---|---|
| Naturalness | Semi-natural, gradually evolved from abandoned farmland in the village environs. | Natural, maintained by periodic hill fire. |
| Size | Small size (2.0 ha) in the Assessment Area. | Very small size (0.1 ha) in the Assessment Area. |
| Diversity | Very low floristic and low fauna diversity | Very low floristic and low fauna diversity |
| Rarity | Lowland grassland of this type is common in village environs in Hong Kong. | Hillside grassland is a common habitat type in Hong Kong. |
| Re-creatability | Readily re-created. | Readily re-created. |
| Fragmentation | Fragmented by village houses. | Not fragmented. |
| Ecological Linkage | Some linkage to hillside secondary woodland in Tai Sheung Tok Hill. | Ecologically linked to hillside secondary woodland and some linkage to shrubby grassland in Tai Sheung Tok Hill. |
| Potential Value | Limited scope due to potential human disturbance in village environs. | Succession to shrubby grassland and woodland in the absence of disturbance. |
| Nursery/ Breeding Ground | Not known for significant nursery/ breeding ground | Not known for significant nursery/ breeding ground |
| Age | Uncertain, but approximately 10 years. | Uncertain, but approximately 10 years. |
| Abundance/ Richness of Wildlife | Low abundance/ richness of wildlife. | Low abundance/ richness of wildlife. |
| **Ecological Value** | **Low** | **Low** |

*Grassland / Shrubland*

**10.5.6** A small piece of shrubby grassland is located in the east of the Study Area. This habitat is a typical hillside habitat dominated by common shrub and small tree species. It supports a moderate floristic diversity but simpler floristic structure; however, at least

10 individuals of the protected Chinese Lily *Lilium brownii* were recorded on the hillside among grasses. A rare butterfly White-banded Flat was also recorded in this grassland/shrubland during the survey.

**10.5.7** The small shrubby grassland within the Study Area extends and connects with the larger patch on Tai Sheung Tok Hill, as well as two relatively small patches of shrubby grassland found between the secondary woodlands in Sam Long and Au Tau areas. These habitats in the Assessment Area support floristic diversity and structure similar to those in the Study Area. A maximum of three individuals of the dragonfly species Emerald Cascader were recorded in the shrubby grassland to the east of Assessment Area. This species is considered to be of Potential Global Concern by Fellowes *et al.* (2002), but is regarded as abundant throughout the territory by Tam *et al.* (2011). The ecological evaluation of grassland/shrubland within the Study Area and Assessment Area is summarized in **Tables 10.13** and **10.14** respectively.

**Table 10.13:** Ecological evaluation of grassland/ shrubland within the Study Area

| Criteria | Grassland/ Shrubland within Study Area |
|---|---|
| Naturalness | Semi-natural to natural through natural succession |
| Size | Small size (3.6 ha) in the Study Area. |
| Diversity | Moderate floristic diversity but simpler floristic structure. |
| Rarity | Hillside Grassland/ Shrubland habitat is common in Hong Kong. At least 10 individuals of the protected Chinese Lily *Lilium brownie,* one rare butterfly species (White-banded Flat) was recorded within the Study Area. |
| Re-creatability | Readily re-created. |
| Fragmentation | Not fragmented. |
| Ecological Linkage | Ecologically linked to the nearby hillside woodland. |
| Potential Value | Succession to shrubland and woodland in the absence of disturbance. |
| Nursery/ Breeding Ground | None of significant nursery/ breeding ground known. |
| Age | Uncertain, but approximately formed in 20 years. |
| Abundance/ Richness of Wildlife | Low. |
| **Ecological Value** | **Low to Moderate** due to the presence of at least 10 individuals of the protected herb Chinese Lily and a rare butterfly White-banded Flat. |

**Table 10.14:** Ecological evaluation of grassland/shrubland within the Assessment Area

| Criteria | Grassland/ Shrubland within Assessment Area |
|---|---|
| Naturalness | Semi-natural to natural through natural succession, with sign of human disturbance (e.g. presence of graves). |
| Size | Small size (11.7 ha) in the Assessment Area. |
| Diversity | Moderate floristic diversity but simpler structure. |
| Rarity | Hillside Grassland/ Shrubland is a common habitat type in Hong Kong. Three individuals of *Emerald cascader* (Potential Global Concern) were recorded in the shrubby grassland to the east of the Assessment Area. |
| Re-creatability | Readily re-created. |
| Fragmentation | No fragmentation for the hillside patch continues with the shrubby |

| Criteria | Grassland/ Shrubland within Assessment Area |
|---|---|
| | grassland within the Study Area. The two smaller patches to the northeast of the Assessment Area are fragmented by secondary woodland and villages. |
| Ecological Linkage | Ecologically linked to the nearby hillside woodland. |
| Potential Value | Succession to shrubland and woodland in the absence of disturbance. |
| Nursery/ Breeding Ground | None of significant nursery/ breeding ground known. |
| Age | Uncertain, but approximately formed in 20 years. |
| Abundance/ Richness of Wildlife | Low |
| **Ecological Value** | **Low** |

*Secondary Woodland*

**10.5.8** Two small patches of secondary woodland were identified in the north and northeast, and southeast of the Study Area. Woodlands in the north and northeast sides are connected with the mature woodland outside the Assessment Area, while the woodlands in the southeast are younger and with simpler floristic structure. Within the Study Area, a Black Kite was observed flying overhead the secondary woodland, while sightings of dragonfly Emerald Cascader and three butterfly species of conservation importance (Swift sp., Constable and Restricted Demon) were made during the survey period. A maximum of one individual was recorded for Swift sp. and Restricted Demon, while two individuals of Constable were recorded in this habitat type within the Study Area. For dragonfly, a maximum of four individuals of Emerald Cascader were recorded in June survey. Botanically, a total of 13 seedlings of shrub *Diospyros vaccinioides* were recorded in these secondary woodlands. This shrub species is regarded as **"**Critically Endangered**"** by IUCN Red List due to its heavy exploitation for ornamental use in Taiwan. However, it is common and widespread in local territory. About 30 seedlings, two young saplings and one tree of *Ormosia pachycarpa*, and a woody climber *Gnetum luofuense* were recorded in this young woodland patch in the southeast of the Study Area. *Ormosia pachycarpa* is an evergreen tree regarded as **"**Endangered**"** in China (AFCD 2003) due to over-exploitation outside Hong Kong. However, this species can be found in several localities in Hong Kong and Guangdong province, and this species is not locally protected. The woody climber *Gnetum luofuense* is regarded as **"**Near Threatened**"** by IUCN Red List due to the loss or fragmentation of its forest habitat in its biogeographical region. However, it is commonly found in forest and shrubland in Hong Kong, and is not locally protected by law.

**10.5.9** Due to its ecological linkage with the nearby mature secondary woodland in Tai Sheung Tok hill, the secondary woodland to the north and northeast within the Study Area supports higher ecological significance than the one at the southeast due to its higher structural diversity and faunal diversity. The ecological evaluation of this habitat type within the Study Area is summarised in **Table 10.15**.

**10.5.10** Secondary woodlands in the Assessment Area comprise the more mature woodland patches in the north and northeast, the younger patches in the southeast, and the younger and simpler woodland patches developed on man-made slopes in the northwest and south of Assessment Area. A single sighting of two bird terrestrial bird species, namely Grey-chinned Minivet and Crested Serpent Eagle, were sighted and heard in the secondary woodland in the northeast side. Both birds are regarded as **"**Local Concern**"** by Fellowes *et al.* (2002). Four butterfly species of conservation importance, namely

Orange Awlet, Restricted Demon, Bamboo Tree Brown and Dark Evening Brown, were also recorded in the northern and northeast woodland patches. Except the very rare Orange Awlet was recorded in the form of caterpillar, the remaining three uncommon butterfly species were recorded in adult form. The remaining woodland patches generally support common to very common fauna species, with faunal diversity lower than the mature woodland patches in the north and northeast side. Due to its higher structural complexity and less disturbed character, the patches in the north and northeast side support higher ecological significance than the rest. The ecological evaluation of this habitat type within the Assessment Area is summarised in **Table 10.16**.

**Table 10.15:** Ecological evaluation of secondary woodland within the Study Area

| **Criteria** | **Secondary Woodland to the north and northeast within Study Area** | **Secondary Woodland to the southeast within Study Area** |
|---|---|---|
| Naturalness | Semi-nature to natural through natural succession. | |
| Size | Small size (6.9 ha) in the Study Area. | Small size (8.5 ha) in the Study Area. |
| Diversity | Moderate floristic diversity and higher structural complexity. | Moderate floristic diversity, with comparatively simpler floristic structure. |
| Rarity | Common habitat type in Hong Kong, two seedlings of *Diospyros vaccinioides*, regarded as "Critically Endangered" by IUCN Red List were recorded. A Black Kite was observed flying overhead the woodland patches, while sightings of other fauna of conservation importance, including a dragonfly Emerald Cascader and three butterfly species (Swift sp., Constable and Restricted Demon) were also made. | Common habitat type in Hong Kong, 11 seedlings of *Diospyros vaccinioides*, a woody climber *Gnetum luofuense*, about 30 seedlings, two young saplings and one tree of *Ormosia pachycarpa* were recorded. Lesser Spiny Frogs have been recorded from streams in this habitat, along with dragonfly Emerald Cascader found in this secondary woodland. |
| Re-creatability | Readily re-created but trees and habitat structure need time to mature. | |
| Fragmentation | Not fragmented | |
| Ecological Linkage | Ecologically linked to secondary woodland to the northeast and north of the Assessment Area. | Ecologically linked to secondary woodland to the southeast of the Assessment Area. |
| Potential Value | Limited scope as near climax stage. | Succession to more mature woodland in the absence of disturbance. |
| Nursery/ Breeding Ground | No significant nursery/ breeding ground known. | Lesser Spiny Frog tadpoles recorded from stream in this habitat. |
| Age | Unknown | |
| Abundance/ Richness of Wildlife | Low to Moderate | Low |
| **Ecological Value** | **Moderate** due to its continuity | **Moderate** due to its size, |

| Criteria | Secondary Woodland to the north and northeast within Study Area | Secondary Woodland to the southeast within Study Area |
|---|---|---|
| | with the more mature secondary woodland to the north and northeast of the Assessment Area and the presence of floral and faunal species of conservation importance. | potential value in developing into more mature woodlands and presence of floral and faunal species of conservation importance in association with the watercourse within this habitat. |

