

## **9 ECOLOGICAL IMPACT ASSESSMENT (TERRESTRIAL & AQUATIC)**

### **9.1 Introduction**

This Section presents the findings of an assessment of the potential ecological impacts associated with the construction and operation of the proposed Project in TKO Area 137. It summarises baseline information gathered from the literature review and baseline ecological surveys on the terrestrial and marine ecological resources in the Study Area, and describes the ecological importance of this area.

### **9.2 Legislative Requirements & Evaluation Criteria**

The local ordinances, regulations and guidelines relevant to protection of species and habitats of ecological importance include the following:

- Environmental Impact Assessment Ordinance ("the EIAO", Cap. 499) and the associated Technical Memorandum (EIAO-TM)
- EIAO Guidance Note No. 6/2010
- EIAO Guidance Note No. 7/2010
- EIAO Guidance Note No. 10/2010
- EIAO Guidance Note No. 11/2010
- Hong Kong Planning Standards and Guidelines Chapter 10 (HKPSG)
- Forests and Countryside Ordinance (Cap. 96) and its subsidiary legislation, the Forestry Regulations
- Wild Animals Protection Ordinance (Cap. 170)
- Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586)
- Country Parks Ordinance (Cap. 208) and its subsidiary legislation
- Town Planning Ordinance (Cap. 131)
- PRC Regulations and Guidelines
- China Red Data Book of Endangered Animals
- IUCN Red List Categories and Criteria
- United Nations Convention on Biological Diversity (1992)
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

These are described in detail in *Annex 9A*.

### 9.3 Baseline Conditions

The baseline conditions of both terrestrial and marine ecological resources of the habitats in the Study Area are reviewed by desktop literature review and dedicated field surveys. The methodology and findings of this review is presented in detail in *Annex 9A*.

In summary, the proposed desalination plant ("Project Site") lies on a reclamation area at the southern end of existing TKO Area 137. The reclamation area for the Project Site is located between Tit Cham Chau and a small unnamed hill to the west of Tin Ha Shan, both of which lie within the Clear Water Bay Country Park. The Clear Water Bay Country Park is a recognized site of conservation importance. The proposed slope mitigation works will be implemented to stabilize the natural slopes and boulders within the Clear Water Bay Country Park overlooking the northeast boundary of the new desalination plant. In addition, the Project will involve the provision of a freshwater main along existing roads of Wan Po Road, Po Hong Road and Tsui Lam Road. Two submarine facilities will be installed on the seabed 200-400m from the reclamation seawall. Considering the environmental setting of the Project and the Project construction and operation activities, the key ecologically sensitive areas are the Clear Water Bay Country Park where slope mitigation works will be undertaken, and the subtidal communities of Joss House Bay where species of conservation interest may be found.

Findings of the literature review (*Annex 9A*) identified that data gaps exist for the ecological habitats and communities in the areas within and surrounding the Project Site. These areas cover both land and sea and in particular represent the areas where direct impacts (e.g. habitat loss) may occur. In accordance with the requirements of the EIA Study Brief, focused field surveys of six months covering both wet and dry seasons were completed in 2014 to verify the information from the desktop review, fill the above information gap, and fulfill the objectives of this EIA. An additional survey was also conducted in the wet season of 2015 to provide supplementary ecological information on the specific locations where slope mitigation works will be implemented inside the Clear Water Bay Country Park. Detailed findings of the field surveys are presented in *Annexes 9A* and *9B*, and the ecological profiles and existing wildlife uses of the various habitats of the Study Area and the Project Site are also described therein.

The field surveys confirmed that a majority (~90%) of the Project Site is man-made habitats with very low to low ecological values. Patches of vegetation of some ecological value were found near the uphill of the study area of slope mitigation works which is located within natural habitats of the Clear Water Bay Country Park. Since no slope mitigation works would be undertaken at the uphill of the Study Area of slope mitigation works, no direct impact is anticipated to vegetation of some ecological value at the uphill natural habitats (*Annex 9A*). At the lower portion of the natural hill of the Clear Water Bay Country Park, a flora species of conservation interest *Marsdenia lachnostoma* was recorded in the shrubland/grassland habitat along the proposed alignment of the flexible barriers within the country park area (*Annex 9B*). The mixed woodland and shrubland/ grassland habitats within slope mitigation works area are located at the edge of Clear Water Bay Country Park with relatively low abundance and diversity of fauna, and the trees were mostly native and common species of fair condition. The mixed woodland and shrubland/ grassland habitats in the Study Area are considered to be of low to moderate ecological value. Also the presence of recent hill fire and disturbed vegetation were observed within the slope mitigation works

area (*Annex 9B*) as well as the Study Area. The watermain is located on existing roads which are of no particular ecological value, and the submarine facilities are located on the seabed with soft and hard bottom communities typical in other similar habitats of Hong Kong.

The ecological values of the habitats recorded within the Study Area have been evaluated in accordance with the criteria stipulated in *Table 2 of Annex 8 of EIAO-TM*. Details of the evaluation are provided in *Annex 9A*. The overall ecological values of the habitats recorded in the Study Area are summarized in **Table 9.1**.

**Table 9.1** *Habitat Evaluation*

Habitat	Overall Ecological Value	Habitat found in Project Site?
Mixed Woodland	Low to moderate	✓ (Desalination Plant site and slope mitigation works)
Plantation	Low	✗
Shrubland/Grassland	Low to moderate	✓ (Desalination Plant site and slope mitigation works)
Agricultural Land	Low	✗
Wasteland	Low	✓ (Desalination Plant Site only)
Watercourse	Low for man-made channel and ditch Low to moderate for the natural section	✓ (Man-made channel and ditch within Desalination Plant Site)
Urbanised/disturbed	Very low	✓ (Desalination Plant Site and water mains)
Natural Rocky Shore	Moderate	✗
Sandy Shore	Low	✗
Artificial Seawall	Very low	✓ (Desalination Plant Site only)
Marine Waters	Low to moderate for subtidal hard bottom Low to moderate for subtidal soft bottom	✓ (submarine facilities)

A total of nine flora and twenty-three faunal taxa (including hard corals) of conservation interest were recorded in the Study Area. The ecological values of species of conservation interest were assessed in accordance with *Table 3, Annex 8 of the EIAO-TM* in terms of protection status (e.g. fauna protected under *WAPO* (except birds), and flora and fauna protected under regional/global legislation/conventions), species distribution (e.g. endemism), and rarity (e.g. rare or restricted). Details of the evaluation are provided in *Annexes 9A and 9B*. Among the recorded flora species of conservation interest, *Marsdenia lachnostoma* is the only flora species found within the area for slope mitigation works, whilst the other flora species of conservation species were recorded outside the proposed slope mitigation works area (i.e. outside the flexible barriers, rock slope stabilization area and soil nailing area) and Project Site. It should also be noted that while five terrestrial fauna species of conservation interest, all bird species, were sighted within the proposed works areas, with their mobility they also make use of other habitats of the Study Area and beyond. Some marine species of conservation interest were recorded, but they are mostly common in Hong Kong and not unique to this Study Area.

