S16 Planning Application For
Proposed Comprehensive Development Scheme to include Wetland Restoration Proposal and Proposed Filling of Ponds and Excavation of Land in "OU(CDWRA)" Zone at Various Lots in D.D. 104, North of Kam Po Road East, Pok Wai, Yuen Long, New Territories

Wetland Restoration Proposal

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1 INTRODUCTION

1.1 Background

1.1.1 The Application Site (about 5.1ha) is mostly identified as abandoned fish ponds in the EcoIA under the present application, while the remaining is composed of developed area contributed to tiny proportion. The Application Site is located to the north of Kam Pok Road East and is over 100m away from the existing drainage channel (Ngau Tam Mei Channel). Some abandoned fishponds are also located adjacent to the Application Site.

1.1.2 According to the Ecological Impact Assessment (EIAO) for the present application, the overall ecological value of these abandoned fish ponds within the Application Site is ranked as low to medium, while the developed area is very low.

1.1.3 The Application Site is zoned as "Other Specified Uses" annotated "Comprehensive Development to Include Wetland Restoration Area" ("OU(CDWRA)") on the Approved Nam Sheng Wai Outline Zoning Plan (No. S/YL-NSW/8) ("OZP"). This zoning is intended to provide incentive for the restoration of degraded existing on-site wetlands within the Application Site through a comprehensive residential and/or recreational development to include wetland restoration area.

1.1.4 The Application Site is also partly within the Wetland Buffer Area (WBA) (about 3.4 ha of pond habitat within the Application Site is located within WBA). The intention of the WBA (i.e. a buffer area of about 500m along the landward boundary of the WCA) is to protect the ecological integrity of the fish ponds and wetlands within the WCA and prevent development that would have a negative off-site disturbance impact on the ecological value of fish ponds. As a substantial amount of the fish ponds within the 500m Study Area that were located within WBA have already been lost over time (used as open storage, car parking and residential purposes), the proposed wetland restoration area is formulated in accordance with the planning intention of "OU(CDWRA)" zone under the statutory OZP with an aim to upgrade and enhance the quality of wetland area inside WBA by providing additional ecologically-enhanced wetland habitats and thus be beneficial for the intention of the WBA.

1.1.5 The proposed development proposes to create an artificial wetland of 2.02 ha within the Application Site as a wetland restoration area with ecological enhancement by creating a variety of micro-habitat, such as water zones of different water depths and island design, attracting and providing optimal habitat for the wetland-associated fauna in the proximity. With active management of the proposed WRA during operational phase, the wetland habitat of WRA could complement the ecological functions of the wetlands and fish pond in the around the Deep Bay Area as the WRA could sustainably provide food supplies, thus safeguarding the waterbird populations form other

potential risks and is in line with the TPB PG-No. 12C, and also the planning intention of the OU(CDWRA) zone in terms of wetland ecological function.

1.2 Purposes of this Document

1.2.1 The purpose of this document is to provide information on the design, operation procedures, and maintenance works for the proposed artificial wetlands as required under the notes of the OZP for "OU(CDWRA)" zone.

1.2.2 As the main objectives of establishing the WCA and WBA aim to protect the habitats for migratory birds in Northwest New Territories (NWNT). The present wetland restoration proposal also aims to benefit to the WCA, WBA, or migratory birds. The wetland will not only provide additional habitats for wildlife, but will also enhance the quality of the WBA/WCA as migratory bird habitats.

1.2.3 The wetland restoration will create additional ecologically-enhanced wetland habitats within the WRA. By increasing the availability and diversity of habitats, it will provide more resources and shelter for migratory birds and other wildlife. This expansion of suitable habitats within the WRA will directly benefit the WBA by extending its reach and capacity to support a greater number of species. The wetland restoration can enhance ecological connectivity within the WCA. By establishing a contiguous wetland habitat in the WRA, it will offer a connected habitats for migratory birds and other wildlife. This connectivity will contribute greater and wider movement of species, facilitates migration patterns, and supports the overall ecological functioning of the WCA.

1.2.4 The wetland restoration efforts will focus on enhancing the quality of the habitats within the WRA. This includes restoring and improving vegetation, water quality, and ecological processes. By implementing sustainable management practices and promoting ecological health, the improved habitat quality will attract more migratory birds and contribute to the overall enhancement of the WCA's ecological value.

1.2.5 Given the close proximity of the restoration wetland and the future residential developments, the design of the wetland should allow the colonization of wildlife, but not produce excessive nuisance to the nearby residential developments. On the other hand, disturbance from the future residence to the wildlife inside the proposed wetland should also be minimized so as a mean to maintain the functions of the wetland.

1.2.6 As the fish ponds are relatively deep in nature (i.e. 2m), which are not favored for the non-dabbling waterbirds, the design of the Wetland Restoration Area will provide shallow water areas for the waterbirds to roost and feeding, in order to provide more micro-habitable conditions for the waterbirds.

2. EXISTING SITE CONDITIONS

2.1 Ecological baseline

Ecological resources in the vicinity

2.1.1 Recognized sites of conservation importance in NWNT included the Mai Po Inner Deep Bay Ramsar Site (Mai Po Nature Reserve, Mai Po Marshes SSSI, Mai Po Village Egretry and Mai Po Village SSSI located within the Ramsar Site), Wetland Conservation Area (WCA) and Wetland Buffer Area (WBA).

2.1.2 The Application Site falls within the WBA. The planning intention of WBA is to protect the ecological integrity of the fishponds and wetlands within the WCA and to prevent development that would have a negative off-site impact on the ecological value of those fishponds. The Application Site is about 176m from the boundary of WCA.

2.1.3 The Mai Po Village SSSI is a piece of fung shui woodland of size about 53ha behind the Mai Po Village, and is about 2.84km from the boundary of the Application Site. This woodland was once provided nesting habitats for a number of ardeid species. The ardeids are now nesting in trees near the former woodland nesting areas.

Conditions of the Application Site

2.1.4 The habitats of the Application Site composed of abandoned fish ponds and developed area. The developed area of the Application Site is mostly concrete-paved with little vegetation areas.

2.1.5 The abandoned ponds were still left with water at a water level similar to that of active ponds. The bunds of these abandoned ponds were grown with fruit tree species typically associated with villages in Hong Kong, such as *Dimocarpus longan* and *Litchi chinensis*. The fishponds in the Application Site were not drained throughout the study period, no sign of traditional fishpond management were observed during the survey period including the period of verification survey. In addition, these ponds were subjected to the disturbance from the activities in the developed area portion of the Application Site, and utilization of these ponds by high abundance and diversity of wildlife is not expected. The ecological value of the abandoned fishponds as habitats of waterbirds is not high.

2.1.6 Fifteen bird species of conservation importance were recorded within the Application Site. These included Little Grebe, Yellow Bittern, Chinese Pond Heron, Grey Heron, Great Egret, Little Egret, Great Cormorant, Black Kite, Eastern Buzzard, Greater Coucal, White-throated Kingfisher, Collared Crow, White-cheeked Starling, Mallard and Purple Heron. All these species were present in low abundance / recorded in low frequency. No breeding and Nesting behaved was observed in Application Site.

2.2 Impact assessment

2.2.1 The potential terrestrial and aquatic ecological impacts arising from the construction works, including loss of habitats, removal of vegetation, and

disturbance to animals, were assessed with reference to the criteria stated in Annexes 8 and 16 of the EIAO-TM.