**Table 10.16:** Ecological evaluation of secondary woodland within the Assessment Area

| Criteria | Secondary Woodland to the north and northeast of Assessment Area | Remaining hillside Secondary Woodland to the southeast of Assessment Area | Secondary Woodland on man-made slopes at the northwest and south of Assessment Area |
|---|---|---|---|
| Naturalness | Semi-natural to natural through natural succession | | Largely semi-natural, with development of self-sown native species and limited human disturbance. |
| Size | Large size (64.0 ha) within Assessment Area | Moderate size (26.6 ha) within Assessment Area | Relatively small size (22.4 ha) |
| Diversity | Moderate to high floristic diversity and higher structural complexity than other woodlands within the Assessment Area. | Moderate floristic diversity, with comparatively simpler floristic structure than the woodland to the north and northeast of Assessment Area. | |
| Rarity | Common habitat in Hong Kong. More than 50 seedlings and larger saplings of *Diospyros vaccinioides*, 13 young seedlings and two tree forms of protected *Aquilaria sinensis*, two individuals of protected *Rhododendron* spp., as well as woody climber *Gnetum luofuense* and three trees of *Artocarpus hypargyreus* of conservation importance recorded in these woodlands.<br>Six faunal species of conservation importance, including two birds (Grey-chinned Minivet and Crested Serpent Eagle), and four | Common habitat in Hong Kong. | Common habitat in Hong Kong. |

| Criteria | Secondary Woodland to the north and northeast of Assessment Area | Remaining hillside Secondary Woodland to the southeast of Assessment Area | Secondary Woodland on man-made slopes at the northwest and south of Assessment Area |
|---|---|---|---|
| | butterflies (Restricted Demon, Bamboo Tree Brown, Dark Evening Brown and caterpillar of Orange Awlet) were recorded. | | |
| Re-creatability | Readily re-created but trees and habitat structure need time to mature. | | |
| Fragmentation | Some fragmentation by buildings in village and urban area. | Some fragmentation by buildings in village and roads. | Highly fragmented by developed area and roads. |
| Ecological Linkage | Ecologically linked with hillside shrubby grassland. | | Limited linkage with other habitats of ecological significance due to fragmentation. |
| Potential Value | Limited scope as near climax stage. | Succession to more mature woodland in the absence of disturbance. | Some scope of enhancement in floristic structure and diversity in the absence of disturbance. |
| Nursery/ Breeding Ground | No significant nursery/ breeding ground known. | | |
| Age | Unknown | | Unknown, but certainly younger than other woodlands within the Assessment Area. |
| Abundance/ Richness of Wildlife | Moderate | Low | Low |
| **Ecological Value** | **Moderate to High** in regard to its mature, continuous canopy structure, as well as the record of five floral and six faunal species of conservation importance. | **Low to Moderate** due to its size and potential value in developing into more mature woodlands in time. | **Low** due to its isolation, higher exotic species domination and human disturbance. |

*Plantation*

**10.5.11** Plantations within the Study Area are established for rehabilitation of natural vegetated area under the operation of the Anderson Road Quarry. These stands are young in age and largely comprise exotic plantation species (such as *Acacia* spp., *Eucalyptus* spp. and *Casuarina equisetifolia*). Natural colonization by native and exotic plant species in the understorey was noted, but the floristic diversity is quite low. However, due to its

proximity to the natural secondary woodland and shrubby grassland to the east, these stands support moderate diversity of fauna, especially for butterfly (48 spp. recorded). Several fauna species of conservation importance were recorded in low number in these stands or in concreted U-channel associated with these stands. Two sightings of Hong Kong Newt were recorded in the concrete U-channel in the plantation in the northeast of the Study Area. Plantation is not a typical habitat for Hong Kong Newt and it is believed that the Newt was washed off from the nearby habitats (e.g. secondary woodland and hillside stream) during their seasonal migration in their non-breeding period. Other species of conservation recorded comprised Common Rat Snake and two dragonfly species, namely Hong Kong Clubtail and Emerald Cascader, and 11 butterfly species. Of the latter, two are considered to be very rare (Indian Awl King and Hainan Palm Dart), two are rare (Common Dart and Banded Awl) and five are uncommon (Indian Palm Bob, Plains Cupid, Dark Evening Brown, Striped Blue Crow and Yellow Orange Tip). The recorded Swift sp. and *Telicota* sp. are of conservation importance. Due to its ecological linkage with the nearby terrestrial habitats, these plantations are of low to moderate ecological significance regarding to the faunal diversity. The ecological evaluation of this habitat type within the Study Area is summarised in **Table 10.17**.

**10.5.12** Plantations within the Assessment Area are composed of stands established on man-made slopes, along roads or on the hill slope surrounding infrastructure. These are primarily monocultural stands, with limited natural colonization by plants in their understorey. These provide limited scope for fauna utilization due to the close proximity with developed areas. The ecological evaluation of these plantations within the Assessment Area is summarised in **Table 10.18**.

**Table 10.17:** Ecological evaluation of plantation within the Study Area

| Criteria | Plantation within Study Area |
|---|---|
| Naturalness | Primarily man-made, with limited natural colonization of native and exotic plant species in time. |
| Size | Moderate size (21.8 ha) in the Study Area. |
| Diversity | Low floristic diversity and structure, but moderate diversity of butterfly diversity (48 spp.) |
| Rarity | A very common habitat type in Hong Kong. Faunal species of conservation importance include tailed amphibian Hong Kong Newt (found in concrete U-channel in plantation), reptile Common Rat Snake, two dragonflies (Emerald Cascader and Hong Kong Clubtail) and 11 butterflies (Indian Awl King, Hainan Palm Dart, Common Dart, Banded Awl, Indian Palm Bob, Plains Cupid, Dark Evening Brown, Striped Blue Crow, Yellow Orange Tip, Swift sp. and *Telicota* sp.) |
| Re-creatability | Readily re-created. |
| Fragmentation | Not fragmented. |
| Ecological Linkage | Ecologically linked with secondary woodland from the north to southeast of the Study Area. |
| Potential Value | Limited scope of enhancement on the quarry slopes and benches with thin soil. |
| Nursery/ Breeding Ground | None of significance known. |
| Age | Established approximately for at least 10 years. |
| Abundance/ Richness of Wildlife | Low as the abundance of each faunal species recorded is in low number. |

| Criteria | Plantation within Study Area |
|---|---|
| **Ecological Value** | **Low to Moderate** due to the presence of floral and faunal species of conservation importance. |

**Table 10.18:** Ecological evaluation of plantation within the Assessment Area

| Criteria | Plantation within Assessment Area |
|---|---|
| Naturalness | Primarily man-made, with natural colonization of native and exotic plant species in time. |
| Size | Small size (13.0 ha) in the Assessment Area. |
| Diversity | Low floral and faunal diversity. |
| Rarity | A very common habitat type in Hong Kong. |
| Re-creatability | Readily re-created. |
| Fragmentation | Highly fragmented by developed area and roads. |
| Ecological Linkage | Plantation to the southeast of the Assessment Area shows some ecological linkage with the surrounding secondary woodlands; other plantations show no ecological linkage with other habitats of ecological significance. |
| Potential Value | Limited potential due to disturbance and plantation stands dominated by exotic species. |
| Nursery/ Breeding Ground | None of significance known. |
| Age | Unknown. |
| Abundance/ Richness of Wildlife | Low |
| **Ecological Value** | **Low** |

*Developed Area*

**10.5.13** The only developed areas within the Study Area comprise the existing construction site to the west of Anderson Road, Anderson Road and southern section of Po Lam Road. These are either construction site or paved areas heavily used for traffic and are of low ecological significance to wildlife. The ecological evaluation of the developed area within the Study Area is summarised in **Table 10.19**.

**10.5.14** Developed area within the Assessment Area includes the ongoing site formation area to the southwest of the Study Area, public housing estates, infrastructures and roads from north to south, and low-rise residential components and village houses in the northeast and southeast. These habitats, especially the site formation area, are highly modified and constantly receive significant human intervention. It supports very simple floristic structure and the vegetation is often cultivated and heavily managed. Some diversity of fauna, including amphibians, dragonflies and butterflies, were recorded in these developed areas (especially in village environs associated with terrestrial habitats). A dragonfly Ruby Darter was recorded at the fringe of the developed area in Tan Shan. This species is considered to be of **"**Local Concern**"** by Fellowes *et al.* (2002), but is common throughout Hong Kong. Any fauna identified in this habitat type are rather common and occur opportunistically due to the connection with the nearby natural terrestrial habitat. The ecological evaluation of the developed area within the Assessment Area is summarised in **Table 10.20**.

**Table 10.19:** Ecological evaluation of developed area within the Study Area

| **Criteria** | **Developed Area within Study Area** |
|---|---|
| Naturalness | Entirely man-made. |
| Size | Small size (11.2 ha) in Study Area. |
| Diversity | Construction site or paved area support very low diversity floral and faunal diversity. |
| Rarity | A very common habitat type in Hong Kong. |
| Re-creatability | Readily re-created. |
| Fragmentation | Not fragmented. |
| Ecological Linkage | Somewhat ecologically linked with the secondary woodlands. |
| Potential Value | Limited scope for enhancement due to high level of disturbance. |
| Nursery/ Breeding Ground | No significant nursery/ breeding ground known. |
| Age | Unknown. |
| Abundance/ Richness of Wildlife | Very low abundance/ richness of wildlife. |
| **Ecological Value** | **Very Low** |

**Table 10.20:** Ecological evaluation of developed area within the Assessment Area

| **Criteria** | **Developed Area (concurrent site formation area) southwest of Study Area** | **Developed Area in the remaining Assessment Area** |
|---|---|---|
| Naturalness | Entirely man-made. | |
| Size | Moderate size (Approx. 36.6 ha) in Assessment Area. | Large size (116.3 ha) in Assessment Area. |
| Diversity | Very low floristic diversity and structure. | Low floristic diversity and structure, most vegetation are planted. |
| Rarity | A common habitat type exists before a fully established urban area. | A very common habitat type in Hong Kong. A dragonfly Ruby Darter was recorded at the fringe of the developed area in Tan Shan. |
| Re-creatability | Readily re-created. | |
| Fragmentation | Not fragmented. | Most are not fragmented, except areas of localized village houses and low-rise buildings. |
| Ecological Linkage | No significant linkage with habitats of ecological importance. | Developed areas with village houses show some linkage with surrounding habitats. |
| Potential Value | Limited scope for enhancement due to high level of disturbance. | |
| Nursery/ Breeding Ground | No significant nursery/ breeding ground known. | |
| Age | Unknown. | |
| Abundance/ Richness of Wildlife | Low | |

| Criteria | Developed Area (concurrent site formation area) southwest of Study Area | Developed Area in the remaining Assessment Area |
|---|---|---|
| **Ecological Value** | **Very Low** | **Very Low to Low** as the ecological value is slightly higher in village environs associated with terrestrial habitats |

*Quarry*

**10.5.15** The Study Area is mainly composed of a quarry site which includes a service reservoir (i.e. provision of water for dust suppression) and heavily modified ground with active human intervention over the past 50 years. The quarry site is largely covered in bare ground and supports very low floristic diversity. Fauna may occur opportunistically via the plantation along the north and northeast side, but generally the quarry site does not provide suitable habitats for wildlife due to high levels of human management. The ecological evaluation of quarry is summarized in **Table 10.21**.