## **9.4 Impact Identification**

Potential sources of impacts to ecological resources can arise from both the construction and operation phases. Each is discussed in turn below.

### **9.4.1 Construction Phase**

Land-based construction activities and minor marine dredging works of this Project have the potential to affect ecological resources by:

- Direct loss of habitats and vegetation removal within the footprint of the land-based works area, including reduction of species abundance/diversity, loss of feeding grounds, reduction of ecological carrying capacity;
- Direct disturbances to benthic habitat within the marine works area;
- Potential disturbance to the recognized site of conservation importance at the Clear Water Bay Country Park;
- Potential disturbance to species of conservation interest;
- Habitat fragmentation and isolation, including restriction of wildlife utilisation of the area (i.e. transit, feeding and roosting) especially for those inactive/ less mobile/ habitat-specific wildlife nesting/inhabiting the habitats, and degradation of habitat quality/ ecological function;
- Physical disturbance to the surrounding habitats and associated wildlife due to noise and increased human activities, etc.; and,
- Potential indirect impact, potential changes in the water quality, hydrodynamics properties, sedimentation hydrology.

### **9.4.2 Operation Phase**

The potential impacts of the operational phase of the Project on the ecology of the Study Area are mainly due to perturbations to key water quality parameters from the discharge of hypersaline water from the Reverse Osmosis process.

Terrestrial ecological resources are not expected to be impacted by the Project's operational activities.

## **9.5 Impact Assessment**

### **9.5.1 Assessment Methodology**

Potential impacts that may arise from the construction and operational phases for the development of the Project are assessed following the *EIAO-TM Annex 16* guidelines, and the impacts evaluated based on the criteria in *EIAO-TM Annex 8*.

9.5.2 Terrestrial Ecology (Construction Phase Only)

a) Habitat Loss/ Disturbance and Vegetation Removal

The major impact on terrestrial ecological resources is the direct loss of habitats and the associated vegetation and fauna. The habitat composition and their areas at the desalination plant and the slope mitigation works (i.e. habitat loss) are summarized in **Table 9.2**, ecological values and the total areas of the habitats within the Study Area are provided as well.

**Table 9.2** *Habitat composition of the proposed desalination plant and slope mitigation works area*

Habitat	Ecological Value of the Habitat	Desalination Plant, with result of Habitat Loss (ha)	Anticipated Slope Mitigation Works Area within Country Park Area (ha) <sup>(1)</sup>			Total Affected Areas (ha)
			Rock Slope Stabilization Area	Soil Nailing Area	Flexible Barrier with Country Park)	
Mixed Woodland	Low to moderate	0.61	0.10	0.08	—	0.79
Shrubland/ Grassland	Low to moderate	0.38	0.10	0.14	0.07	0.69
Wasteland	Low	3.78	—	—	—	3.78
Watercourse – man-made channel and ditch	Low	0.18 (0.7 km)	—	—	—	0.18 (0.7 km)
Urbanised/ Disturbed Land	Very low	5.24	—	—	—	5.24
Subtidal hard and soft bottoms (marine waters)	Low to moderate	0.11 (submarine facilities)	—	—	—	0.11 (submarine facilities)
Seawall	Very low	0.28	—	—	—	0.28
<b>Total:</b>		<b>10.58</b>	<b>0.20</b>	<b>0.22</b>	<b>0.07</b>	<b>11.07</b>

Note

(1) Total area of habitat disturbance without tree felling in the Clear Water Bay Country Park due to slope mitigation works = 0.2 + 0.22 + 0.07 = 0.49 ha

*Habitat Loss due to Desalination Plant*

A total of 10.58 ha of habitat loss is anticipated for the construction of desalination plant. Site clearance will be undertaken prior to major civil works and all existing vegetation (predominately grass, weedy plants and also with some scattered shrubs and possibly some trees) within the affected habitats will be removed. The habitat loss due to the desalination plant are largely urbanized/ disturbed land and wasteland of very low to low ecological value with no species of conservation interest relying on these habitats. The affected vegetation is confined to common and amenity planting. No habitats of high ecological values will be affected. According to the findings of the baseline surveys, all the plants found within the Project Site are common species, with no flora species of conservation interest recorded. Also the diversity of and use by wildlife is low, thus the potential impacts on fauna are minimal.

*Habitat Disturbance due to Anticipated Slope Mitigation Works Area*

A total of 0.49 ha of natural habitats would be disturbed due to the implementation of slope mitigation works. The localized soil and rock slope stabilization works will be optimized as much as practicable to avoid impacts on existing habitats and vegetation, and temporary access for the construction works would be limited to within the works areas as far as practical to reduce the footprint of potential disturbance. Localized clearance of vegetation to allow construction of the slope mitigation works will be minimized. Whilst the slope mitigation works area is located within the Clear Water Bay Country Park with habitats of low to moderate ecological value (shrubland/grassland and mixed woodland), the habitats are expected to be disturbed temporarily during the construction works only and will be reinstated by hydro-seeding and planting of climbers and native shrub seedlings where practical upon completion of the slope mitigation works. For proper reinstatement, the selection of native shrub seedlings would take original natural habitat into account.

Also, the affected shrubland/grassland and mixed woodland habitats are located at the edge of the country park area adjacent to the disturbed land, typically subjected to higher levels of disturbance, and therefore generally support faunal generalists that are adapted to human disturbance and using a range of habitats. Consequently, the ecological value/significance of the affected shrubland/grassland and mixed woodland habitats are further less than those at the inner part of the habitats. There are extensive similar habitats available nearby for any fauna displaced due to the project. Therefore long-term impacts are not anticipated. As the diversity of fauna and their utilization of the habitat are low, the potential impacts on fauna in these natural habitats are anticipated to be minimal.

The above estimate represents the worst case assumption at the time of preparing this report and currently the slope mitigation works are planned at the lower portion of natural hill slope only. The area for slope mitigation works will be reduced as far as practicable. This would significantly reduce the magnitude of impacts of natural habitats and the core area in Clear Water Bay Country Park. No habitats of high ecological values will be affected.

No trees will be felled for the implementation of slope mitigation works. To avoid tree felling, the exact locations of the flexible barrier foundation plates, soil nails and rock dowels can be adjusted during detailed design when detailed topographic data are available. To further minimize potential impacts on trees including the root system, a setback distance (e.g. 1-1.5m from stem) from existing trees can be maintained as far as practical. For the flexible barriers which are 4-5m tall, canopies of existing trees, if any, may be in conflict with the barriers and pruning may be required. This will be minimized as far as practicable and will be undertaken properly to reduce damages to trees.