2.2.2 Loss of habitats and associated vegetation due to site formation within the Application Site will constitute the direct ecological impacts of the Project. The Application Site is partly composed of developed area with little vegetation cover used for temporary storage (with very low ecological value) and partly composed of seven abandoned fish ponds (with low to medium ecological value).

2.2.3 As the developed area of the Application Site is mostly concrete-paved with little vegetation areas, there would be little need for additional site clearance. The impact of the loss of this 0.2 ha of developed area and their associated flora and fauna are considered insignificant due to the small area affected, high level of disturbance, and very low diversity of wildlife. No mitigation for the habitat loss is required.

2.2.4 A total of about 4.9 ha abandoned fishponds was existing within the Application Site. There will be permanent loss of about 2.88 ha abandoned fishponds within the Application Site, to be converted into residential area. A portion of abandoned fishponds (about 2.02 ha in size) will be included in the wetland restoration area as temporary habitats loss. As this area covers portions from seven different ponds, re-profiling would be required to be constructed before this area could form part of the wetland restoration area of the Project. The conversion might involve the removal of ruderal vegetation on existing pond bunds, drain-down of two existing ponds and reprofiling of the pond bunds. This will only result in temporary loss of the seven abandoned fishponds, but not permanent loss of habitats. There will be net-gain of shallow wetland area available for waterbirds in this Project and the Project will have positive influences after implementation.

2.3 Mitigation targets

2.3.1 The mitigation objective for the proposed Wetland Restoration Area is to follow the "no-net-loss in wetland" principle and wetland enhancement and management scheme of the TPB Guidelines (TPB PG-No. 12C).

2.3.2 The proposed Wetland Restoration Area in the Project will be composed of areas created by conversion of 2.02 ha abandoned fishponds. Currently the ponds in the Application Site are abandoned/not actively managed for commercial fish farming and thus the ponds are left without drain down practices just as the traditional management of the other active fishponds. There is only limited area, a narrow stripe along the pond bunds currently, could be utilized actively by waterbirds habituated in the wetland habitat in the proximity of the Study Area.

2.3.3 Shallow water region is considered more attractive to the majority of the waterbirds recorded in the Application Site, including but not limited to Grey Heron, Chinese Pond Heron and Little Egret, of which their foraging behavior are found more frequent within the shallow water region than deep water region.

Details will be discussed in section 3.4. Appendix 1 shows some of the waterbird species and plant species that could be attracted or planted in the WRA. The proposed restoration of wetland habitats will create more shallow water areas than the present conditions. Thus, the provision of more shallow water regions could compensate the loss of abandoned fishponds, resulting "no-net-loss in wetland" in terms of enhanced ecological functions and provide more microhabitats that are favorable for waterbirds.

2.3.4 Given the lack of traditional pond drain down practice and the overgrown of vegetation inside or along the bunds of the abandoned pond within the Application Site, only 15 species of bird, 1 dragonfly, 1 reptile and 1 mammal of conservation importance were recorded during the baseline survey. The provision of wetland habitats aims to provide ecological functions as well as suitable habitats for the recorded species of conservation importance.

2.3.5 It is stated that within the Application Site, there is a loss of wetland area of 2.88 ha, which represents approximately 56% of the total area of the Application Site. The mitigation target aims to address the potential impacts on waterbird species due to habitat loss resulting from the proposed construction. The target is set to **twice** the abundance of the targeted waterbird groups/families as recorded during the pre-construction surveys during the same period/season after the establishment of the WRA (scope of surveys will be discussed in section 3.5).

2.3.6 To compensate the loss of the wetland area within the Application Site, one of the mitigation targets is to achieve a **two-fold increase** in the total abundance of waterbirds of target families/groups of waterbird (as shown in Table 2.1) within the proposed Wetland Restoration Area in the same period/season when the pre-construction surveys conducted (details of surveys will be discussed in section 3.5). This increase will in turn constitute to **about two-fold increase** in the density of target waterbird families/groups in wetland habitat within the Application Site, due to the substantial increase in the ecological function to be provided by the proposed WRA.

Table 2.1 List of mitigation targets of the waterbirds families/groups

No.	Waterbirds families/groups
1	Podicipedidae (鸊鷉科)
2	Phalacrocoracidae (鸕鷀科)
3	Ardeidae (鷺科)
4	Anatidae (鴨科)
5	Cuculidae (杜鵑科)
6	Alcedinidae (翠鳥科)

2.3.7 Table 2.2 shows that the preferred habitats for the species and the families of waterbird recorded within the existing on-site abandoned pond. The proposed

managed ponds with varied depths of water zone and reedbed can provide suitable habitats for these species. The mitigation target of the proposed WRA is also to maintain the specific habitat condition of the preferred habitats for the wetland-associated species.

Table 2.2 The preferred habitats with condition target for the fauna taxa groups recorded within the abandoned pond of the Application Site

Taxa groups	Preferred habitats/WRA elements with condition target				Ecological considerations of the designs
	Managed pond with varied water depth	Wood log	Island	Submerge plant	
Bird	✓	✓	✓		● Shallow water zone provides feeding opportunities for non-swimming waterbirds (e.g. Cuculidae (杜鵑科) and Alcedinidae (翠鳥科)) ● Deep and middle water zones provide swimming area for dabbling waterbirds (e.g. Podicipedidae (鸊鷉科), Phalacrocoracidae (鸕鷀科) and Anatidae (鴨科)) ● Wood log and strips of island provide standing places and feeding opportunities for birds and waterbirds, including but not limited to Ardeidae (鷺科)
Dragonfly	✓	✓	✓	✓	● Ponds provide breeding and feeding habitats for dragonfly ● Wood log and island for roosting places for the dragonfly species ● Submerge plant will offer habitats for their nymphs
Reptile	✓				● Ponds provide feeding opportunities for reptile
Mammal	✓				● Habitat with water body provide feeding opportunities for bats

2.3.8 Besides, the creation of wetland habitats would also enable to provide habitats for wetland-associated dragonfly, reptile and mammal. With planting of submerge plant, reed and the soft substrate water bodies, there will be perching spots for dragonfly adults and habitats for their nymphs. Wetlands with submerge plants would also attract insects and provide feeding opportunities for amphibian, reptile and mammal.

2.3.9 In order to maintain the ecological functions of the proposed compensatory wetlands in the long run, a detailed management plan for the compensation ponds will be submitted to the authorities during the detailed design stage. A tentative outline of the content of the plan is presented in Table 2.3.

Table 2.3 Outline of key items in the WRA habitat creation and management plan

Key Sections in the plan	Outline content to be further developed
Objectives	● Presents the key objectives of the plan ● Describes site conditions such as location, boundary, topography, hydrology etc. ● Summarises / updates habitat evaluation, species of conservation importance, impact evaluation
Mitigation Objectives	● Proposes management goals and objectives of the WRA, for both construction and operational phases ● Recommends suitable targets (e.g. habitat condition targets) for the WRA
Detailed Design and Construction Methods	● Design for water sources (mainly from rain water and surface runoff) ● Design for hydrology and water level based on latest site conditions ● Recommend vegetation species
Management Strategy	● Interface with the other areas of the development ● Detailed management strategy of the water levels, water quality, habitat condition and quality, trash fish size and species for fish stocking
Monitoring	● Monitoring of water level and water quality ● Monitoring of the habitat condition and quality ● Monitoring of wildlife use including bird, dragonfly, reptile and mammal

2.3.10 With the provision of the wetland habitat of a total 2.02 ha with long-term management and monitoring, and the ecological functions as habitats for waterbirds and other fauna, the ecological function lost due to the permanent habitat lost impact could be compensated and is expected to be enhanced significantly. The spirit of 'no-net-loss in wetland' principle for this 'Wetland Restoration Area' in terms of long-term ecological function offering a high quality alternative wetland habitat to replace the present abandoned and unattended ponds for providing foraging habitat in a sustainable manner under TPB PG No. 12C can also be realized in practice.