**Table 10.21:** Ecological evaluation of Quarry

| Criteria | Quarry within Study Area |
|---|---|
| Naturalness | Entirely man-made and highly modified. |
| Size | Large within Study Area (46.5 ha). |
| Diversity | Very low in faunal and floral diversity. |
| Rarity | One of the four quarry sites in Hong Kong, but the highly modified habitat nature is common in Hong Kong. |
| Re-creatability | Readily re-created, but it takes time to undertake excavation works over extensive area. |
| Fragmentation | Not fragmented. |
| Ecological Linkage | Somewhat linked ecologically with benches of plantation and secondary woodland within the Study Area. |
| Potential Value | Limited potential for direct increase in habitat value unless the current mining and quarrying activities cease. |
| Nursery/ Breeding Ground | Not known for significant nursery/ breeding ground. |
| Age | Almost 50 years. |
| Abundance/ Richness of Wildlife | Low abundance and diversity of wildlife. |
| **Ecological Value** | **Very Low** |

## *Species*

**10.5.16** A total of seven plants, one mammal, three birds, three amphibians, one reptile, five dragonflies, 16 butterflies and two freshwater crabs of conservation importance were identified within the Assessment Area. Locations of these floral and faunal species of conservation importance identified within the Study Area and Assessment Area are shown in **Figures 227724/E/6301 – 227724/E/6308**. Assessment of the ecological significance of these species is summarized in **Tables 10.22 – 10.28**.

**Table 10.22:** Ecological evaluation of flora of conservation significance recorded in the Study Area and the Assessment Area

| Species | Protection Status | Conservation Status | Distribution in Hong Kong[1-5] | Ecological Value |
|---|---|---|---|---|
| Small Persimmon *Diospyros vaccinioides* | Nil | Critically Endangered[6] | Very common in shrubland, thin forest and thickets in ravines or hillslope habitats | Low |
| Chinese Lily *Lilium brownii* | Cap. 96A | Nil | Restricted to grassy hillside habitat at restricted locations | Medium |
| Incense Tree *Aquilaria sinensis* | Cap. 586, State Protection (Category II) [7] | Vulnerable[6]; "Near Threatened" [7]* | Commonly found in lowland forest and *fung shui* wood | Medium |
| *Rhododendron* spp. (Wild population) | Cap. 96A | Nil | Found in shrubland and forest | Medium |
| Luofushan Joint-fir *Gnetum luofuense* | Nil | Near Threatened[6] | Commonly found in forest and shrubland | Low |
| Silver-back Artocarpus *Artocarpus hypargyreus* | Nil | Vulnerable[6]; "Near Threatened" [7]* | Commonly found in lowland forest | Medium |
| Hairy-fruited Ormosia *Ormosia pachycarpa* | Nil | Endangered[7] | Restricted, found in several localities | Medium |

Notes:

[1] Xing *et al.* (2000)

[2] AFCD (2007)

[3] AFCD (2008)

[4] AFCD (2009)

[5] AFCD (2011)

[6] IUCN (2013)

[7] AFCD (2003)

* Conservation/ Protection Status is stated in *China Plant Red Data Book* and *Illustration of Rare & Endangered Plant in Guangdong Province* as stipulated in AFCD (2003).

**Table 10.23.** Ecological evaluation of mammal of conservation significance recorded in the Study Area and the Assessment Area

| Species | Protection Status | Conservation Status | Distribution in Hong Kong | Ecological Value |
|---|---|---|---|---|
| Japanese Pipistrelle | Cap. 170 | - | Widely distributed in HK [2] | Low |

Notes:

[1] Fellowes *et al.* (2002)

[2] Shek (2006)

**Table 10.24:** Ecological evaluation of birds of conservation significance recorded in the Study Area and the Assessment Area

| Species | Protection Status | Conservation Status | Distribution in Hong Kong | Ecological Value |
|---|---|---|---|---|
| Black Kite | Cap. 170, Cap. 586 | (Regional Concern)[1] | Common resident and winter visitor, widely distributed in HK | Low (as no roost or breeding site recorded) |
| Grey-chinned Minivet | Cap. 170 | Local Concern[1] | Common in winter, scarce in summer | Low |
| Crested Serpent Eagle | Cap. 170, Cap. 586 | (Local Concern)[1] | Uncommon resident, widely distributed in HK | Low (as no breeding site recorded) |

Notes:

[1] Fellowes *et al.* (2002)

**Table 10.25:** Ecological evaluation of herpetofauna of conservation significance recorded in the Study Area and the Assessment Area

| Species | Protection Status | Conservation Status | Distribution in Hong Kong | Ecological Value |
|---|---|---|---|---|
| Hong Kong Newt | Cap. 170 | Potential Global Concern[1] Near Threatened[2] | Common and widespread | Medium to High |
| Lesser Spiny Frog | Nil | Potential Global Concern[1] Vulnerable[2] | Widely distributed in HK | Medium |
| Short-legged Toad | Nil | Potential Global Concern[1] Vulnerable[2] | Widely distributed in HK | Medium |
| Common Rat Snake | Cap, 568, Appendix II CITES | Potential Regional Concern[1] | Common | Medium |

Notes:

[1] Fellowes *et al.* (2002)

[2] IUCN (2013)

**Table 10.26:** Ecological evaluation of dragonfly of conservation significance recorded in the Study Area and the Assessment Area

| Species | Protection Status | Conservation Status | Distribution in Hong Kong | Ecological Value |
|---|---|---|---|---|
| Chinese Yellowface | Nil | Local Concern[1] | Abundant[2] | Low |
| Blue-tailed Shadowdamsel | Nil | Global Concern[1] | Common[2] | Low to Medium |
| Hong Kong Clubtail | Nil | Local Concern[1] | Common[2] | Low to Medium |
| Ruby Darter | Nil | Local Concern[1] | Common[2] | Low to Medium |
| Emerald Cascader | Nil | Potential Global Concern[1] | Abundant[2] | Low |

Notes:

[1] Fellowes *et al.* (2002)

[2] Tam *et al.* (2011)

**Table 10.27:** Ecological evaluation of butterfly species of conservation significance recorded in the Study Area and the Assessment Area

| Species | Conservation Status | Distribution in Hong Kong | Ecological Value |
|---|---|---|---|
| Orange Awlet | Nil | Very Rare[1] | Medium |
| Indian Awl King | Local Concern[2] | Very Rare[1] | Medium |
| Banded Awl | Nil | Rare[1] | Medium |
| Swift sp.[3] | [3] | [3] | Medium |
| Restricted Demon | Nil | Uncommon[1] | Low to Medium |
| Common Dart | Local Concern[2] | Rare[1] | Medium |
| Indian Palm Bob | Nil | Uncommon[1] | Low to Medium |
| Hainan Palm Dart | Local Concern[2] | Very Rare[1] | Medium |
| White-banded Flat | Nil | Rare[1] | Medium |
| Plains Cupid | Nil | Uncommon[1] | Low to Medium |
| Striped Blue Crow | Nil | Uncommon[1] | Low to Medium |
| Constable | Local Concern[2] | Rare[1] | Medium |
| Bamboo Tree Brown | Nil | Uncommon[1] | Low to Medium |
| Dark Evening Brown | Nil | Uncommon[1] | Low to Medium |
| Yellow Orange Tip | Nil | Uncommon[1] | Low to Medium |
| *Telicota* sp. [4] | [4] | [4] | Medium |

Notes:

[1] Chan *et al.* (2011)

[2] Fellowes *et al.* (2002)

[3] Paintbrush Swift (*Baoris farri*), Colon Swift (*Caltoris bromus*) and Dark Swift (*Caltoris cohira*) are in distinguishable in field. Paintbrush Swift and Dark Swift are 'Rare' species and Colon Swift is 'Very Rare in Hong Kong (Chan *et al.* 2011).

[4] There are four species of Dart in the Genus *Telicota* in Hong Kong. Of which *T. besta* and *T.colon* are species of Local Concern (Fellowes *et al.* 2002). In Chan *et al. (2011), T. ancilla* is listed as 'Uncommon', *T.colon* and *T. ohara* are listed as 'Rare' and *T. besta* is listed as 'Very Rare'.

**Table 10.28:** Ecological evaluation of stream fauna of conservation significance recorded in the Study Area and the Assessment Area

| Species | Protection Status | Conservation Status | Distribution in Hong Kong | Ecological Value |
|---|---|---|---|---|
| *Crytopotamon anacoluthon* | Nil | Potential Global Concern[1]<br>Vulnerable[2] | Common and widespread in unpolluted streams; Endemic to Hong Kong | Low to Medium |
| *Nanhaipotamon hongkongense* | Nil | Potential Global Concern[1] | Endemic to Hong Kong | Low to Medium |

Notes:

[1] Fellowes *et al.* (2002)

[2] IUCN (2013)

# 10.6 Potential Ecological Impacts of the Proposed Development

## *Assessment Methodology*

**10.6.1** The potential direct and indirect terrestrial and aquatic ecological impacts arising from the construction and operation of the latest Recommended Outline Development Plan (RODP) are assessed below in accordance with Annexes 8 and 16 of the EIAO-Technical Memorandum. A series of infrastructure options for the Study Area were prepared and reviewed relative to the ecological survey findings (see details in **Chapter 3**). Estimates of habitat lost and identification of areas to be affected by development have been calculated as accurately as possible.

## *Identification of Impacts*

**10.6.2** The potential ecological impacts considered are listed in the Study Brief:

- Direct loss of habitats of ecological importance, either permanent or temporary, which may occur on-site and/or off-site, due to various elements such as excavation works and other associated works of the Project.
- Direct loss of flora and fauna species of conservation importance arising from the Project.
- Indirect impacts on the natural environment and the associated wildlife groups, habitat and/or vegetation as a result of changes of water quality, hydrodynamic properties, hydrology and accidental discharge of untreated sewage arising from the construction works and operation activities of the Project.
- Potential indirect impact on species abundance or diversity and ecological carrying capacity due to habitat fragmentation and isolation arising from the Project.
- Potential indirect impacts on habitats and wildlife groups due to increased human activities and disturbance (such as increase in light intensity) during the construction and operation phases of the Project.

- Cumulative impacts due to other planned and committed concurrent development projects at or near the Project area.

## *Evaluation of Impacts in the Absence of Mitigation Measures*

**10.6.3** Following the criteria in Annex 8 in the EIAO-TM, habitats under the present study directly impacted by residential development in the Study Area are evaluated and presented in the following tables. Habitat loss as a result of direct impact from the Study Area is assessed in tables whatever the significance of the loss. Evaluations of indirect impacts are assessed in tables only where impacts above the level of insignificance or zero are predicted.

## *Direct Impacts on Habitats*

**10.6.4** The proposed development in the Study Area will include residential development (including public housing) and other associated commercial and recreational uses to meet district and local needs. The development also includes constructing a road and a underpass to connect Po Lam Road in the southern part, and a Quarry Park in the proposed 'Regional Open Space' on the north side of the Study Area. The existing rehabilitation plantations, as well as two to three benches of plantations to be built upon completion of the quarry activity located from north to southeast of the Study Area will be proposed as 'Green Belt' area, where minor civil works for public or commercial platforms and shops will be built (refer to **Chapter 3** and **Figure 227724/E/0003** detailing the RODP for the proposed zone planning and the associated road connection).