To restore the naturalness of habitats within the Country Park and improve the vegetation cover in the desalination plant, landscaping works will be provided at the desalination plant and slope mitigation works area upon completion of the construction. With the implementation of these mitigation measures, the impact of habitat loss/disturbance and vegetation removal arising from the construction is hence considered to be within acceptable levels. No unacceptable impact of reduction of species abundance/diversity, loss of feeding grounds, and reduction of ecological carrying capacity is expected.

b) Impact on Recognized Sites of Conservation Importance

The 5.94 ha study area of slope mitigation works falls into the gazetted area of Clear Water Bay Country Park which is a recognized site of conservation importance. However, by considering the different slope mitigation works method as discussed in *Section 2*, only a small lower portion of natural slope within the Clear Water Bay Country Park (0.49 ha) would be unavoidably affected by the slope mitigation works. Despite encroachment onto the areas of planning/ conservation concern, the ecological values of the affected habitats as mentioned above are low to moderate. Recent site visits have suggested that the affected area which is located at the fringe of the natural habitat of country parks area has subjected to higher levels of disturbance, the vegetation is in fair conditions with trees young in age. The diversity of flora and fauna is low and most of the species identified are common, widespread and typical of such habitat in Hong Kong. In accordance with the findings from the vegetation survey (*Annex 9B*), the direct footprint of slope mitigation works area was dominated by native herb/climber with low diversity of tree species. All tree species recorded within the slope mitigation works area are common in Hong Kong. Although one flora of species conservation interest *Marsdenia lachnostoma* within the slope works in the Country Park would be directly affected (*Annex 9B*), the slope mitigation works is planned to avoid trees as far as practicable, thus potential tree felling works would be avoided. The potential impact on flora of species conservation interest and corresponding mitigation measures are discussed in the sections below. It is important to note that the implementation of the slope mitigation works would result in loss of naturalness of habitats in Clear Water Bay Country Park, but the naturalness is partially reversible and permanent loss in the habitats of the Clear Water Bay Country Park is not anticipated. Given the small scale of the slope mitigation works and no slope cutting will be involved, ecological impact on the overall country park area and its associated wildlife is considered to be low.

The method of slope mitigation works would be mixed use of flexible barrier, soil nail and rock stabilization. This method has been chosen to minimize the direct habitat loss and disturbance to the natural habitats of low to moderate ecological values within the country park area. By using such construction method as well as the implementation of good practice to control site run-off (see *Section 6* for detailed mitigation measures to control construction site runoff and drainage), the potential impact of land based construction activities on the habitats surrounding the slope mitigation works is predicted to be minor.

c) Impact on Species of Conservation Interest

For terrestrial ecology, a total of nine flora and 21 fauna species of conservation interest were recorded in the Study Area. All flora species of conservation concern, except for *Marsdenia lachnostoma*, are recorded outside the proposed slope mitigation works area and desalination plant site, hence no impacts on these species is anticipated. Ten specimens of *M. lachnostoma* were identified along the proposed alignment of flexible barriers in shrubland-grassland habitat. *M. lachnostoma* is a very rare species documented in the *Rare and Precious Plants of Hong Kong* with status of Critically Endangered (CR) in mainland China. Without mitigation, potential impact to this species would be of moderate significance. To avoid direct conflict between the construction of flexible barrier (including the temporary access) and individuals of *M. lachnostoma*, the exact alignment of flexible barriers can be further adjusted during detailed design. Further mitigation measures are discussed in *Section 9.7* with a view to preserving individuals of this species in its totality. With the proper implementation

of the proposed mitigation measures, no unacceptable adverse impact on *M. lachnostoma* is anticipated.

Of the 22 fauna species of conservation interest, only five species were recorded within the proposed Project Site and works areas. These five species are birds, including Black Kite, Black-crowned Night Heron, White-throated Kingfisher, Collared Scops Owl and Lesser Coucal. Only one individual of each species were recorded. While these species were sighted and/or their calls were heard within the proposed works areas, with their mobility they are expected to make use of other similar habitats and vegetation of the Study Area and beyond, and are therefore unlikely to rely solely on the works areas.

An empty bird nest was recorded on a tree in the northern edge of the slope mitigation works area which is close to where the Collared Scops Owl was recorded (by bird call) (*Annexes 9A and 9B*). It has been reported that Collared Scops Owl uses old Common Magpie nests and also hollow trees for breeding <sup>(1)</sup>. The baseline survey found that the nest was not occupied, and no recently fledged individuals or Collared Scops Owl was sighted or heard again in a recent survey (*Annex 9B*). Also, this species is a widespread and common resident in lowland areas of closed canopy shrubland and woodland habitats <sup>(2)</sup><sup>(3)</sup>. Therefore, this species is considered to be an occasional visitor to the slope mitigation works area and does not rely solely on the works areas.

Furthermore, it is important to note that trees within the area for slope mitigation works in the Clear Water Bay Country Park, where the Collared Scops Owl and other species of conservation interest were recorded, will be retained and so these habitats remain to be available to the species. Disturbance to natural habitats will be minimized where possible to reduce impact to these species. As such, no unacceptable impacts on the fauna species of conservation interest in the Study Area is anticipated.

#### d) Habitat Fragmentation and Isolation

Construction phase activities could lead to a direct 'barrier' effect, where the movement of animals (in particular terrestrial mammals and herpetofauna) through an area would be obstructed. The division of the habitats may lead to indirect fragmentation and isolation impacts. Whilst fragmentation and isolation effects are often difficult to quantify, potential impacts resulting from habitat fragmentation would include:

- Decline in species number and densities over and above that which would be expected from habitat loss alone;
- Loss of 'core' or characteristic species dependant on large habitat patches, and concomitant increases in 'edge' or more facultative species; and
- Other changes in community composition.

For the desalination plant with footprints extending to mixed woodland and shrubland/grassland, no habitat fragmentation and isolation impacts is anticipated as

<sup>(1)</sup> Viney C, Phillipps K and Lam CY (2005) *The Birds of Hong Kong and South China*. pp 255.

<sup>(2)</sup> Ibid

<sup>(3)</sup> Allcock J, Carey GJ, Chow G and Welch G (eds) (2012) *Hong Kong Bird Report (2009 - 10)*. The Hong Kong Bird Watching Society.



the affected habitats are in close proximity to disturbed area (e.g. Fill Bank at Tseung Kwan O Area 137), and the proposed freshwater mains will be laid along existing roads / accesses. For the slope mitigation works, the large continuous and undisturbed habitats such as shrubland-grassland in the Clear Water Bay Country Park are of low to moderate ecological value and will remain largely untouched throughout the construction of the Project. Also, the affected mixed woodland and shrubland/grassland habitats are located at the edge of the natural habitats within country park area with relatively low diversity and abundance of fauna species. Hence, the reduction of wildlife utilisation of the areas (i.e. transit, feeding and roosting) especially for those less mobile / habitat-specific species as a result of habitat fragmentation/ isolation are unlikely to be significant. For the provision of flexible barriers, whilst the baseline surveys suggest that wildlife use of the Clear Water Bay Country Park appears to be minimal, gaps (post-to-post) will be provided to allow passage for wildlife, hence reducing potential impacts on fragmentation and isolation.

e) Noises, Human Activities and Other Disturbances

Secondary impacts to the surrounding habitats and associated wildlife may arise from increased noise, human activities and other physical disturbances. These disturbances would in turn bring about indirect impacts to nearby habitats and their associated fauna. Potential impacts to wildlife include avoidance of areas in the vicinity of works area, and decline in density in areas close to the source of disturbance.