3. CONSIDERATION OF THE WETLAND RESTORATION AREA

3.1 Rationale of the wetland restoration area

3.1.1 Each wetland habitat composes a number of physical, chemical or biological components such as soil, water, plant and animal species, and nutrients. Wetlands perform certain functions such as flood control and storm water protection, generation of products such as fishery and forest resources, and provision of support for wildlife species and habitats (Davis, 1994).

3.1.2 Conventional artificial wetland systems which are being increasingly used for wastewater treatment to remove nutrients, various chemical contaminants, and microorganisms because biological treatment is one of the most effective means for removing nitrogen (Gerba *et al*. 1999; Hamersley and Howes, 2002).

3.1.3 There are examples of artificial wetland systems to serve different functions such as aquaculture facilities (Hosokawa, 1997), recreational purposes such as swimming (Lee *et al*., 1998), as well as conservation purposes for waterbirds (Evans *et al*., 1998).

3.1.4 As there are some recognized sites of conservation importance identified within and in the vicinity of the Application Site, which provide important habitats for waterbirds and other wildlife. Hence, the wetland restoration proposal targets to provide feeding and roosting habitats for waterbirds as well as other wetland dependent wildlife.

3.2 Types of artificial wetland system for attracting waterbirds

3.2.1 Some of the Habitat Creation and Management Plans (HCMP) of wetlands such as Lok Ma Chau Spurline Wetland and Mai Po Nature Reserve were reviewed.

Lok Ma Chau Spur Line Wetland

3.2.2 As compensation for habitat loss of the Lok Ma Chau Spurline Project, an area of fishponds in Lok Ma Chau was transformed in mitigation wetlands for this purpose and a HCMP was prepared for the mitigation wetland.

3.2.3 In order to provide in-advance compensation before the construction, the mitigation wetlands were implemented in two phases, Initial Enhancement Area (IEA) which was implemented before the construction, and Ecological Enhancement Area (ECA) which replaced the IEA.

3.2.4 The above IEA cover 15.5ha and including 8 ponds. The primary objective of the management of the IEA was to increase the abundance of six target waterbird species (Great Cormorant, Great Egret, Little Egret, Grey Heron, Chinese Pond Heron and Black-faced Spoonbill) to levels double those in active fishponds of the control areas – i.e. Mai Po San Tsuen and San Tin. The target levels were considered achieved if their abundance in the IEA exceeded 160%

of the mean of the control areas. The management measures implemented in the IEA include, but were not limited to the following:

- Re-profile of pond levels to create shallow feeding habitats;
- Fish stocking; and
- Management of water levels.

3.2.5 While the Ecological Compensation Areas (ECA) cover 33.1ha and including ponds and marsh. The primary objective of the management of ECA was to increase the abundance of six target waterbird species as IEA to levels double those in the control areas as IEA. The target levels were considered achieved if the abundance of the target species in the ECA exceeded 160% of the mean of the control areas. The management measures implemented in the IEA include, but were not limited to the following:

- Enlarging small fish ponds to reduce enclosure effects;
- Re-profiling of fish pond bunds to provide shallow sloping margins to increase feeding;
- Establishing marginal emergent vegetation; and
- Manipulating fish stocking, feeding/fertilizing regimes and drain-down to optimize food availability for birds.

3.2.6 The target species and target levels were clearly stated in the HCMP, and the number of target species increased to 30 upon the operation of the ECA. This consisted of 20 birds (including the original 6 target species), one mammal and three herpetofauna species (e.g. Burmese Python). The monitoring showed that the abundance of most target species met the target levels.

Mai Po Nature Reserve

3.2.7 The Mai Po Nature Reserve (MPNR) is located in the northwestern New Territories of the HKSAR on the eastern shore of Deep Bay. It significantly supports wetland biodiversity, especially migratory waterbirds. Since 1983, it was set up and managed by the World Wide Fund for Nature Hong Kong (WWF-HK) on behalf of the Agriculture, Fisheries and Conservation Department (AFCD) of the HKSAR Government, and designated as Mai Po and Inner Deep Bay Ramsar Site in 1995.

3.2.8 The Reserve has an area of 377 ha, which composed of different habitat types, including brackish open water, rain-fed open water, reedbed, mangrove and bunds. Mangrove and brackish shrimp ponds (gei wai) in MPNR are habitats of high regional importance.

3.2.9 The MPNR is a significant site for a variety of bird species. It provides habitat to 28% of the waterbirds in the Ramsar Site, and roosting area for the majority of 20000-30000 shore birds that pass through Deep Bay annually. It is also important for the Black-faced Spoonbill (*Platalea minor*) which is globally endangered, as the Reserve supports the largest roost in Hong Kong. The globally near-threatened Collared Crow (*Corvus torquatus*) also roosts in the MPNR and its adjacent area of inter-tidal mangrove. There were 34 bird species

considered as internationally important, of which four are critically endangered, including the Christmas Island Frigatebird (*Fregata andrewsi*), Siberian Crane (*Grus leucogeranus*), Spoon-billed Sandpiper (*Eurynorhynchus pygmaeus*) and Baer's Pochard (*Aythya baeri*).

3.2.10 Management work implemented in MPNR varies with the habitats and mainly include:

- Cut vegetation;
- Maintain open water by controlling the spread of emergent vegetation and desilting channels;
- Provide foraging opportunities to waterbirds by drawing down water levels in certain area ;
- Manage water levels by sluice gate operation;
- Maintain water and sediment quality by water exchange and sun-bake;
- Remove predatory fish species;
- Manage invasive climbers in mangrove tree stands;
- Cut reedbed;
- Create/repair islands; and
- Increase the area of brackish waterbird roosts by constructing earth bund sections

3.2.11 MPNR is operated as a nature reserve rather than mitigation wetland like Spurline wetland. The management work emphasizes more on creating suitable habitats or enhancing the existing habitats for wildlife. While the waterfowl abundance and diversity are constantly monitored and reviewed, numerical target levels are not adopted.

3.2.12 The management strategy of present Wetland Restoration Proposal can make reference to the management measures adopted in the above two successful artificial wetlands. The management measures implemented in the wetland of the Lok Ma Chau Spurline Wetland include the re-profile of pond levels to create shallow feeding habitats, fish stocking and management of water levels. These management measures are also adopted in the current WRP, which could maintain the wetland habitats favorable for the wetland associated species. The provision of habitats and the management measures proposed to be adopted in the current project will greatly enhance the functioning ecological value in the proposed Wetland Restoration Area when compared to the current abandoned/unattended ponds within the Application Site.

3.3 Constraint and limitation

3.3.1 The sole source of water for the wetland is rainwater. During the construction period the only rainwater available will be falling directly on the wetland. This is adequate to replenish the wetland during wetter years but may not be sufficient to permit the wetland to be refilled in years when rainfall is significantly below average. In order to resolve this potential problem it is proposed that the rainwater runoff generated from the developed parts of the Application Site will be intercepted and go through silt and grease traps before

diverted to the wetland. The propose reedbed also provides ecological function of treating the wastewater runoff, to secure the water quality reaching the wetland.