**10.6.5** Four habitats, namely quarry, developed area, plantation and secondary woodland, within the Study Area will be directly impacted due to the proposed residential development. No other habitats within the Study Area and no habitats within the Assessment Area will be directly impacted by the proposed development. Potential indirect impacts on these habitats and their associated species are evaluated in the "Indirect Impact" section.

*Quarry*

**10.6.6** Quarry is the major habitat type in the Study Area and includes a service reservoir (i.e. provision of water for dust suppression) and heavily modified ground with active human intervention in the past 50 years. This habitat supports low floristic diversity and no fauna were recorded during the survey period. The Quarry in the Study Area is of very low ecological value and loss of this habitat type is of very low ecological significance.

**10.6.7** Residential development and its associated road infrastructure will be proposed on the existing quarry site. Two to three benches of plantations (~7.7ha) will be rehabilitated from north to southeast of the Study Area upon completion of quarry activity; hence, except for minor civil works for small-scale commercial use as well as building a pedestrian trail on these benches, these rehabilitated plantations with a matrix of native and exotic plants will provide some ecological value for fauna colonization in the long term. Evaluation of direct ecological impacts to quarry in the absence of mitigation measures is shown in **Table 10.29**.

**Table 10.29:** Direct ecological impacts to Quarry in the absence of mitigation measures

| Criteria | Assessment |
|---|---|
| Habitat Quality | Very Low |
| Species | Very low in floral and faunal diversity. No species of conservation importance was found in this habitat. |

| Criteria | Assessment |
|---|---|
| Size/ Abundance | Large in size (about 38.7ha will become urbanised area, while about 7.7ha will become rehabilitation plantation and zoned as green belt) will be directly impacted, but faunal abundance is very low. |
| Duration | Habitat loss would be permanent. |
| Reversibility | Habitat loss would be irreversible. |
| Magnitude | Existing habitat would be completely lost. |
| **Overall Impact Severity** | **Negligible** due to its existing highly modified and disturbed habitat which is of very low ecological value |

*Developed Area*

**10.6.8** The developed areas within the Study Area comprise the existing construction site to the west of Anderson Road, as well as the entire Anderson Road and its immediate sloping area with on-going civil works running north to south and Po Lam Road to the south. These areas, either paved road or bare ground under construction works for a public housing development, are heavily disturbed and of very low ecological value, and the loss of this habitat is of negligible significance. Evaluation of direct ecological impacts to developed area in the absence of mitigation measures is shown in **Table 10.30**.

**Table 10.30:** Direct ecological impacts to Developed Area in the absence of mitigation measures

| Criteria | Assessment |
|---|---|
| Habitat Quality | Very Low. |
| Species | Flora diversity is very low, and only supports low abundance of common fauna species. No species of conversation importance was found in this habitat. |
| Size/ Abundance | Small in size (about 1.4ha) will be directly impacted, with very low faunal abundance. |
| Duration | Habitat loss would be permanent. |
| Reversibility | Habitat loss would be irreversible. |
| Magnitude | Existing habitat would be completely lost. |
| **Overall Impact Severity** | **Negligible** |

*Plantation*

**10.6.9** Plantations within the Study Area are established for rehabilitation of natural vegetated area under the operation of the Anderson Road Quarry. They are formed by planting native and exotic plant species on benches. Majority of these plantations from north to southeast will be preserved under the proposed land use zonings as **'**Regional Open Space**'** and **'**Green Belt**'**, and civil works for future Quarry Park and small-scale public (including a pedestrian trail) and commercial use will be carried out in the north, northeast and east parts. These plantations within the Study Area support low faunal abundance, including Hong Kong Newt, which was only found in a concrete U-channel, probably washed down from nearby terrestrial habitat, and other faunal species of conservation importance (including Common Rat Snake, two dragonflies and 11 butterflies). Nevertheless, the proposed development in the plantation area is away from the locations where these fauna were recorded, and as highly mobile species they are considered able to colonize other nearby unaffected terrestrial habitats. Given these are exotic plantations in which only small areas will be permanently lost, the loss of this

habitat is of low significance. Evaluation of direct ecological impacts to plantation in the absence of mitigation measures is shown in **Table 10.31**.

**Table 10.31:** Direct ecological impacts to Plantation in the absence of mitigation measures

| Criteria | Assessment |
|---|---|
| Habitat Quality | Low due to dominance of exotic plant species and simpler structural complexity. |
| Species | Low floristic diversity and dominated by exotic plant species. A total of 15 faunal species of conservation importance (including herpetofauna Hong Kong Newt (found in a u-channel in a plantation) and Common Rat Snake, dragonflies Hong Kong Clubtail and Emerald Cascader, and butterflies Indian Awl King, Banded Awl, Swift sp., Common Dart, Indian Palm Bob, *Telicota* sp., Hainan Palm Dart, Plains Cupid, Striped Blue Crow, Dark Evening Brown and Yellow Orange Tip) were recorded in very low numbers. |
| Size/ Abundance | Small in size (about 2.0ha) will be directly impacted, and supports low faunal abundance. |
| Duration | Habitat loss would be permanent. |
| Reversibility | Habitat loss would be irreversible. |
| Magnitude | Low as only a small proportion of the existing habitat will be impacted by civil works for future Quarry Park and small-scale public and commercial use in the north, northeast and east parts. |
| **Overall Impact Severity** | **Low** |

*Secondary Woodland*

**10.6.10** Two small secondary woodlands were found within the Study Area, comprising a more mature patch in the north and northeast, and a younger patch with simpler structure in the southeast. Similar to the plantations, the majority of these woodlands will be preserved under the proposed land use zonings as **'**Regional Open Space**'** and **'**Green Belt**'** (locations of these proposed planning zones are shown in **Figure 227724/E/0003**), except for three small woodland patches in the south and southeast that will be lost due to the construction of an access road and a underpass connecting to Po Lam Road. Locations of these three small secondary woodland patches to be impacted are shown in **Figure 227724/E/6401**). The secondary woodlands in the Study Area generally support moderate floral diversity, and low faunal diversity. Eleven seedlings of the shrub *Diospyros vaccinioides*, a woody climber *Gnetum luofuense*, and about 30 seedlings, two young saplings and one tree of *Ormosia pachycarpa* were recorded within these woodland patches, as well as faunal species of conservation importance, including the dragonfly Emerald Cascader and three butterfly species (Swift sp., Constable and Restricted Demon). However, no faunal or floral species of conservation importance identified within the secondary woodlands (including one isolated woodland patch and two other very small woodland patches at the fringe of the young secondary woodland) will be directly impacted by the proposed construction works at the south and southeast parts (1.13 ha) of the Study Area. Nevertheless, this habitat in the Study Area is considered to be of low to moderate ecological value, and the loss of this habitat of low to moderate significance due to its continuity with the adjacent young woodland patch and provision of suitable habitats for local fauna. Evaluation of direct ecological impacts to secondary woodland in the absence of mitigation measures is shown in **Table 10.32**.

**Table 10.32:** Direct ecological impacts to Secondary Woodland in the absence of mitigation measures

| Criteria | Assessment |
|---|---|
| Habitat Quality | Generally semi-natural to natural habitat of low to moderate ecological value. |
| Species | No floral and faunal species of conservation importance were recorded |
| Size/ Abundance | Small in size (1.13ha) and the impacted habitat supports low faunal abundance. |
| Duration | Habitat loss would be permanent. |
| Reversibility | Habitat loss is reversible, if planting is allowed on the proposed slope works. |
| Magnitude | Only a very small proportion of the existing habitat would be completely lost. |
| **Overall Impact Severity** | **Low to Moderate** |

## *Direct Loss to Flora and Fauna Species of Conservation Importance*

*Flora*

**10.6.11** Seven floral species of conservation importance were found within the Study Area and Assessment Area. These are largely common and widespread, and they were recorded in the secondary woodland and grassland/shrubland in the present study. Three of these floral species, including shrub *Diospyros vaccinioides*, a woody climber *Gnetum luofuense* and tree *Ormosia pachycarpa*, are located in a young secondary woodland to the north and northeast parts of the proposed access road and underpass. However, such young secondary woodland will not be directly impacted by the proposed development. Other floral species of conservation importance will not be directly impacted by the proposed development. Therefore, the potential direct ecological impact to any of these floral species of conservation importance is of negligible significance.

*Birds*

**10.6.12** A total of 40 bird species were recorded in the present study. Of these, Black Kite was recorded flying above the secondary woodland in the Study Area, while two birds, Crested Serpent Eagle and Grey-chinned Minivet, were heard and/or sighted within the secondary woodlands in the Assessment Area. None of these bird species will be directly impacted by the proposed development since the majority of the secondary woodland within the Study Area will be preserved. Further, the Black Kite was just recorded flying above the Study Area, with no roost or breeding site found on site. Therefore, the potential direct ecological impact to Black Kite is of negligible significance.

*Herpetofauna*

**10.6.13** A total of 12 amphibian and three reptile species were recorded in the present study. All the recorded herpetofauna species are common and widely distributed in Hong Kong. Of these, three amphibians (including Hong Kong Newt, Lesser Spiny Frog and Short-legged Toad) and one reptile (Common Rat Snake) are considered of conservation importance due to their being assessed as of Potential Global or Regional concern by Fellowes *et al.* (2002). These amphibians of conservation importance were mainly recorded in the watercourses within the Assessment Area, except for two sightings of

Hong Kong Newt made in the concrete U-channel in the plantation in the northeast of the Study Area.

**10.6.14** Plantation is not a typical habitat for Hong Kong Newt and it is believed that these individuals had been washed off from nearby terrestrial habitats (e.g. secondary woodland and hillside stream) during their seasonal migration in the non-breeding period.

**10.6.15** An individual of Common Rat Snake was observed in the plantation in the northeast of the Study Area. Given that existing benches of plantations within the Study Area will be preserved, with only small-scale civil works to be conducted on selected sections of benches for public and commercial uses, these highly mobile amphibian and reptile species are not predicted to be directly impacted by the proposed development (see **Table 10.33**).

**Table 10.33:** Potential direct ecological impacts to Hong Kong Newt and Common Rat Snake in the absence of mitigation

| Criteria | Hong Kong Newt | Common Rat Snake |
|---|---|---|
| Conservation/ Protection Status | Regarded as 'Potential Global Concern' by Fellowes *et al.* (2002) and 'Near Threatened' by IUCN (2013); locally protected under Cap. 170. | Regarded as 'Potential Regional Concern' by Fellowes *et al.* (2002); locally protected under Cap. 568, and Appendix II CITES |
| Distribution | Widespread in Hong Kong. | Widespread in Hong Kong. |
| Rarity | Common in Hong Kong. | Common in Hong Kong. |
| Abundance | Only one individual was recorded in a concrete U-channel in the Plantation within the Study Area; a maximum of nine individuals were recorded in a natural watercourse at Tan Shan Village. | An individual was recorded in Plantation habitat within the Study Area. |
| Magnitude | Low due to the very low number of individuals observed and the recorded habitat (concrete U-channel) is not its usual breeding and activity habitat. | Low due to the very low number of individuals observed and the fact it is a highly mobile species. |
| **Overall Impact Severity** | **Low** | **Low** |

*Butterflies*

**10.6.16** A total of 63 species of butterflies was recorded in the present study, the majority of which are common to very common in Hong Kong. Of these 63 species, a total of 13 butterfly species of conservation importance were recorded in the plantation or secondary woodland within the Study Area. These comprise two very rare species (Indian Awl King and Hainan Palm Dart), three rare (Constable, Common Dart and Banded Awl), six uncommon (Indian Palm Bob, Plains Cupid, Dark Evening Brown, Striped Blue Crow, Yellow Orange Tip and Restricted Demon), and another two species of conservation concern (Swift sp., and *Telicota* sp.) (assessments based on Chan *et al.* 2011).