The construction works for desalination plant and slope mitigation works would be temporary and for a duration of about 3.5 years. Moreover, the works areas, in particular the slope mitigation works, will be reduced as far as practical to minimize disturbance to the natural habitats. The impacts are expected to be low owing to the existing human presence in nearby areas (e.g. Fill Bank at Tseung Kwan O Area 137), the temporary nature and relatively small scale of the construction works. Given the implementation of environmental mitigation measures and regular checks on construction practices, the impacts are not expected to be unacceptable.

### 9.5.3 Marine Ecology

As indicated by the findings of the water quality impact assessment and water quality modeling results (Section 6 refers), the predicted zone of influence of the Project is limited to the immediate vicinity of the submarine intake and outfall. In this context, the marine ecological impact assessment in this section focuses on the area around the development footprint.

#### **Construction Phase**

Potential impacts of the construction activities on marine ecological resources are presented in *Section 9.4.1*.

#### **Habitat Loss**

The direct impacts of the minor marine dredging activities will be the loss of subtidal soft bottom habitats for the installation of the submarine intake and outfall pipelines and the removal of organisms associated with the habitats. The marine dredging area would be very small, i.e. 0.11 ha. It is important to determine whether the area of disturbance contain species of interest or noteworthy benthic assemblages, which will be lost during the marine works. Findings from the literature reviews and the baseline

subtidal benthos survey indicated that the benthic assemblages within and in the vicinity of the works areas were dominated by polychaetes. All species recorded are found to be common in Hong Kong and no rare species were observed, except for the individual of *Amphioxus Branchiostoma belcheri*. The occurrence of the individual amphioxus in the baseline survey is possibly due to random settlement via the planktonic larval stage of *B. belcheri*. The very low occurrence of amphioxus suggests that the conditions within Joss House Bay might not be suitable for continual survival of amphioxus after settlement. As a result, the assemblages were regarded as low to moderate ecological value. Considering the very small extent and low to moderate ecological value of the habitat of concern, no unacceptable impacts is expected.

#### Changes in Water Quality

##### *Suspended Sediments*

##### Subtidal Soft Bottom Habitat

The subtidal soft benthos in and around the proposed submarine facilities are considered to be of low to moderate ecological value. Sessile organisms will be susceptible to the effects of increased sediment loads through burial. Sediment may be deposited on the seabed within and near the works areas during dredging due to the dispersion of sediments. Temporary impacts are expected to be the largest in the immediate vicinity of the dredging works (i.e. in the mixing zone) when the works are underway, while impacts on the wider marine environment (>1 km away from the works area) expected to be very low due to gradual deposition of SS over a short distance.

Owing to the small scale and the low level of sedimentation associated with the marine dredging works, the indirect disturbance on benthic assemblages in the vicinity if the works area are expected to be of low severity and localized. With the assumption that the temporarily affected subtidal soft bottom habitats due to marine dredging works could be recolonised by fauna which is typical to that area, the temporary disturbance to these low to moderate ecological value assemblages is not considered to be unacceptable.

##### Subtidal Hard Bottom Habitat (including Corals)

No rare species was found in the subtidal hard bottom habitat in the vicinity of the submarine intake and outfall. The shallow subtidal hard bottom habitat is regarded as low to moderate ecological value. The transient nature of any increase in suspended sediment arising from marine dredging works will have no unacceptable adverse impacts on this habitat and this is confirmed by results of the water quality modelling (*Section 6.8.1*).

##### Intertidal Habitats

Intertidal habitats within the Study Area which can be affected by the marine dredging works include natural rocky shore, sandy shore and artificial seawall. Sediment dispersion modeling results predicts that the SS elevations due to marine dredging will be transient and will be confined to the proposed works area. Thus, it is expected that unacceptable impacts from elevated SS levels to the intertidal assemblages.

### Coastal / Marine Water Habitats

The minor marine dredging works may cause deterioration to water quality, which may potentially impact marine ecological resources. Information from the water quality impact assessment (*Section 6.8.1*) indicates that indirect impacts are not predicted to impact these resources adversely as the elevation of suspended sediments due to sediment plume will be transient and localized to the works area. As a result, unacceptable impacts to open water habitats due to increased suspended sediment levels will not occur.

### *Dissolved Oxygen*

The assessment examining potential impacts of elevated SS levels associated with the proposed marine dredging works showed that the impacts are likely to be minor, localised to the mixing zone and transient. Consequently, DO depletion as a result of dispersion of sediment plumes associated with marine works of the Project is expected to be within acceptable levels and its effect on marine ecological resources is also likely to be very limited.

### *Contaminant Release*

Owing to the unpolluted nature of the seabed sediment within the dredging area (see *Section 8* of this EIA Report), unacceptable water quality impacts due to the potential leaching of metals and micro-organic pollutants from the disturbed sediments into the water column are not expected to occur.

### Vessel Operational Discharges

As discussed in *Section 6*, construction vessels have the potential for the liquid discharges of uncontaminated deck drainage, potentially contaminated drainage from machinery spaces, and sewage/grey water. These waste streams are all readily amenable to control as part of appropriate practice on vessels. Possible impacts associated with construction vessel discharges are therefore considered to be negligible.

### Site Runoff from Land-based Construction Activities

Discharges and runoff from the land-based sites during the construction phase, particularly during the site formation, excavation and backfilling works, will contain suspended solids which could be a source of water pollution, causing short-term degradation of habitat quality. However, considering that the scale of the construction works and with effective implementation of good site management practices as well as mitigation measures mentioned in *Section 6*, site run-off is not predicted to have an adverse impact on the natural coastline.

In summary, unacceptable impacts (elevated SS, nutrient and contaminant levels and DO depletion) on sensitive receivers from sediment release associated with dredging works are not expected to occur. Potential impacts arising from vessel operational discharges and land-based site runoff during construction stage are also considered to be negligible.

### Operation Phase

Impacts due to operational effluent discharge from the desalination plant on marine ecological resources are not expected as the discharge should satisfy the relevant requirements of *WPCO-TM effluent discharge standards* (details refer to *Sections 6 and 7*) and in compliance with the relevant assessment criteria which are of relevance for the protection of marine ecological resources (see *Section 6*). No unacceptable impacts associated with the release of residue chemical constituents are thus anticipated.

The amount of seawater taken from the nearby marine waters for the proposed Project daily operation would be small comparing with the waterbody and intake of seawater is not expected to affect the hydrology within the study area.

The major impacts during operation phase would be perturbations to key water quality parameters from the discharge of hypersaline water from reverse osmosis process. Changes in the hydrodynamic regime and water quality due to the discharge of RO concentrate from the Project are anticipated. A maximum of 464,000 m<sup>3</sup>/day of saline water from the proposed desalination plant would be discharged to the coastal water.