3.3.2 The water quality and soil of the fish ponds within the Application Site are acidic in nature. The phenomenon is well known to fish farmers (who take routine measures to reduce acidity as a part of their standard fish farming activities). The primary source of acidity is the acid soils of the system, and the acidity may also be exacerbated by acid rainfall.

3.3.3 The following methods may be adopted to reduce the acidity in the wetland:

- Liming: liming is a traditional method of reducing pond acidity when the ponds are drained, dried and recontoured. Lime is spread over the pond base prior to refilling of water. However, application of too much will result in causing the death of aquatic life.

- Addition of organic matter: a variety of organic matter may be used to reduce acidity. Suitable materials for use in the wetland (avoiding the risk of transfer of pathogens to the site) are addition of peanut residue and use of grass cuttings.

- Transfer of water: transfer of water does not reduce acidity per se. However, mixing of water from a wetland where water quality is less acidic with one where it is more acidic will reduce acidity in the latter. Mixing of water may be considered as a management option where there is an urgent need to reduce acidity quickly or where less acid water might otherwise be lost to the system through drain-down.

3.4 Opportunities in wetland creation

3.4.1 The variety of microhabitat within the existing ponds of the Application Site is very homogenous (i.e. pond bunds and deep water region). In fact, the more the microhabitats could be created, the higher biodiversity of organisms can be attracted. According to the result of the EcoIA for present application, most of the waterbirds (e.g. ardeids, sandpipers) recorded within the Study Area are not dabbling species, existing deep water region are not suitable for them. The waterbird species recorded within the Application Site mainly fed at the edge of the waterbody where is shallow for those non-dabbling species. Hence, present Wetland Restoration Proposal could provide more area as well as more microhabitats that would be utilized by the waterbirds for roosting and feeding.

3.4.2 No reedbed has been identified within the 500m Study Area according to the EcoIA. Hence, in order to enhance the diversity of the types of habitat and ecological functions, a reedbed will be proposed in the Wetland Restoration Proposal. Reedbed provides habitats for wildlife, especially for birds, and it can filter the surface runoff of the Application Site, to protect the water quality in the proposed wetland. Besides, the drainage will eventually discharge to the drainage channel to the western side of the Application Site, where a number of bird species of conservation importance were recorded according to the EcoIA, the reedbed can further secure the water discharge to the drainage channel is

filtrated naturally and will not affect the wildlife depends on the drainage channel.

3.4.3 With the implementation of the proposed WRA with ecological enhancement, active management and monitoring, the overall ecological value of the original wetland habitat (i.e. abandoned pond) within the Application Site will be increased from low to medium to **medium to high** maximally. The integrity and connectivity of wetland habitats in the vicinity will in turn be enhanced. As the Application Site is located at the fringe of the Wetland Buffer Area and is considered as remotely connected to Deep Bay Area, the creation of the WRA can act as an enhancement to the overall ecological value of the region, given that the Application Site is already subjected to fragmentation to other wetland habitat with higher ecological value and connectivity, such as the channel habitat to the west of the Application Site and the active fishpond in the southwest of the Study Area. Table 3.1 summarizes the wetland habitats and the corresponding ecological value before and after the wetland restoration.

Table 3.1 The summary of the ecological values of the wetland habitats before and after construction

Habitat/zone	Area (ha)	Ecological value	Impact
Before construction			
Abandoned pond	4.9	Low to medium	Will be lost
After construction			
Water zones with different depths	1.24	Medium to high	Positive ecological impact with enhanced ecological connectivity and integrity in the vicinity
Reedbed zone	0.59	At least medium	Positive ecological enhancement by habitat provision
Island, Submergent plant and wood log	0.19	At least medium	Positive ecological enhancement by habitat provision

3.5 Pre-construction surveys

3.5.1 Pre-construction surveys will be conducted before any construction works within the Application Site to gather Control Dataset that can be used for comparison in later stages of ecological monitoring during operational phase. Surveys will be undertaken monthly. During each survey visit, the surveyor will walk slowly around the perimeter of the wetland and along bunds, and will identify and enumerate all birds recorded. Surveys will commence within one hour of sunrise. Control Dataset refers to the collected baseline information from the pre-construction surveys, which will serve as a reference or control group for future monitoring and assessment. The detail programme and methodology of the pre-construction surveys will be discussed in later stage.

4. GENERAL LAYOUT AND DESIGN OF WETLAND SYSTEM

4.1 Location and general layout

4.1.1 The proposed artificial wetland, is planned to be located in the middle part of the Application Site with its northern sides immediately next to other abandoned fish ponds adjacent to the Application Site (**Figure 4.1**). There is no blockage by the proposed development between the northern part of the WRA and the wetland habitat to the north of the Application Site. Ecological connectivity between the proposed WRA and the wetland habitat in WBA is expected to be enhanced by the WRA. In return the ecological value of the wetland habitat in the WBA will be enhanced by the establishment of WRA. The artificial wetland is about 2.02ha (~39.6% of the Application Site) comprising different elements to provide variety of microhabitats i.e. water zones with different water depth, wood log, island, submerge plant and reedbed. **Figure 4.1** shows the configuration of the proposed artificial wetland.

4.1.2 The surface runoff / storm water will be collected via the drainage system within the Application Site. After passing silt traps, the runoff will go into the proposed reedbed for filtering. The water will then feed the main water body of the artificial wetland. The surplus of the runoff / storm water, if any, will then discharge to the nearby drainage channel.

4.2 Wetland elements

Reedbeds

4.2.1 According to the EcoIA for the present planning application, there is no reedbed identified within the 500m Study Area. Reedbed is an important habitat in the Deep Bay area and is known to have high ecological value for a number of wetland-dependent species, including several species that are of global/regional conservation concern. Reedbed provides habitats for wildlife (e.g. birds) and creation of reedbed can provide a good habitat for cryptic species such as bitterns as a foraging and roosting grounds. The reedbed will also provide a variety of micro-habitat surrounding the water zones, which could provide increased cover and feeding habitats for mammals, insects, other invertebrates, amphibians, reptile and birds, such as bitterns, smaller herons, rails, crakes and dragonflies. The establishment of such reed species will help to enhance the overall biodiversity value of the ponds, making them more attractive habitats for a broader range of species.

4.2.2 More importantly, reedbed could provide clean up function by filtering the surface runoff, to enhance the water quality in the nearby drainage channel which are feeding ground for waterbirds. Hence, reedbed is proposed in the Wetland Restoration Proposal (~0.59ha), which will be vegetated with common reed *Phragmites australis*.

4.2.3 *Phragmites australis* is one of the most productive, perennial, widespread and variable wetland species in the world. This species can tolerate widely variable water depths and quality. They are able to grow in waterlogged soils and to

tolerate seasonal water table fluctuations of one meter. This species is native to Hong Kong, and would not trigger issue about invading to other habitats in the vicinity.

Shallow water zones

4.2.4 It is widely known that water depth is an important factor affecting the utilization of wetland habitats by waterbirds (Velasquez 1992; Campos and Lekuona 1996; Ntiamoa-Baidu *et al*. 1998). Each waterbird species has a range of preferred foraging/roosting water depths. For example, Kwok (1993) reported the optimum ranges of water levels of Great Egret, Little Egret and Grey Heron in gei wais of Mai Po Nature Reserve were 41-60mm, 21-40mm and 21-40mm, respectively. Deep water pond is of limited value for foraging waterbirds except species with very long legs/necks or diving species. Shallow water zone with about 0.2 to 0.6m depth can provide feeding area and roosting area for non-swimming water birds such as sandpipers and egrets. A total of 0.80 ha of shallow water zone (0.5m) will be provided, which is much bigger than that in the existing shallow water area (0.22ha) within the site currently.