**10.6.17** Very low numbers of these butterfly species were recorded, usually a single sighting or a maximum of one individual recorded. In addition, no plants suitable as larval food

plants could be provided by majority of the quarry or developed areas (see **Table 10.34**) impacted by the proposed development. Even the low number of herb species suitable as larval food plants found in the plantation and hillside terrestrial habitats at the fringe of the Study Area are common and widespread species that are available in the nearby hillside habitats. Hence, the habitats in the Study Area are not considered to be of significance to local populations of these butterfly species of conservation significance. Given the majority of the plantation and secondary woodland habitats within the Study Area will be preserved and any proposed civil works will be small-scale and temporary only, impacts arising from the proposed development to these habitats and their butterfly community are anticipated to be low (see **Table 10.35**).

**Table 10.34:** Known larval food plants for the butterfly species of conservation importance found within the Study Area and the Assessment Area

| **Butterfly species** | **Status in Hong Kong (Chan *et al.* 2011)** | **Larval food plants** | **Habitat(s) recorded in Study Area** | **Habitat(s) recorded in Assessment Area** |
|---|---|---|---|---|
| Indian Awl King | Very Rare | *Sabia limoniacea* | / | / |
| Banded Awl | Rare | *Pongamia pinnata, Derris trifoliata* | / | / |
| Swift sp. | [1] | *Brachypodium kawakamii, Microstegium ciliatum* | *Microstegium ciliatum* in secondary woodland and plantation | / |
| Restricted Demon | Uncommon | *Hedychium coronarium, Alpinia japonica, Zingiber officinale, Z. zerumbet, Alpinia zerumbet, Musa x paradisiaca, Curcuma sp, Alpinia hainanensis* | *Alpinia hainanensis* in secondary woodland | *Musa x paradisiaca* in watercourses, grassland and secondary woodland in the Assessment Area |
| Common Dart | Rare | *Cymbopogon tortilis, Miscanthus floridulus* | *Cymbopogon tortilis* in grassland/shrubland; *Miscanthus floridulus* in grassland/ shrubland and plantation | / |
| Indian Palm Bob | Uncommon | *Phoenix hanceana, P. roebelinii, P. canariensis, P. dactylifene, Rhapis excelsa, Caryota mitis, Arenga engleri, Livistona chinensis, Washingtonia sp.* | / | *Caryota mitis, Livistona chinensis, Phoenix roebelinii* and *Rhapis excelsa* in developed area |
| *Telicota* sp. | [2] | No relevant information available | | |

| **Butterfly species** | **Status in Hong Kong (Chan *et al.* 2011)** | **Larval food plants** | **Habitat(s) recorded in Study Area** | **Habitat(s) recorded in Assessment Area** |
|---|---|---|---|---|
| Hainan Palm Dart | Very Rare | *Miscanthus sinensis* | / | *Miscanthus sinensis* in secondary woodland |
| Plains Cupid | Uncommon | *Cycas taiwaniana, C. revolute* | / | / |
| Striped Blue Crow | Uncommon | *Nerium oleander, Toxocarpus wightianus, Ficus nervosa, Ficus formosana, Ichnocarpus frutescens, Aristolochia spp., Ficus benjamina, F. microcarpa, F. sarmentosa, Urceola rosea, Gymnema sylvestre, Cryptolepis sinensis, Ficus fistulosa* | *Ficus microcarpa* in plantation and developed area | *Ficus benjamina* in developed area;<br>*Ficus microcarpa* in developed area;<br>*Ficus fistulosa* in watercourses, secondary woodland and plantation |
| Constable | Rare | *Meliosma rigida, M. fordii* | / | / |
| Dark Evening Brown | Uncommon | *Microstegium ciliatum, Setaria palmifolia, Arundo donax, Isachne globosa, Miscanthus sinensis, Pennisetum purpureum, Oryza sativa* | *Microstegium ciliatum* in secondary woodland and plantation | *Miscanthus sinensis* in secondary woodland;<br>*Pennisetum purpureum* in grassland |
| Yellow Orange Tip | Uncommon | *Capparis cantoniensis, C. acutifolia, Crateva unilocularis* | / | / |

Notes:

[1] Paintbrush Swift (*Baoris farri*), Colon Swift (*Caltoris bromus*) and Dark Swift (*Caltoris cohira*) are indistinguishable in field. Paintbrush Swift and Dark Swift are 'Rare' species and Colon Swift is 'Very Rare in Hong Kong (Chan *et al.* 2011).

[2] There are four species of Dart *Telicota* in Hong Kong, of which *T. besta* and *T. colon* are species of Local Concern (Fellowes *et al.* 2002). In Chan *et al.* (2011), *T. ancilla* is listed as 'Uncommon', *T. colon* and *T. ohara* are listed as 'Rare' and *T. besta* is listed as 'Very Rare'.

**Table 10.35:** Potential direct ecological impacts to butterflies of conservation importance in the absence of mitigation

| Criteria | Assessment |
|---|---|
| Conservation/ Protection Status | None of these species are protected by laws; Indian Awl King, Common Dart, Hainan Palm Dart and Constable are considered to be of 'Local Concern' by Fellowes *et al.* (2002). |
| Distribution | Two very rare (Indian Awl King and Hainan Palm Dart), three rare (Constable, Common Dart and Banded Awl), six uncommon (Indian Palm Bob, Plains Cupid, Dark Evening Brown, Striped Blue Crow, Yellow Orange Tip and Restricted Demon), and another two species of conservation concern (Swift sp., and *Telicota* sp.). |
| Rarity | Same account as shown in 'Distribution' in Hong Kong. |
| Abundance | Very low numbers of these butterfly species were recorded. |
| Magnitude | Habitat impacts are of low value for butterflies, so magnitude of impacts fairly low. |
| **Overall Impact Severity** | **Low** |

## *Indirect Impacts*

*Indirect impacts on the natural environment and associated wildlife groups and habitat and/or vegetation as a result of changes of water quality, hydrodynamic properties or hydrology, or accidental discharge of untreated sewage arising from construction works or operation activities of the Project*

**10.6.18** Except a few channelized drains or partly channelized sections along watercourses, the watercourses present in the Study Area and Assessment Area are largely semi-natural to natural, usually with a retained natural bottom and sometimes partly concrete-lined. One young seedling of *Aquilaria sinensis* and a number of faunal species of conservation importance (including Hong Kong Newt, Lesser Spiny Frog and Short-legged Toad, and two freshwater crabs *Crytopotamon anacoluthon* and *Nanhaipotamon hongkongense*) were recorded in these surveyed watercourses, though all were in low numbers.

**10.6.19** Potential indirect impact during the construction phase may include construction run-off or accidental spillage of chemicals, lubricants or pollutants entering these seasonal or permanent wet watercourses identified in the northeast, east and southeast of the Assessment Area. However, given the separation of these hillside watercourses by the Tai Sheung Tok Hill and given the major construction works will concentrate in the existing quarry site and developed area, potential indirect impacts on these watercourses behind Tai Sheung Tok Hill, where most of these floral and faunal species of concern were recorded, potential indirect impacts on these water body resulting from the proposed development are considered negligible.

**10.6.20** Watercourses located to the southeast of the Study Area could potentially be disturbed by the proposed road and underpass if there would be accidental run-off during the construction phase. The upper and lower natural and partly channelized sections of this watercourse, as well as another watercourse located to the east, will potentially be disturbed by construction run-off in the absence of mitigation. Such construction run-off is potentially destructive to water quality and the aquatic environment, which will in turn impact the aquatic fauna community. Without proper site practices to avoid construction run-off during the construction phase, sediment from the run-off, particularly during periods of heavy rain, will raise the turbidity level in the watercourse,

which would lead to direct mortality of aquatic fauna such as fish, as their gills could be covered, hence adversely affecting respiration. Increased sediment load in the watercourses can also lead to eutrophication as a result of nutrient enrichment. Aquatic macrophytes may be reduced as a result of reduced light penetration or increased free-floating algae populations following eutrophication. Severe eutrophication can lead to oxygen depletion and the impoverishment of aquatic communities, as well as animals that prey on them (e.g. herpetofauna). Chemicals from construction run-off may have acute toxic effects on aquatic fauna. Nevertheless, the indirect impacts arising from construction run-off during the construction phase are usually greater than that in the operation phase, in which the run-off would be substantially lower in magnitude.

**10.6.21** Impacts from run-off during the operation phase are generally much lower, as, integral to the design, all domestic effluent and wastewater will be connected to the main sewer to ensure that there is no pollution into surrounding watercourses or other wooded habitats. Surface water run-off will be collected internally by a surface water drainage system, and will pass through a series of silt and oil interceptors within the road gullies as well as a main silt and oil trap before discharge into local watercourses. All such interceptors will be properly maintained on a regular basis to ensure continued function. Evaluation of potential indirect hydrological and water quality impacts on natural environments and associated wildlife is shown in **Table 10.36**.

**Table 10.36:** Potential indirect hydrological and water quality impacts on natural environments and associated wildlife in the absence of mitigation

| **Criteria** | **Assessment** |
|---|---|
| Habitat Quality | Variable. Majority of the watercourses within the Study Area and Assessment Area are semi-natural to natural and range from permanently wet to dry in nature. Seasonal or permanently wet and semi-natural/natural watercourses are of higher quality due to their naturalness and their provision of suitable habitats for aquatic fauna, amphibians and dragonflies.<br>Channelized or partly channelized sections of the watercourses are highly modified with concrete lining and bottom. The quality is generally lower. |
| Species | Low floral diversity; faunal diversity varies according to quality of the watercourses. Low numbers of flora (one young seedling of *Aquilaria sinensis*) and faunal species of conservation importance (including herpetofauna Hong Kong Newt, Lesser Spiny Frog and Short-legged Toad, and two freshwater crabs *Crytopotamon anacoluthon* and *Nanhaipotamon hongkongense*) were recorded in watercourses that are not anticipated to be impacted by the construction works. |
| Size/ Abundance | Due to the natural barrier of Tai Sheung Tok Hill and concentration of construction works at the quarry site, potential indirectly impacted watercourses will be small in length, with low number of faunal species. |
| Duration | Temporary for construction phase impact |
| Reversibility | To some extent reversible via implementation of mitigation. |
| Magnitude | Construction phase impacts are Low to Moderate in magnitude; operation phase impacts are Low given that proper sewer treatment will be provided for the proposed development. |
| **Overall Impact Severity** | Construction phase: **Low to Moderate.**<br>Operation phase: **Low.** |

*Potential indirect impacts on habitats and wildlife groups due to increased human activities and disturbance (such as increase in light intensity) during the construction and operation phases of the Project*

**10.6.22** Potential indirect disturbance to the surrounding habitats and their associated wildlife groups during the construction phase includes construction noise. The existing quarry site has been actively operated for at least 50 years, and noisy machinery and activities such as drilling, excavation and controlled explosion works have disturbed adjacent habitats and their associated wildlife groups for a prolonged period. Given the construction noise level would be comparable to the existing level, marginal disturbance impacts from construction works resulting from the proposed development are predicted to be of low significance. However, greater impacts would be anticipated if such construction works are not programmed appropriately to reduce the noise level.