According to the modelling results in *Section 6*, a likely effect of the discharge of RO concentrate at outfall would be the elevation in salinity. However, there are only limited reports available indicating that brine discharges have led to reductions in the abundance and diversity of marine ecological assemblages <sup>(1)</sup>. While larger, mobile biota such as fish would be able to avoid the zone of influence, invertebrates and some fish species inhabiting bottom sediments within the predicted near field mixing zone would be impacted <sup>(2)</sup>. The brine solution discharged into the sea from the desalination plant has the potential to alter marine assemblages in the near field mixing zone as a results of the influences on the following aspects <sup>(3)</sup> <sup>(4)</sup>:

- Development of species and the propagation activity and faster individual growth;
- Survival of larval stages of animals and life expectancy (shorter or longer generation time);
- Population density of organisms (higher or lower population growth rate); and,
- Breeding of species and reproductive traits.

According to the water quality impact assessment in *Section 6*, the salinity would be approximately 2 times higher than the ambient condition. As per the modelling results in *Section 6*, the concentrated saline water would be localized closely to the submarine outfall area with a small mixing zone in approximately 0.09 ha (approximately 30 m x 30 m = 900 m<sup>2</sup> = 0.09 ha). The baseline survey results suggest that corals are recorded at all dive sites along the shoreline of Tit Cham Chau, Kwun Tsai and Tung Lung Chau, whilst no coral was recorded at the direct footprint of submarine intake and outfall

<sup>(1)</sup> Mabrook B (1994) Environmental impact of waste brine disposal of desalination plants, Red Sea, Egypt. *Desalination* (97): 453 - 465

<sup>(2)</sup> New South Wales (2006) Major project Assessment – Kurnell Desalination Plant and Associated Infrastructure. pp. 68.

<sup>(3)</sup> Neuparth F, Coasta O & Coasta MH (2002) Effects of temperature and salinity on life history of the marine Amphipod *Gammarus locusta* - Implications for ecological texting. *Ecotoxicology* (11): 61 - 73

<sup>(4)</sup> Danoun R (2007) Desalination Plants: Potential impacts of brine discharge on marine life. pp. 55.

diffusers which are soft substrata. Also, the plume of discharge is offshore and localized in nature and will subsequently be diluted and dispersed to the level as the feedwater. Thus, the impact would be localized and confined to close proximity of the submarine outfall. Besides, marine organisms recorded during field surveys are widely distributed in local waters and could be recorded in the more saline eastern waters. It is expected that these species are able to adapt to changes in salinity. Therefore, ecological impact on the identified marine habitats and their associated fauna due to the intake of seawater/discharge of saline water would be insignificant.

Apart from the salinity change, anti-scalants in the RO concentrate discharge, when discharged at high concentration, may be toxic to ecological resources. Based on the acute toxicity test of antiscalants on amphipods *Gammarus pules* and *Gammarus roseli*, the derived EC<sub>50</sub> is ranged between 4 – 8.7 mg/L <sup>(1)</sup>. Another toxicity test on sea urchin *Arbacia punctulata* gametes and embryos found that abnormal embryo development was observed at concentration > 100 mg/L (i.e. Lowest Observable Effect Concentration, LOEC) <sup>(2)</sup>. With reference to the modelling results in *Section 6*, the maximum predicted level of anti-scalants in the RO plume at Tit Cham Chau, where the coral community was recorded, is below the assessment criteria (0.362 mg/L), which is also well below than the EC<sub>50</sub> and LOEC derived in the published literatures. Therefore, no unacceptable adverse impact is anticipated on the coral communities and marine ecological resources in the vicinity of this Project.

## **9.6 Impact Evaluation**

### **9.6.1 Terrestrial Ecology (Construction Phase Only)**

#### Habitat Loss/Disturbance

From the information presented in *Section 9.5.2*, overall ecological impact associated with habitat loss/disturbance is considered to be low. An evaluation of habitat loss for each affected habitat within the areas for desalination plant and slope mitigation works is provided in **Tables 9.3 to 9.7**.

#### Mixed Woodland

Approximately 0.61 ha and 0.18 ha of mixed woodland will be lost/disturbed due to the construction works of the desalination plant and slope mitigation works, respectively. However, the overall unmitigated impact of habitat loss on mixed woodland is considered to be low due to the small size of the affected area of low to moderate ecological value and the fact that no unacceptable impacts on flora and fauna species of conservation interest is anticipated (see **Table 9.3**).

<sup>(1)</sup> Feiner M, Beggel S, Jaeger N and Geist J (2014) Increased RO concentrate toxicity following application of antiscalants - Acute toxicity tests with the amphipods *Gammarus pulex* and *Gammarus roseli*. Environmental Pollution: 1 – 4.

<sup>(2)</sup> Cekolin CS, Donachy JE and Sikes CS (1993) Toxicity studies of antiscalant agents using *Arbacia punctulata* gametes and embryos as test organisms. Bulletin of Environmental Contamination Toxicology (50): 108 - 155

**Table 9.3 Impact of Habitat Loss on Mixed Woodland during Construction Phase**

Evaluation Criteria	Mixed Woodland - Desalination Plant	Mixed Woodland - Slope mitigation works area*
Habitat Quality	The habitat quality is low to moderate.	
Species of Conservation Interest	No plant or fauna species of conservation interest (Refer to Section 4 of Annex 9A for the flora and fauna species of conservation interest recorded within the habitat of mixed woodland but outside the Project Site.)	
Size/ Abundance	Permanent loss approximately 0.61 ha.	Affected areas of approximately 0.18 ha.
Duration	The impact will persist during construction and operation phases.	
Reversibility	The loss of habitat is permanent and not reversible.	The loss of naturalness is partially reversible.
Magnitude	The scale of the habitat loss/ disturbance and impact is small in the context of the surrounding similar habitat, flora and fauna.	
Overall Impact Before Mitigation	Low	Low

\*This refers to the area to be subject to direct impact from slope mitigation works, including rock slope stabilization area, soil nailing area and flexible barriers.

#### Shrubland/grassland

Approximately 0.38 ha and 0.31 ha of shrubland-grassland will be lost/disturbed due to the construction works of desalination plant and slope mitigation works, respectively. The protected plant species *Pachystoma pubescens* and *Pectellis susannae* were recorded at the study area of slope mitigation works within the uphill area of Clear Water Bay Country Park; however the works area for slope mitigation has avoided the uphill area of the Clear Water Bay Country Park where the protected plant species are recorded, thus there is no direct conflict of these plant species (Figure 7e of Annex 9A). One flora species of conservation interest *Marsdenia lachnostoma* was recorded along the proposed alignment of the flexible barriers within the Clear Water Bay Country Park (Annex 9B). As such, the overall unmitigated impact of habitat loss/disturbance on shrubland/grassland in slope mitigation works area and desalination plant is considered to be low to moderate and low, respectively, due to the small size of the affected area of low to moderate ecological value (see Table 9.4).