Deep water and medium depth zones

4.2.5 Deep water zone with about 2m depth can provide swimming area for dabbling waterbirds (e.g. Little Grebe, Cormorant as recorded in the EcoIA), together with the provision of submerge plant, aquatic life such as fish and snail can be introduced that form the food source of the waterbirds. The deep-water depth can prevent submerge plant encroachment, and it can also serve as a water reserve and prevent the wetland from drying out completely in the dry season. A total of 0.13 ha deep water zone (1m) and 0.31 ha medium depth zone (2m) will be provided.

Islands

4.2.6 Island with short grass or without vegetation can provide roosting area for water bird during high tide in Deep Bay area. The margins can provide additional foraging habitats for non-swimming water birds such as sandpipers and egrets. Belt-shape island design could increases the area of edge and margins for the usage of waterbird. Three small islands of sizes about 0.15 ha in total.

Wood logs

4.2.7 Wood log can provide perching area for water birds such as ducks. The wood log will be distributed at various locations in the wetland, mainly the areas with deeper and medium depth. Wood logs placing in the middle of the water zones also provide roosting places for the dragonfly species. A total of 0.02 ha of wood logs will be provided.

Submerged plants

4.2.8 Submerged plant can be the primary producer of the habitat and provide microhabitat for amphibians and other aquatic life. In wet season, it can also

serve as a suitable breeding habitat for them. Aquatic life such as fish and snail can be introduced to become food source for water birds. By planting submerged plants and creating soft substrate water bodies, the wetland will offer perching spots for adult dragonflies and habitats for their nymphs. Wetlands with submerged plants can also attract insects and provide feeding opportunities for amphibians, reptiles and mammals.

4.2.9 Besides, submerged plant can provide additional dissolved oxygen for the wetland. *Vallisneria natans*, *Rotala indica*, *Rotala rotundifolia* will be considered. A total of 0.02 ha of submerged plants will be provided.

4.2.10 The areas of the tentative wetland elements design within the WRA are summarized in **Table 4.1**.

Table 4.1 Area of the tentative wetland elements design within the WRA

Wetland Elements	**Area (ha)**
Shallow Water Zone	0.80
Middle Depth Zone	0.31
Deep Water Zone	0.13
Reedbed	0.59
Submerge Plant	0.02
Island	0.15
Wood Log	0.02
Total	**2.02**

4.3 Creation of main waterbody

4.3.1 As the existing Application Site already consisted of abandoned fishponds, earthmoving works have been restricted to the reprofiling and modification of existing ponds rather than construction of new ponds. Most modifications would involve the combing ponds to reduce enclosure effects and to provide islands with gentle gradients, and to create shallow water zones.

4.3.2 Where ponds are joined, the bund material is lowered and side cast to create shallow sloping margins to islands and shallow water zone. The islands and the shallow water zones provide suitable feeding areas for small and non-dabbling waterbirds.

4.3.3 While the planting buffer and the submerged plant will be established by a landscape contractor. The recommended plant species for the planting buffer and the submerged plants mentioned above should be sourced with higher priority. Wood logs from not easily decomposed tree species should be considered.

4.4 Creation of reedbed

Reedbed establishment techniques

4.4.1 Previous reed planting examples worldwide were reviewed and there are different techniques for reedbed establishment, including direct seeding, transplanting seedlings, planting cuttings, planting rhizomes, rhizome mat transplants, and planting purchased seedlings. However, considering the scale of the planting, time and intensity of labour required, some of these techniques are not preferred, and two options are proposed.

4.4.2 Reeds in the form of rhizome mats will be separately planted at appropriate spacing over the wetland restoration area. Planting a small patch of reeds in an area with water will create a source of reed that can spread out through vegetative propagation into appropriately managed areas. Extent of propagation of reeds within the reedbed system will be regularly monitored after planting. If necessary, additional planting will be added.

4.4.3 Reed seedlings can be sourced from local/commercial suppliers. Individual pot-grown reeds sourced from a commercial supplier will be planted manually. To prevent introduction of invasive pest or plant species, qualified ecologist / botanist should be present to check if there are any invasive species mixed with the reed source.

4.4.4 Similar to turf transplant, the planted reed seedlings will be established in water with a target water depth of 0.5m. A planting density of 18,000 to 28,000 seedlings per hectare (0.60 – 0.75m spacing) will be used to ensure faster plant cover. The total number of seedlings needed will be between 10,620 and 16,520 individual plants, assuming planting for 0.59ha of area is required. A contingency stock of up to 30% should be included in the procurement.

4.4.5 While the earth works of the WRA and water filling will be completed within April to Oct, the planting of seedlings should be conducted in early spring (March – April) to avoid frost while not missing the growing season and thus will be conducted in the following spring time. Water levels in the WRA will be lower at the time of planting (after thse winter). When planting is completed, water level will increase as the rainfall in wet season, and will be adjusted to about 0.5m by pumping out excessive water by submersible pumps to suppress competition of other weeds. Care should be taken not to compact the soil of the wetland restoration area during planting.

Timeline of the construction of the WRA

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Installation of sheet pipe to separate ponds lying on boundary													
Drain down of Ponds													
Construction of bunds/walls for ponds lying on boundary													
Re-profiling earth works													
Planting													
Re-filling WRA													
Commencement of Establishment													

4.5 Soil

4.5.1 The soil type for the substrate of the main waterbody and reedbed will be a soil mix consists of pond bund material, completely decomposed granite and river sand at a ratio 11:6:3 by volume. It is expected that the soil type is impermeable. Preferably 1,000mm thick soil mix is required for the substrate of the main waterbody and reedbed.

4.6 Fish stocking

4.6.1 Fish stocking is the process of releasing fish fry into the waterbody, to create a fish population to provide food sources for waterbirds and biological control of excessive aquatic weeds. A health and diverse fish population is an important part of creating an environmentally balanced wetland.

4.6.2 Species of fish would prefer those require low management efforts and the release density would be much lower than the normal fish pond operation in Hong Kong. For example, planktivorous fishes bighead carp, silver carp, and herbivorous fishes grass carp could feed on planktons and vegetation self colonized in the wetlands.

4.6.3 The purpose of fish stocking is to attract the waterbirds to feed and roost by providing the food source for them. Besides, fish stocking also provide side benefits such as controlling undesirable weeds, mosquitos and other aquatic pests.

4.6.4 Habitats within the proposed WRA will be monitored and managed, including areas of Deep Water Zone (2m) and Middle Water Zone (1m) will be maintained throughout the operational phase for ardeids to wade for an extended period except the period of partial drain down. The usefulness of fish stocks for birds is maximized in the way that most fishes are of suitable size to be eaten by the different types of waterbird species. By reviewing the Lok Ma Chau Loop – Ecological Mitigation/Habitat Creation and Management Plan, the existing fisponds at the Offsite Wetland Compensation Areas are enhanced to provide foraging ground and food source for target species and the enhancement is

deemed feasible. The measures and activities as stated in the Plan have been considered in the current proposed WRA.

5. ADVERSE IMPACT AND MITIGATION MEASURES

Noise

5.1.1 The reconstruction works of wetland are likely to produce noise and cause disturbance. High level noise disturbance can potentially lead to behavioral disturbance, auditory masking, and physiological stress to wildlife. In the most serious cases, it may also lead to abandonment of preferred habitats by the wildlife if the noise disturbance is constantly present for a prolonged duration. In order to mitigate the construction noise, temporary noise barriers are proposed as noise mitigation measures. The WRA should also be constructed during wet season prior to main construction (third phase of the construction) of the residential development, hence providing habitats for the migratory birds in wintering season.