**10.6.23** Species inhabiting adjacent terrestrial habitats, especially birds, herpetofauna and butterflies using the secondary woodlands and shrubby grassland, could be affected by these disturbance impacts. However, such habitats are closed, in the sense that fauna within them cannot easily see human or machine activity in adjacent areas. Fauna can, generally speaking, habituate to auditory disturbance fairly readily in the absence of corresponding visual disturbance, or other activity that is a threat to the species concerned. For this reason, closed habitats are significantly more disturbance insensitive than open habitats. Furthermore, these species are rather mobile and similar habitats suitable for foraging and roosting are abundant in areas adjacent to the Study Area. In addition, disturbance from construction will be short-term. Hence, overall, indirect impacts to wildlife using the surrounding habitats are considered to be temporary and of negligible significance.

**10.6.24** Potential indirect disturbance during the operation phase includes the increased level of human disturbance and artificial light from the proposed residential and commercial development in the Study Area. The Project will involve residential development (including public housing) and other associated commercial and recreational uses concentrated in the existing quarry site and developed area in the west and southwest of the Study Area. Most plantations on the benches from north to southeast parts will be preserved, with minor civil works conducted for public use (such as pumping stations, service reservoirs, lookout points and pedestrian trails) and commercial uses (such as small shops inside the cavern).

**10.6.25** As noted previously, the existing quarry and developed areas are not of significance to wildlife groups; however, increased levels of human disturbance to plantation and secondary woodlands could potentially disturb these terrestrial habitats and fauna communities. However, most of these terrestrial habitats (including secondary woodlands, shrubby grassland and watercourses) adjacent to the Study Area are located on steep topography of Tai Sheung Tok Hill, and any visits by human are considered to be of occasional use only (such as hiking). In addition, these faunal groups (such as butterflies, birds and herpetofauna) are usually highly mobile, they could inhabit other terrestrial habitats continuous with those in the Study Area if in case their habitats are disturbed. Given the limited magnitude of increase in the level of human activity, and given the lack of disturbance-sensitive species of conservation significance, disturbance impacts to the habitats and wildlife groups during operation phase are predicted to be negligible.

**10.6.26** Potential indirect impacts on habitats and wildlife groups due to increased light intensity during the construction phase are of low magnitude, since major construction works will

be programmed during daytime and the works are temporary only. However, artificial light from the future residential, commercial and/or recreational buildings during operation phase will increase the light disturbance effect on the surroundings habitats and wildlife groups. Given the densely populated areas of Sau Mau Ping, Lam Tin and Tsui Lam lie close to the western and southwestern boundaries of the proposed development, it is, however, considered that the marginal impact of this light disturbance will be insignificant.

**10.6.27** There is the potential for impacts on surrounding habitats if lights are directed to terrestrial habitats, which in turn could affect nocturnal mammals using the habitats. However, based on literature review and survey data, mammal use of this area appears to be very limited, and confined to Eurasian Wild Pig, Short-nosed Fruit Bat and Japanese Pipistrelle. Since only small number of faunal species and individuals (which are common and widespread) and limited area will be impacted from the increased light intensity on the nearby terrestrial habitats, the significance of this potential impact is predicted to be negligible.

*Potential indirect impact on species abundance or diversity and ecological carrying capacity due to habitat fragmentation and isolation arising from the Project*

**10.6.28** The proposed development will be concentrated at the existing quarry site and developed areas of low ecological value for faunal colonization and utilization. From the north to southeast boundaries of the Study Area, the majority of plantation and secondary woodland habitats will be preserved and remain contiguous with the terrestrial hillside habitats at Tai Sheung Tok Hill. Hence, the continuity and connectivity of the terrestrial habitats within and adjacent to the Study Area will be kept, with no significant fragmentation.

**10.6.29** The proposed road and underpass at the southeast part of the Study Area will cause the loss of small-sized young secondary woodlands. These affected areas of woodland are either isolated patches or at the woodland fringe, and the proposed underpass will go underneath the woodland and emerge at Po Lam Road. However, in view of the location of these small-sized areas to be lost (on the fringe of the main wooded area) and small numbers of species and individuals are likely to be affected in these small areas, there will be no fragmentation on the overall integrity of the major woodland patch at the southeast.

## *Cumulative Impacts*

*Cumulative impacts due to other planned and committed concurrent development projects at or near the Project area*

**10.6.30** According to CED (1998) and (Arup 2009), an existing construction site located southwest of Anderson Road and the Study Area will be developed for housing, educational and open space (EIA-005/1998 and known as **"**Development at Anderson Road**"**). According to the latest Final Environmental Review Report (Arup 2009), this public housing development scheme covers an area of about 20ha, and will provide 37 residential blocks of 27 to 40 storeys high, providing more than 17,000 residential units. Five schools will also be built under this development scheme. The construction works of this housing scheme will involve site formation works, access road and infrastructure works, as well as building sewerage treatment and water supply facilities, and building construction works. The site formation works has been in progress under Contract No. CV/2007/03 **"**Development at Anderson Road – Site Formation and Associated Infrastructure Works**"**, and will last about 3.5 years. The whole development scheme is

scheduled to be completed in 2016. Major habitat loss due to this project includes the permanent loss of woodland (15ha), grassland (14ha), agricultural land (1 ha) and 300m streams of polluted run-off from the quarry operation. As such, mitigation via reprovision of an area of 13.4ha of woodland utilising native trees and shrubs on soft cut slopes was proposed. Other potential impacts or disturbances during the construction and operation phases of this project were considered to be of low significance due to the limited signs of fauna utilization and urbanised nature of the surrounding habitats.

**10.6.31** Impacts from this project will be mitigated and reduced to low levels. Given the construction phase of the current project will be largely carried out after the completion of the construction works of development at Anderson Road, and the latter project is separated from the terrestrial habitats in Tai Sheung Tok Hill, potential cumulative impacts arising from the development at Anderson Road during construction and operation phases are considered to be of low significance.

**10.6.32** Other potential concurrent projects include the proposed road improvement works and rock cavern development located to the northwest and south of the Assessment Area, and in the north of the Study Area (refer **Chapter 3**). As mentioned in **Section 1.5**, further EIA study for these road improvement works and rock cavern developments will be carried out by the Project Proponent. The proposed works include road improvement works at the junction of Lin Tak Road and Sau Mau Ping Road, the junction of Near Clear Water Bay Road, as well as at the merging lane at Clear Water Bay Road near Shun Lee Tsuen Road. These works largely cover the existing roads, nearby vegetated man-made slopes and other developed areas. The rock cavern development is proposed on the benches of the plantation located in the north of the Study Area, however proposal of the design and usage within the rock cavern is still under investigation. Given the proposed road improvement works are either located outside or close to the fringe of the Assessment Area, as well as the major civil works will be concentrated on the existing road, no cumulative impact is predicted and any direct habitat loss may be restricted to developed areas only. The proposed rock cavern development in the north of the Study Area may involve direct loss of rehabilitation plantation. However, as this young plantation patch is established by planting mainly exotic plantation species which are of lower ecological significance, and majority of the civil works will be taken within the rock cavern, insignificant cumulative impact is predicted in respect of direct habitat loss due to such development.

## *Summary of Potential Ecological Impacts*

**10.6.33** **Table 10.37** summarises potential ecological impacts arising from construction and operation phases of the proposed development, and whether mitigation is required. Impacts assessed as either low or negligible are not considered to require mitigation, and are not taken further in this report.

**Table 10.37:** Summary of potential ecological impacts

| Potential Impacts | Impact Severity | Mitigation required |
|---|---|---|
| **Permanent Direct Loss of Habitats** | | |
| Quarry | Negligible | No |
| Developed Area | Negligible | No |
| Plantation | Low | No |

| Potential Impacts | Impact Severity | Mitigation required |
|---|---|---|
| Secondary Woodland (~1.13 ha) | Low to Moderate | Yes |
| **Permanent Direct Loss to Flora and Fauna Species of Conservation Importance due to Project** | | |
| Flora | Negligible; but Low to Moderate as may have potential presence of any floral of conservation importance in the inaccessible secondary woodland at the SE part of the Study Area | Yes |
| Birds | Negligible | No |
| Herpetofauna: Hong Kong Newt and Common Rat Snake | Low | No. Precautionary measures/good site practices proposed. |
| Thirteen butterfly species of conservation importance | Low | No |
| **Indirect Impacts on Habitats** | | |
| Construction phase hydrological and water quality impacts | Low to Moderate | Yes |
| Operation phase hydrological and water quality impacts | Low | No |
| Construction phase disturbance impact on habitats due to increased human activities and disturbance | Low | No |
| Operation phase disturbance impact on habitats due to increased human activities and disturbance | Low | No |
| **Indirect Impacts on Species** | | |
| Construction phase disturbance impact on wildlife groups due to increased human activities and disturbance | Low | No |
| Operation phase disturbance impact on wildlife groups due to increased light disturbance | Low to Moderate | Yes |
| Indirect impact on species abundance/ diversity and ecological carrying capacity due to habitat fragmentation | Negligible for habitats and species | No |
| **Cumulative impacts due to other concurrent development projects** | | |

| Potential Impacts | Impact Severity | Mitigation required |
|---|---|---|
| Construction and operation phase impacts in respect of habitats and species | Low | No |

## 10.7 Mitigation Measures Adopted to Avoid, Minimise and Compensate for Ecological Impacts

**10.7.1** Throughout the assessment period, different infrastructure options involving the design of road connection and construction methodology of access road were generated. In particular, an alternative construction method of an access road leading to Po Lam Road is proposed to reduce excavated soil volume and woodland habitat area to be lost, as well as preserving a natural watercourse within a young secondary woodland. Evaluation of the alternative infrastructure options and construction methods were detailed in **Section 3.4** of **Chapter 3**. Mitigation measures adopted to avoid, minimize and compensation for the ecological impacts discussed above are presented in the following sections.