**Table 9.4 Impact of Habitat Loss on Shrubland-grassland during Construction Phase**

Evaluation Criteria	Shrubland/grassland - Desalination Plant	Shrubland/grassland - Slope mitigation works area*
Habitat Quality	The habitat quality is low to moderate.	
Species of Conservation Interest	No plant and fauna species of conservation interest (Refer to Section 4 of Annex 9A)	Plant species of conservation interest include <i>Marsdenia lachnostoma</i> (Refer to Annex 9B). Fauna species of conservation interest included Collared Scops Owl (Refer to Section 4 of Annex 9A for the fauna species of conservation interest recorded within the habitat of shrubland/grassland but outside the Project Site)

Evaluation Criteria	Shrubland/grassland - Desalination Plant	Shrubland/grassland - Slope mitigation works area*
Size/ Abundance	Permanent loss approximately 0.38 ha.	Affected area of approximately 0.31 ha.
Duration	The impact will persist during construction and operation phases.	
Reversibility	The habitat loss is permanent and not reversible.	The loss of naturalness is partly reversible.
Magnitude	The scale of the habitat loss and impact is small in the context of the surrounding similar habitat, flora and fauna.	
Overall Impact Before Mitigation	Low	Low to moderate

\*This refers to the area to be subject to direct impact from slope mitigation works, including rock slope stabilization area, soil nailing area and flexible barriers

#### Urbanised/ Disturbed Area

The habitat loss of urbanised/ disturbed area of 5.24 ha is anticipated for the development of desalination plant. No plant species of conservation interest was recorded within the affected area. In view of its negligible ecological value and artificial nature that results in a high recreatability, it is considered that the habitat loss of urbanised/ disturbed area would be of negligible significance (see **Table 9.5**).

**Table 9.5 Impact of Habitat Loss on Urbanised/Disturbed Area during Construction Phase**

Evaluation Criteria	Urbanised/ Disturbed Area
Habitat Quality	The habitat quality is very low.
Species of Conservation Interest	No plant species of conservation interest was recorded within the affected area. Black kite was recorded within the affected area. (Refer to <i>Section 4 of Annex 9A</i> for the flora and fauna species of conservation interest recorded within the habitat of urbanised/ disturbed area but outside the Project Site.)
Size/ Abundance	Loss of approximately 5.24 ha for the desalination plant
Duration	The impact will persist during construction and operation phases.
Reversibility	The loss of this habitat is considered reversible since the desalination plant is also part of urbanised/ disturbed area.
Magnitude	The scale of the habitat loss and impact is moderate in the context of the surrounding similar habitat, flora and fauna.
Overall Impact Before Mitigation	Negligible

#### Wasteland

Approximately 3.78 ha of wasteland will be lost due to the construction works. The overall unmitigated impact of habitat loss on wasteland is considered to be negligible due to the size of the affected area, low ecological value and high recreatability of the habitat, and the fact that no flora species of conservation interest was recorded during the surveys (see **Table 9.6**).

**Table 9.6 Impact of Habitat Loss on Wasteland during Construction Phase**

Evaluation Criteria	Wasteland
Habitat Quality	The habitat quality is low.
Species of Conservation Interest	No plant species of conservation interest was recorded within the affected area. Fauna species of conservation interest, White-throated Kingfisher, Black-crowned Night Heron and Lesser Coucal, were recorded ( <i>Annexes 9A and 9B</i> ). (Refer to <i>Section 4 of Annex 9A</i> for the flora and fauna species of conservation interest recorded within the habitat of wasteland but outside the Project Site.)
Size/Abundance	Loss of approximately 3.78 ha for the desalination plant
Duration	The impact will persist during construction and operation phases.
Reversibility	The loss of this habitat is considered reversible since the desalination plant is also part of urbanised/disturbed area.
Magnitude	The scale of the habitat loss and impact is moderate in the context of the surrounding similar habitat, flora and fauna.
Overall Impact Before Mitigation	Negligible

#### Man-made Watercourse

Approximately 0.18 ha of 0.7 km man-made watercourse will be lost due to the construction works of desalination plant. The overall unmitigated impact of habitat loss on watercourse is considered to be low due to the small size of the affected area, low ecological value and high recreatability of the habitat, and the fact that no flora and fauna species of conservation interest was recorded during the surveys (see **Table 9.7**).

**Table 9.7 Impact of Habitat Loss on Man-made Watercourse during Construction Phase**

Evaluation Criteria	Man-made Watercourse
Habitat Quality	The habitat quality is low.
Species of Conservation Interest	No species of conservation interest was recorded within the affected area. (Refer to <i>Section 4 of Annex 9A</i> for the flora and fauna species of conservation interest recorded within the habitat of Man-made Watercourse but outside the Project Site.)
Size/Abundance	Loss of approximately 0.18 ha (0.7 km) for the desalination plant.
Duration	The impact will persist during construction and operation phases.
Reversibility	The loss of this habitat is considered reversible since the watercourse is artificial in nature.
Magnitude	The scale of the habitat loss and impact is small in the context of the surrounding similar habitat, flora and fauna.
Overall Impact Before Mitigation	Low

#### 9.6.2 Impact on Recognized Sites of Conservation Importance

The desalination plant site is outside of the boundary of the Clear Water Bay Country Park. The slope mitigation works of the Project will be undertaken in the woodland



and shrubland/grassland habitats within the Clear Water Bay Country Park. Given the relatively low to moderate ecological value of most of the affected area and the small scale of the Project within Clear Water Bay Country Park, potential impact on the Sites of Conservation Importance is considered to be low to moderate.

#### 9.6.3 Impact on Species of Conservation Interest

One flora and five bird species of conservation interest were recorded within the footprints of the desalination plant and slope mitigation works. Considering the mobility of bird species and the availability of similar habitats in the surrounding environment, the potential impact on bird species is considered to be minimal. However, the construction of flexible barriers has the potential to directly affect the flora species of conservation interest *Marsdenia lachnostoma* recorded along the indicative alignment of the flexible barriers. Avoidance and mitigation is required.

#### 9.6.4 Habitat Fragmentation and Isolation

The construction works of the desalination plant will mainly be conducted along existing roads and within reclamation area, no habitat fragmentation and isolation impact is therefore expected. For the slope mitigation works, the affected mixed woodland and shrubland/grassland habitats are located at the edge of the natural habitats within country park area with relatively low diversity and abundance of fauna species. In view of the small scale (0.49 ha) of the slope mitigation works area and the availability of surrounding similar habitats, the potential impact of habitat fragmentation and isolation on associated wildlife utilising the affected habitats is considered to be minimal.

#### 9.6.5 Noise, Human Activities and Other Disturbances

Increased human activities and disturbances due to the Project construction have the potential to affect the surrounding natural habitats and the associated wildlife. These potential impacts are expected to be low given that regular checks on construction practices and boundaries will be conducted.

#### 9.6.6 Marine Ecology

The following section discusses and evaluates the impacts to marine ecological resources as a result of the resources identified in the previous sections. Based upon the information presented above, the significance of the marine ecological impact associated with the construction and operation of the submarine outfall has been evaluated in accordance with the *EIAO-TM (Annex 8, Table 1)* as follows.