5.1.2 The construction period will be divided into four phases (Figure 5.1 refers), the first phase (in green box) will be the WRA; the second phase (in red box) in southwestern part of the Application Site; the third phase (in blue box) on building construction in northwestern part; and the final phase (in purple box) on building construction at rest parts of Application Site.

5.1.3 The wetland establishment period prior to construction, is being planned for a period of 6 months. During the establishment period, the second phase (25 nos. of Housing Unit C) in the southwestern part of the Application Site, which are located further away from the WRA, will be constructed to minimize the disruption to the proposed WRA. To further lower the impact of wetland during establishment period, the buildings to be located far away from the WRA will be constructed as third phase. After the completion of the establishment period, the last phase will then be commenced accordingly.

Water Quality

5.1.4 Regarding the aquatic habitats in Deep Bay, discharge, if any, from the Project Site may cause impacts if containing pollutants. The existing ponds within Subject Site used to be commercial fishponds. At that time when drain-down of these existing ponds within the Subject Site were needed due to operational needs, water would discharge into adjacent existing drainage ditches then to the existing Ngau Tam Mei Drainage Channel without any treatment. During construction of the proposed development, construction activities will be conducted in phases. The WRA will be created first, before the construction of the residential buildings. The construction activities at the existing abandoned ponds will be scheduled to immediately after the dry season as far as possible when the water level is lowest in the year. Prior to the construction commences, water from the ponds within the WRA extent will be drained to other ponds as temporary storage. If there is still water in the WRA, the remaining water will, with the consent of the owners of those ponds sought by the Applicant, be transferred to other ponds outside the Application Site as temporary storage.

The chance to drain pond water to the adjacent existing ditches would thus be low. Even if a discharge is needed, as it is expected that the water is of similar quality as when these ponds were commercial fishponds, but with less organic content as no fish feeding, it should not be a water quality issue.

Alteration of landscape

5.1.5 The landscape of existing fishponds will be reconstructed into wetland landscape. The construction works include removal of pond bunds and drain off water in the ponds. These practices are similar to the typical commercial fishponds. The area will provide more microhabitats favored for waterbirds after the restoration. The impact of landscape alteration is insignificant.

Impact to Winter Birds

5.1.6 The existing fishponds are the important wetland habitats for winter birds, serve as a roosting and foraging area for the birds. To minimize the impact of construction to winter birds, the restoration of wetland will be implemented during wet season (from April to October) before the birds arrive.

Connectivity to Other Fishponds

5.1.7 The wetland restoration area will still have ecological connectivity with other adjacent fishponds outside the Application Site, given their similar nature and little obstacles in between. To prevent the loss of the remaining parts outside Project Site of the abandoned ponds lying on the Application Site boundary, bunds will be built to separate the ponds lying across the boundary of the wetland restoration area.

6. GENERAL MAINTENANCE AND MANAGEMENT STRATEGY

6.1 Water source

6.1.1 Water source is one crucial issue for inland artificial wetland like the proposed wetland system. Based on the information from the website of the Hong Kong Observatory, the annual rainfall of Hong Kong is 2,398.5mm while the annual evaporation is 1,227.3mm, thus resulting in a net gain of about 1,150mm rainwater annually. Besides the WRA itself would receive rainwater which forms part of the water source, the rainfall in the residential areas of the Application Site will also contribute to the water sources of the WRA. Currently the WRA occupies about 40% of the Application Site, but it will receive rainfall of about two times of its own area size (to take a conservative estimation, assuming not all rainfall at the residential area of the Application Site could be collected). The annual net gain of rainwater will be at least 2,300mm. This will be more than enough to achieve the desirable water depth in different parts of the WRA. No other surface or groundwater water supplies will be used for the wetland operations.

6.2 Reedbed establishment

6.2.1 A period of 12-month maintenance will be allowed for the reedbed to be developed. The extent of propagation of newly planted reedbed will be reviewed by the Contractor. The necessity of additional planting will be reviewed.

6.2.2 Horticultural maintenance operations (e.g. weeding, replacement planting) will be regularly provided by Contractor after completion of construction of the system. Visual inspection should be carried out by the Contractor to determine the health of the reed.

Vegetation maintenance

6.2.3 Survival of planted reedbed will be monitored during the maintenance period. Weeding will be conducted once every month during wet season and once every two months during dry season to control the growth of weeds which would compete with the Common Reed for water, nutrient and space until the plants are well established. During the weeding, only exotic weeds and ruderal species should be removed. Replacement planting for dead plants will also be implemented.

Water level maintenance

6.2.4 Water levels of the reedbed will be maintained at desired depths with the recommended impermeable soil type. Under normal condition, water depth of the planting zone will be about 0.5 m in reedbed. Water depths of the reedbed will be monitored by water gauge weekly. Water level will be adjusted by pumping out excessive water by submersible pumps when necessary.

6.2.5 Regular water level management (such as partial drain down) in the proposed WRA will be commenced through the year, in particular during dry season, to allow waterbirds fully utilize different portion of the WRA. The details of the management regime (e.g. the target water level, frequency and duration) regarding the water level management of the WRA will be discussed in detailed design stage and also be reviewed regularly based on the results of the ecological monitoring of the WRA during the operational phase. Management Plan of Mai Po Nature Reserve is reviewed for the activities of management of the proposed WRA in the current case.

6.2.6 In addition to development projects, Nature Conservation Management Agreement (MA) projects by the Hong Kong Bird Watching Society (HKBWS) in the Ramsar Site Priority Site and the Deep Bay Wetland outside Ramsar Site Priority Site in the Northwest New Territories demonstrated successful examples of enhancement of ecological value of pond by active management. The fishponds without drain-down could have greater ecological value during the drain-down practice. Statistical analysis of the survey findings from 2012 to 2016 indicated that there were higher abundance and species richness of all bird groups during the drain-down compared to before the drain-down (Table 6.1 refers).

Table 6.1 Survey Findings from 2012 to 2016 regarding Nature Conservation Management Agreement

	Before Drain-down	During Drain-down
Mean abundance per fishpond	6	122
Mean no. of waterbird species per fishpond	1	9
No. of waterbird species in all fishpond	38	68

6.3 Vegetation management (except Reedbed)

6.3.1 Vegetation should be managed in accordance with the habitat targets as follows:

- The bunds of the main waterbody should be maintained with short herbaceous vegetation (less than 10cm in height) by regular manual cutting. Shrubs and larger herbaceous vegetation should be removed, in order to maintain an open waterbody for waterbirds.
- The extent of the planting buffer should be maintained, colonization to other area should be avoided through manual removal.
- Submerged plant will be retained or planted over ~10% of the main waterbody.
- In order to minimize erosion of bunds during heavy rain (which may weaken bund structure and result in silt deposits harming pond fauna), hydroseeding of grass *Cynodon dactylon* may be used to stabilize bare bund areas.

6.3.2 The vegetation management regime is adaptive and should be reviewed annually in the light of conservation priorities and targets.