*Mitigation of impacts of secondary woodland loss at the southeast of the Study Area*

**10.7.2** Three small young secondary woodland patches (a total of approximately 1.13 ha) will be directly impacted by the proposed road and underpass at the southeast of the Study Area. Loss of this secondary woodland is compensated by planting of native tree and shrub species and to be re-provided at the proposed Quarry Park in the **"**Regional Open Space**"** Zone at the northeast part of the Project Area. To create an ecological linkage with the existing rehabilitation plantations and their subsequent mature woodlands at the northern part of the Study Area, the Wooded Area will be mainly re-provided at the northern side of the Quarry Park. An approximately 1.2 ha of the future Quarry Park is proposed for compensatory planting for the loss of secondary woodlands, so as to achieve the ecological function and value of the area to be lost (location refer to **Figure 227724/E/6501)**. Though the proposed Wooded Area will be on the existing quarry site sitting on a gentle flat land, the proposed Wooded Area will be restored and connect with the adjacent plantation to the north. To provide a better growth environment for the compensatory planting of the tree and shrub species, ground preparation and modification of planting medium (including subsoil, topsoil and addition of compost) may be required to improve the soil condition for vegetation growth. Routine monitoring on the survival and growth of the compensatory planting is required to monitor the seedling performance throughout the monitoring period. Moreover, it is agreed that LCSD will be responsible for the long-term maintenance and management of this Wooded Area and Quarry Park throughout the operation phase.

**10.7.3** According to the latest RODP, a pedestrian trail will be proposed along the lowest bench of plantation from southeast to north, and finally connect with the northern wooded area in the Study Area. There may be some insignificant fragmentation between the fringe of the future Wooded Area with the existing plantations, and this fragmentation can be minimized by planting trees of wider and larger canopies along the woodland and plantation fringes, so as to form some kind of overstorey connection between the habitats.

**10.7.4** A list of native tree and shrub species is proposed in **Table 10.38**. The proposed tree species are common in natural woodlands and form key canopy cover, while those of shrub species are common in shrubland and forest edges, as well as providing fleshy

fruits for native fauna such as birds. Low density of common exotic plantation species (such as *Acacia* spp. and *Lophostemon confertus*) may be proposed if the establishment of the woodland coverage needs to be accelerated.

**Table 10.38:** A list of native tree and shrub species proposed for Wooded Area

| **Species** | **Planting form** |
|---|---|
| **Trees** | |
| *Aporusa dioica* | Whip |
| *Castanopsis fissa* | Whip |
| *Cinnamomum camphora* | Whip |
| *Cyclobalanopsis championii* | Whip |
| *Ilex rotunda* | Whip |
| *Machilus breviflora* | Whip |
| *Mallotus paniculatus* | Whip |
| *Microcos paniculata* | Whip |
| *Schefflera heptaphylla* | Whip |
| **Shrubs/ Small Trees** | |
| *Gardenia jasminoides* | Shrub |
| *Ilex asprella* | Shrub |
| *Litsea rotundifolia* var. *oblongifolia* | Shrub |
| *Melastoma malabathricum* | Shrub |
| *Melastoma sanguineum* | Shrub |
| *Polyspora axillaris* | Shrub |
| *Rhaphiolepis indica* | Shrub |
| *Rhodomyrtus tomentosa* | Shrub |

Note:

[1] The above proposed list is not exhaustive or exclusive, and a qualified plant ecologist/ botanist of the Environmental Team shall be permitted to proposed suitable alternative species that meet the functional requirements of the ecological planting or if in case the proposed tree or shrub species are not available in the nurseries by the time of compensatory planting.

**10.7.5** Compensatory planting of native tree and shrub species will be supervised by a qualified botanist/ horticulturist/ Certified Arborist with relevant experience in reforestation. A detailed Wooded Area Proposal will be prepared by a qualified ecologist/ botanist specifying the planting location, planting period (early wet season), planting methodology, post-transplantation monitoring and maintenance programme. The proposal should be agreed by EPD/LCSD/AFCD. A monitoring and maintenance

period of 5 years is proposed to ensure the establishment of the planted trees and shrubs within the Wooded Area. For the long-term management of the compensatory planting, it is agreed that LCSD will be responsible for the maintenance and management of the Wooded Area and Quarry Park during the operation phase. Monitoring methodology will be detailed in the Wooded Area Proposal but the monitoring will be formulated on the basis of having quantitative survey (involving survey quadrats) and walk-through surveys covering all representative areas with ecological compensatory planting. The monitoring shall include measuring parameters (such as growth, health condition, seedlings' survival rate), record any natural recruitments and condition of the site environments (such as any site factors that may be influencing the establishment or human interference of the area).

**10.7.6** Given the survival rates of the planted tree whips and shrubs could be higher if the compensatory planting is to be conducted in early wet season (February/March) of Year 1, a baseline quantitative monitoring and a walk-through survey should be carried out after the completion of the planting. The baseline monitoring can also allow remedial measures to be undertaken during the first half of the ensuring wet season (April to June), and quantitative monitoring again in September of the first year to allow measurement of the annual growth/ establishment increment during the wet season. Bi-annual quantitative monitoring will be carried out in the followed Years 2 to 5. In addition, walk-through survey will be conducted on a bi-monthly basis in Year 1, while reduced to quarterly from Years 2 to 5. The walk-through survey should be undertaken in order to inform any adaptive or proactive management measurement, such as the need to clear invasive vegetation.

*Mitigation of impacts to floral species of conservation importance*

**10.7.7** No floral species of conservation importance was located in the accessible secondary woodlands and other habitats to be directly impacted by the proposed road work in the southeast part of the Study Area. However, given part of these impacted woodlands were inaccessible during the ecological survey and the inaccessible part share floristic composition and structure similar to that of the adjacent hillside young secondary woodland with records of floral species of conservation importance, a vegetation survey is proposed to ascertain the presence of any floral species of conservation importance in the impacted secondary woodlands or other habitats once would be accessed in the future detailed design stage. This is to further minimize the potential impact on any floral species of conservation importance resulting from the proposed development.

**10.7.8** Prior to the commencement of the construction works, an updated vegetation survey will be conducted in the habitats which are to be affected by the proposed construction works. The survey will ascertain the presence, as well as update the conditions, number, locations and habitat types of these species and other rare/protected plant species (if any) identified within construction works areas. The survey will determine the number and locations of the affected individuals of floral species of concern and evaluate the suitability and/or practicality of the transplantation. The survey will be conducted by a qualified ecologist/ botanist and any necessary mitigation works will be discussed and agreed with AFCD.

**10.7.9** A Transplantation Proposal will be prepared by a qualified ecologist/ botanist with full details of the findings of the comprehensive survey (including number and locations of the affected individuals, and assessment of suitability and/or practicality of the transplantation), locations of the receptor site(s), transplantation methodology, implementation programme of transplantation, post-transplantation monitoring and

maintenance programme. The proposal should be submitted to and approved by AFCD prior to construction. The approved transplantation works will be supervised by a qualified botanist/horticulturist/Certified Arborist with relevant experience in transplanting floral species of conservation importance.

*Mitigation for construction phase hydrological and water quality impacts*

**10.7.10** Sources of pollution during the construction phase include sedimentation from soil excavation, release of contaminants during excavation, chemical waste from equipment, surface run-off from roads and hard-standing and domestic waste water. The following mitigation measures will be adopted during the construction phase to mitigate these impacts.

(1) Temporary sewerage and drainage will be designed and installed to collect wastewater and prevent it from entering nearby watercourses;

(2) Proper locations well away from nearby watercourses will be used for temporary storage of materials (i.e. equipment, fill materials, chemicals and fuel) and temporary stockpile of construction debris and spoil, and these will be identified before commencement of works;

(3) To prevent muddy water entering nearby watercourses, work sites close to nearby watercourses will be isolated, using such items as sandbags or silt curtains with lead edge at bottom and properly supported props. Other protective measures will also be taken to ensure that no pollution or siltation occurs to the water gathering grounds of the works site;

(4) Stockpiling of construction materials, if necessary, will b properly covered and located away from nearby watercourses;

(5) Erection of temporary geotextile silt fences will be carried out around earth-moving works to trap any sediments and prevent them from entering watercourses;

(6) Construction debris and spoil will be covered and/or properly disposed as soon as possible to avoid being washed into nearby watercourses;

(7) Exposed soil will be covered as quickly as possible following formation works, followed, where appropriate, by covering with biodegradable geotextile blanket for erosion control purposes;

(8) Where appropriate, earth-bunding will be carried out of areas where soils have been disturbed or where vegetation has been cleared, to ensure that surface runoff will not move soils off-site;

(9) Construction effluent, site run-off and sewage will be probably collected and/or treated. Wastewater from any construction site will be minimised via the following in descending order: reuse, recycling and treatment;

(10) Proper locations for discharge outlets of wastewater treatment facilities well away from sensitive receivers will be identified and used;

(11) Site traps will be installed at points where drainage from the site enters local watercourses;

(12) Appropriate sanitary facilities for on-site workers will be provided;

(13) The site boundary will be clearly marked and any works beyond the boundary strictly prohibited, and

(14) Regular water monitoring and site audit will be carried out at suitable points. If the monitoring and audit results show that pollution occurs, adequate measures including temporary cessation of works will be considered.

**10.7.11** Accidental spillage events could potentially have a large impact on nearby habitats in view of their susceptibility to such pollution. Therefore, an emergency contingency plan should be established and implemented by the Project Proponent or its delegate prior to construction, and will be in place at times during the construction phase. The plan will include, but not be limited to, the following:

(1) Potential emergency situations;

(2) Chemicals or hazardous materials used on-site (and their location);

(3) Emergency response team;

(4) Emergency response procedures;

(5) List of emergency telephone hotlines;

(6) Locations and types of emergency response equipment, and

(7) Training plan and testing for effectiveness.

*Mitigation for operation phase disturbance impact on wildlife groups due to increased light disturbance*

**10.7.12** It is assessed that increased light disturbance resulting from artificial lights of commercial and/or recreational buildings, as well as landscaping areas may have adverse impact on the surrounding habitats and their associated wildlife groups during the operation phase. The assessment of light impacts is considered to be of Low to Moderate in the absence of mitigation measures.

**10.7.13** In order to reduce the light pollution on the nearby habitats and their associated wildlife groups, particularly nocturnal mammals and amphibians, installation of environmentally-friendly lighting system is recommended in open space areas, landscaping areas, and commercial and recreational buildings in the proposed development. The most straightforward approach in reducing light pollution is to avoid pointing light sources directly toward terrestrial habitats (i.e. plantations, secondary woodlands, shrubby grassland and watercourses) within and adjacent to the Study Area. The engineering design of the artificially lit areas and lighting system should also consider options to reduce light pollution on the ecosystems, such as a limit the duration of lighting at night (high levels of lighting may not be necessary in the middle of the night), change the intensity of lighting, avoid sky glow and limit the number of intensively lit buildings by green building design, change the spectral composition of lighting, and reduce lights infringing into areas that are not intended to be lit. Since higher diversity of fauna was recorded in the plantations and secondary woodlands within and adjacent to the Study Area, any lighting systems proposed for public and commercial purposes on or nearby these two terrestrial habitats should be carefully designed. Protocols and design guidelines should be established at the early engineering design stage for summarising the concept of these suggested lighting design criteria and the implementation of the appropriate lighting system. The engineers, architects, landscape architects and other relevant professionals involved in the future development design of the project, as well as the future operators of the building and utility facilities are advised to follow these protocols, design guidelines and implementation manual on lighting system.