*Habitat Quality:* Direct impacts are only predicted to occur to habitat of low to moderate ecological value (i.e. subtidal soft bottom habitats) at the footprint of minor marine dredging site. The selection of trenchless method will avoid direct impacts to artificial seawall and subtidal hard bottom habitats which are of low and low to moderate ecological values, respectively. Operation phase impacts are not expected to impact habitats of high ecological value.

*Species:* Based on literature and supplementary baseline surveys, some isolated coral colonies are found on subtidal hard bottom habitats. However, due to their location is not under the footprint of marine dredging site, no significant construction or

operation phase impacts are expected to these sensitive receivers. Thus, no significant construction or operation phase impacts are expected.

*Size:* The maximum size of loss of subtidal soft bottom habitats due to the marine dredging activity is approximately 0.11 ha. The impact to such a small area of low to moderate ecological value of benthic assemblages is expected to be acceptable.

*Duration:* The marine works will approximately continue for a period of 18 months. Increases in suspended sediments are expected to be low and transient, and within acceptable environmental limits. The operation phase of the submarine outfall diffuser will be long-term but the impacts to marine ecological resources would be acceptable.

*Reversibility:* Impacts to the benthic assemblages on the subtidal soft bottom habitats which are regarded as low to moderate ecological value within the marine dredged areas are irreversible. Disturbance from marine construction activities and associated water quality changes are expected to be relatively short term and recolonisation of the disturbed areas is expected to occur.

*Magnitude:* No unacceptable impacts to marine ecological resources are predicted to occur. Operation phase impacts are not expected to cause any adverse impacts and are considered to be of low magnitude.

The impact assessment presented above indicates that no unacceptable impacts to various marine ecological resources mentioned in the above sections would be expected.

## **9.7 Mitigation Measures**

### General

In accordance with the guidelines in the *EIAO-TM* Annex 16 on ecological impact assessment, the policy adopted in this EIA for mitigating significant impacts to ecology, in order of priority, is:

- **Avoidance:** Potential impacts should be avoided to the maximum extent practicable by adopting suitable alternatives;
- **Minimisation:** Unavoidable impacts should be minimised by taking appropriate and practicable measures such as constraints on intensity of works operations or timing of works operations; and
- **Compensation:** The loss of important species and habitats may be provided for elsewhere as compensation. Enhancement and other conservation measures should always be considered whenever possible.

### Avoidance

The above impact assessment demonstrates that the Project will minimize encroachment onto any habitat of low to moderate ecological value during its construction, particularly to those key ecological sensitive receivers such as the Clear Water Bay Country Park. Direct impacts on plant and wildlife species of conservation interest will also be avoided.

For slope mitigation works within the Clear Water Bay Country Park, to avoid tree felling and damages to trees, the exact locations of the flexible barrier foundation plates, soil nails and rock dowels can be adjusted during detailed design, and a setback distance from existing trees is recommended to be maintained as far as practical. Pruning of tree canopies along the alignment of the flexible barriers shall be limited to a minimum.

In addition, the alignment of flexible barriers shall be optimized to preserve all flora species of conservation interest and minimize potential impact to existing vegetation as far as practicable. All individuals of *Marsdenia lachnostoma* within the slope mitigation areas shall be retained *in-situ*, by positioning the alignment of flexible barriers at a minimum 1.5m in a radius away from these individuals. The implementation of this mitigation measures is presented in **Figure 9.1** as an illustration. The following practices shall be implemented as far as practicable for the protection of flora species of conservation interest:

- Temporary fencing will be installed to fence off the concerned species either in groups or individually within the works area and in its close proximity to prevent from being damaged and disturbed during construction. A sign identifying the site shall be attached to the fence and flagging tape shall be attached to the individuals to visualize their locations.
- Induction training shall also be provided to all site personnel in order to brief them on this flora of conservation interest including the locations and their importance.
- The resident site supervisory staff will closely monitor the conditions of concerned individuals during construction of flexible barriers in the close proximity.

Construction impacts to marine ecological resources have largely been avoided by optimizing the length and alignment of the submarine facilities to avoid key ecologically sensitive areas, and by applying the trenchless method for installing submarine intake and outfall and through proper planning design and execution of the works (i.e. optimisation of project construction schedule/ sequence, using good engineering/ industry practice, timely completion of construction works to reduce impact duration, etc.).

Indirect impacts on marine sensitive receivers due to the dispersion of sediment plume can be avoided as the dredging works will be designed to confirm compliance with the assessment criteria at sensitive receivers and control water quality impacts to within acceptable levels, and water quality mitigation measures will be developed and implemented when required to further avoid/ reduce potential impacts (See *Section 6*).

To summarise, this initial assessment of impacts demonstrates that impacts will largely be avoided during the construction and operation of the proposed Project, particularly to the key terrestrial and marine ecological sensitive receivers through the avoidance of direct and indirect impacts to ecological sensitive habitats and wildlife/ species of conservation interest.

### Minimisation

As part of the site selection process, mixed use of flexible barrier, soil nail and rock slope stabilization have been adopted for slope mitigation works. This would minimise the overall footprint and hence habitat loss and vegetation removal associated with the landslide mitigation works. Affected habitats within the Clear Water Bay Country Park will be reinstated by hydro-seeding and planting of climbers and native shrub seedlings where practicable upon completion of the slope mitigation works. The detailed design of the soil nailing works and alignment of flexible barrier should take into consideration to provide the best opportunities for planting success such as spacing of soil nails. The selection of native shrub seedlings should match the original natural habitat for proper reinstatement.

Trenchless construction method will be considered wherever necessary for laying the proposed water mains. The present alignment of freshwater water mains overlaps with the main roads and accesses at Tseung Kwan O. The sites of the proposed desalination plant and freshwater main will be located within disturbed area as much as practicable. Only the lands in close vicinity to developed area will be taken to minimise the habitat fragmentation and isolation arising from the construction of Project.

The use of trenchless method is particularly suitable for the construction of the proposed submarine intake and outfall from the desalination plant because marine dredging would be minimal (the total dredging extent at intake and outfall is estimated to be 0.11 ha) compared with conventional submarine outfall pipeline installation methods (total dredging extent is about 1.2 ha), during which a trench in seabed is needed to be formed along the entire alignment and backfilling is required after pipe laying. The trenchless method will minimise the potential impacts on water quality and marine ecological resources.

To minimize the other disturbances of the construction works to the surrounding habitats and associated wildlife, the following appropriate construction practices should be implemented as far as practicable.

- Erect fences along the boundary of the works area before the commencement of works to prevent vehicle movements and encroachment of personnel onto adjacent areas;
- Regularly check the work site boundaries to ensure that they are not breached and that damage does not occur to surrounding areas;
- Avoid any damage and disturbance, particularly those caused by filling and illegal dumping, to the surrounding habitats through proper management of waste disposal;
- Reinstatement temporarily affected areas, particularly the habitats of mixed woodland and shrubland-grassland immediately after completion of construction works, through on-site hydro-seeding and tree/shrub seedling planting. The tree/shrub species will be chosen with reference to those in the surrounding area (See Annex 9A); and

- Closed grab dredger will be used to dredge down about -11mPD which is approximately 6m below the current seabed and there will be no excessive dredging.