6.4 Prevention of disturbance

6.4.1 The WRA is designed as a habitat for waterbirds. If there is disturbance from the residential buildings, it might potentially impact the waterbirds utilizing the WRA. There will be reed zone of about 0.59 ha between the residential buildings and the WRA. In addition, wood trellis (of the design similar with bird hide, closely arranged wood poles) will be provided behind the reed zone. For the nearest buildings (those immediately adjacent to the WRA) the windows will be switchable glass and would not be allowed to fully open, to reduce the potential disturbance on the WRA. There will be one major footpath/EVA inside the Application Site along the site boundary, but is mostly shielded from the WRA by the residential buildings, and residents on the footpath are not expected to cause disturbance impact to the WRA.

6.4.2 The fauna in WRA may be affected by the future residential internal traffic. However, most of the houses are served by underground car parking space and linked with an underground vehicular access, and thus future internal traffic would be limited to near the site entrance. The potential impact to the WRA and associated fauna due to internal traffic during operation phase would not be significant.

6.4.3 The fauna in WRA may affected by the increased residential lighting. However, buffer zone with planting between the houses and the WRA is proposed in the surrounding wetland area, will form a barrier between the houses and the WRA. For the nearest buildings (those immediately adjacent to the WRA) the windows will be switchable glass and would not be allowed to fully open, to reduce the potential disturbance on the WRA.

6.4.4 As the proposed wetland is for conservation purpose, access to the wetland will be limited to authorized personnel. Lockable gates at access points to prevent other persons to disturb the wildlife inside the wetland. Warning signs should be erected at the potential access points to deter pedestrian trespassers.

6.4.5 Other than the planting buffer, fencing of the wetland is not required for the Wetland Restoration Proposal. However, the security of the Application Site and the possible requirement to erect permanent fencing along vulnerable boundaries will be kept under review.

7. IMPLEMENTATION, MONITORING AND CONTINGENCY ACTION

7.1.1 The implementation of wetland restoration area should be completed before the construction of the Project. In order to minimize the impact due to construction works on winter visitor bird species, the restoration works of wetland should be implemented during wet season (from April to October). The construction of the Project may then commence at the start of dry season (i.e. November).

7.1.2 Monitoring of the wetland restoration area will be conducted by a special team under the property management company. The company can hire staff or invite landscape contractors to implement the monitoring programme. The company may also cooperate with NGO to monitor and manage the wetland restoration area.

7.1.3 The maintenance and management strategy of the WRA includes the hiring of the conservation manager and field officer, the purchase of equipment and materials (plant material, fish, lime, and peanut residue), facility maintenance, ecological monitoring and the office administration. The detailed Scope of monitoring works included the following:

Vegetation and habitat monitoring

7.1.4 Habitat monitoring will be conducted at six monthly intervals at the end of the wet season (September) and the end of the dry season (March) by monitoring the health of reedbed, coverage of submerged plant and water level of the main waterbody and reedbed, in order to inform management actions.

7.1.5 Detailed vegetation surveys will be conducted in each habitat at six monthly intervals at the middle of the wet season (July/August) and the middle of the dry season (Dec/Jan). Transects with a fixed number of 2m x 2m quadrats will be located in major habitats in the Wetland Restoration Area. Within each 2m x 2m quadrat, all plant species will be identified to species-level and their densities will be estimated. The percentage cover of bare ground, leaf litter

cover and coverage by each species will also be measured. The tallest height of each plant species will be measured to be the nearest cm. Any rare or protected species will also be identified within the quadrats. Along the fixed transects placed in the wooded bund area, all woody species and their health conditions will be recorded and assessed respectively.

Fauna monitoring

7.1.6 Monitoring of families/groups of bird species is required in order to demonstrate success in reaching the target (**two-fold increase** of abundance in the same period of pre-constructions surveys conducted) of the restored wetland supporting, the total number of individuals of waterbird species of the families/groups of birds including Cuculidae, Alcedinidae, Podicipedidae, Phalacrocoracidae, Ardeidae and Anatidae (e.g. Little Grebe, Black-faced Spoonbill, Yellow Bittern, Black-crowned Night Heron, Chinese Pond Heron, Eastern Cattle Egret, Grey Heron, Great Egret, Intermediate Egret, Little Egret, Great Cormorant, Black-winged Stilt, Pied Avocet, Spotted Redshank, Common Redshank, Marsh Sandpiper, Common Greenshank, Wood Sandpiper, White-throated Kingfisher, Pied Kingfisher if present) that were recorded during the 12-month survey conducted for the EcoIA. Surveys will be undertaken monthly. During each survey visit, the surveyor will walk slowly around the perimeter of the wetland and along bunds, and will identify and enumerate all birds recorded. Surveys will commence within one hour of sunrise.

7.1.7 In addition to the bird monitoring, surveys for other fauna groups are also required to be conducted to exhibit the successfulness of the habitat condition targets. Fauna groups of dragonfly, reptile and mammal are also needed to be recorded during the monthly survey visits. For the reptile and mammal (specifically for bats), the surveys will commence before sunset and during night time.

Fish monitoring

7.1.8 The purpose of freshwater fish survey during the operational phase is to monitor the prey availability for the waterbirds. Monitoring of freshwater fish will be conducted by throw and drag-netting at six monthly intervals at the end of the wet season (September) and the end of the dry season (March). A fishing throw-net with a mesh size of 30mm, a diameter of about 4 m and a surface area of about 14m^2 will be used to catch larger fish and a drag net of mesh size <10mm will be used to sample smaller fish. Five randomly-placed replicates with each net will be conducted in each pond. Fish will be identified to species and the weight and length recorded (if fish length is greater than 10 cm) and then released back into the wetland.

Water quality monitoring

7.1.9 In-situ water quality will be measured in each sampling location once per month. Additional measurements of these parameters should also be made in order to inform management decisions (e.g. fish re-stocking programme) and in

response to unexpected events (e.g. algal blooms or fish die-offs). Parameters including temperature, pH, salinity and dissolved oxygen will be monitored.

7.1.10 In addition, every six months (at the end of the wet season and end of the dry season) water samples will be sent to a HOKLAS-accredited laboratory for analysis. Parameters including Ammoniacal nitrogen, Biochemical oxygen demand, Total oxidized nitrogen, Total phosphorus and Total reactive phosphorus (orthophosphate) will be monitored.

Action level and contingency action

7.1.11 The action levels include but not limited to the absence of the monitoring targets during surveys, undesirable monitoring results, percentage of the vegetation coverage (planted and/or exotic species), percentage variance of water depths in each zone, habitat conditions and water quality parameters. Criteria of action levels mentioned in Development of Lok Ma Chau Loop - Ecological Mitigation/ Habitat Creation and Management Plan are also reviewed and considered.

7.1.12 Contingency action is one of the important factors to safeguard the operation of the wetland area, particularly related to water supply, water retention, and plant growth. These include the review of management regime and other factors, the use of freshwater supply to maintain water levels within target depth if required. The water from the fresh water supply will be used to replenish the fishponds during dry seasons, ensuring that the fish have access to sufficient water for sustainable living. Effort of removal of exotic species and the replenishment of the planted flora species within the WRA will be placed if the habitat condition is considered unsatisfactory when necessary. Detail Investigation will be engaged to the detailed action level and contingency action plan in the next stage including the Environmental Impact Assessment submission stage under EIAO.

8. FUNDING

8.1.1 To ensure the proposed wetland area could be implemented and would be operated in accordance with the above proposed long-term management, it is essential to have a mechanism to provide funding to support the cost involved and the management works to be implemented. The funding arrangement is provided in the WRA Funding Arrangement and the detailed recurrent cost for the management and maintenance of the wetland will be provided in later stage.