## 10.8 Precautionary Measures for Herpetofauna

**10.8.1** Given the presence of a single of Hong Kong Newt in a concrete u-channel in the Study Area, it is recommended that prior to site clearance works, any water channels or streams that may been within the developable area of the site are searched by an appropriately qualified ecologist. Any individual newts (or other species of conservation significance) found should be caught and relocated to a suitable nearby location outside of the development area, such as an adjacent stream in the Assessment Area where this species is known to be present.

**10.8.2** More mobile species, such as Common Rat Snake, are predicted to avoid construction works of their own accord. However, should these be found within the works area, they will also be relocated to suitable habitats in adjacent areas.

**10.8.3** The relocation exercise is a precautionary measure to move any individuals that may have accidently strayed into the development area to an area where they will not be impacted. As such, no formal monitoring requirements are proposed.

## 10.9 Residual Impacts

**10.9.1** **Table 10.39** summarises the ecological impacts that require mitigation, the mitigation to be carried out and the presence or otherwise of residual impacts. It can be anticipated that with the implementation of the proposed mitigation measures described in **Section 10.7**, residual impacts can be reduced to Low significance.

**Table 10.39:** Summary of potential residual impacts

| Potential Impacts | Severity in absence of mitigation | Mitigation proposed | Significance of Residual Impacts |
|---|---|---|---|
| **Permanent Direct Loss of Habitats** | | | |
| Loss of 1.13 ha of secondary woodland | Low to Moderate | Compensatory planting in the future Quarry Park to achieve ecological value of the area to be lost | Low and Positive enhancement of existing habitat |
| **Permanent Direct Loss on Species** | | | |
| Loss of flora of conservation importance | Negligible; but Low to Moderate as may have potential presence of any floral of conservation importance in the inaccessible secondary woodland at the SE part of the Study Area | Transplantation of identified individuals to receptor site prior to the commencement of construction works | No |

| Potential Impacts | Severity in absence of mitigation | Mitigation proposed | Significance of Residual Impacts |
|---|---|---|---|
| **Indirect Impacts on Habitats** | | | |
| Construction phase hydrological and water quality impacts | Low to Moderate | Implementation of good site practices described in **Section 10.7** | Low |
| **Indirect Impacts on Species** | | | |
| Operation phase disturbance impact on wildlife groups due to increased light disturbance | Low to Moderate | Implementation of appropriate light design as described in **Section 10.7** | Low |

## 10.10 Environmental Acceptability of Schedule 2 Designated Projects

**10.10.1** The engineering feasibility study of the proposed ARQ development is a Schedule 3 Designated Project (DP) under the EIAO, whilst there will be two Schedule 2 DPs; i.e. road improvement works and rock cavern developments under the ARQ project. Details of these two Schedule 2 DPs are provided in **Section 1.4** and shown in **Figure 227724/E/0002**.

### *Road Improvement Works*

**10.10.2** Three road improvement works were proposed at junction of (J/O) Lin Tak Road and Sau Mau Ping Road, at J/O Clear Water Bay Road and Road L1 of the Development at Anderson Road (DAR), as well as at the new merging lane at New Clear Water Bay Road near Shun Lee Tsuen Road. In view of the road project nature, the civil works of these three road improvement works and their associated slope upgrading works will be principally concentrated on the existing roads, urban structures, rock slopes and exotic plantations on man-made slopes, with some natural habitats (such as fringe of secondary woodlands on natural slopes and man-made slopes, and small section of watercourses) that may be affected. Impact to the natural watercourses and water quality is not anticipated and such impact will be avoided as far as practical by good site practices.

**10.10.3** There would be potential habitat loss or disturbance to the secondary woodland and the associated flora and fauna arising from the road improvement and the associated slope upgrading works at J/O Clear Water Bay Road and Road L1 of DAR. The secondary woodlands to be affected are located at the fringe of the mature hillside secondary woodland to the northwest of Tai Shung Tok Hill, and the plant species identified in this woodland are similar in composition (i.e. share similar floristic characteristic) in compare with the mature woodland nearby. However, since it is located at the fringe of the mature secondary woodland only and receives higher human disturbance (i.e. traffic, pedestrian, creation of man-made slope), it has simpler floristic structure than the nearby mature secondary woodland. Besides, the size of this affected secondary woodland is small (approximately 0.65ha). Significant ecological impact is therefore not anticipated with regard to its small size and location at the woodland fringe.

Nevertheless, the detailed ecological impact of this Schedule 2 DP will be further investigated in a separate EIA under the EIAO.

### *Rock Cavern Developments*

**10.10.4** The proposed cavern development is located on the existing cut slopes (currently as bare rock slope surface) on the hillside of the proposed ARQ Development. According to the best available information at this stage, the caverns are proposed for commercial use (e.g. food and beverage) as well as museum, and ecological impacts arise due to these cavern developments are considered unlikely. Nevertheless, the detailed ecological impact of this Schedule 2 DP will be further investigated in a separate EIA under the EIAO.

## 10.11 Conclusion

**10.11.1** No major ecological impacts are expected of the current project. Habitats (mainly including the existing quarry site and developed area, and small areas of plantation and secondary woodland) would be directly affected by habitat loss, while disturbance impacts are restricted in scope due to the nature of adjacent habitats and their isolation of nearby terrestrial habitats from the proposed development site.

**10.11.2** A Wooded Area of about 1.2 ha will be provided to compensate the loss of small and young secondary woodlands due to the proposed road and underpass. An updated vegetation survey identifying any potential presence of floral of conservation importance within the inaccessible secondary woodland and habitats to be directly impacted by the proposed development, as well as transplantation of the affected individuals will be conducted prior to the construction phase. Relocation of Hong Kong Newts (or other species of conservation significance) found in the water channels or streams within the proposed development area will also be carried out as a precautionary measure. Overall, with mitigation measures all ecological impacts of the implementation of the Project will be fully mitigated. Low or insignificant residual impacts are predicted after the implementation of the mitigation measures. In particular, there will be a positive enhancement on the existing habitat with the compensatory planting in the future Quarry Park.

## 10.12 References

AFCD. 2003. *Rare and Precious Plants of Hong Kong.* Agriculture, Fisheries and Conservation Department, HKSAR, Hong Kong. 234pp.

AFCD. 2005. *A Field Guide to the Amphibians of Hong Kong*. Friends of the Country Parks.

AFCD. 2006. *A Field Guide to the Venomous Land Snakes of Hong Kong*. Friends of Country the Parks.

AFCD. 2007. *Flora of Hong Kong Vol. 1***.** Edited by Hong Kong Herbarium, Agriculture, Fisheries and Conservation Department & South China Botanical Garden, Chinese Academy of Sciences. 329pp.

AFCD. 2008. *Flora of Hong Kong Vol. 2***.** Edited by Hong Kong Herbarium, Agriculture, Fisheries and Conservation Department & South China Botanical Garden, Chinese Academy of Sciences. 352pp.

AFCD. 2009. *Flora of Hong Kong Vol. 3***.** Edited by Hong Kong Herbarium, Agriculture, Fisheries and Conservation Department & South China Botanical Garden, Chinese Academy of Sciences. 352pp.

AFCD. 2011. *Flora of Hong Kong Vol. 4***.** Edited by Hong Kong Herbarium, Agriculture, Fisheries and Conservation Department & South China Botanical Garden, Chinese Academy of Sciences. 379pp.

Arup. 2001. *Agreement No. CE32/99 Comprehensive Feasibility Study for the Revised Scheme of South East Kowloon Development.* Environment Impact Assessment Report.

Arup. 2009. *Agreement No. CE 55/2005 (CE) Development at Anderson Road – Design and Construction.* Final Environmental Review Report.

Arup. 2012. *Planning Study on Future Land Use at Anderson Road Quarry – Feasibility Study*. Working Paper 6 on Feasbility Assessments of Preferred Option.

Carey, G.J., Chalmers, M.L., Diskin, D.A., Kennerley, P.R., Leader, P.J., Leven, M.R., Lewthwaite, R.W., Melville, D.S., Turnbull, M., Young, L. 2001. *The Avifauna of Hong Kong*. Hong Kong Bird Watching Society. Hong Kong. 563pp.

CED. 1998. *Planning and Engineering Feasibility Study for Development at Anderson Road,* Final Environmental Impact Assessment Report.

CEDD. 2008. *Agreement No. CE 35/2006(CE) Kai Tak Development Engineering Study cum Design and Construction of Advance Works – Investigation, Design and Construction,* Environmental Impact Assessment Report.

Chan, S.K.F., Cheung K.S., Ho, C.Y., Lam, F.N., Tang, W.S., Lau, M.W.N., Bogadek, A. 2005. *A Field Guide to the Amphibians of Hong Kong*. Cosmos Books Ltd., Hong Kong. 212pp.

Chan C.S.M. and Shek C-T., 2006. Survey on the Short-nosed Fruit Bat (*Cynopterus sphinx*) in the Urban Areas of Hong Kong. *Hong Kong Biodiversity* 11: 8-10.

Chan, A., Cheung, J., Sze, P., Wong, A., Wong, E. and Yau, E. 2011. A Review of the Local Restrictedness of Hong Kong Butterflies. *Hong Kong Biodiversity* 21: 1-12.

EPD 2011. *River Water Quality in Hong Kong in 2011*. 91pp.

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

Fu, W.K., 2010. *Population dynamics, diet and morphological variation of the Hong Kongnewt (Paramesotriton hongkongensis)*. Unpublsihed M.Phil Thesis, University of Hong Kong.

Hong Kong Lepidopterists' Society. 2010. *A Photographic Monograph on Hong Kong Butterflies (Vol 1-4).*Hong Kong.

IUCN 2013. http://www.iucnredlist.org/

Karsen, S.J., Lau M.W.N. and Bogadek, A., 1998. *Hong Kong Amphibians and Reptiles*. Urban Council, Hong Kong.

Lo, P.Y.F., Hui, W.L. 2010. *Hong Kong Butterflies*. Friend of the Country Parks. 565pp.

Lu, S.Y. & Pan, F.J. 1998. *Diospyros vaccinioides*. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. <www.iucnredlist.org>. Downloaded on 14 August 2013.

Shek, C.T. 2006. *A Field Guide to the Terrestrial Mammals of Hong Kong*. Cosmos Books Ltd., Hong Kong. 403pp.

Tam, T.W., Leung, K.K., Kwan, B.S.P., Wu, K.K.Y., Tang, S.S.H., So, I.W.Y., Cheng, J.C.Y., Yuen, E.F.M., Tsang, Y.M., Hui, W.L. 2011. *The Dragonflies of Hong Kong*. Friend of the Country Parks.366pp.

Xing, F.W., Ng, S.C., Chau, L.K.C. 2000. Gymnosperms and angiosperms of Hong Kong. *Memoirs of the Hong Kong Natural History Society* 23: 21-136.

Zhao, E. 1998. *China Red Data Book of Endangered Animals*: Amphibia and Reptilia. Science Press. Beijing. China. 330pp.