#### Compensation

Since habitat loss due to other land-based construction and marine dredging works for laying the submarine intake and outfall of the Project only occurs on the habitats of low or low to moderate ecological value where no species of conservation interest will be lost, ecological compensation is not required.

### **9.8 Cumulative Ecological Impact**

Information from publicly available sources suggested that the construction/implementation programmes of the major projects identified in *Section 3.8* would coincide with the construction of this Project. These projects either do not have a marine element or are at large separation distances (> 3 km) from this Project. It is noted from the approved EIA reports of these projects that their impacts are not expected to be significant for ecological resources in this part of Hong Kong. Consequently, no unacceptable cumulative impacts is anticipated. In addition, a discussion of potential cumulative water quality impacts arising from concurrent projects is provided in *Section 6*. Since it is unlikely for water quality mixing zone of this Project to overlap with those of other concurrent projects in this part of Hong Kong, it is thus concluded that cumulative impacts on water quality impacts and consequently on fisheries are not predicted to occur.

Given that the no operational impacts on ecological resources are anticipated from the concurrent projects, operational cumulative impacts with other development in and around Tseung Kwan O Area 137 are not predicted to occur.

### **9.9 Residual Impact**

As a result of land-based construction activities, up to 0.61 ha mixed woodland, 0.38 ha of shrubland/grassland, 3.78 ha of wasteland, 0.18 ha (0.7km) ha of man-made watercourse and 5.24 ha of urbanised/disturbed area would be permanently lost due to the construction of the desalination plant. Within the slope mitigation works area, approximately 0.18 ha mixed woodland and 0.31 ha of shrubland-grassland would be affected. The affected habitats are considered to be of very low, low or low to moderate ecological values. With the implementation of the recommended mitigation measures discussed in *Section 9.7*, it is anticipated that all potential ecological impacts will be reduced to an acceptable level. Therefore, no adverse residual impact due to the construction of proposed desalination plant, freshwater rising main and slope mitigation works is expected from the aspect of terrestrial ecology.

In terms of marine-based construction works, approximately 0.11 ha of subtidal soft bottom habitats of low to moderate ecological value will be lost due to the marine dredging activity. Since the loss of subtidal soft bottom habitats is very small in size in the context of surrounding similar habitat, therefore no unacceptable residual impacts are anticipated from the aspect of marine ecology.

## **9.10 Environmental Monitoring & Audit (EM&A)**

### Terrestrial Ecology

The assessment presented above indicates that unacceptable construction and operation phase impacts are not expected to occur to terrestrial ecological resources. The implementation of the ecological mitigation measures described in *Section 9.7* will be inspected regularly as part of the EM&A procedures during the construction period.

At the detailed design stage prior to the commencement of the slope mitigation works, a vegetation survey shall be carried out at the slope mitigation areas within the Clear Water Bay Country Park to assess the condition and identify the location of each individual of *Marsdenia lachnostoma* and other flora species of conservation interest that may be directly affected by the construction works. A specification for fencing and demarcating individuals of *Marsdenia lachnostoma* (or other flora species of conservation interest, if found) adjacent to the proposed alignment of the flexible barriers will be prepared to protect the species, and a detailed specification describing the exact locations of the flexible barrier foundation plates, soil nails and rock dowels will be prepared to illustrate how the setback distance from existing trees would be implemented for tree avoidance.

No terrestrial ecology specific operational phase monitoring is considered necessary.

### Marine Ecology

#### *Construction Phase*

During the construction phase, the following EM&A measures will be undertaken to verify the predictions in the EIA and ensure the environmental acceptability of the construction works. Water quality impacts will be monitored and checked through the implementation of a Water Quality EM&A programme (refer to *Section 6* for details). The monitoring and control of water quality impacts will also serve to avoid unacceptable impacts to marine ecological resources.

#### *Operation Phase*

To ensure compliance to the effluent standard specified in *Section 6* (or other standard stipulated in the WPCO Discharge Permit), regular monitoring of effluent quality is recommended during normal operation. The monitoring and control of water quality impacts will also serve to avoid unacceptable impacts to marine ecological resources.

Details environmental monitoring procedures and audit requirements are provided in the standalone EM&A manual.

## **9.11 Conclusions**

This Section of the EIA has described the potential terrestrial and marine ecological impacts associated with the construction and operation of the Project in Tseung Kwan O Area 137. The purpose of the assessment is to evaluate the acceptability of predicted impacts to terrestrial and marine ecological resources and sensitive receivers. Findings of literature review and dedicated baseline field surveys have provided information for the evaluation of species of conservation interest and ecological importance of various habitats within the Study Area as well as in the Project Site.

A total of 11 habitat types were identified within the Study Area. They are terrestrial habitats (i.e. mixed woodland, plantation, shrubland-grassland, agricultural land, wasteland, watercourse and urbanised/disturbed area) and coastal habitats (i.e. rocky shore, sandy shore, subtidal hard and soft bottom habitats and artificial seawall habitat). All of the habitats are of very low or low ecological value, except for mixed woodland, shrubland/grassland, watercourse (natural section) and subtidal hard and soft bottoms (marine water) of low to moderate ecological value. Apart from this, the Clear Water Bay Country Park is the recognized ecologically important / sensitive sites are located within the Study Area.

Regarding to species of conservation interest, nine flora species, one mammal species, 14 bird species, 5 butterfly species, one aquatic fauna, amphioxus from subtidal soft bottom habitat and hard corals from the subtidal hard bottom habitat were recorded during the field baseline surveys. Except for the flora species *Marsdenia lachnostoma* was recorded within the slope mitigation works area, none of the other species were found residing within the Project Site. Mitigation measures are recommended to avoid and minimize potential impact on the aforementioned flora species of conservation interest in the slope mitigation works area. Although bird species of conservation interest and an unoccupied bird nest were recorded within the Project Site and slope mitigation works area, these species have high level of mobility and no sign of nursery or breeding activities of these species were found within the Project Site area, thus no direct impact on these species of conservation interest is anticipated.

During the construction phase, construction activities may cause direct ecological impacts including habitat loss and vegetation removal, whereas indirect impacts on wildlife include disturbances and changes in water quality. Potential impacts of increased human activities and other disturbances due to the Project construction would not be significant provided that regular checks on construction site practices and boundaries will be conducted. In addition, in the view of the availability of surrounding similar habitats, the potential impact on wildlife especially on the species of conservation interest as a result of habitat fragmentation and isolation is considered to be minimal.

For marine ecological impact, habitat loss of subtidal soft bottom habitat which is of low to moderate ecological value (within the Project footprint) will also arise from minor marine dredging activity for installing the submarine facilities and there will be potential burial of benthic organisms. Intertidal and subtidal habitat (including corals) will be impacted temporarily due to the deterioration of water quality arising from minor marine dredging works.

With the implementation of the proposed mitigation measures, no adverse residual impact due to the land-based and marine-based construction of proposed desalination plant, slope mitigation works, freshwater rising main and submarine intake and outfall pipelines is anticipated.