8.1.2 There are several approaches on arranging the funding for the construction as well as long-term operation and maintenance of wetlands. The mitigation wetlands in Lok Ma Chau as a mitigation measure for Lok Ma Chau Spur Line is directly supported and run by the Project Proponent. There are also examples of donating seed money to Environment and Conservation Fund by the Project Proponent, in an agreed amount, to support the application of annual funding for management by the future wetland operators. In some cases of residential developments, the management of the wetlands is taken up by the management company of the development.

8.1.3 In the present project, subject to the TPB / relevant Government department's agreement or further refinement, if required, the Applicant has proposed the following approach for the long-term funding arrangement for the consideration of the EPD and AFCD:

- To set up an endowment fund which would be specifically managed by an Investment Bank to provide a long-term source of funding to cover all of costs required for maintaining the WRA in accordance with all of the approval requirements to be placed on the Applicant.

8.1.4 The Applicant would set up the independent fund to own, to manage, and to operate the proposed WRA. The individual owners of the residential portion would not be liable to manage and to maintain the WRA in future.

8.1.5 Regarding the funding arrangement, the Applicant would propose to allocate an amount of approx. $3M per annum, subject to section 8.1.7, to sustain the long-term operation of the proposed WRA. The amount is anticipated to cover the implementation and operation of wetland management office as well as maintenance and monitoring measures as mentioned in sections 6 and 7 of Wetland Restoration Proposal.

8.1.6 Upon obtaining an approval from the TPB on the present planning application and confirmation of wetland restoration proposal approach, the Applicant will further develop and refine the proposal into a detailed management and maintenance proposal. The proposed quantity and quality of vegetation and water level maintenance, as well as the proposed quantity and quality of vegetation, habitat, bird, fish as well as water quality monitoring would be further studied by specialist. The Applicant is anticipated to vary the amount of funding arrangement subject to further refinement upon detailed management and maintenance proposal.

8.1.7 Regarding the practical funding mechanism, we would target to source and lobby with Investment Banks after the approval from the TPB as well as subsequent approval from EPD on Environmental Permit, plan approval from Buildings Department and Lease modification / Land Exchange from Lands Department in order to secure the commercial details upon confirmation of development approaches.

8.1.8 The Applicant will ensure that the detailed proposal will be formulated to the satisfaction of all relevant departments prior to commencement of the project.

9. CONCLUSION

9.1.1 The proposed Wetland Restoration Proposal is in line with the "OU(CDWRA)" zone under the OZP. This paper was prepared to fulfill the requirements in the OZP, and to provide information on the design, operation procedures, and maintenance works for the restored wetlands.

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Figure 4.1 Configuration details of the proposed wetland and the building layout

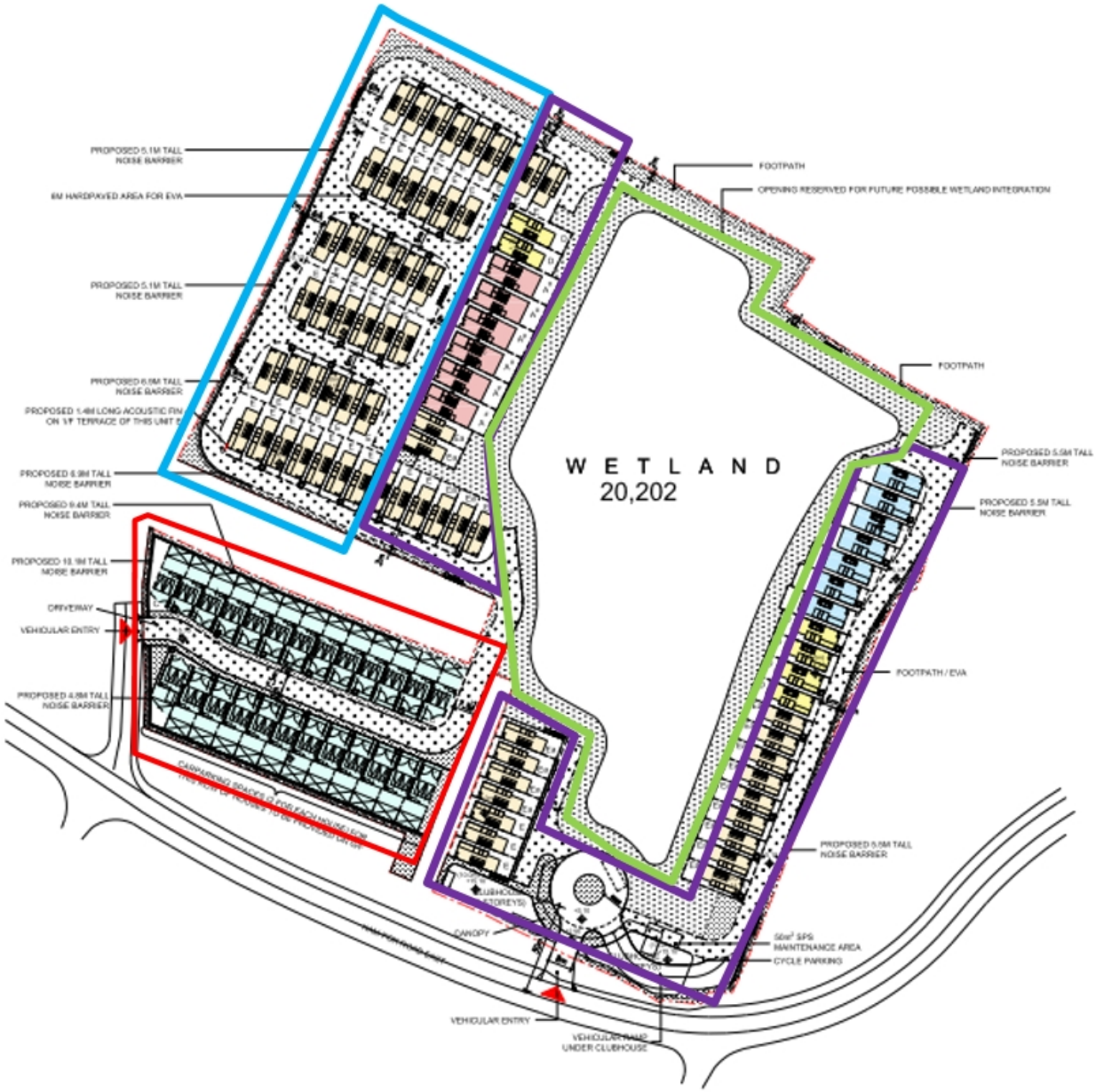


Figure 5.1 Different phases of the construction

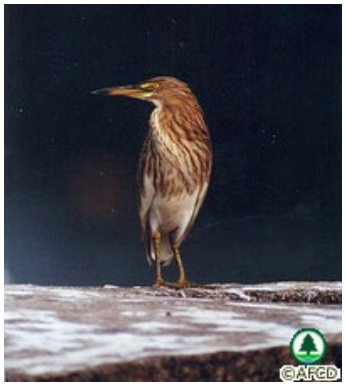
Appendix 1 Photo of wetland species


Little Grebe *Tachybaptus ruficollis*


Yellow Bittern *Ixobrychus sinensis*


Great Egret *Ardea alba*


Grey Heron *Ardea cinerea*


Chinese Pond Heron *Ardeola bacchus*


Little Egret *Egretta garzetta*


Great Cormorant *Phalacrocorax carbo*


White-throated Kingfisher *Halcyon smyrnensis*


Phragmites australis


Juncus effuses


Cyperus malaccensis


Rotala rotundifolia